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DAVID WARREN/SHOSTAL

Oporto rises on a terraced slope from the Douro River, along which casks of port wine are ferried.

OPORTO, ô-pôr'tô, the second-largest city in Portugal and the largest in northern Portugal. Oporto (Portuguese, *Pôrto*) is situated on the north bank of the Douro River, about 3 miles (5 km) from the river's mouth and approximately 175 miles (280 km) north of Lisbon.

Oporto rises from the riverbank on a terraced slope. In the old sections the streets are steep, narrow, and congested. Often they are lined with tall, narrow houses, some completely faced with decorative blue tiles. The modern sections have broad streets, public gardens, and promenades.

Places of Interest. The Douro is crossed by a railway bridge and two road bridges, all remarkable feats of engineering. The Dom Luis Bridge consists of superimposed roadways, one serving the lower town, the other the upper town. There are fine views of the city from the bridges and from the 246-foot (75-meter) tower of the Baroque Clérigos Church.

The Praça da Liberdade, an oblong plaza, is the center of the city. Oporto's cathedral rises on a promontory between this plaza and the river. Built as a fortress in the 12th century, it was altered in the 17th and 18th centuries. Nearby, the Church of Santa Clara is famous for its extensive, dazzling goldwork. The Romanesque-early Gothic period is represented by the Cedofeita Church, built in the 12th century and restored in the 16th. Perhaps the finest example in Portugal of the rococo period is found in the gilded-wood decorations of the Church of St. Francis. The mid-19th century Stock Exchange (Bolsa) has a reception hall in Moorish style.

Economy. An important commercial and manufacturing center, Oporto conducts its shipping through Leixões, 5 miles (8 km) to the northwest. This artificial harbor, begun in 1890, was constructed because silting had made the Douro River impassable for large ships.

Oporto's principal item of trade is port wine, named for the city and shipped mainly to Britain. Port is fortified wine made from grapes grown in

a legally defined area of the Douro Valley. It is processed and aged in the numerous wine warehouses of Vila Nova de Gaia, across the river from Oporto.

Oporto is principally a center for light industry, notably the milling of cotton, silk, and wool, the processing of food and beverages, and the manufacture of tires, clothing, furniture, and ceramic wares. The city also has an oil refinery and produces chemicals and machinery.

History. Even before the Roman conquest, a village stood on the site of Oporto, which means "the port." The Roman town was called *Portus Cale*, or *Portucale*, the origin of the name Portugal. A new city, begun by the Alani, was captured by the Visigoths in the 6th century. In the 8th century it fell to the Moors, who held it until Christian forces gained permanent possession of it at the end of the 11th century. Henry the Navigator, whose monument stands in the Jardim do Infante, was born in Oporto in 1394.

Although the center of Portuguese political authority shifted southward from Oporto as the Christian reconquest of Moorish lands progressed, the city prospered from commerce. Its wine trade expanded with the signing of the Methuen Treaty (1703), which gave Portuguese wines preference in Britain. But later in the century the Portuguese minister Pombal granted a Portuguese company monopoly control of the industry, to the detriment of independent Portuguese merchants as well as to the British. As a result, the abortive "Drunkards' Rebellion" broke out in Oporto in 1757.

The city was the focal point of the liberal revolution of 1820 and a center of resistance to the dictatorship (1828-1834) of Dom Miguel, whose army besieged the city in 1832-1833. A premature republican revolution began in Oporto in 1891.

In the 20th century, Oporto experienced impressive industrial growth. By 1980 the population of the city and its suburbs totaled more than 1.5 million. Population: (1981) 329,104.



BEN AND DES BARTLETT, FROM PHOTO RESEARCHERS

OPOSSUM, ə-ˈpɒsʻəm, any of about 65 species of small to medium-sized American marsupials of the family Didelphidae. The name opossum (or possum) was applied to some superficially similar Australian marsupials of the family Phalangeridae, but these are more properly called phalangers.

Opossums are found from Canada to the tip of South America. Typically they are nearly omnivorous, slow-moving, live mostly in trees, and have prehensile tails for grasping branches. Some, but not all, carry their young in pouches like most other marsupials.

The Common Opossum. The most familiar opossum in the United States is the common, or Virginia opossum (*Didelphis marsupialis*), which ranges from southern Canada to northern Argentina. It is about the size of a cat, has thick whitish gray fur; a pointed snout; large bare gray ears; a long, nearly bare, scaly prehensile tail; and hands and feet with five digits. The hind feet can be used for grasping, since the great toe, which is provided with a nail instead of a claw, opposes the other toes just as the human thumb opposes the fingers.

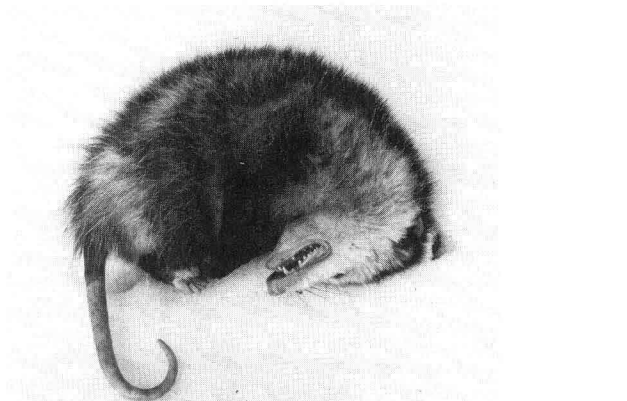
The female opossum has a large, forward-opening pouch or pocket on the lower surface of the abdomen, in which the young, clinging to the nipples, are nursed for five or six weeks. The number of functional nipples in the pouch may reach 13. Several more than this number of young may be born at a birth. Since each young, after dragging itself hand over hand through the mother's fur to the pouch, becomes firmly attached to a teat for several weeks, the excess members of the litter necessarily die. When sufficiently developed the young opossums free themselves from the mother's teats and leave the pouch for increasingly longer periods. At this stage they may travel on the mother's back, clinging to her hair with their hands and feet or with their rope-like tails wrapped about hers. Breeding occurs from midwinter to late autumn, with up to three litters in one season.



GORDON SMITH, AUDUBON/PR

Baby opossums instinctively cling to their mother's body until they are old enough to fend for themselves.

When an opossum takes to a tree to escape from a predator or search for food, its prehensile (grasping) tail comes in handy.



LEONARD LEE RUE III, AUDUBON/PR

The opossum's last line of defense is to play dead—a convincing act that turns away many predators.

The common opossum dens in hollow trees or holes under stumps and roots. It is virtually omnivorous, feeding on insects, fruits, eggs, both fresh and rotten meat, and offal. The hunting of opossums in the southern United States is a popular sport, especially during autumn and winter months, when a thick layer of fat lies under the animal's skin. The animals are usually treed with the aid of dogs and flashlights at night. When taken, the opossum feigns death, from which comes the expression "playing possum."

Near relatives of the common opossum live in Central America and tropical South America from sea level to as high as 12,000 feet (about 3,700 meters) in the Andes. The lowlands form is pale gray in color, and the uplands form is sharply marked with black and white.

Other Species. Other members of the opossum family are found from Mexico to Patagonia. Many have no true pouches, though they are believed to have evolved from ancestors with pouches. Their newborn young seek out and attach themselves to the mother's nipples just as do

those of the common opossum. Among the opossums of Central and South America are the brown four-eyed opossums (*Metachirus nudicaudatus*), which are so named for the white spot just above each eye. Females have folds of skin on either side of the nipple area instead of a pouch. South Brazil and Paraguay are the home of the short-legged, aquatic, thick-tailed opossums (*Lutreolina*). These animals are gray-brown above and grayish white beneath. They feed chiefly on crustaceans and small fish. The only other opossum with a well-developed pouch is the water opossum, or yapok (*Chironectes minimus*). It has webbed hind feet and a broad flat tail.

The remaining Latin American opossums lack pouches. They are quite diversified, including many species of small murine, or mouse, opossums (*Marmosa*); a group of short-tailed shrew-like opossums (*Monodelphis*); the long-tailed, highly arboreal, woolly opossum (*Caluromys*); and two types with very furry tails.

The murine opossums include a distinct group of species in Argentina and Chile that store body fat in a seasonal swelling of the base of the tail. The fat provides a winter reserve of food. Most species of mouse opossums, which are distributed from Mexico to Patagonia, have a small black area around each eye. The body may be gray to dark brown, depending on the species.

The shrew opossums, which are restricted to tropical America, are the most nearly terrestrial of all opossums. One Brazilian species, *Monodelphis domestica*, is popular among householders because it kills insects and rodents in dwellings where it lives.

In a few other species, as in the woolly opossums, the base of the tail is fur-covered, but two small opossums have tails entirely covered with fur. One, *Dromiciops australis* of south central Chile, is about the size of a rat. The other, the bushy-tailed opossum (*Glironia*) of northern South America, is slightly larger.

GEORGE H. H. TATE*

American Museum of Natural History

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OPPENHEIMER, op'ən-hīm, E. Phillips (1866–1946), English novelist. Edward Phillips Oppenheim was born in London on Oct. 26, 1866. He sold his first short story in 1884. His first novel, *Expiation*, was published in 1887. During World War I, Oppenheim served in the British intelligence service, escorting neutral journalists on tours of French battlefields.

Oppenheim quickly gained renown for his novels dealing with high adventure and international intrigue. His books, with simple plots, generally involved mysterious persons on secret missions in glamorous surroundings.

Oppenheim wrote about three novels a year for 50 years. His best-known work is *The Great Impersonation* (1920), which was filmed several times. His other books include *A Maker of History* (1906), *The Misnomer* (1908), *The Great Prince Shan* (1922), *The Inevitable Millionaires* (1923), *The Wrath to Come* (1924), *Gabriel Samara* (1925), *The Light Beyond* (1928), *The Spy-master* (1938), and *The Last Train Out* (1940).

Oppenheim published his autobiography, *The Pool of Memory*, in 1941. He died in St. Peter Port, Guernsey, on Feb. 3, 1946.



UPI

J. Robert Oppenheimer (left) stands with Maj. Gen. Leslie Groves in Alamogordo, N. Mex., at the spot where the first atomic bomb was exploded in July 1945.

OPPENHEIMER, op'ən-hī-mər, J. Robert (1904–1967), American physicist, who led the growth of American theoretical physics from provincialism in the 1920's to world parity by the end of the 1930's, and directed the development of the atomic bomb during World War II.

Life. J. Robert Oppenheimer was born in New York City on April 22, 1904, the son of a prosperous textile importer. He attended the Ethical Culture School and graduated from Harvard in 1925. He spent the next two years at Ernest Rutherford's laboratory in Cambridge, England, and with Max Born in Göttingen, Germany. He received his Ph.D. from the University of Göttingen in 1927. Two years of fellowships followed, first at Harvard and the California Institute of Technology, and then at Leiden and Zurich, where he was greatly influenced by Wolfgang Pauli. In 1929 he returned to the United States and accepted appointments at both the University of California at Berkeley and the California Institute of Technology, dividing his time between the two institutions.

Oppenheimer devoted the years 1943–1945 to war work—1942 at Berkeley and 1943–1945 at Los Alamos, N. Mex. He returned to the California Institute of Technology in 1946 and spent the next year and a half there and at Berkeley. In 1947 he accepted the directorship of the Institute for Advanced Study in Princeton, a post he held until his death, from cancer, on Feb. 18, 1967.

Early Research. At Göttingen, Born and Oppenheimer wrote a famous paper on the structure of molecules. Oppenheimer's theory of field emission gave the first example of an effect due to barrier penetration, one of the most spectacular of the divergences between quantum and classical mechanics.

The Berkeley School. At Berkeley, Oppenheimer created a school of theoretical physics that played the most important role in the astonish-

ingly rapid development of American theoretical physics in the 1930's. Berkeley graduates filled chairs in many of the great centers of physics in the United States.

Oppenheimer and his students developed almost all the consequences of the Dirac theory of the electron, although much of this work was paralleled by the leading European physicists. They made important contributions to nuclear physics, meson physics, and astrophysics. The paper by Oppenheimer and Hartland Snyder on the gravitational collapse of massive stars was the first theoretical exposition of black holes.

War Work. At the end of 1941, Oppenheimer became a consultant to the Chicago Metallurgical Laboratory, and in June 1942 he was placed in charge of the weapons design section of the project. From Berkeley he supervised the creation of the Los Alamos laboratory, which began work in March 1943 with Oppenheimer as its director and moving spirit. Its work culminated in the atomic-bomb test at Alamogordo, N. Mex., in July 1945, the bombing of Japan in August, and the peace in September.

Public Service. Oppenheimer received the Medal of Merit from President Truman in 1946, and thereafter served the government in many advisory capacities. As a member of the Lilienthal committee he devised the plan that became the official U.S. policy on international control of atomic energy. He was chairman of the General Advisory Committee of the Atomic Energy Commission from 1946 to 1952. This committee did much to develop the atomic military capabilities of the U.S. and to support pure research in nuclear physics. When the drive to develop the hydrogen bomb followed the first Soviet atomic weapon test, the committee became involved in controversy by urging a pause in the development of ever more destructive weapons. The controversy was intensified when the Soviet Union successfully tested a hydrogen bomb six months before the United States. Oppenheimer served on the Joint Research and Development Board of the Armed Services from 1947 to 1952 and on the Science Advisory Committee from 1951 to 1954.

Oppenheimer earned the enmity of important officers in the Air Force when the Vista Project, of which he was a member, proposed the deployment of tactical nuclear weapons to defend Europe, rather than placing reliance completely on massive retaliation. With the coming of the McCarthy era, these enemies saw an opportunity to destroy his influence. They persuaded President Eisenhower to rescind his security clearance in December 1953. After a long hearing a security board denied clearance, partly because of long-time associations with Communist friends even though these relationships had been known to the government in Oppenheimer's Los Alamos days. The overwhelming majority of the scientific community felt that this decision was a grave injustice. In 1963, President Kennedy moved to redress the injustice by choosing Oppenheimer for the Fermi Award. It was given to him by President Johnson in December 1963, but his security clearance was not restored.

The Institute for Advanced Study. When Oppenheimer became director of the institute in 1947, he greatly enlarged its distinguished physics faculty. He appointed brilliant young theoretical professors and created many fellowships for young theorists from throughout the world. The

institute became the center that Berkeley had been in the 1930's. Although Oppenheimer himself was no longer active in research, he kept abreast of new developments, directed the theoretical seminars and encouraged, inspired, and guided his young colleagues. He wrote about problems of the atomic age and about the relationship between science and the general culture.

ROBERT SERBER, *Columbia University*

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OPPOSITION, in astronomy, the alignment of the sun, the earth, and the moon or an outer planet at the point in their orbits when the earth comes between the moon or outer planet and the sun. The full moon is in opposition to the sun when the earth is in a direct line between them.

OPRICHNINA, ə-prĕch'nē-nə, the private domain established within the Russian state by Ivan IV (the Terrible) in 1565, and the separate administration designed to control it. Not a contiguous territory, it consisted of towns and estates, mostly in Russia's central and northern provinces, seized from boyars and princes accused by Ivan of treason and personal disloyalty. The old owners who were not executed received land grants elsewhere in the state. Ivan eventually added portions of Moscow and its suburbs to the Oprichnina. When in 1572 he began to dismantle the Oprichnina, his personal realm included about one third of the Muscovite state.

The Oprichnina's administrative center was in the village of Aleksandrov in Vladimir province. During the period in which these lands were held apart from the other territory of the state, they were administered by officials called *Oprichniki*. Drawn mostly from the lesser nobility, these new officials, dressed in black and mounted on black horses, conducted a reign of terror for 16 years. Thousands of nobles and masses of commoners perished in an orgy of torture and murder. The height of the terror was reached in 1570 when the population of Novgorod was condemned and the city sacked.

Ivan's reasons for the Oprichnina remain obscure. Introduced against a background of continual warfare between Russia and its neighbors and a weakening national economy, it failed by 1572 to allay his paranoid suspicions.

All the lands of Muscovy eventually were returned to a single administration, but the cause of central government had been severely damaged. The Oprichnina left large parts of Russia ruined and depopulated and must be viewed as a prelude to the Time of Troubles (1598–1613).

PETER CZAP, JR., *Amherst College*

OPS, ops, in Roman mythology, an ancient goddess of agriculture, especially of sowing, and of abundance. She was also a fertility goddess, and newly born children were in her special care. Ops was believed to be the wife of Saturn, in whose temple she was worshiped and with whom she shared the Saturnalia festival.

The Opalia, the leading festival in her honor, was celebrated on December 19. As Ops Consvia, consort of the earth god Consus, she was given a festival on August 25. As the mother of Jupiter, she was also honored with her son on the Capitoline Hill.

OPTIC NERVE. See EYE.

OPTICAL ACTIVITY, the rotation of the polarization plane of plane-polarized light when it passes through a homogeneous transparent substance. In modern usage, however, the term embraces virtually any change of polarization occurring when any form of electromagnetic wave, however polarized, strikes an appropriate sample. Materials whose molecules or crystal structures have a particular asymmetry produce natural optical activity. Similar effects, known as magnetic optical activity, are obtained from materials placed in a static magnetic field.

In plane-polarized light, such as that produced by a Polaroid sheet, a vector quantity such as the electric field remains in a fixed plane as the wave travels. In 1825 the French scientist A.J. Fresnel was the first to visualize a circularly polarized electromagnetic wave, with the field vector rotating as the wave travels, tracing a surface resembling a circular fire-escape slide. He showed that a plane-polarized wave is equivalent to two equal-amplitude circularly polarized components rotating in opposite directions. All optical activity is now viewed as resulting from these two components having different velocities (circular birefringence) and different absorption rates (circular dichroism) in a substance.

Many natural organic compounds, including turpentine and solutions of sugar or tartaric acid, exhibit optical activity. Such optical activity results from the fact that the molecules all have the same "handedness" or chirality. (See **STEREO-CHEMISTRY**.) Two molecules differing only in chirality constitute an enantiomeric pair. Enantiomeric molecules are nonsuperposable mirror images of each other, and they rotate polarized light in opposite directions. Nature tends to produce optically active compounds (such as tartaric acid) consisting of only one enantiomer. Since the discovery of enantiomerism by Louis Pasteur in 1848, scientists have been mystified by this fact. When similar compounds are produced synthetically, they contain equal amounts of both enantiomers and are optically inactive.

The main application of natural optical rotation is the measurement of the density of solutions of optically active molecules, such as sugar. The major uses of magnetic optical rotation are in optical engineering, including control of high-intensity laser beams and readout from thin-film optical computer memories.

OPTICAL ART. See **OP ART**.

OPTICAL ILLUSION. See **ILLUSION**.

OPTICS, the science of light and vision. Physical optics deals with the origin, nature, and properties of light; geometrical optics with the geometry of the formation of images by lenses, mirrors, and prisms; and physiological optics with the role of the light in vision. See also **EYE**; **LENS**; **LIGHT**.

OPTIMIST INTERNATIONAL, an association of community-service clubs active in the United States, Canada, Mexico, and the Caribbean. It comprises business, industrial, and professional persons in a federation of about 4,000 clubs with some 160,000 members. Headquarters are in St. Louis, Mo. The expressed purposes are to develop optimism as a philosophy of life, to promote active interest in good government and civic affairs, to inspire respect for the

law, to promote patriotism, to work for international accord and friendship among all peoples, and to aid and encourage the development of youth.

Optimist clubs engage in a wide variety of projects tailored to the needs of the communities they serve. They help to improve the physical appearance of the community, participate in get-out-the-vote campaigns, launch bike and traffic safety programs, and work to prevent drug abuse. Two affiliated organizations also participate in such programs: the Junior Optimist clubs for junior high school pupils, and the Octagon clubs for high school students.

The first local Optimist club was organized in 1911 in Buffalo, N.Y. The forerunner of Optimist International was established in Louisville, Ky., in 1919.

OPTION TRADING, the right to buy or sell a specific security or property at a predetermined price within a specified time period. A *put* gives the holder the right to sell the stock, a *call* the right to buy the stock. The price specified in a put or call is usually close to the market price of the stock at the time the contract is made. Puts are purchased by those who think a stock may go down. A put obligates the seller of the contract to take delivery of the stock and pay the specified price to the owner of the option within the time limit of the contract.

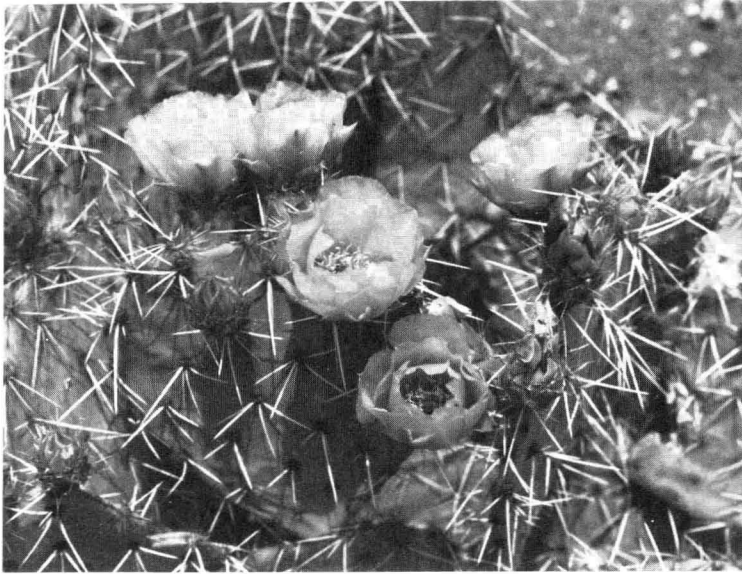
Calls are purchased by those who think a stock may rise. A call gives the holder the right to buy the stock from the seller of the contract at the specified price within a fixed period of time. If the purchaser of a put or call does not wish to exercise the option, the price he paid for the option becomes a loss.

OPTOMETRY, *op-tom'ə-trē*, a health-care profession concerned primarily with the diagnosis, treatment and correction of defective vision. Optometrists prescribe and provide eyeglasses and contact lenses, other special optical aids, and vision therapy. They also detect and identify such vision-related disorders as diabetes, glaucoma, and cataracts for referral to physicians and routinely provide advice on the use and care of the eyes. Related professionals and technicians often confused with optometrists include *ophthalmologists*, physicians who specialize in eye problems; and *opticians*, technicians who make or dispense lenses and eyeglasses.

All schools and colleges of optometry in the United States and Canada require a high school degree together with a minimum of two to four years of college study as prerequisites for admission. The study program consists of at least four additional academic years of full-time resident study and clinical training.

Optometry traces its beginnings to the early 14th century, when eyeglasses were invented, but competent assistance in the design and selection of corrective lenses did not appear until early in the 17th century, when guilds of ophthalmic lens makers were formed. Optometry is now regulated by statutory law in most English-speaking countries and western Europe. In some European countries, the profession is still administered by craft ministries originally established to regulate the guilds of ophthalmic artisans.

HENRY HOFSTETTER
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JOHN J. SMITH

The plains prickly pear cactus (*Opuntia polyacantha*) forms large clumps in Western U.S. desert areas. Its yellow flowers give way to spiny, brownish fruits.

OPUNTIA, ō-pun'shē-ə, a genus of about 300 species of cacti, found from western Canada and New England to the tip of South America. Also known as prickly pear, tuna, and cholla, the opuntias typically have cylindrical or flat jointed stems covered with sharp spines or glochids (small barbed bristles). The flowers most often are yellow but may be orange, purple, or white. Some treelike species reach 18 feet (5.5 meters) in height, but most opuntias are low growing.

Among the more familiar species are the bear-tail cactus (*O. basilaris*) with flattened stems called pads; the teddy-bear cactus (*O. bigelovii*) densely covered with spines; the common prickly pear (*O. vulgaris*) with large yellow flowers and red, pear-shaped fruits; and the jumping cactus (*O. fulgida*) with easily detached spines and joints.

The Indian fig (*O. ficus-indica*), a bushy or treelike species, is widely grown for its edible fruits. A variety of this species, Burbank's spineless cactus, is cultivated for livestock fodder in desert areas. See also CACTUS.

OPUS DEI, ō'pəs dā'ē, a Roman Catholic organization founded in Madrid, Spain, on Oct. 2, 1928, by Msgr. José María Escrivá de Balaguer, who became the organization's first president general. On Feb. 14, 1930, a female branch was established, to function as an association distinct from the male branch but governed by the same president general. The Opus Dei (Societas Sacerdotalis Sanctae Crucis) received final papal approval in 1950.

In the decades that followed the founding of the Opus Dei, its membership grew to tens of thousands of men and women drawn from all parts of the world. Their commitment is to a profoundly spiritual life, pursued while they continue the work in which they were engaged before they made this commitment. The purpose of the organization is to serve as a persuasive example of the Christian way of life.

The educational institutions of the Opus Dei include the Catholic University of Navarre in Pamplona, Spain; the Strathmore College of Arts

and Sciences in Nairobi, Kenya; the Seido Language Institute in Osaka, Japan; and the Instituto Chapultepec in Culiacán, Mexico. Its members have been particularly active among intellectuals and others in positions of influence within society and government. The Opus Dei was prominent in the government of Spain toward the close of Francisco Franco's regime; at one time more than half of the cabinet ministers were members or sympathizers of the movement.

In 1982 the Opus Dei, which until then had the status of a secular institute, was reconstituted by a decree of the Sacred Congregation for Bishops into a personal prelature. As such the status of its leader as prelate became that of a superior general of a religious order. The Opus Dei, however, remained under diocesan authority in matters pertaining to its local activities.

ORACH, ōr'ich, the common name for 100 to 200 herbs or shrubs of the genus *Atriplex* in the goosefoot family, Chenopodiaceae. Also known as saltbush, orach typically grows in saline soil and has mealy gray or whitish leaves and clusters of tiny green flowers in spikes. Garden orach (*A. hortensis*) is grown as a garden green and is used in emetics. Creeping saltbush (*A. semibaccata*) grows along the California coast. Sea orach (*A. halimus*) is a silvery shrub. Quail brush (*A. lentiformis*) is a shrub of southern California. See also ATRIPLEX.

ORACLE, ōr'ə-kəl, in ancient religions, a shrine or temple in which a person considered to be divinely inspired answered perplexing questions or made prophecies to visitors in quest of guidance. The term also denoted the priest or priestess assigned this role, as well as the reply given. Essentially, the person delivering an answer or prophecy was the instrument through whom a special deity spoke.

Various methods were used in arriving at inspired utterances. Responses often were based on interpreting the rustling of leaves in a sacred tree; the sound of water in a sacred spring; the flight of birds; celestial occurrences such as thun-

der, lightning, meteors, and eclipses; the vital organs of animals; or on casting lots or throwing dice. Some pronouncements made use of dreams. Others prophecies resulted from induced trances or states of frenzy and were accompanied by writhings of the body and hysterical speech.

Among the most famous Greek oracles were those of Zeus at Dodona, in Epirus; of Apollo at Delphi; and of Trophonius in Boeotia. The Delphic Oracle is discussed in detail under the article DELPHI.

The Egyptians had oracles at Apis and Memphis. The Romans consulted oracles primarily in times of calamity to learn why the gods were displeased. In ancient Israel, oracles mainly took the form of messages from the deity that were communicated through dreams and inspired speeches given by the prophets, but omens were of minor significance. Ancient Christian writers alleged that the custom and practice of consulting oracles fell into disuse at or shortly after the birth of Jesus.

ORADEA, ô-ră'dyă, a city in western Romania. Oradea (Hungarian, Nagyvárad; German, Grosswardein) is on the Criș Repede River, near the Hungarian border, at the juncture of the Hungarian plain and the Transylvanian highlands.

A marketing center for the livestock and agricultural products of the surrounding area, Oradea also became a significant industrial city after 1945. It manufactures aluminum, machinery, chemicals, building materials, processed foods and textiles.

The Baroque core of the city contains Roman Catholic and Orthodox cathedrals (18th century), the Gothic Church of St. Ladislav (whose remains are interred there), and the citadel. Thermal health resorts are nearby.

Originally a Hungarian town, Oradea became the seat of a Roman Catholic bishopric in 1083. It was sacked by the Mongols in 1241 and held by the Turks from 1660 to 1692. Hungary ceded it to Romania in 1919, reoccupied it in World War II, and returned it to Romania at war's end. Population: (1981) 192,644.

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ORAIBI, ô-rî'bē, a Hopi Indian village in north central Arizona, in Navajo county, on the Hopi reservation, 78 miles (125 km) northeast of Flagstaff. It is also known as Old Oraibi to distinguish it from a more modern community, New Oraibi.

Established as early as 1125, Oraibi may be the oldest continuously occupied settlement in the United States. Built atop a projection from Black Mesa, the town could easily be defended. Once the largest Hopi village, it may have had 14,000 residents before the Europeans came. The Spanish established a Franciscan mission here early in the 17th century. In 1692, when suppressing other pueblos that had revolted, the Spanish chose not to attack Oraibi.

Smallpox caught from whites devastated Oraibi in the 19th century. The Hopi quarreled over how much they should cooperate with Americans who sought to employ them and teach their children. One faction left in 1906 and established Hotevilla. Later, a Christian group left to found New Oraibi at the foot of the mesa. The population of Old Oraibi fell to about 100.

ORAL HISTORY, the collection of spoken memoirs for use in the documentation of the past. Although interviewing for the purpose of reconstructing the past is as old as Herodotus, modern oral history dates only from 1948, when the distinguished historian Allan Nevins established the first formal project at Columbia University. Thereafter the growth in oral-history programs was rapid, particularly in North America, Europe, and Australia.

While the value of oral history in supplementing the written record is obvious, the techniques of oral history must be used with prudence and intelligence. Oral histories are documents of the time they were collected and not of the period under investigation. This blend of the past and present offers the interviewer an extraordinary opportunity to capture the process of historical reconstruction, but it can lead to a bias in favor of the present. The rapport generated in the interviews can also distort the testimony. In addition there are problems raised by the vagaries of memory, although the trained interviewer has ways of jogging memory to promote recall. These problems may limit the usefulness of oral histories unless the interviewer has prepared carefully for the interviews.

Oral history is most often used as documentation for a historical narrative. In such cases brief quotes from the interviews are selectively used in conjunction with other more traditional manuscript documents. Some oral histories, however, consist of the publication of the testimony itself, as in Theodore Rosengarten's *All God's Dangers* (1978) or the works of Studs Terkel. The author of this type of published oral history usually provides very little narrative of his or her own.

Oral histories are used widely in documentary films, radio broadcasts, and television dramas. Many community history projects depend on oral histories not only to document the past but also to involve citizens of the community in the creation of their own history.

Oral histories must be understood in the context of their creation and of the lives and attitudes of those interviewed. When used with care, oral history opens new vistas to the historian and throws light on once obscure historical processes.

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ORAL LAW, in Judaism, additions to and explanations of the Torah, or Written Law, as developed and transmitted by word of mouth over generations by rabbinic authorities. See JUDAISM—*Sacred Writings and Codes*; TALMUD—*The Mishnah*.

ORAL SURGERY, the specialty of dentistry concerned with the diagnosis and surgical treatment of disease, defects, and injuries of the mouth, jaw, and associated structures. Oral surgeons extract teeth; repair congenital abnormalities such as cleft palate; treat lesions, tumors, cysts, and infections of the jaws and mouth; and repair facial injuries relating to the jaw and mouth. Special problems for oral surgeons are posed by the limited access to the mouth region afforded by the cheeks and lips, movement of the tongue, presence of germ-laden saliva, and the fact that the mouth opens into the air and food passage-way.



FRENCH EMBASSY PRESS

The port of Oran, on an open bay of the Mediterranean Sea, is protected by a long jetty.

ORAN, ō-ran', the chief city of western Algeria. Situated on the Bay of Oran, which is formed by a broad curve of the Mediterranean coast, the city has a large harbor protected by a jetty. At the western end of the bay is the naval port of Mers el-Kebir.

Oran (Ouahran) is the commercial outlet for the products of western Algeria, such as wheat, wine, fruits and vegetables, meat, wool, tobacco, and esparto fiber. The city's manufactures, based mainly on agriculture, include foodstuffs, woolen textiles, clothing, and cigarettes. Farm machinery, glassware, chemicals, and plastic goods also are produced.

Description. Oran is divided into three sections: the waterfront and the old and new cities above. A ravine leading down to the bay has been largely covered over by streets and buildings.

The old Spanish and Arab-Turkish city lies west of the ravine at the foot of the Aidour, a spur of the mountain mass that dominates the western half of the Bay of Oran. On the summit of the Aidour, at an elevation of 1,200 feet (365 meters), stands the Spanish-built fortress of Santa Cruz. Below are the Casbah, the Great Mosque, and the Château Neuf, a castle that was the seat of Oran's Spanish and Turkish governors.

The new city, begun by the French after 1831, extends eastward on a terraced plateau. In this section are handsome boulevards, civic and commercial buildings, and the railroad and bus stations. The modern city has expanded southward and eastward with the construction of industrial zones and residential suburbs.

History. Founded about 903 by Muslims from southern Spain, Oran prospered on trade between Spain and the African interior. In the 12th century, merchants from Barcelona, Marseille, and Italian ports began to visit Oran to exchange European manufactures for wool, ivory, gold dust, and Sudanese slaves. The city's commerce declined late in the 15th century with the expulsion of the Muslims from Spain and the diversion of West African trade with

Europe from trans-Saharan routes to Atlantic sea lanes. The Spaniards seized Oran in 1509 to deny pirates the use of its harbor, and it remained a Spanish military outpost in North Africa until its capture by the Turks in 1708. Piracy then resumed, and the Spaniards reoccupied the city in 1732. Destroyed by earthquakes in 1790, Oran was abandoned to the bey of Mascara in 1792.

To combat continuing piracy from North African ports, the French took over the rebuilt city in 1831. Harbor improvements, the construction of roads and railways, and the development of agriculture—especially the cultivation of wine grapes by French and Spanish colonists—made Oran the economic center of western Algeria. By the 20th century it was the country's most European city. The independence of Algeria in 1962 caused an exodus of Oran's European residents. Population: (1977 est.) 500,000.

ORANGE, a city in southern California, on the Santa Ana River, in Orange county, about 25 miles (40 km) southeast of Los Angeles. Formerly in a region noted for its oranges, the city grew so much that it displaced nearly all the citrus groves in the late 1960's. Its industries produce quartz crystals, polyurethane, foam rubber, oil-well drilling equipment, and asphalt. Chapman College, a coeducational liberal arts college, is in the city.

Founded in 1868 as Richland, the city adopted its present name in 1875. Orange was incorporated in 1888 and has a council-manager form of government. Population: 91,788.

ORANGE, ô-ränzh', a town in southern France in the department of Vaucluse. It is situated 16 miles (25 km) north of Avignon in the lower valley of the Rhône and is traversed by the highway between Lyon and Marseille.

When market gardening developed in the Vaucluse during the 19th century, Orange became an important center for handling fruit, vegetables, wine, and cereals. Today the town's economy is

based not only on the marketing of agricultural produce but also on the fiberglass industry and on tourism.

History. It was here that Germanic invaders defeated a Roman army in 105 B.C. About 80 years later Augustus established a city on this spot for his veterans of the 2d Legion. The Romans named the city Arausio. At its peak it housed 80,000 to 100,000 people. One of its public buildings that survived is a great commemorative arch; the decorations on its northern face have been particularly well preserved. Nothing remains of the baths, amphitheater, or forum, but the large Roman theater is in a fine state of repair. Still used for public performances, it can seat over 7,000 spectators.

Orange eventually became a small, independent principality, which in the 16th century was inherited by William of Nassau (William the Silent), who was thereafter styled prince of Orange. The town was fortified in 1622 by William's son Maurice of Nassau, who made the Roman arch part of a fort and incorporated the theater into the ramparts. Orange fell to France's Louis XIV and became part of France in 1713. Population: (1982) 26,000.

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ORANGE, a city in the Watchung Hills region of east central New Jersey, in Essex county. It is about 3 miles (5 km) northwest of Newark and 9 miles (15 km) west of New York City, and many of its residents commute to jobs in the two cities. Eagle Rock, a nearby landmark 650 feet (198 meters) high, gives an extensive view of New York City and its harbor.

Orange manufactures calculating machines, pharmaceutical supplies, textiles, electrical supplies, radios, and roller bearings. During the mid-19th century Orange was a shoe-manufacturing center, and later the making of hats was its leading industry.

The area was settled by Connecticut colonists about 1666. Known as Mountain Plantations in 1678 when the town was founded, it later was renamed in honor of William of Orange, who became William III of England. It had an academy as early as 1785 and a public library by 1793. Once a part of Newark township, Orange was separated from it in 1806 and incorporated as a town in 1860 and as a city in 1872. Orange has a mayor-council form of government. Population: 31,136.

ORANGE, a city in southeastern Texas, the seat of Orange county. Situated on the Sabine River, 110 miles (175 km) east of Houston, it is a port of entry and an industrial center. Orange's industries produce petrochemicals and chemicals, rubber-polymer resins, ships, steel pipe, portland cement, and paper bags.

Orange's cultural institutions include a branch of Lamar University. The Stark Museum has a large collection of the art of the American West, and the Frances Ann Lutcher Theater serves as a center for the performing arts.

Orange was established in 1836 and incorporated in 1858. In the 19th century it was a port for ships transporting cotton on the Sabine River. It was a boom town during World Wars I and II because of its shipbuilding industry. Orange has a council-manager form of government. Population: 23,628.

ORANGE. One of the oldest of cultivated fruits, oranges are among the most popular of all fresh fruits and are by far the most important source of fresh, frozen, and canned juice.

Oranges grow on evergreen trees of the rue family (Rutaceae). The trees reach a height of about 30 feet (9 meters) and are symmetrical and upright. Like other citrus trees, they thrive in high temperatures and require abundant water. The broad, waxy, evergreen leaves remain on the tree for as long as three years. New leaves are produced several times per year, and the number of new leaf-growth cycles is greater in warm, wet climates. The white, waxy, fragrant flowers grow on mature leafy shoots, usually after a period of cool or dry weather. Flowering in most commercial orange-growing areas occurs in spring, after cold weather.

The orange fruit is a specialized type of berry known to botanists as a hesperidium. It has a soft, pithy central axis surrounded by 10 to 15 segments containing pulp and juice. Enclosing the segments is a rind that has a white, spongy inner part and a harder, orange-colored outer part. In the outer part are many glands that secrete an oil. The segment juice contains sugars; several organic acids (chiefly citric acid); many other components, which give it a distinctive flavor; and high amounts of vitamins A, B, and C. The fruit varies in number of seeds from none to many.

Three different fruits are commonly called oranges: the sweet oranges, the bitter or sour oranges, and some mandarins and mandarin hybrids such as tangors and tangelos. The mandarin group, although not true oranges, are the loose-peeled, easily segmented oranges of commerce, such as the tangerines. The sweet orange is considered to have originated in southern China, the bitter orange in India, and the mandarins in Indochina and southern China. The sweet and bitter oranges were taken to the Americas in the 1500's by the Spanish and Portuguese. The mandarin oranges arrived in the 1800's.

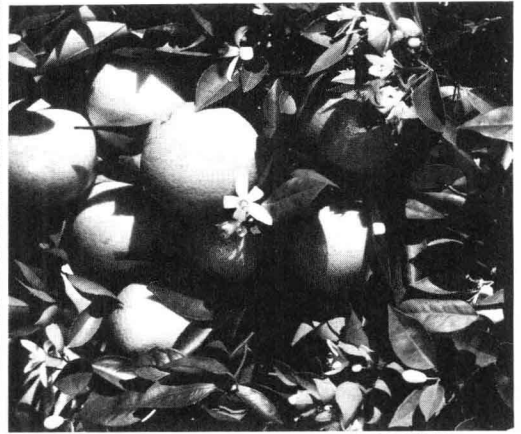
The United States produces 30% of the world's oranges, almost all for domestic consumption. Brazil produces about 34%, much of which is exported as orange-juice concentrate, and the Mediterranean basin about 28% of world production, mostly for shipment to northern Europe. Of the oranges grown in the United States, Florida produces 74%, California 21%, and Arizona and Texas the remainder. In Florida, 94% of the oranges are processed into orange-juice concentrate and other products. Other states sell most of their oranges as fresh fruit. Only a small proportion of U.S. oranges and orange products is exported.

World production of oranges is about 29 million metric tons and is exceeded in importance only by grape production. In the United States the sweet orange is the most important fruit, and production exceeds that of all noncitrus fruits combined.

Kinds of Oranges—Sweet. Sweet oranges (*Citrus sinensis*) are divided into three types: common, navel, and blood. All types have the characteristics that have made oranges popular: pleasing flavor with dessert quality; suitability for many uses, fresh or processed; and a choice of varieties available during a long marketing period. The common sweet orange is the most important. This group includes the widely planted, early, seedless variety Hamlin from



FLORIDA NEWS BUREAU DEPT. OF COMMERCE BY KARL HOLLAND



FLORIDA DEPT. OF CITRUS

(Left) Harvesting oranges in central Florida. Florida grows most of the United States' oranges and nearly all of its juice oranges. (Above) Flowers and fruit ready for picking can be found on the same orange tree—unlike apples, peaches, and other northern tree fruits.

Florida, ripening from October to January; the midseason, seedy Pineapple from Florida, ripening from December to February; and the Valencia, the late-maturing, seedless fruit that is the major variety in both Florida and California, ripening from February to June in Florida and from February to November in California.

Navel oranges are commercially important in California, Brazil, Israel, Spain, and many other countries. Few are produced in Florida because of climatic limitations. This group is characterized by a small second fruit imbedded in the end of the main fruit. The navel orange is seedless, somewhat less juicy than others, and of pleasing flavor. It is the California "winter" orange, harvested from November to May. The California fresh-orange industry, using the early navels and the Valencia, is able to ship fresh fruit during the entire year.

Blood oranges develop red coloring through the flesh and sometimes on the rind. For good color, they need cool weather during ripening. Blood oranges are important in the Mediterranean basin countries but a curiosity elsewhere.

Bitter. The bitter, or sour, orange (*C. aurantium*) has been in cultivation as long as the sweet orange and was introduced earlier to Europe, where it was esteemed for its acidity and greater tolerance of cold. Its chief present uses are for making marmalade from the whole fruit (in Europe), for oils from the rind, for perfume ingredients from the leaves and flowers, and as an ornamental tree in colder regions.

Mandarin Group. Traditionally classified as *C. reticulata*, the mandarins are now often divided into several species. The most important are the satsumas (*C. unshiu*), the principal oranges of Japan and central China; the Mediterranean or Willowleaf (*C. deliciosa*) of the Mediterranean and South American countries; and the common mandarins (*C. reticulata*), the major type in the United States. The common mandarins include

the Dancy and Clementine of California and the Dancy, Murcott, and Ponkan of Florida.

Mandarin hybrids are widely known and used. They include several natural tangors (mandarin \times sweet orange), such as the King orange, a distinctive, late fruit, often used in the gift-fruit trade in Florida, and the Temple orange, a favorite late-season fruit in Florida. Synthetic, or man-made, mandarin hybrids include tangelos (mandarin \times grapefruit), such as Orlando, Minneola, Robinson, Osceola, Lee, Nova, and Page, grown in Florida; the tangelos Fairchild, Fremont, and Fortune grown in California; and tangor varieties, such as Dweet. Breeding work with mandarin hybrids continues to produce new varieties with highly desirable characteristics such as more intense color, better flavor, easier peeling, and earliness or lateness of bearing.

Culture. The orange tree grows well in most subtropical and tropical climates. In very warm climates the tree grows profusely but produces only a few fruits of poor quality and color. In cold climates it is damaged by low temperatures. The ideal climate is warm in summer for good fruit growth and maturity but cold enough in winter to assure good flowering and fruit setting and in the fall to assure good fruit color and flavor. Preferably, the soil should be deep, well drained, and moderately fertile.

Orchard trees are propagated on seedling rootstocks of especially selected species or varieties. The top, or canopy, is an especially selected scion variety that is budded or grafted on the rootstock. Properly grown nursery trees (one or two years old) are planted in the orchard 15 to 25 feet (5–8 meters) apart in a row with 20 to 25 feet (6–8 meters) between rows in order to accommodate the passage of equipment such as sprayers, fertilizer distributors, and harvesting trucks.

When transplanted from nursery to orchard, usually in winter or early spring, the trees are

pruned and dug carefully to avoid root damage. Trees can be transplanted either "bare-root" (without soil around them) or with a ball of soil around them. The transplanted trees must be watered frequently if there is no rainfall, and weeds must be eliminated from around them, either with cultivating equipment or with chemicals. The young trees are fertilized sparingly but frequently with fertilizer elements not present in sufficient quantity in the soil.

Orange trees begin to produce at four to five years of age and continue for as long as 50 years. During productive years they require continual care, including control of weeds, insects, and disease; fertilization; irrigation; and protection from cold. Periodically, they require pruning to keep them in bounds and to open up the trees for more efficient use of equipment and better penetration of sunlight.

Chemical and biological control of insects, diseases, and weeds is practiced during the entire life of the orchard. This consists both of chemical spraying, when necessary, and of cultural practices that encourage the development of beneficial insects and diseases for "natural" (biological) control of pests. These practices help protect the health of the tree and produce unblemished, attractive fruit. Fruit that is to be processed requires less control because appearance is not important.

Most commercial citrus orchards are irrigated by various methods, depending on the soil type, the amount and quality of water available, and the amount of rainfall. Irrigation is a major cost in producing oranges, especially in dry areas like California and the Mediterranean countries.

Citrus orchards frequently are damaged by winter cold. Young trees commonly are banked with earth during the first three or four years of growth. The banks are removed in the spring. Later, various types of heaters and other devices are used to protect the trees and fruits during cold periods.

Harvesting and Marketing. As the orange matures, the content of sugars and juice increases and the percentage of acid decreases. When juice content is high enough and a suitable ratio of sugars and acids is reached, the fruit can be picked. In the United States federal and state laws establish suitable maturity standards. Oranges can remain unpicked on the tree for several weeks or months after reaching satisfactory maturity, which allows for orderly picking and marketing. Mature oranges are either pulled or clipped from the fruit stems by pickers equipped with ladders and picking bags. Machines are being developed to harvest oranges mechanically. The oranges then go either to a packinghouse for washing, drying, waxing, grading, sizing, and packing into boxes for shipment as fresh fruit, or to canneries for processing into canned juice or frozen juice concentrate. Fresh fruit in the packinghouse often is treated with ethylene gas, or colored with a dye, to improve the color, especially early in the harvest when color is poor.

When picked and handled carefully and treated with decay-preventing fungicides, oranges keep for weeks at ordinary temperatures and for months in cold storage.

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Further Reading: McPhee, John, *Oranges* (Farrar, Straus 1967).

ORANGE, House of, a noble house that originated in the area around Orange in what is now southern France. It endures today in the royal house of the Netherlands. The counts of Orange emerge in the 12th century as feudatories of the Holy Roman emperor rather than of the king of France. In the 13th century they assumed the title of prince. The Burgundian house of Chalon gained the principality through marriage in the 15th century.

When Philibert de Chalon, prince of Orange, died in 1530, his sister's son René succeeded to the title. René thus added the principality of Orange to the German and Dutch possessions of his father's family of Nassau-Dillenburg-Breda. Through him the title of prince of Orange passed to William the Silent, founder of the Dutch Republic, and in the 17th century to William III of England. For the history of the devolution of the title to the royal family of the Netherlands, see NASSAU, HOUSE OF.

ORANGE FREE STATE, or Oranje Vrystaat in the Afrikaans language, the second smallest of the four provinces of the Republic of South Africa (RSA). The provincial capital, Bloemfontein, is the judicial capital of the RSA insofar as the highest court, the Appellate Division, is established there by constitutional law.

The Land. The province covers only one tenth of the area of South Africa—or 49,645 square miles (128,580 sq km)—but forms the geographic heart of the country. The northern border is the Vaal River, which separates the province from the Transvaal; on the east the Drakensberg range and Lesotho divide the Free State from Natal; southward across the Orange River and to the west is the Cape Province.

The Orange Free State (OFS) lies within the elevated inland plateau of South Africa, and throughout the region the generally flat landscape is interspersed with flat-topped hills called kopjes, or koppies. The lowest elevation, 4,000 feet (1,220 meters), occurs in the southwestern corner, near the confluence of the Vaal and Orange rivers. In the east is a small mountainous area where the boundaries of the Free State, Natal, and Lesotho meet on top of Mont-aux-Sources in the Drakensberg.

The elevation of the inland plateau moderates the summer heat, but winters are cold, with frost throughout the province. The high-lying border region between the OFS and Natal gets the sharpest winter cold in South Africa.

The average annual rainfall varies from about 33.5 inches (850 mm) in the northeast to some 15 inches (380 mm) in the southwest. Approximately 60% of the province receives more than 20 inches (500 mm) per year. Rainfall is almost exclusively in the form of thunderstorms, which occur mainly in summer, from October to March. Sunshine is abundant, failing in Bloemfontein only about six days a year.

The People. The three main population groups are officially designated as Black, Coloured, and White. In 1981 the province had 1,931,860 people—Blacks, 1,549,600; Whites, 326,220; and Coloureds, 56,040. The OFS is the only province of the republic in which Asians are prohibited by law from settling permanently.

Among the Whites, 84% are Afrikaners and 13% are English-speaking South Africans. About 60% of the Blacks belong to the Southern Sotho ethnic group, and the remainder to the Zulu,

Xhosa, and Tswana groups. The two self-governing Black areas—Thaba 'Nchu (part of Bophuthatswana) and Qwaqwa—amount to 0.5% of the total area of the province.

The University of the Orange Free State, in Bloemfontein, has nine faculties (schools) and more than 8,000 students. A nonresidential university for Blacks is located in Botchabela township, Bloemfontein. Almost 85% of Blacks between 7 and 20 years old can read and write. The Black literacy rate has risen considerably higher than levels outside the RSA.

For lovers of opera, ballet, music, and drama, the Performing Arts Council of the Orange Free State (PACOFs) presents a wide variety of performances each year. Important museums are located in Bloemfontein, including the War Museum, the National Museum, the National Afrikaans Literary Museum and Research Center, and the Military Museum.

The Economy. The Free State is the RSA's largest grain producer, accounting for 51% of the national wheat crop, 40% of the maize, and 30% of the grain sorghum. It supplies 38% of the sunflower seed. In the Ficksburg district are the orchards of the largest commercial cherry grower in the Southern Hemisphere.

Free State farmers own 31% of the country's sheep and produce 24% of its wool. Cattle raising is important in the northwest.

The main mineral products of the Free State are gold, diamonds, uranium, coal, silver, bentonite, salt, pyrites, limestone, and gypsum. South Africa is a leading world source of the first three of these. The province accounts for more than a quarter of national gold production, or about 200 metric tons of gold per year. Its diamonds are of very high quality, in 1980 realizing approximately 146 rands per carat as against the national average of 65 rands per carat. The Free State contains 97% of the country's uranium mines.

Although the province still is predominantly rural in character, it has more than 700 factories in such lines as food, metal products, building materials, farm machinery, fuels, and chemicals. The chief industrial center is Bloemfontein, whose railway yards—the largest in the republic—employ more than 12,000 people. Sasolburg is the focal point of fuel and chemical production. Other manufacturing centers are Welkom, Kroonstad, Harrismith, Bethlehem, and Parys. Private-sector industrial employment is made up of 70% Blacks, 26% Whites, and 4% Coloureds.

History. The region between the Orange and Vaal rivers was first called the Transgariëp or Transoranje when various population groups moved into this largely uninhabited area between 1800 and 1820. Barolong and Basotho tribes from the northeast and Griquas, Koranas, and White farmers from the west all arrived at about the same time. The first settlement was Philippolis, where a mission station for the native Bushmen was established in 1823. Maj. Henry Douglas Warden was appointed as British resident at Bloemfontein in 1846 with a garrison to maintain peace between the Whites and Blacks. On Feb. 3, 1848, the governor of the Cape, Sir Harry Smith, declared the region between the Orange and Vaal rivers British territory (the Orange River Sovereignty) and subsequently defeated Gen. A. W. J. Pretorius, who resisted the annexation on behalf of the Boers

(Afrikaners). But after Warden's defeat by the Basotho in 1851, the British government relinquished its sovereignty, and on Feb. 23, 1854, at the Bloemfontein Convention, the Republic of the Orange Free State came into being.

The first matter that required attention was the institution of a permanent central governing body. An elective assembly of representatives was called to draft a constitution. With the assistance of a few foreigners this group of untutored farmers succeeded in formulating their democratic aspirations in constitutional terms, following the French constitution of 1848 with a few modifications based on the American constitution. Legislative power was vested in a freely elected Volksraad (people's council) whose members were chosen from the field-cornetcies and principal towns.

The first three presidents, J. P. Hoffman (1854–1855), J. H. Boshof (1855–1859), and M. W. Pretorius (1859–1863), tried in vain to end Basotho raids. Two Basotho Wars took place during the presidency of J. H. Brand (1864–1888), who succeeded in terminating the Basotho problem in 1869 with the Second Treaty of Aliwal North. The treaty determined the final Free State–Lesotho border, although it is still contested by the Lesotho government. Under Brand's exceptional leadership the pioneer republic became a "model state."

The last years of republican government were under "poet president" F. W. Reitz (1889–1895) and President M. T. Steyn (1896–1902). A trade and friendship agreement was concluded with the Cape Colony in 1889, and a defensive alliance was formed with the South African (Transvaal) Republic in 1897. Meanwhile, in 1890 the first train had steamed into Bloemfontein. The imposing Fourth Raadzaal (House of Assembly) Building, completed in 1893, symbolized the progress of the government and administration of the republic.

After the failure of the Bloemfontein Conference in June 1899, war broke out between Britain and the two Afrikaner republics. During the Anglo-Boer war, Steyn played a key military role, and the Free State general C. R. De Wet attained world renown for his guerrilla tactics. In the end, however, the republics were no match for the superior British forces. On March 13, 1900, Lord Robert occupied Bloemfontein, and in May 1900, Britain proclaimed its annexation of the Orange Free State as the Orange River Colony. The two republics continued their heroic fight for two more years, winning the admiration of the world. They lost their independence on May 31, 1902, with the signature of the Peace Treaty of Vereeniging.

The war had stimulated the national consciousness of the people of the Free State. In May 1906 the Orangia Unie political party was founded at the initiative of Gen. J. B. M. Hertzog, Abraham Fischer, and General De Wet. In June 1907 the colony received responsible government, and on May 31, 1910, it became the Orange Free State province of the Union of South Africa. When the Union became the Republic of South Africa in 1961, the province remained unchanged in form and administration.

Significant events occurred in Bloemfontein after 1910. The South African party was founded in Ramblers Hall in 1911 under the leadership of Gen. Louis Botha. Early in 1914, General Her-

tzog, inspired by the republican idea, founded the National party in the same hall in opposition to Botha's party. Various cultural organizations originated in Bloemfontein, such as the South African Academy of Science and Art (1909), the Association of Afrikaans Cultural Activities in 1929, the Voortrekker (pioneer) youth movement in 1931, and the Reddingsdaadbond (a movement to help Afrikaners gain their rightful place in the national economy) in 1938.

Government. The Orange Free State is governed by an appointed administrator, an elected council, and an executive committee chosen by the council. The provincial council has legislative responsibility for education, hospital services, roads and bridges, traffic regulations, markets, and fish and game conservation.

Blacks are administered by boards that deal with matters affecting the interests of Blacks who are residents in white areas. Black homeland authorities have special representatives on these boards.

J. C. MOLL

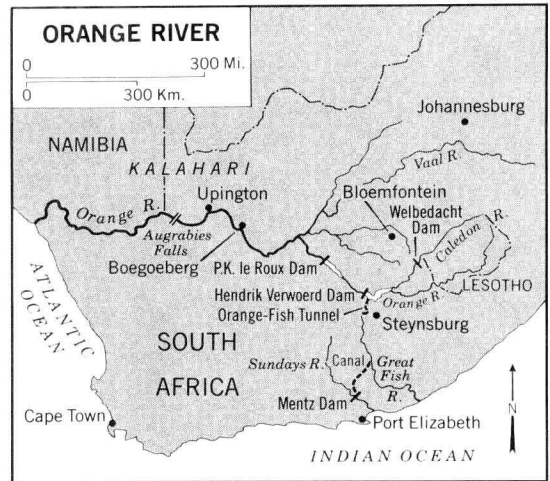
University of the Orange Free State

ORANGE RIVER, the chief river of South Africa. Rising in the Drakensberg range within Lesotho, it flows westward in South Africa and on the Namibian border through increasingly drier country to the Atlantic Ocean. The Orange follows a course of 1,400 miles (2,250 km), but the distance from source to mouth measured along its principal tributary, the Vaal, is 1,550 miles (2,480 km). Neither river is navigable.

The Basin. The Orange River basin, excluding that of the Vaal, covers at least 130,000 square miles (336,700 sq km). Estimates vary because the northern boundary is indefinite where the basin borders areas of subsurface drainage and of windblown sands from the Kalahari dryland. The upper Orange, above the Vaal, is marked by many rapids and receives the only other major tributary, the Caledon. Below the Vaal, as far downstream as Upington, the river passes through several rocky gorges alternating with open valleys. At Augrabies Falls, below Upington, the Orange drops 80 feet (24 meters) in rapids and 400 feet (122 meters) in an almost sheer fall, followed by a cataract plunging 140 feet (43 meters). Finally the river reaches the desolate coastal plain 60 miles (95 km) from its mouth.

Over its last 800 miles (1,280 km), the Orange loses more water by evaporation than it receives, so that in the dry season it discharges little water into the sea. Farming in the basin depends on irrigation, but until the 1970's only a tenth of the land for which the river could supply water was irrigated—chiefly the one long stretch of floodplains, between Boegoeberg and Augrabies Falls. Construction of two large storage dams on the upper Orange makes it possible to irrigate the full potential of 568,000 acres (230,000 hectares), mostly higher land away from the river channel.

The Orange River Project. Two concrete arch dams are the key elements of the 30-year Orange River Project, authorized in 1962 and representing the largest water development scheme in South Africa. The dams regulate 97% of the surface runoff in the Orange River catchment area. Hendrik Verwoerd Dam (1972), one of the largest in Africa, stores sufficient water for the whole project in a lake 3 miles wide and 44 miles long (5 by 70 km). It releases water to P. K. le Roux



Dam (1977) for distribution to irrigation canals. Both dams have hydroelectric stations, which together can supply 540 megawatts of power to meet peak and emergency demands. The Welbedacht gravity dam (1974) on the Caledon River provides water to Bloemfontein for urban and industrial use.

A major feature of the Orange River Project is the transfer of water from the Orange to the Fish and Sundays basins on the other side of the continental divide. The diversion was made in order to revitalize irrigation in those productive valleys and to supply water to Port Elizabeth. The 52-mile (83-km) Orange-Fish Tunnel (1975) runs from the reservoir of Hendrik Verwoerd Dam to the Fish River system. From the Great Fish River, canals and a tunnel cross the Fish-Sundays watershed to the reservoir of Mentz Dam, on the lower Sundays River.

ORANGEMEN, members of the Loyal Orange Association, which takes its name from King William III of England, the prince of Orange. The society was founded in 1795 by Protestants in Ireland to foster loyalty to Britain and support the Protestant succession to the English throne.

The organization recruited its membership in the late 18th and early 19th centuries largely among the Protestants of Ulster, and founded lodges in England and Scotland as well. In the 19th century many thousands of Ulster Protestants emigrated to the United States and Canada, where branches of the Orange Association were established. Lodges were also organized in Australia and New Zealand in the 19th century.

Requirements for membership vary. The Loyal Orange Association of British America, for example, with headquarters in Toronto, requires new members to be at least 18 years old and to profess Protestantism and loyalty to the British crown, the English language, and public education. There are also associated organizations for women and boys.

Most Orangemen societies observe July 12 as an annual holiday, commemorating the anniversary of the Battle of the Boyne, in Ireland, where in 1690 the forces of the deposed King James II, a Roman Catholic, were defeated by his successor, William of Orange. Orangemen in Northern Ireland and elsewhere often parade on that day, wearing orange insignia and sashes.



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Orangutan mother and baby. The young orangutan will spend its first few years of life close to its mother.

ORANGEROOT. See GOLDEN SEAL.

ORANGEVALE, an unincorporated community in north central California, in Sacramento county. It is a residential suburb of Sacramento, which is situated about 15 miles (24 km) to the southwest.

Orangevale lies between the Sierra Nevada and the Coast mountain ranges in the fertile Central Valley, an important agricultural region that produces fruits, cereal grains, and vegetables. McClellan Air Force Base is about 8 miles (13 km) to the southwest. Population: 20,585.

ORANGUTAN, ə-rang'ə-tan, a large, tree-living great ape of southeastern Asia. Its name means "person of the forest in Malay," and except for gorillas and chimpanzees it is the closest living relative to humans.

Orangutans live in forests of north Sumatra and Borneo. In Borneo they are most common in eastern forests of Sabah, Malaysia, and in the eastern and southern forests of Kalimantan, Indonesia. Formerly common in the Kuching River basin of Sarawak, they have been hunted out and displaced by humans there in the last 100 years. The restricted distribution of orangutans is partly a consequence of hunting by humans and expansion of agriculture, but it may also be a consequence of more complex changes in the ecology of tropical forests of southeastern Asia in the past million years.

Physical Characteristics. Orangutans usually have a head-body length of about 4 to 5 feet (1–2

meters). Adult females reach a weight of 65 to 110 pounds (30–50 kg); males, 175 to 220 pounds (80–100 kg). The body of an orangutan is covered with long red hair. From birth to three or four years of age, white rings surround the eyes, but these disappear, leaving the bare skin of the face generally dark brown like that of the hands and feet. Large cheek pads grow outward behind the eyes of adult males, and a large throat sack develops. At maturity the throat sack is often inflated to act as a resonator for the male's *long call*, a startling roar like that of a male lion.

All orangutans share a skeletal form closely adapted to life in the forest canopy. They have unusually long arms, with long and markedly curved fingers. Their relatively short legs attach at extremely mobile hip joints and end in feet that function as a second set of hands. In the forest canopy they progress by quadrumanal ("four handed") clambering, moving with all four hands on top of large limbs, dropping below to swing from smaller limbs, and turning to spur-of-the-moment grasping among less stable smaller branches. At a gap in the canopy an orangutan stops and rhythmically swings the tree until its arc moves the animal within reach of the next tree. To move longer distances, males—unlike females—often descend to the ground. There the male often uses a "crutch walk," in which he moves by planting both fists on the ground and swinging his legs forward between the arms.

Behavior. Orangutans live in populations of about 2 to 10 animals per square mile (1–4 per sq km). Unlike any other species of monkey or ape, orangutans are solitary animals. Adult males and adult females with dependent young use overlapping but distinct home ranges of 0.2 to 2 square miles (0.5–5 sq km) in area. Subadult males and some adult males wander nomadically. During a day an orangutan travels 0.25 to 0.5 mile (0.4–0.8 km) and spends about half its waking time feeding. Its diet includes about 60% fruit, 20% leaves, 18% bark, and 2% insects. At night orangutans, like chimpanzees and gorillas, construct sleeping nests by breaking branches and weaving them roughly together. Predators, with the possible exception of humans, appear to have little influence on them.

Adult orangutans seldom meet. They may encounter each other in food trees, and females, probably guided by the long calls, seek out adult males for mating once every three or more years. An infant spends its first three or four years close to its mother. At the birth of the next infant, the mother aggressively rejects the older one when it tries to climb on her or to sleep with her. The older one follows the mother during the day, but sleeps alone and gradually spends more nights away from her. At sexual maturity, a young female occupies a home range overlapping her mother's. A young male leaves its mother's range and wanders farther, first joining other juveniles but later attempting to follow adult females. At maturity the young male may begin to challenge other adult males for sexually receptive females.

Classification. The orangutan (*Pongo pygmaeus*) belongs to the family Pongidae, which it shares with the gorillas and chimpanzees of Africa, and to the superfamily Hominoidea, which it shares with the African apes, gibbons, and humans.

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