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Tiranë, Italian *TIRANA*, capital of Albania and of Rrethi i Tiranës (Tiranë district); it lies 17 mi (27 km) from the Adriatic coast on the Ishm River, at the end of a fertile plain. It was founded in the early 17th century by a Turkish general, Barkinzade Süleyman Paşa, and was first called Teheran. It was chosen capital of Albania in 1920 by a congress of patriots at Lushnje. Under King Zog I (reigned 1928–39), Italian architects were employed to re-plan the city. The focus is Skanderbeg Square, whose Etehem Bey Mosque (1819) is now flanked by the Soviet-built House of Culture. Nearby is the state university. The old city stretches to the east and north of the main square, and features alehouses and old architecture. The newer, western portions lack distinction.

Following the successive Italian and German occupations (1939–44), a Communist People's Republic was proclaimed in Tiranë on Jan. 11, 1946. After World War II, the city expanded considerably with Soviet and Chinese assistance. Hydroelectric power was installed in 1950, and Tiranë ranks now as the nation's largest city and main industrial centre, with metal working and the manufacture of textiles, cigarettes, wood products, shoes, butter, and cheese. Coal mines operate nearby and there are rail connections to Durrës, Laç, and Elbasan. Tiranë has four museums, a national institute of folklore, a national theatre, and a concert hall. In 1969, on the 23rd anniversary of the People's Republic, a large statue of Skanderbeg (Gjergj Kastrioti, the Albanian national hero) was unveiled on Skanderbeg Square. The inhabitants of Tiranë are mostly Muslim. There is an international airport. Pop. (1970 est.) city, 171,300; district, 254,000.

41°20' N, 19°50' E

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·province area and population 1:419f; table

Tirap River Valley, Arunachal Pradesh, India.

Tiraqueau, André, 16th-century French Humanist.

·Rabelais's friendship 15:345g

Tiraspol, city, Moldavian Soviet Socialist Republic, on the Dnestr River and the Odessa–Kishinyov railway. It was founded in 1792 alongside a fortress built in 1792. Although the centre of an agricultural area, it is well industrialized, producing wines, spirits, foodstuffs, textiles, carpets, glass, furniture, and electrical equipment; it also has a teacher training institute. Pop. (1970) 105,700.

46°51' N, 29°38' E

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tirth, places of Hindu pilgrimage.

·Ganges River and Hindu pilgrimages 7:881c

Tirath Rama (Hindu religious leader): see Ramatirtha.

Tircis et Doristée, opera by Christoph Gluck, first performed in 1756.

·vaudeville comedies in Vienna 8:213a

tire, vehicle, air-filled, rubber-and-fabric cushion that fits snugly to the rim of a wheel and produces traction while acting as a shock absorber.

The first patent for a pneumatic tire, taken out by Robert William Thomson in England in 1845, showed a nonstretchable outer cover and an inner tube of rubber to hold air. Although a set of Thomson's "Aerial Wheels" ran for 1,200 miles on an English brougham, the same inventor's solid-rubber tires were

more popular; and thus, for almost half a century, air-filled tires were forgotten. The growing popularity of the bicycle in the latter half of the 19th century revived interest in tire design, and in 1888 John Boyd Dunlop, a veterinary surgeon of Belfast, obtained patents on a pneumatic tire for bicycles. Pneumatic tires were first applied to motor vehicles by the French rubber manufacturer Michelin & Cie. For over 60 years, pneumatic tires had inner tubes to contain the compressed air and outer casings to protect the inner tubes and provide traction. Since the 1950s, however, puncture-sealing, tubeless tires have been standard equipment on most new automobiles.

In the early 1970s there were three main types of tubeless tires: the conventional bias-ply, the belted bias-ply, and the belted radial-ply. The ply of a tire refers to the way in which the cords in the inner carcass or foundation structure are laid. As shown in the illustration, the cords in a bias-ply tire are laid at an angle of about 55 degrees to the wheel axle, and the cords in successive layers (two or four) cross one another; in a radial-ply tire, the cords run parallel to the axle. The cords in conventional and "old-style" bias-ply tires are either rubberized fabric or, as in the other two types, nylon, rayon, or polyester. In the bias-ply belted tires, the belts, which encircle the tire between the tread and the plies, are fibre-glass, whereas the radial-ply belted tires have steel wire-mesh belts.

Belted-bias tires are more expensive than conventional tires, but they are reputed to give about 20 percent longer tread life, to have better resistance to blowouts, to reduce stopping distance in braking, and to provide increased gasoline mileage. Although their use required minor adjustments by automobile manufacturers, in the early 1970s they were increasingly supplanting the older type in the United States, while in Europe radial tires were already standard equipment. Radial tires provide better steering characteristics and less rolling resistance than the bias-ply tires, tend to run cooler, are safer in bad weather, and are said to give considerably more mileage.

They are more expensive than bias-ply tires, but slightly harder riding, and require less substantial maintenance and suspension systems on the wheels on which they are used. Snow tires having an extra-tough tread, and reputed to have 50 percent more pulling ability than regular tires on loose-packed snow and nearly 100 percent more on bare ice. In stopping, they are better than snow tires have no advantage over regular tires; tire chains or studded tires are best for ice sur-

face driving. Studded tires usually have about 100 studs tipped with tungsten carbide which contact the road as the tire rotates. Because of the damage they are said to cause road surfaces, they are prohibited in certain localities. Research and development in the early 1970s aimed at a stud tire that would meet this objection.

·automobile design and construction 2:525d

·bicycle tire types 2:982a

·scrap rubber disposal 14:754h

·truck and bus tires 18:722h

Tiree, also called TYREE, most westerly island of the Inner Hebrides Atlantic group, county of Argyll, Scotland, situated 15 mi (24 km) west of Mull and 50 mi west of Oban, from which it is reached by a thrice-weekly steamer. The island, 12 mi (19 km) long by ½ to 6 mi broad, is low, 460 ft (140 m) being the highest point, windswept and treeless but fertile. Its name derives from *tireth* ("land of the

corn") for in the days of the 6th-century Celtic missionary and abbot St. Columba Tiree provided the monastic community of Iona with grain. Today crofting (subsistence tenant farming), cattle raising, and fishing are more important than grain; and the mild climate, long hours of sunshine, and fertile sandy soil (machair) have resulted in the successful cultivation of tulip and daffodil bulbs. Other occupations include tourism and the mining of marble. Pop. (1971 prelim.) Tiree and Coll, 1,054.

56°31' N, 6°49' W

·map, United Kingdom 18:866

·Scottish coastal temperatures 16:405b

Tirel, Guillaume, also called TAILLEVENT (1326–95), French chef.

·culinary flavour-obscuring devices 7:940g

Tiresias, in Greek mythology, a blind Theban seer. In the *Odyssey* he retained his prophetic gifts even in the underworld, where the hero Odysseus was sent to consult him. At Thebes he played an active part in the tragic events concerning Laius, the king of Thebes, and his son Oedipus (*q.v.*). Later legend told that he lived for seven (or nine) generations, dying after the expedition of the Seven Against Thebes (*q.v.*), and that he had once been turned into a woman as the result of killing the female of two coupling snakes; on killing the male he regained his own sex. His blindness was variously explained. One theory was that it was a punishment for revealing the secrets of the gods, which he had learned from his mother, the nymph Chariclo. Another theory was that he enraged Hera, who had contended to her husband, Zeus, that women had less pleasure in love than men, by telling her that love gave women ten times more pleasure than it gave men. Hera thereupon struck him blind, but Zeus gave him the gift of prophecy. A third explanation was that Tiresias was blinded by Athena because he had watched her undressing to bathe.

The figure of Tiresias recurs in European literature, both as prophet and as man-woman, as in Guillaume Apollinaire's surrealist play *Les Mamelles de Tirésias* (first performed 1917) and T.S. Eliot's *The Waste Land* (1922).

·mythical sexual transformation 8:405g

Tirgoviste, capital, Dimbovița district (*județ*), south central Romania. It is situated on the Ialomița River, on the southeast-facing slopes of the southern Carpathians, 47 miles (75 km) northwest of Bucharest. The former capital of Walachia (from the 14th to the 17th century), it contains several monuments—the 16th-century Prince's Church, within the precincts of the Prince's Court (15th century); the 16th-century watch tower, and a 17th-century church founded by Vasile Lupu. The town has become a centre of the oil industry with a refinery, an oilfield-equipment works, and many new residential buildings. Pop. (1970 est.) 33,359.

44°56' N, 25°27' E

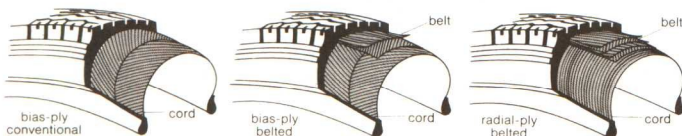
·map, Romania 15:1048

Tirgu Jiu, capital of Gorj district (*județ*), southwestern Romania, on the Jiu River. Although a market settlement of only local importance until after World War II, Tirgu Jiu has become a rapidly developing industrial centre—producing timber, clothing, cigarettes, and foodstuffs—in the southern part of the Petroșeni depression. There are open-cut coal mining operations in the area and recent oil drillings in a new field south of the town.

The valley of the Jiu was a scene of heavy fighting in World Wars I and II, especially in 1916. In the town park is a monument to Romanian heroes of World War I by the sculptor Constantin Brancusi. Pop. (1970 est.) 42,935.

45°02' N, 23°17' E

·map, Romania 15:1048



Basic types of automobile tire

From Consumer Reports Buying Guide Issue 1972, by permission

Tirgu Mureş, capital, Mureş district (*județ*), central Romania, northwest of Bucharest. It is in the valley of the Mureş River, in the southeast of the Transylvanian Plain. First mentioned in the 14th century, it was a cattle and crop market town called Neumarkt by the Germans, Agropolis by Greek traders, and Marosvásárhely by the Magyars. In the 15th century it had 30 guilds. The city's greatest growth has been in the 20th century. It now has a sugar refinery, a nitrogenous fertilizer works using natural-gas by-products, and factories producing furniture, clothing, leather goods, and processed foods. New residential districts at Oancea and Merişani contrast with surviving old buildings.



The Roses' Square in Tirgu Mureş, Romania
By courtesy of Editura Enciclopedica Romana

Tirgu Mureş is also an important cultural centre in the heart of the Magyar and German minority area and was the administrative capital of the former Mureş Magyar Autonomous Region. There is a state theatre with Magyar and Romanian sections, a Szekler song and dance ensemble, a theatre institute, teacher-training college, and medical-pharmaceutical institute.

The Teleki Documentary Library, founded at the end of the 18th century by Count Samuel Teleki, chancellor of Transylvania, contains a large collection with first editions and rarities and important manuscripts documenting Transylvanian history. The Palace of Culture houses many activities; its stained-glass windows depict historical scenes. The 18th- and 19th-century mathematician Farkas Bolyai lived in Tirgu Mureş, and his son János Bolyai was born there. The Bolyai scientific library and museum was opened in 1955. Pop. (1980 est.) 134,287.

46°33' N, 24°33' E

·map, Romania 15:1049

Tirgu Neamţ, town, in northern Neamţ district (*județ*), Romania, in the Neamţul River Valley. It has long been a local market centre and a major focus of culture in Moldavia. West of the town is Neamţ Monastery, founded by Stephen (Ștefan) the Great in 1497. On the north bank of the Neamţul stands the Fortress of Neamţ, founded in the late 14th century and now a national historical monument. To the west, Agapia Monastery, founded in 1585, stands close to a newer monastery, built in the early 17th century. There are murals there by the painter Nicolae Grigorescu. Pop. (1980 est.) 16,224.

47°12' N, 26°22' E

·map, Romania 15:1049

Tirhaka (Egyptian king): see Taharqa.

Tirhut, former division, Bihār state, northeastern India. Its area (12,591 sq mi [32,611 sq km]) comprised Champaran, Darbhanga, Muzaffarpur, and Saran districts. The division consisted of vast alluvial plains of the Ganges River, bordered by Himalayan foothills and Nepal (north).

Tirhutia dialect: see Bihari language.

Tirich Mir, highest peak (25,263 ft [7,700 m]) in the Hindu Kush mountain system, lies 155 mi (249 km) north of Peshāwar, Pak., in the Northwest Frontier Province near Afghanistan. The first ascent of the mountain was made by Norwegians in July 1950.

36°15' N, 71°50' E

·map, Pakistan 13:893

·mountaineering record and data table 12:585

Tiridates (fl. 1st century AD), Arsacid king of Armenia. He was officially crowned in AD 66 by the Roman emperor Nero.

·Parthian compromise with Rome 9:845b

Tiridates II, also called KHOSROW THE GREAT or KHOSROW I (ruled AD 217–c. 238), Arsacid king of Armenia whose sovereignty was recognized by the Romans after they had unsuccessfully tried to annex the country. Tiridates II's resistance to Sāsānian Persia ended in his assassination by a Persian agent.

·Sāsānid rule resistance 18:1041g

Tiridates II, Parthian TRDAT II (fl. late 1st century BC), an Arsacid prince of the Parthian Empire who revolted against King Phraates IV and drove him into exile (32 BC) among the Scythians. The next year Phraates returned, and Tiridates fled to Rome, taking Phraates' son as hostage. The Roman emperor Augustus returned the son, but not Tiridates, to Phraates. In the spring of 26 Tiridates launched an unsuccessful invasion of Mesopotamia, and he may have returned to Mesopotamia early in 25; but by May of that year Phraates seems to have regained power. Augustus, preoccupied with Spanish affairs, had no more use for Tiridates.

·Parthian wars with Rome 9:844c

Tiridates III, Parthian TRDAT III (238–314), Arsacid king of Armenia who brought Christianity to his kingdom. His father, the Parthian king Tiridates II (ruled 217–c. 238), was overthrown by the Sāsānians of Persia. With the aid of the Roman emperor Diocletian, Tiridates III regained the throne in about 287. His early reign was marked by the persecution of Christians, but after his conversion (c. 301) by St. Gregory the Illuminator, Tiridates declared Christianity the official religion of Armenia.

·Eastern Christianity in Armenia 6:139d

Tiridates III, Parthian TRDAT III (fl. early 1st century AD), grandson of the Parthian king Phraates IV and an unsuccessful contender for the Parthian throne.

·role in Parthian history 9:844h

Tirmidhi, at-, in full ABŪ 'ISĀ MUHAMMAD IBN 'ISĀ IBN SAWRAH IBN SHADDĀD AT-TIRMIDHĪ (d. c. 892), Arab scholar and author of one of the six canonical collections of traditions (*ḥadīth*).

His *al-Jāmi 'as-ṣaḥīḥ* ("The Sound Collections") includes every *ḥadīth* that had ever been used to support a legal decision. While it is shorter than the compilations of al-Bukhārī and Muslim, it has the virtue of avoiding repetition; the author's critical remarks on the links in the chains of transmission (*isnāds*) are of special interest.

In the *Kitāb ash-shamā'il* ("Book of Good Qualities"), at-Tirmidhi presented those *ḥadīths* specifically commenting on the character and life of Muḥammad.

Tirnovo (Bulgaria): see Veliko Tŭrnovo.

Tiro, Marcus Tullius, 1st-century-BC Roman inventor of shorthand.

·shorthand system invention 16:709b

Tiro, Prosper: see Prosper of Aquitaine, Saint.

Tirol, or TYROL, *Bundesland* (federal state), western Austria, consisting of North Tirol (Nordtirol) and East Tirol (Osttirol), bounded by West Germany (north), by the states of Salzburg and Kärnten (Carinthia) east, by Vorarlberg (west), and by Italy (south). Tirol (area 4,883 sq mi [12,647 sq km]) is wholly Al-

pine in character. North Tirol is traversed from southwest to northeast by the Inn River, and East Tirol is drained by the Drava (Drau) River. The Lechtaler Alps lie between the Lech and the Inn rivers in the northwest, while the rugged and barren Karwendel and Kaiser ranges of the Limestone Alps extend across the north and northeast. The Silvretta, Ötztaler, Stubai, Tuxer, Zillertaler, and Hohe Tauern ranges of the Central Alps extend across the southern part of the state. Although the loftiest peak in the Austrian Tirol, the Wildspitze (12,382 ft [3,774 m]), is in the Ötztaler Alps and its highest parts are covered by glaciers, the Central Alps generally are less rugged than the Limestone Alps and much of their original wood cover has been cleared for pasture. Their terrain is ideal for skiing. In the eastern part of North Tirol are the slate mountains of the Kitzbühler Alps, and the Lienz Dolomites rise in East Tirol. The mountain groups are separated by the Inn Valley and by lower stretches and passes, the most important of which are the Arlberg Pass in the west and the Brenner in the south.

Population distribution is uneven, with the highest concentrations in the Inn and Drava valleys. The principal towns are Innsbruck (the capital), Kufstein, Lienz, and Solbad Hall (*qq.v.*). The largely rural population is engaged primarily in pasture farming, cattle and livestock raising, dairy farming, and forestry. Wheat and rye are grown in the Inn Valley. There is some mining (salt, copper, magnesite), and most of the industries are small and highly specialized enterprises, some of long tradition, such as the textile mills of Innsbruck. Since World War II, chemical, pharmaceutical, and electrotechnical industries have been developed. Alpine health and winter-sports resorts support a vigorous tourist trade. Most road and rail traffic follows the Inn Valley, the Brenner Pass road, and the Drava Valley. Pop. (1981 prelim.) 586,297.

·geography and population 2:441f; table 444

·map, Austria 2:443

Tirol, history of. Tirol originated as a family name, derived from a castle near Merano, now in Italy. By AD 1150 scions of the family were counts and bailiwicks (land agents) for the bishops of Trent. In 1248 the counts of Tirol acquired extensive lands from the bishop of Brixen (Bressanone, Italy) and by 1271 had practically replaced the ecclesiastical power in the area. In 1342 the Holy Roman emperor Louis IV the Bavarian married Margaret Maultasch (Margaret of Carinthia), heiress to the Tirol, to his son after declaring her marriage to a member of the House of Luxembourg null. In 1363, however, Margaret's death left the Tirol, by previous arrangement, to the Habsburgs, who retained it until 1918. At first the Tirol was held by a junior branch, but it was united with the main Austrian possessions in 1665. Independent-minded Tirolese rose in 1525, when Protestantism was strong there, and again in 1809, when French and Bavarian rule proved irksome. The Counter-Reformation effectively Catholicized the Tirol after the first incident. In 1617 the area's strategic importance in linking Italy and Germany made it a bargaining counter between the Austrian archduke Ferdinand (later Holy Roman emperor as Ferdinand II), who wanted the imperial crown, and his cousin and potential rival, Philip III of Spain, who received the Tirol in return for standing down.

After World War I, Italy obtained the southern Tirol, with its sizable German-speaking majority, and retained it after World War II, despite objections by Austria.

·folk culture patterns 1:628b

·Metternich's recreation of ancient diet 12:64b

·Renaissance literary tradition 10:1144b

·Slavic and Germanic expansion 2:450a

TIROS, acronym for TELEVISION AND INFRA-RED OBSERVATION SATELLITE, U.S. meteorological satellite first launched on April 1, 1960.

·weather forecasting use 17:372c; table 364

Tirpitz, Alfred von 18:437 (b. March 19, 1849, Küstrin, Prussia, now Kostrzyn, Pol.—d. March 6, 1930, Ebenhausen, now in West Germany), admiral and politician who exerted a dominant influence on German foreign policy before World War I and created the formidable German high seas fleet.

Abstract of text biography. A Prussian (afterward imperial German) naval officer from 1869, Tirpitz, as cruiser squadron commander in East Asia, chose Tsingtao, on the Shantung Peninsula, as the German naval base in China (1897). As secretary of state in the Imperial Navy Department (1897–1916) he built up the high seas fleet as a rival to the British Royal Navy, at that time the greatest seagoing force in the world. After leaving office, he was active in conservative politics.

REFERENCES in other text articles:

- German battle fleet creation 17:732f
- German naval expansion 19:828b
- naval race with Britain 8:114d

Tirreno, Mare (Mediterranean Sea): see Tyrrhenian Sea.

Tirso de Molina, pseudonym of GABRIEL TÉLLEZ (b. c. 1584, Madrid—d. 1648), one of the outstanding dramatists of the Spanish Golden Age. He studied at the University of Alcalá and in 1601 was professed in the Mercedarian Order. As the order's official historian he wrote *Historia general de orden de la Merced*. He was also a theologian of repute. Guided to drama by an inborn sense of the theatrical and inspired by the achievements of Lope de Vega (1562–1635), creator of the Spanish *comedia*, he built on the foundations that Lope had laid down for the Spanish theatre, writing to the “free-and-easy” prescriptions that Lope had propounded for dramatic construction. Sometimes he accentuated the religious and philosophical aspects that attracted his theological interest; at other times he drew on his own topographical and historical knowledge, gained while travelling for his order through Spain, Portugal, and the West Indies. Sometimes he borrowed from the vast common stock of Spanish stage material; at other times he relied on his fantastic imagination.

Three of his dramas appeared in his *Cigarales de Toledo* (1621), a set of verses, tales, plays, and critical observations that, arranged after the Italian fashion in a picturesque framework, affect to provide a series of summer recreations for a group of friends. Otherwise his extant output of about 80 dramas—a fragment of the whole—was published chiefly in five *Partes* between 1627 and 1636. Of these, the second part, containing several of his famous pieces, presents apparently insoluble problems of authenticity; and the authorship of certain other of his plays outside this *Parte* has also been disputed.

The most powerful dramas associated with his name are two tragedies, *El burlador de Sevilla* and *El condenado por desconfiado* (1635; Eng. trans., *The Doubtful Damned*, 1956). The first, introducing into literature the hero-villain Don Juan, derived from popular legends but recreated with originality, rises to a majestic climax in which the libertine is confronted with the statue-ghost of the man he has killed and deliberately chooses to defy this emanation of his conscience. *El condenado por desconfiado* exteriorizes a theological paradox: Tirso contrasts the case of a notorious evildoer who has kept and developed the little faith he had, and who is granted salvation by an act of divine grace, with the example of a hitherto good-living hermit, eternally damned for allowing his one-time faith to shrivel.

Tirso was at his best when portraying the psychological conflicts and contradictions involved in his master characters. At times he reached Shakespearean standards of insight, tragic sublimity, and irony. The same qualities are found in isolated scenes of his historical dramas: in *Antona García* (1635), notable for its objective analysis of mob emotion; in *La*

prudencia en la mujer (1634), with its insights into ancient regional strife; and in the violently realistic scenes of the biblical *La venganza de Tamar* (1634).

On such occasions Tirso, even against the background of Spain's Golden Age, stands out. When inspired, he had the gift of dramatizing personality, and his best characters are memorable as individuals. He was more stark and daring than Lope but less ingenious, more spiritually independent than Pedro Calderón de la Barca (1600–81), one of the greatest Spanish dramatists of the age, but less poetic. Where he approximated to the Golden Age norm, his plays of types and manners, such as *El vergonzoso en palacio* were animated, varied in mood, and usually lyrical. But his style was erratic and sometimes trite. In pure comedy he excelled in cloak-and-sword situations; and in, for example, *Don Gil de las calzas verdes* (1635), he manipulated a complex, rapidly moving plot with vitality. He is famous, in both tragedy and comedy, for his clowns, whose wit had an air of spontaneity. Naturalness in diction suited his dramatic purpose better than the ornamental rhetoric that was then coming into vogue, and generally he avoided affectations, remaining in this respect nearer to Lope than to Calderón. He was not as consistently brilliant as some of his dramatic contemporaries, but at his greatest, even in comedy, the Spanish specialty, he could rival them, and in tragedy he towered above them all.

·literature of the Renaissance 10:1137a

Tirso River, ancient THYRSUS, in central Sardinia, the chief stream of that island. It rises on a plateau near Buddusò and flows about 90 mi (150 km) southwest through Lago Omodeo and across the marshy plain of Oristano to enter the Golfo di Oristano. It is used for hydropower and irrigation.

39°52' N, 8°33' E

·length and topography 16:245e

·length table of rivers in Apennines 1:1011

·map, Sardinia 16:244

Tirtha (Sanskrit: “fords”), river fords venerated in India.

·sacred places for nature veneration 3:1175f

Tirthaṅkara (Sanskrit: “ford-maker”), in Jainism, a religion of India, a saviour who has succeeded in crossing over life's stream of rebirths and has made a path for others to follow.

Mahāvīra (6th century BC) was the last of the Tirthaṅkaras, or Jinas (“victors”), to appear. His predecessor, Pārśvanātha, lived about 250 years earlier; the other Tirthaṅkaras mentioned in the Jaina scriptures cannot be con-

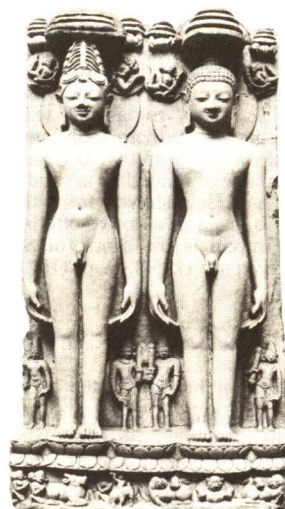
sidered historical figures. According to Jaina belief, each cosmic age produces its own group of 24 Tirthaṅkaras, the first of whom—if it is an age of descending purity—are giants, but they decrease in stature and appear after shorter intervals of time as the age proceeds. There will be no more Tirthaṅkaras in the present age, but Jaina literature records the names and present circumstances of the future 24 Tirthaṅkaras, who will be born in the next cycle of time.

In art the Tirthaṅkaras are represented either standing stiffly in the pose known as *kāyotsarga* (“dismissing the body”) or seated cross-legged on a lion throne in the posture of meditation, *dhyanamudrā*. They are shown naked or with only a thin loincloth; stylistic features such as the elongated earlobes and the *uṣṇīṣa* (tightly curled hair) bear great similarity to representations of the Buddha. The images are often carved out of marble or other highly polished stone or are cast in metal, the cold surfaces serving to emphasize the frozen detachment from life. Only the attendant figures, the *yakṣa* and *yakṣiṇī* (male and female nature deities) and the musicians or garland bearers, show some vitality. Since all Tirthaṅkaras are perfect beings, there is little to distinguish them from one another, except for symbolic colours or emblems, such as the bull shown on the pedestal or throne under images of Rṣabhanātha (“Lord Bull”).

The names of the 24 Tirthaṅkaras are attributed to dreams that were seen by their mothers before their births or to some other circumstance surrounding their entry into the world. The word *-nātha*, “lord,” may be added as an honorific to their names. In order of their appearance, the names, signs, and colours of the Jinas of this age are (1) Rṣabhanātha (“bull”; see Rṣabhanātha) or Ādi (“first”), his emblem the bull, his colour golden; (2) Ajita (“the invincible one”), elephant, golden; (3) Śambhava (“auspicious”), horse, golden; (4) Abhinandana (“worship”), ape, golden; (5) Sumati (“wise”), heron, golden; (6) Padmaprabha (“lotus-bright”), lotus, red; (7) Supārśva (“good-sided”), the swastika symbol, golden; (8) Candraprabha (“moon-bright”), moon, white; (9) Suvidhi or Puṣpadanta (“religious duties” or “blossom-toothed”), dolphin or *makara* (sea dragon), white; (10) Śītala (“coolness”), the *śrīvatsa* symbol, golden; (11) Śreyāṃśa (“good”), rhinoceros, golden; (12) Vāsupūjya (“to be worshipped with offerings of possessions”), buffalo, red; (13) Vimala (“clear”), boar, golden; (14) Ananta (“endless”), hawk (according to the Digambara sect, ram or bear), golden; (15) Dharma (“duty”), thunderbolt, golden; (16) Śānti (“peace”), antelope or deer, golden; (17) Kunthu (meaning uncertain), goat, golden; (18) Ara (a Jaina division of time), the *nandyāvarta* (an elaborated swastika with arabesque-like arms formed of double lines) symbol (according to the Digambara sect, fish), golden; (19) Mallin (“wrestler”), water jug, blue; (20) Suvrata or Munisuvrata (“of good vows”), tortoise, black; (21) Namin (“bowing down”) or Nimin (“eye-winking”), blue lotus, golden; (22) Ariṣṭanemi (“the felly, or rim, of whose wheel is unhurt”; see Ariṣṭaneminātha), conch shell, black; (23) Pārśva (“earth”; see Pārśvanātha), snake, green; (24) Vardhamāna (“increasing”), later called Mahāvīra (“great hero”), lion, golden.

All of the Jinas were born to Kṣatriyas (the warrior caste). Two of them, Suvratānātha and Ariṣṭaneminātha, belonged to the same clan as the Hindu god Kṛṣṇa and the others to the Ikṣvāku dynasty, from whom the Hindu god Rāma is said to be descended. One of them, Mallinātha, is identified by the Jaina Śvetāmbara sect as a woman, though the Digambara sect does not agree.

Images of the Tirthaṅkaras are not worshipped as personal gods, capable of giving



Rṣabhanātha and Mahāvīra, the first and last Tirthaṅkaras. stone sculpture from Orissa, India, 11th century; in the British Museum

By courtesy of the trustees of the British Museum

blessings or interfering with human events. Rather, the Jaina believer pays them homage as representatives of great beings in the hope that he may be filled with a sense of renunciation and thus encouraged along the path toward his final liberation.

·Jain worship and principles of sanctity 10:8a
passim to 13d

·sainthood in Jainism 16:164h

·spiritual beings in Eastern religion 1:873e

RELATED ENTRIES in the *Ready Reference and Index*:

Aṣṭāneminātha; Bāhubali; Jina; mahāpuruṣa; Pārśvanātha; Rṣabhanātha; siddha; Trīśālā

tirthayātrā (Sanskrit: "journey to a place of pilgrimage"), Hindu pilgrimage undertaken to a holy river, mountain, or other place made sacred through association with a deity or saint. The word *tirtha* means "river ford," and, by extension, a sacred spot. Honoured as the seven holiest Hindu cities are Kāśī (modern Vārāṇasī, Uttar Pradesh), the centre of Śiva worship; Ayodhyā (Oudh, in Uttar Pradesh), birthplace of the god Rāma; Mathurā (in Uttar Pradesh), scene of Kṛṣṇa's (Kṛishna's) nativity; Dwārka (Dvāraka, in Gujarāt state), where the adult Kṛṣṇa ruled as king; Kānchipuram (Conjeeveram, in Tamil Nadu), where the temple to the divine mother is built in the form of a *yantra*, or sacred diagram; Hardwār (in Uttar Pradesh), the spot where the Ganges River is said to have come to Earth; and Ujjain (Madhya Pradesh), the site of a Śaiva *linga* (sign of Śiva, or Shiva).

Bathing is said to be particularly cleansing of sin when performed in the confluence of two rivers (*prayāga*) or at the source or joining of one of the seven sacred rivers—the Ganges, Yamunā, Godāvari, Narmada, Indus, Cauvery, and the no longer visible Saraswati. The four great abodes of the gods, located at the four corners of India—Badrīnātha in the north, Dwārka in the west, Rāmeswaram in the south, and Puri in the east—attract large numbers of pilgrims yearly. The *pīṭhās*, or spots that mark where pieces of the body of Śiva's wife Sati fell to Earth, are particularly sacred to devotees of the goddess Śakti. Special occasions, such as an eclipse of the sun, a Kumbha Melā (*q.v.*), or the Rathayātrā (car festival) at the Jagannātha (*q.v.*) temple in Puri, will draw large gatherings.

The Hindu pilgrim undertakes his journey to a sacred spot as an act of devotion, to carry out a vow, to appease a deity in the face of misfortune, or to seek prosperity. Upon reaching the *tirtha* he will usually bathe (*snāna*), circumambulate the temple or holy place (*pradakṣiṇā*), make an offering, carry out a rite such as the *śrāddha* ceremony performed in honour of dead ancestors, have his name recorded by the priests who specially cater to the needs of pilgrims, and listen to the evening expositions of music and religious discourses.

·Ganges River and Hindu tirath 7:881c

·Hindu sites, practices, and traditions 8:903a

Tiruchchirāppalli, also called TIRUCHIRAPPALLI or TRICHINOPOLY, administrative headquarters of Tiruchchirāppalli district, Tamil Nadu state, southern India. It is on the main road and rail routes between Madras and Trivandrum, at the head of the Cauvery Delta. It was an important regional capital of the Pallava, Cōla, and Vijayanagar dynasties from the 7th to the 17th century. Its rock fortress, dominating the town, was the scene of bitter fighting between Muslim, Marāṭhā, British, and French troops from the 17th to the 19th century.

Now an industrial and educational centre, it has modern heavy electrical, thermal boiler, and locomotive construction workshops alongside the cotton hand weaving and cigar-rolling cottage industries. It has nine colleges affiliated with the University of Madras.

Tiruchchirāppalli district (area 5,518 sq mi [14,291 sq km]) lies almost entirely in the Cauvery River Valley, the best rice-growing region in the state. Rice, sugarcane, and betel crops are irrigated from the Cauvery River. Pop. (1971) town, 307,400; district, 3,848,816. 10°49' N, 78°41' E
·map, India 9:279

Tirukkural, Tamil poetic anthology.

·structure and themes 17:139c

Tirumala, 16th-century chief minister of Vijayanagar in India.

·political and military policies 9:377c

Tirumāṅkaiyālvār (c. 8th century), Indian poet.

·literary and social achievements 17:140b

Tirunelveli, also spelled TINNEVELLY, administrative headquarters, Tirunelveli district, Tamil Nadu state, southern India, on the Tāmbraparni River. It was a commercial centre during the Pāṇḍya dynasty. Its name is derived from the Tamil words *tiru* ("holy"), *nel* ("paddy") and *veli* ("fence"), referring to a legend that the god Śiva (Shiva) protected a devotee's rice crop there. With electricity supplied from the Pāpanāsam Dam, it is now an industrial town specializing in textiles, manufacture of cigars and jewelry, and motor workshops. It is the site of four colleges affiliated with Madurai University.

Tirunelveli district (area 4,414 sq mi [11,433 sq km]) lies in the shadow of the Western Ghāts and is the driest region in the state. It forms part of the Coromandel Coast, sloping gently eastward from the Cardamom Hills to the Gulf of Mannar. The Tāmbraparni River, rising in the Western Ghāts, flows eastward through the centre of the district, irrigating a fertile alluvial valley. It is dammed at Pāpanāsam, and one of its headstreams has become the site of a healing, tourist, and pilgrimage centre at Courtallam Falls, near the Tenkāsi Gap.

The twin cities of Tirunelveli and Pālayan-kottai (Pālamcottah) lie on the banks of the Tāmbraparni, which flows out to sea at Kolkai, a seaport known to the ancient Greeks for its export trade in pearls. The modern port of Tuticorin is 9 mi south of Kolkai.

The district has long been famous for pearl and conch fishing, cigar making, and cotton hand weaving. Since the 16th century it has been an important centre for Christian missionary activities. Its chief large-scale industry is cotton milling. Pop. (1971) town, 108,498; district, 3,200,515.

8°44' N, 77°42' E

·map, India 9:279

Tirupati, town in Chittoor district of southeastern Andhra Pradesh state, southern India. Located in the Pālkonda Hills, Tirupati is known as the abode of the god Venkatesvara, Lord of Seven Hills. The Tirumala hill temple, one of the richest in southern India, nestled among sacred waterfalls and tanks (reservoirs), is a fine example of Dravidian art and a centre of pilgrimage. Hair shaven from the heads of pilgrims is given as a votive offering to the temple. Tirupati is the centre of Sri Venkateswara University (1954). Pop. (1971) 65,843.

13°39' N, 79°25' E

Tiruppāṇālvār (c. 8th century), Indian mystical poet.

·mystical and devotional themes 17:140b

Tiruppūr, town, Coimbatore district, Tamil Nadu state, southern India, on the Noyil River. It is an active cotton-ginning and distribution centre. Its name means Holy City, and its Śaiva temple attracts large crowds of pilgrims, especially at the time of the Rathayātrā (car festival) celebrated in the Tamil month of Vaikāci (May–June). Pop. (1971) 113,302.

11°06' N, 77°21' E

·map, India 9:279

Tiruvācakam, 9th-century collection of hymns by Māṇikkavācakar.

·Śaivite bhakti themes 17:140a

Tiruvottiyūr, northern industrial suburb of Madras, Tamil Nadu state, India.

13°09' N, 80°18' E

·Madras urbanization 11:283h

Tiryns, Modern Greek TIRINS, prehistoric city in the present-day department of Argolis, Greece, noted for its architectural remains of the Homeric period.



Gallery and casements in the east bastion of the palace at Tiryns, 14th century BC

Hirmer Fotoarchiv, München

Excavations show the area to have been inhabited from the Neolithic Age. At the beginning of the Early Bronze Age, or Early Helladic Period (c. 3000–c. 2200 BC), a pre-Greek agricultural people arrived, probably from western Anatolia, as suggested by place-name endings such as *-ssos*, *-ttos*, *-inthos*, *-indos*, and *-enai*. In the Middle Bronze Age, or Middle Helladic Period, people from the north moved in who are believed to have spoken an early variant of the Greek language. In contrast to the violent invasions by these people in other areas, their arrival at Tiryns appeared to have been peaceful. The settlement at Tiryns developed into a centre of the Mycenaean, or Late Helladic, culture, influenced by that of Minoan Crete. Tiryns, situated on a ridge in the plain between Nauplia (Návpليون) and Mycenae, survived into the classical period but was destroyed by Argos c. 468 BC. From the construction of the walls of its citadel, supposedly built by the Cyclopes for the legendary king Proteus, the expression Cyclopean masonry is derived.

·Bronze Age remains 1:113h; map 112

·clothing and body decoration richness 5:1020e; illus. 1021

Tirzah (ancient Palestine): see Tall al-Fāri'ah.

Tisa River (Europe): see Tisza River.

Tisbe reticulata, species of marine copepod of the arthropod order Crustacea.

·polymorphism and heterozygous advantage 14:775a

Tischbein, Johann Heinrich Wilhelm (b. Feb. 15, 1751, Haina, Hesse, now in West Germany—d. June 26, 1829, Eutin), portraitist and friend of Goethe.

Tischbein began his career painting portraits at the Prussian court in Berlin. In 1779 he

went to Italy and in 1789 was appointed director of the art academy in Naples. Forced to leave in 1799 because of war, the painter retired to north Germany. Tischbein's most famous painting is that of "Goethe in the Campagna," painted in 1787 at the time the two men travelled from Rome to Naples. Though Goethe induced the artist to turn his interest toward the Classical movement, Tischbein later became interested in the ideas of German Romanticism.

Tischbein belonged to a family that produced more than 20 artists in three generations. Others of importance include Johann Heinrich Tischbein the Elder (1722-89), who painted portraits and mythological canvases as a court painter in Kassel, in Hesse, and the portraitists Johann Valentin Tischbein (1715-68) and Anton Wilhelm Tischbein (1730-1804).

·"Goethe in the Campagna," illus., 19: Visual Arts, Western, Plate 19

·Neoclassical painting developments 19:443e

Tischendorf, (Lobegott Friedrich) Konstantin von (b. Jan. 18, 1815, Lengefeld, Saxony—d. Dec. 7, 1874, Leipzig), German biblical critic who made extensive and invaluable contributions to biblical textual criticism, famous for his discovery of the *Codex Sinaiticus*, a celebrated manuscript of the Greek Bible.

While a student at the University of Leipzig, he began his work on the recensions of the New Testament text, a task that he was to pursue for the rest of his life. In 1844 he went to the Middle East. While working in the library of the Monastery of St. Catherine in the Sinai Peninsula he discovered, among some old parchments, leaves of what he was certain were among the oldest biblical manuscripts that he had ever seen. He was permitted to take 43 of these leaves back with him to Leipzig and in 1846 published a facsimile edition, taking care to keep secret the place where he had obtained them. In 1853 he made a second journey to Sinai with the hope of recovering the other leaves he had seen on his first trip, but he found no trace of them. He made still a third trip, with the support of the Russian government, in 1859. Just as he was about to give up all hope of finding the manuscripts, the steward of the monastery showed Tischendorf the manuscripts he was looking for, and others besides. After intricate negotiations, and for a sum that has been estimated at about \$7,000, Tischendorf procured for the tsar Alexander II what is now known as the *Codex Sinaiticus*. In 1933 the codex was purchased from the Soviet government by the British Museum for £100,000, of which half was supplied by the British government, half by public subscription. These manuscripts date probably from the latter half of the 4th century, were probably written in Egypt, and include most of the Old Testament and the entire New Testament plus the *Letter of Barnabas* and part of the *Shepherd of Hermas*.

In numerous writings, Tischendorf presented the results of his work. His eighth edition of the Greek New Testament is considered to be of most value to contemporary textual critics.

·New Testament research 2:942f

Tischeriidae, family of moths of the insect order Lepidoptera.

·classification and general features 10:828e

Tisdale, town, east central Saskatchewan, Canada, in the Carrot River valley. Named after a railroad surveyor, Frederick W. Tisdale, it was settled early in the 20th century by homesteaders. The town serves a mixed-farming and lumbering region and is noted for its production of honey; the Saskatchewan Honey Producers Co-operative Association has its headquarters there. Other activities include flour and lumber milling and dairying. Inc. village, 1905; town, 1920. Pop. (1976) 3,026.

52°51' N, 104°04' W

·map, Canada 3:716

Tiselius, Arne (Wilhelm Kaurin) (b. Aug. 10, 1902, Stockholm—d. Oct. 29, 1971, Uppsala, Swed.), biochemist who won the Nobel



Tiselius, oil painting by William Fleetwood, 1965; in Gripsholm Castle, Mariefred, Swed.

By courtesy of Svenska Porträttarkivet, Stockholm

Prize for Chemistry in 1948. As an assistant to Theodor Svedberg at the University of Uppsala (1925-32), he developed the use of electrophoresis for the delicate task of separating proteins in suspension on the basis of their electrical charge.

After lecturing at Uppsala, he did research at the Institute for Advanced Study at Princeton (1934-35). Back in Uppsala (1937), he became a professor in biochemistry and was provided with a newly built institute to house his department. He used electrophoretic methods to separate the chemically similar proteins of blood serum, an achievement that was especially cited in the Nobel award. In 1940 he began research into the separation of proteins and other substances by adsorption chromatography. Chairman of the Swedish Natural Science Research Council (1946-50), he became vice president (1947-60) and then president (1960-64) of the Nobel Foundation.

Tisha be-Av (Hebrew: Ninth of Av), in Judaism, traditional day of mourning for the destruction of the First and Second Temples. According to the Talmud, other disastrous events such as the following occurred on Av 9: the decree that the Jews would wander 40 years in the wilderness; the fall of Bethar in AD 135, ending the second Jewish revolt against Rome; and the establishment in 136 of a pagan temple in Jerusalem, which Jews were no longer permitted to enter. The expulsion of the Jews from Spain in 1492 is also traditionally believed to have occurred on that date. From sunset to sunset, a 24-hour fast is observed, except by Reform Jews. The liturgy of the day, performed by candlelight in a gloomy atmosphere, includes the reading of the Lamentations of Jeremiah and the recital of dirges (*qinot*); certain passages from the Old Testament are also read. Many Jews visit the cemetery on this day, and those who can do so, ascend Mt. Zion. If Tisha be-Av falls on the Sabbath ("Black Sabbath"), the observance is postponed one day.

·ritual and commemorative aspects 10:221g

Tishri (Mesopotamian and Hebrew month): see Jewish calendar.

Tisias (fl. c. 5th century BC), rhetorician of Syracuse.

·development of rhetoric in Greece 8:353g

ti-sikkhā (Buddhism): see tri-śikṣā.

Tisiphone (Greek mythology): see Erinyes.

Tisat Falls, waterfalls at the headwaters of the Blue Nile on the Ethiopian Plateau.

11°29' N, 37°38' E

·location and age 19:638e

Tiso, Josef (b. Oct. 13, 1887, Velká Bytča, Slovakia—d. April 18, 1947, Bratislava), priest and statesman who fought for Slovak autonomy within the Czechoslovak nation during the interwar period and headed the German puppet state of independent Slovakia (1939-45) until he was overthrown by the Red Army and Czechoslovak Partisans at the end of World War II.

Becoming a prominent member of Andrej Hlinka's (q.v.) Slovak People's Party after World War I, Tiso was a member of the Czechoslovak government from 1927 to 1929 and succeeded Hlinka as party leader in 1938. On Oct. 6, 1938, he became premier of the autonomous Slovakia in the new federal Czecho-Slovakia, assuming the presidency after his country declared its independence (1939) to forestall annexation by Hungary.



Tiso, 1946

Keystone

Throughout World War II, though closely supervised by Germany, Tiso's authoritarian government retained a degree of freedom of action, but it collapsed with the arrival of the Red Army in April 1945. Tried for treason, he was executed in 1947.

·Czechoslovak political leadership 2:1196d

Tis Pitty Shees a Whore (published 1633), tragedy of blood by the English dramatist John Ford, set in Renaissance Italy and concerning the incestuous love of Giovanni for his sister Annabella. Found to be pregnant, Annabella agrees to marry her suitor, Soranzo. When the lovers' secret is discovered, Soranzo's plans for revenge are thwarted by Giovanni's murder first of Annabella and then of Soranzo. Giovanni himself dies at the hands of Soranzo's hired banditti. The play is notable for Ford's handling of the lovers' sensual, at times arrogant, acceptance of their relationship.

·literature of the Renaissance 10:1142d

Tissa, Devānampiya (d. c. 207 BC), king of Ceylon.

·Buddhist conversion and patronage 3:411f

·Ceylonese conversion to Buddhism 4:2d

Tissandier, Gaston (1843-99), French aeronaut.

·airship design and electric power 7:384b

Tissaphernes, Old Persian CHITHRAFARNA (d. 395 BC, Caelaenae, modern Dinar, Tur.), satrap (governor) who played a leading part in Persia's struggle to reconquer the Ionian Greek cities of Asia Minor that had been held by Athens since 448. In 413 Tissaphernes, then satrap of Lydia and Caria, formed an alliance with Sparta and by the next year had regained most of Ionia. Fearing that a complete victory of Sparta over Athens in the Peloponnesian War would endanger Persian interests, he supplied only limited assistance to his ally.

As a result, when the Persian king Darius in 407 decided to support Sparta, Tissaphernes was replaced as commander in chief in Asia Minor and as satrap of Lydia by Darius' son,

Cyrus the Younger, and was limited to the satrapy of Caria. Cyrus revolted, however, shortly after his brother Artaxerxes succeeded to the throne.

Tissaphernes, supporting Artaxerxes, distinguished himself in the Battle of Cunaxa (401), where Cyrus was killed, and afterward treacherously seized the leaders of Cyrus' Greek mercenaries. Reinstated as satrap of Caria and Lydia, he attacked the Ionian cities, control of which had been lost during Cyrus' revolt. This attack led to war with Sparta, and, after Tissaphernes' severe defeat at Sardis in 395, his enemy Parysatis, mother of Cyrus, succeeded in persuading Artaxerxes to have him executed.

Tisserand, (François) Félix (1845-96), French astronomer noted for his excellent textbook *Traité de mécanique céleste* (four volumes, 1889-96) and an international photographic catalog, *Carte du Ciel*, a vast compilation of astronomical data.

tissue culture 18:438, the maintenance of cells, tissues, or organs under precisely controlled artificial conditions within the laboratory.

The text article deals with the general background, history, techniques, and importance of tissue culture.

REFERENCES in other text articles:

- aging effects on cells in vitro 1:302g
- biological development processes 5:647d
- cancer's viral relationship 3:765c
- cell growth studies 8:444a
- diagnosis of metabolic diseases 11:1051c
- DNA in vitro replication experiments 7:986h
- microbiology study techniques 12:113c
- plant propagation techniques and uses 8:1107c
- virus cultivation methods 19:169e
- virus vaccine research 11:834f

RELATED ENTRIES in the *Ready Reference and Index*:

cell culture; in vitro; Ringer's solution

tissues and fluids, animal 18:442, respectively, a collection of cells having similar structures and performing special, as well as similar, functions; and the liquid media in which those tissues are bathed.

The text article covers tissues for assimilation, storage, transport, and excretion; tissues for coordination; tissues for support and movement; and other tissues (reproductive and hemopoietic tissues and fluids).

REFERENCES in other text articles:

- fluids**
 - annelid coelomic fluid metabolic processes and osmosis regulation 1:933g
 - chondrichthyan maintenance of blood's ionic balance 4:40d
 - Chondrichthyes urea regulation 16:496e
 - coelomic fluid with skeletal function 1:931b
 - complement systems in vertebrates 9:255f
 - ear fluid comparisons in man 5:1122f
 - human body fluid components and abnormalities 7:429d; table
 - lymph formation, flow, and pressure 11:210h
 - membrane permeability study 11:880d
 - mollusk blood skeletal function 12:328h
 - osmotic pressure regulation in clupeiform birds 4:767b
 - renal regulatory function 7:35f
- food and water storage**
 - camel fat accumulation 10:1285e
 - insectivore prey caches and body fat 9:623f
 - insect nutrient organ 9:616c
 - mosquito and earthworm adaptations 5:783g
 - yolk and other egg nutrients throughout embryonic development 5:625h
- tissues**
 - atrophic physiological and pathological changes 2:351h
 - cancer's universality and variation 3:763e
 - cell junction structure 3:1051a
 - circulatory system comparisons 4:619e
 - connective tissue diseases 5:17c
 - digestive system comparisons 5:782f

- evolution of organization levels 14:381f
- frostbite penetration of skin 7:750c
- human cardiovascular system anatomy 3:875g; illus. 876
- human digestive system anatomy 5:789b
- human reproductive system components 15:690a; illus. 691
- morphologic classification of tissues 12:454c
- muscle contraction mechanisms 12:620g
- muscle types and functioning in different animals 12:637g
- nerve structure and impulse conduction 12:969a
- nervous system diseases and diagnosis 12:1042a
- organ systems comparisons 13:722a
- ostariophysian electricity generation 13:761f
- oxygenation of tissues in man 15:749h
- primate structural variations 14:1023g
- radiation effects on tissues 15:381c
- reproductive system comparisons 15:702b
- tissue culture requirements 18:438f; illus. 439
- tissue description in terms of cells 3:1061c
- wool fibre cell structure 7:285a
- tissues and fluids**
 - aging processes and effects 1:301f
 - animal disease detection and diagnosis 5:866d
 - biological importance of alkali metals 1:585f *passim* to 586g
 - blood group incidence and inheritance 2:1143d
 - blood physiology in humans 2:1112c
 - bone and interstitial fluid composition 3:18b
 - deep-sea life and specific gravity 13:499d
 - dehydration processes and effects 5:560b; table 561
 - dietary component replacement 13:417h
 - disease causes and internal balance 5:843c; table
 - ear disorders and treatments 5:1133e
 - embryonic origins and special types 5:627c
 - endocrine system disorders in humans 6:818b
 - evolution of the immunological system 9:249b
 - excretory system role in homeostasis 7:45c
 - freezing cold adaptations of insects 9:613e
 - germfree life and toxin studies 8:130e
 - human ear evolution and embryology 5:1131g
 - human eye anatomy and function 7:91h
 - immunological response mechanisms 9:248c
 - inflammatory response to injury 9:559d
 - inner ear mechanisms in vertebrates 17:44g
 - joint anatomy and physiology in vertebrates 10:252f; illus. 253
 - mammalian structures and adaptations 11:405h
 - pesticide accumulation in humans 14:143e
 - physiological demands of hibernation 5:964a
 - renal maintenance of ECF volume 7:44a
 - respiratory organs and gas transport 15:751f
 - salinity tolerance of marsh animals 17:841e
 - skeletal structures and functions 16:818e

tissues and fluids, plant 18:451, assemblages of cells of like origin and structure, adapted by this structure and by their chemical makeup to perform specialized functions in the plant.

The text article describes epidermal (protective), vascular (conducting), and ground (fundamental) tissues from their unspecialized initial forms to their fully developed stages, explaining and correlating thereby the structure and functioning of plants.

REFERENCES in other text articles:

- comparative botany**
 - aging and meristem functions 10:914f
 - aging processes and effects 1:300a
 - biological importance of alkali metals 1:585f *passim* to 586g
 - bulbous plant nutrition 7:904b
 - colloid increase in response to cold 5:959h
 - endosperm formation and function 15:723f
 - food preservation technology 7:491d; table 493
 - form determination in development 5:664f
 - growth and turgor movements 17:672d
 - growth rates and meristematic centres 8:441d
 - hormonal stimulus-response reactions 12:975h

- integumentary structures and dynamics 9:665a; illus.
- morphologic classification of tissues 12:454f
- organ and organ system development 13:726g
- pressure and temperature effects 14:995a
- propagation and regeneration techniques 8:1107b
- regeneration and role of meristem 15:578g
- salinity tolerance of marsh flora 17:841d
- terrestrial existence adaptation 18:144g
- tissue culture requirements 18:438f; illus. 441
- food and water storage**
 - angiosperm seed evolutionary trends 1:878h
 - lichen fat in algae cells 10:887a
 - moss deposition and composition 3:354a
 - taproot functional modifications 13:733b
- non-vascular plants**
 - algae differentiation and organization 1:487c
 - lichen symbiotic accommodations 10:884g
 - moss leaf and stem simulation 3:351f
 - motility in bacteria and slime molds 12:621c
- vascular plants**
 - active transport in root systems 11:883e
 - Alismaceae vascular system 1:577b
 - Bromeliales stem tissue function 3:326a
 - Caryophyllales cambium arrangement 3:974d
 - conifer form and function 5:4f
 - cotton, kapok, jute, flax, and ramie cell description 7:275d
 - Darwin and insectivorous plant adaptations 5:495a
 - Dipsacales anatomical development 5:816h
 - fern stem form and function 7:241d
 - land plant evolution from sea weeds 14:379d
 - Laurales vascular system 10:709e
 - long-distance transport in plants 14:500g
 - Nymphaeaceae vascular system 13:429g
 - pitcher plant digestion 16:296c
 - psilopsid vascular tissue forms 15:137f
 - radiation effects on seeds 15:381c
 - stem and leaf composition in palms 1:1132g
 - tree growth and internal structure 18:691d; illus.
 - Zingiberales leaf development 19:1153a

RELATED ENTRIES in the *Ready Reference and Index*:

annual ring; cambium; cork; cortex; guard cell; heartwood; lenticel; meristem; parenchyma; periderm; phloem; sapwood; sclerenchyma; sieve-tube; tracheid; vascular bundle; vascular ray; vascular system; vessel; xylem

tissue typing, laboratory procedure for identifying antigens in body tissues other than blood.

·organ and tissue transplantation 18:631d

Tista River, 250-mi (400-km) tributary of the Brahmaputra, flowing through Sikkim, India, and Bangladesh (formerly East Pakistan). It rises in the Himalayas near Chungthang, Sikkim, flows south through the Darjeeling Mountains, and turns southeast to run onto the plains of West Bengal, India, through Sivok Gota Pass. The river then crosses Rangpur district, Bangladesh, to join the Jamuna (Brahmaputra) River downstream of Chilmari. Its lower reaches are called the Pagla (Mad) River because of frequent and violent course changes; navigation is made difficult by the shoals and quicksand that form near the junction with the Jamuna. The Tista Barrage Project provides irrigation of about 30,000 ac (12,000 ha) in the Bārid region.

25°23' N, 89°43' E

- Bangladesh river systems 2:688a
- Brahmaputra floodplains scheme 3:106a
- course, importance, and flood control 3:104f; map 105
- Himalayan drainage pattern 8:884a; map 882
- map, Bangladesh 2:688

Tistian Isthmus, isthmus connecting Concepción and Madera volcanoes, the three together comprising Ometepe island in Lake Nicaragua, Nicaragua.

11°31' N, 85°34' W

·formation and location 13:64a

Tistou of the Green Fingers (1957), book by Maurice Druon.

·artistic juvenile moral tales 4:241b

Tisza, Neolithic culture of eastern Hungary and the Yugoslav Banat, dating to the latter 6th millennium BC. It practiced domestication of cattle.

·dwellings and animal domestication 2:613e

Tisza, István, Count (b. April 22, 1861, Budapest—d. Oct. 31, 1918, Budapest), statesman who became prime minister of Hungary as well as one of the most prominent defenders of the Austro-Hungarian dualist system of government, an opponent of reform in Hungary, and a loyal supporter of the monarchy's German alliance throughout World War I.



István Tisza, portrait by G. de Benczur (born 1844); in the Hungarian National Museum, Budapest

Interfoto MTI, Hungary

Entering the Hungarian Parliament in 1886, Tisza, a leader of the Liberal Party and a defender of the dual monarchy and of Hungary's large landed interests, became prime minister in 1903 but was heavily defeated at the polls in 1905. President of the lower house from 1912 and again prime minister from June 1913, he agreed to support the war against Serbia in 1914 only if Austria-Hungary would not annex further Slav territory; he regarded an increase in Slav subjects as a danger to the dualist system. Tisza ruled Hungary until resigning in protest over the new emperor Charles I's (Hungarian king Charles IV) decree for suffrage reform in Hungary (June 15, 1917). Held responsible for his country's suffering during World War I, Tisza was assassinated shortly before the end of the war.

·Austrian ultimatum to Serbia 2:474b
·coalition government and Party of Work 9:37h

Tisza, Kálmán (b. Dec. 16, 1830, Geszt, Hung.—d. March 23, 1902, Budapest), statesman and longtime premier who led the coalition that ruled Hungary for the last 30 years of his life and who is credited with creating the political alignment that ruled the nation until World War II.

Member of an old Calvinist landowning family, Tisza participated in the first Hungarian parliamentary government during the Revolution of 1848–49. Exiled after the restoration of Austrian rule, he returned to Hungary and took a major part in the battle for national autonomy. After holding many ministerial posts, he served as premier from 1875 to 1890. He succeeded in fusing the often contradictory interests of the nobility, business, and the small landowners. As leader of the Freethinkers' Party, he instituted many social, economic, and legal reforms. To maintain his coalition, however, he had to institute reactionary policies that went against the interests of ethnic minorities and of the peasants and workers.

Tisza resigned in 1890, protesting at alleged interference from the Austrian emperor, but to his death retained political pre-eminence in his party. He was nicknamed "the General" in political circles.

·Liberal Party formation and leadership 9:37g

Tisza River, Serbo-Croatian, Russian and Romanian *tiša*, a major tributary of the Middle Danube, rises in the Bukovina segment of

the Carpathian Mountains. Its two headstreams, the Black and White Tisza, unite east of Sighet on the Russian–Romanian border. From Sighet, Romania, the Tisza flows northwest and then in a great northward loop to Chop (U.S.S.R.), where the Czechoslovak, Russian, and Hungarian frontiers converge. Entering Hungary, it continues southwest to Szolnok; then it cuts southward across the Hungarian plain, paralleling the Danube, which it joins 28 mi (45 km) north of Belgrade after a meandering course of 619 mi. Its drainage area is 60,690 sq mi (157,186 sq km).

The Tisza in its mountain course is a clear, rapid stream; the lack of an extensive lake system in the Carpathians to steady the seasonal runoff explains the spectacular contrast between its maximum and minimum levels and results in three annual floods—in early spring, early summer, and fall. When high water in the Tisza meets similar conditions in the Danube, the Tisza flows back into its own course, causing severe flooding. Such a coincidence destroyed Szeged, Hungary, in the spring of 1879; dikes now protect the city. Regulation of the river was begun in the second half of the 19th century and there are 2,400 mi of flood-control levees along its course. The Tisza River downstream from Csongrád, Hungary, has a low-cliff western bank that is subject to seasonal flooding. The main east-bank tributaries are the Szamos, Körös, and Maros; on the west bank are the Bodrog and the Sajó. The Tiszalök Dam (1954) on the upper river forms the largest reservoir in Hungary providing hydroelectric power and, with the 58-mi-long Eastern Main Canal linking the Tisza and the Berettyó to the Körös, supplies year-round irrigation water to the Hajdúság and Hortobágy plains. The Tisza is navigable for river boats for about 200 mi up to Szolnok, and for smaller craft almost to the Hungary–Czechoslovakia border. Szolnok, Csongrád, and Szeged rank as river ports. A canal in Yugoslavia links the Tisza with the Danube before the natural confluence.

45°15' N, 20°17' E

·Carpathian Mountains' drainage 3:948d
·Danube tributaries and drainage 9:23g
maps

·Hungary 9:22
·Romania 15:1048
·Yugoslavia 19:1100

tit, or **TITMOUSE**, any of a number of small active birds of the songbird family Paridae (or-



(Top) Tufted titmouse (*Parus bicolor*). (bottom) blue tit (*Parus caeruleus*)

(Top) Dan Sudia—National Audubon Society. (bottom) Brian Bevan—Ardea Photographics

der Passeriformes). The name tit (plural titmice) is used primarily in the Old World; in the New World a parid is called titmouse or chickadee. The term tit is also used in combinations for birds of other families that resemble parids in behaviour and appearance—e.g., tit babbler, tit tyrant, wren-tit.

Parid tits are woodland and garden birds. Perhaps the best known species is the great tit (*Parus major*), found in Europe, northwestern Africa, and Asia nearly to Java; 14 centimetres (5½ inches) long, it has a white-faced black head and a black centre line on its underparts, which are yellow in Western races and whitish or buffy in the Orient.

In North America "titmouse" applies only to four species that are crested. Best known of these is the tufted titmouse (*P. bicolor*), a 17-centimetre (6½-inch) bluish-gray bird with pinkish-brown flanks.

blue titmouse (*Parus caeruleus*)

·alarm call characteristics, illus. 4 4:1017

·bird clutch size and survival 14:827f

·classification and general features 13:1061a

Titāgarh, also spelled TITTĀGARH, town, Twenty-four Parganas district, Jalpaiguri division, West Bengal state, India, just east of the Hooghly River. Connected by road and rail with Calcutta, Titāgarh has jute and paper milling, manufactures glass and textile machinery, and processes tea. The town was the site of a Danish factory (trading station) and was once a fashionable place of residency for Europeans. Titāgarh was constituted a municipality in 1895, when it was separated from Barrackpore (q.v.) municipality. Pop. (1971 prelim.) 88,318.

22°48' N, 88°22' E

Titan, The (1914), novel by U.S. writer Theodore Dreiser.

·Dreiser's novels about Charles Yerkes 5:1014g

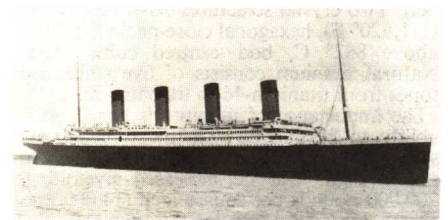
titanates: see ceramics, piezoelectric.

titanaugite (mineral): see augite.

Titania, a satellite of Uranus.

·Uranus' satellites 18:1038f; table

Titanic, British luxury passenger liner that sank on April 14–15, 1912, during its maiden



The "Titanic"
The Bettmann Archive

voyage, with a loss of 1,513 lives, about 95 miles (150 kilometres) south of the Grand Banks of Newfoundland, after it struck an iceberg. The great ship, at that time the largest and most luxurious afloat, had a double-bottomed hull, divided into 16 watertight compartments. Because four of these could be flooded without endangering the liner's buoyancy, it was considered unsinkable. Shortly before midnight on April 14, however, while steaming at 22 knots (22 nautical miles or 41 kilometres per hour), adjudged at the time to be too fast for existing conditions, the ship collided with an iceberg that ripped a 300-foot (90-metre) gash in its right side, ruptured five of its watertight compartments, and caused it to sink at 2:20 AM April 15. Inquiries held in the U.S. and Great Britain alleged that the Leyland liner "Californian," which was less than 20 miles (32 kilometres) away all night, could have aided the stricken vessel had its radio operator been on duty. Only the arrival of

the Cunard liner "Carpathia" 1 hour and 20 minutes after the "Titanic" went down prevented further loss of life in the icy waters.

As a result of the disaster, the first International Convention for Safety of Life at Sea was called in London in 1913. The convention drew up rules requiring that every ship have lifeboat space for each person embarked (the "Titanic" had only 1,178 boat spaces for the 2,224 persons aboard); that lifeboat drills be held during each voyage; and, due to the "Californian" not having heard the distress signals of the "Titanic," that ships maintain a 24-hour radio watch. The International Ice Patrol also was established to warn ships of icebergs in the North Atlantic shipping lanes.

- cause and results 9:160e
- sea safety standards impact 18:671a

titanite (mineral): see sphene.

titanium (for the mythological Titans), symbol Ti, chemical element, silvery gray metal of transition Group IVb of the periodic table, lightweight, high-strength, low-corrosion structural metal, used in alloy form for parts in high-speed aircraft. A compound of titanium and oxygen was discovered (1791) by the English chemist and mineralogist William Gregor and independently rediscovered (1795) and named by the German chemist Martin Heinrich Klaproth. Widely distributed and plentiful, titanium is the ninth most abundant element in the Earth's crust, found combined in practically all rocks, sand, clay, and other soils. It is also present in plants and animals, natural waters and deep-sea dredgings, and meteorites and stars. The two prime commercial minerals are ilmenite and rutile. The metal was isolated in pure form (1910) by the New Zealand-born U.S. metallurgist Matthew A. Hunter by reducing titanium tetrachloride (TiCl_4) with sodium in an airtight steel cylinder. After 1947 titanium changed from a laboratory curiosity to an important structural metal commercially produced by the Kroll process (magnesium reduction of the tetrachloride). In pure form titanium is ductile, about half as dense as iron and less than twice as dense as aluminum; it can be polished to a high lustre. The metal has a very low electrical and thermal conductivity and is paramagnetic (weakly responsive to a magnet). Two crystal structures exist: below 882°C ($1,620^\circ\text{F}$), hexagonal close-packed (alpha); above 882°C , body-centred cubic (beta). Natural titanium consists of five stable isotopes from titanium-46 to titanium-50.

The importance of titanium is based on its ability to be alloyed with most metals and some nonmetals. By alloying titanium, its tensile strength can be increased fivefold to 200,000 pounds per square inch (14,000 kilograms per square centimetre). Titanium has excellent corrosion resistance in many environments because of the formation of a passive oxide surface film. No noticeable corrosion of the metal has been found after exposure to seawater for over three years. Its combination of high strength, low density, and excellent corrosion resistance explains why titanium is used for many parts of aircraft, spacecraft, missiles, and ships. It is used in prosthetic devices also, because there is no reaction between titanium and fleshy tissues and bones. Titanium has also been utilized as a deoxidizer in steel and as an alloying addition in many steels to reduce grain size, in stainless steel to reduce carbon content, in aluminum to refine grain size, and in copper to produce hardening.

Although at room temperatures titanium is resistant to tarnishing, at elevated temperatures it reacts with oxygen in the air. This is no detriment to the properties of titanium during forging or fabrication of its alloys; the oxide scale is removed after fabrication. In the liquid state, however, titanium is very reactive and reduces all known refractories. It exhibits

three valences in compounds of the type TiO , Ti_2O_3 , and TiO_2 . The +4 oxidation state is the most stable as in the dioxide (TiO_2 , a white pigment) and the tetrachloride (a liquid smoke-producing compound used for skywriting and smoke screens).

atomic number	22
atomic weight	47.90
melting point	$1,675^\circ\text{C}$ ($3,047^\circ\text{F}$)
boiling point	$3,260^\circ\text{C}$ ($5,900^\circ\text{F}$)
specific gravity	4.5 (20°C)
valence	2, 3, 4
electronic config.	2-8-10-2 or (Ar) $3d^24s^2$

Major ref. 18:612a

- atomic weight and number table 2:345
- catalytic stereochemical specificity 3:1003b
- concentration by magmas 9:220a
- concentration factor in marine organisms table 6:714
- element abundance, table 6 17:602
- geochemical abundances, table 1 6:702
- interstellar absorption lines, table 4 7:840
- interstellar gas contents 9:793d
- lunar abundance study 12:431a
- polymorphism, alloying, and production 18:455e
- pressure effects on polymorphism 8:869c
- solar abundances, table 2 17:803
- transition element general properties 18:601c; tables
- vacuum sputter ion and sublimation pump 19:16b

titanium dioxide, the most important compound of titanium, used extensively as a pigment because of its excellent hiding power, or opacity. It is a nontoxic, pure white powder with high reflectivity used alone in white paints, enamels, and lacquers and in conjunction with other pigmentary compounds in coloured paints. Its chemical formula is TiO_2 .

Titanium dioxide occurs in nature as the minerals brookite, octahedrite, anatase, and rutile. The material used for the manufacture of titanium dioxide pigments is produced from rutile or from ilmenite (ferrous titanate ore) by dissolving the ore in sulfuric-acid solution and precipitating the impurities. The solution is then hydrolyzed, producing hydrous titanium dioxide, which is then washed and calcined. In another method, ground rutile is chlorinated in the presence of carbon and the resulting titanium tetrachloride is burned in oxygen to produce the oxide.

- chemical industry production 4:132g
- crustal and upper mantle abundances tables 5:120
- crystal forms and uses 18:612e
- Kroll titanium process and pigment uses 18:455h *passim* to 457c
- luminescence activation and enhancement 11:181c
- paint composition and manufacture 13:888e
- paper pigment preparation and use 13:972e
- synthetic fibre spun dyeing 7:259h

titanium products and production 18:455. Known since the late 18th century, titanium was not produced in commercial quantities until the 1950s. Its strength at high temperatures and its light weight are valued in the aerospace industry, its corrosion resistance is important in chemical and food processing industries, and an oxide (titanium dioxide) is a stable white pigment widely used in the paint industry.

The text article covers mining, refining and recovery, the metal and its alloys, preparation and uses of chemical compounds, and economic importance.

REFERENCES in other text articles:

- African distribution and tonnage 1:200a
- chemical industry use 4:132g
- chlorination production process 11:1065h
- glass products design 8:206a
- jet engine heat-resistant metals 10:159h
- metallic titanium preparation 18:612b
- metallurgical vacuum-induction melting 11:1069f
- polyethylene catalytic mechanism 13:717a
- sodium reduction process 1:584c
- sources and importance in world market 13:662g

- tin alloy production and use 18:431g; table
- U.S. consumption and world reserves, table 7 13:504
- vacuum sputter ion and sublimation pump 19:16b
- world mineral production table 12:247
- zinc alloy properties and uses 19:1149g; table 1150

Titano, Monte, mountain notable for its three peaks in San Marino, southern Europe. $43^\circ55'\text{N}$, $12^\circ28'\text{E}$

• San Marino landscape 16:223c

Titanomachia, in ancient Greek mythology, 10-year struggle for the rule of the world in which Zeus and his brothers and sisters defeated Cronus and the Titans; one of the principal Greek theogonic myths.

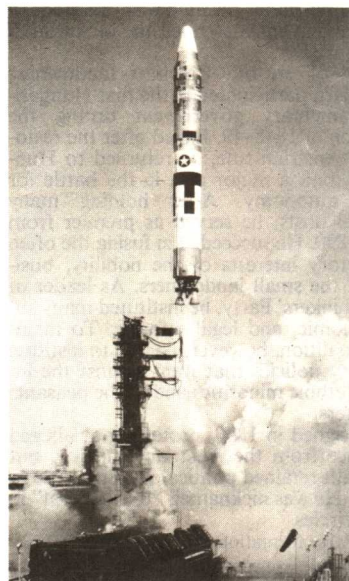
• Hesiod's account in the Theogony 8:830f

Titanosuchus, extinct genus of advanced mammal-like reptiles found in Middle Permian deposits of South Africa (the Permian Period began 280,000,000 years ago and lasted 55,000,000 years). *Titanosuchus* was a relatively generalized form that retained many carnivorous traits, such as strongly developed canine teeth. Later forms became herbivores.

titanotheres, extinct group of large-hoofed mammals that originated in North America during the early Eocene Epoch (about 54,000,000 years ago) and were present in North America and Asia during the Oligocene Epoch (which began 38,000,000 years ago and lasted 12,000,000 years). The titanotheres became extinct during the middle Oligocene. Most were large forms that fed largely on soft vegetation. The skulls were massive and frequently adorned with large, grotesque horns that were probably effective battering rams in combat with other titanotheres, perhaps between males for territorial dominance, or as defensive weapons against predators. The bodies were bulky, the limbs pillar-like and strong, and the brain very small and primitive. The remains of titanotheres are abundantly represented in the geological record, and the different forms must have been locally numerous; it is possible that the titanotheres moved about in herds. Anatomically, it is frequently possible to differentiate between males and females. The titanotheres probably became extinct because their relatively simple dentition could not effectively cope with the high silica content of the grasses that were spreading during the Oligocene Epoch.

- fossil record and era 7:573d; illus.
- horse relatives' evolution 14:87d; illus.

Titan rocket, originally developed as a two-stage, U.S. intercontinental ballistic missile



Titan II being fired from its launcher, 1962
By courtesy of the US Air Force

with a range exceeding 5,000 miles (8,000 kilometres) and, in its later versions, as a space-launch vehicle. Titan I, the original rocket, burned kerosene with liquid oxygen. Titan II was modified to use storable, self-igniting fuel, eliminating the need to add liquid oxygen just prior to launching, and was assigned the mission of orbiting manned satellites as part of the Gemini (*q.v.*) program. Titan III exists in several versions designated by letters (Titan IIIA, IIIB, IIIC, and IIIM) and was scheduled for heavy use in the 1970s as a space launch vehicle. It can launch manned or unmanned payloads of 35,000 pounds (16,000 kilograms). The Titan IIIM is planned as the launch vehicle for the Manned Orbiting Laboratory program of the late 1970s. Employing three stages and solid-propellant boosters, it is to have an overall height of 177 feet (54 metres), weight of about 1,818,500 pounds (824,860 kilograms), and thrust at lift-off of 3,160,000 pounds.

· design, development, and fuel system 15:930c
· performance and design, table 1 17:363

Titans, in Greek mythology, the children of Heaven and Earth (Uranus and Ge). According to Hesiod's *Theogony*, there were 12 Titans: the brothers Oceanus, Coeus, Crius, Hyperion, Iapetus, and Cronus and the sisters Thea, Rhea, Themis, Mnemosyne, Phoebe, and Tethys. Most of the Titans rebelled against the chief god, Zeus, the son of Cronus and Rhea, and after being defeated were imprisoned in the underworld. The Titans may have been gods of an earlier cult ousted by the Olympic pantheon under Zeus. But if, as seems likely, the story of Zeus's overthrowing his father is borrowed from Hittite mythology, the Titans could be explained as an awkward invention of the allies of Cronus.

The Titans are mentioned in Orphic doctrine as wicked beings destroyed by Zeus's thunderbolt after devouring Dionysus, the god of wine.

tit-babbler, name for birds of the subfamily Timaliinae of the babbler family Timaliidae (order Passeriformes). The 35 to 40 species are small and short-billed, rather like titmice in appearance and behaviour but mostly somewhat larger with proportionately shorter tails. Tit-babblers are chunky birds, 10 to 18 centimetres (4 to 7 inches) in length, with fluffy plumage, characterized by hairlike feathers on the back. They are not brightly coloured, being black, gray, reddish, or brown, with yellow or white below. They occur, chiefly in scrub and wetlands, from eastern Asia to the Philippines, with one genus, *Neomixis*, of uncertain relationships, in Madagascar. The 26 species of *Stachyris* are sometimes called tree babblers. Most tit-babblers are poor singers, but the red-capped babbler (*Timalia pileata*), found from Nepal to Java, whistles pleasantly.

Tit-Bits, British weekly newspaper founded in 1881.

· magazine publishing history 15:249c

Titchener, Edward Bradford (b. June 11, 1867, Chichester, Sussex—d. Aug. 3, 1927, Ithaca, N.Y.), psychologist and a major figure in the establishment of experimental psychology in the United States. A fervent and faithful disciple of the German psychologist Wilhelm Wundt, the founder of experimental psychology, he gave Wundt's theory on the scope and method of psychology a precise, systematic expression. His *Experimental Psychology* (4 vol., 1901–05), regarded as one of the most learned works on psychology ever written in English, served to make the study a discipline comparable to other laboratory sciences.

In 1890 Titchener entered Wundt's laboratory at the University of Leipzig (now in East Germany) and, after an unusually brief candidacy, received his Ph.D. in 1892. Though he had little personal contact with Wundt, he thoroughly assimilated and espoused the view

that the concern of psychology is the systematic, experimental study of the normal, adult mind and that its proper, not to say exclusive, method is introspection, or the precise examination and description of conscious experience. He continued to expound Wundt's views after his arrival at Cornell University, Ithaca, N.Y. (1892), where he became professor of psychology (1895–1927).

From 1898 Titchener was the foremost exponent of structural psychology, which concerns itself with the components and arrangement of mental states and processes. Vigorously asserting the scientific nature of psychology, he insisted that its concern was with description, not with application or use. In his ambition to transplant the psychology established by Wundt and nurtured in Germany, he translated 11 German works, including titles by Wundt and Oswald Külpe. He himself wrote eight works, many of which went through several revised editions and were translated into a number of languages. By far the most important was *Experimental Psychology*, consisting of two student manuals and two teachers' manuals. Designed to drill students in laboratory method, the manuals were patterned on those used in qualitative and quantitative experiments in chemistry. His qualitative works dealt with describing such phenomena as sensations, attention, association of ideas, and perception. The quantitative manuals included measurement of response thresholds and reaction times.

Among Titchener's other works was *A Textbook of Psychology* (1910), the most comprehensive, yet concise, exposition of his psychology. He also published 216 papers, and the Cornell laboratory issued 176 more, many of them appearing in the *American Journal of Psychology*, which he edited for 31 years. Though a charter member of the American Psychological Association in 1892, he did not remain with it for long and in 1904 founded the Society of Experimental Psychologists.
· history of American psychology 15:157d

Titchmarsh, Edward Charles (b. June 1, 1899, Newbury, Berkshire—d. Jan. 18, 1963, Oxford), mathematician whose prodigious contributions to mathematical analysis placed him in the forefront of 20th-century mathematicians.

A lecturer at University College, London, from 1923, Titchmarsh was appointed professor of pure mathematics at the University of Liverpool in 1929 and two years later became Savilian professor of geometry at Oxford University. He devoted his early research to the theory of Fourier integrals and series and added new findings to the study of Fourier transforms. He further contributed to the theory of conjugate functions and general integral transforms and thus formed a major part of his *Introduction to the Theory of Fourier Integrals* (1937). He next turned his attention to the study of the theory of integral functions, especially the Riemann zeta-function (a complex-number function), and published his results in *The Zeta-Function of Riemann* (1930) and more fully elaborated this work in *The Theory of the Riemann Zeta-Function* (1951). From his studies of complex-variable theory he wrote *The Theory of Functions* (1932), which became a leading textbook on real and complex function theory and was translated into numerous languages.

After 1939 Titchmarsh concentrated his research on the theory of function expansion in eigenfunctions of differential equations, an area of vital importance to quantum theory, and published many of his results in *Eigenfunction Expansions Associated with Second-Order Differential Equations* (Part 1, 1946; Part 2, 1958). His contributions helped resolve the differences between the general theory of quantum mechanics and the methods used to solve particular problems in quantum theory.

Titcomb, Timothy (pseudonym): see Holland, Josiah Gilbert.

Titelouze, Jean (b. 1563, Saint-Omer, Fr.—d. Oct. 25, 1633, Rouen), organist and composer whose improvisatory skills and virtuosic technique made him much sought after as a performer and whose compositions rank him among the finest French Baroque church composers.

Titelouze's family had been active musically in Saint-Omer since the early 16th century. Jean's formal and informal training included close acquaintance with the music of leading Franco-Flemish and English composers of the late Renaissance as well as thorough study of counterpoint (combination of simultaneous melodic lines), modal harmony (based on the medieval and Renaissance modes, rather than the major and minor scales), and music theory. In 1585 he was appointed organist at the church of Saint-Jean in Rouen; in 1588 he rose to the post of Rouen cathedral organist, and by 1610 he had become a canon at the cathedral, where he remained until his death, although he left the city to give organ recitals all over France.

His most important publication, *Hymnes de l'église pour toucher sur l'orgue...* (1623; "Church Hymns for the Organ"), was followed in 1626 by publication of organ versets (interludes) built on the chant of the Magnificat (the "Song of Mary"). He also wrote several masses for choir.

Titelouze's music is strictly contrapuntal and modal but rhythmically free; it is not flashy but rather reflective and mystical, as befits liturgical music. His reputation remains high, although his music is not easily available in modern editions.

· organ literature development 13:680g

tithe (from Old English *teogothian*, "tenth"), a custom dating back to Old Testament times and adopted by the Christian Church whereby lay people contributed a tenth of their income for religious purposes, often under ecclesiastical or legal obligation. The money (or its equivalent in crops, farm stock, etc.) was used to support the clergy, maintain churches, and assist the poor. Tithing was also a prime source of subsidy for the construction of many magnificent cathedrals in Europe.

Despite serious resistance, tithing became obligatory as Christianity spread across Europe. It was enjoined by ecclesiastical law from the 6th century and enforced in Europe by secular law from the 8th century. In England in the 10th century, payment was made obligatory under ecclesiastical penalties by Edmund I and under temporal penalties by Edgar. In the 14th century Pope Gregory VII, in an effort to control abuses, outlawed lay ownership of tithes.

During the 16th-century Protestant Reformation, Martin Luther approved in general of paying tithes to the temporal sovereign, and the imposition of tithes continued for the benefit of Protestant as well as Roman Catholic churches. Gradually, however, opposition grew. Tithes were repealed in France during the Revolution (1789), without compensation to tithe holders. Other countries abolished certain kinds of tithes and indemnified the holders. By 1887 the tithe had been brought to an end in Italy. It was abolished in Ireland at the disestablishment of the Anglican Church in 1871, and it gradually died out in the Church of Scotland. In England in 1836, the tithe was commuted for a rent charge depending on the price of grain, and in 1936, the tithe rent charges were abolished. New methods of taxation were developed in those countries that provided financial support of the church out of government funds.

Tithe was never a legal requirement in the United States. Members of certain churches, however, including the Latter-day Saints and Seventh-day Adventists, are required to tithe, and some Christians in other churches do so voluntarily.

The Eastern Orthodox churches never accepted the idea of tithes, and Orthodox church members have never paid them.

- abolition in France 17:1003h
- medieval sources of church revenue 12:155c
- Roman taxation methods 17:1077h

Tithonian Stage, major division of Upper Jurassic rocks and time in central and southern Europe. (The Jurassic Period began about 190,000,000 years ago and lasted some 54,000,000 years.) It consists in many areas of thick, white limestones. Numerous ammonite zones (shorter spans of time characterized by fossil mollusks) are recognized in the Tithonian. In central and southern Europe, the Tithonian is the uppermost stage of the Jurassic and follows the Kimmeridgian Stage; elsewhere, the Purbeckian is the uppermost Jurassic stage.

- rock sequence 10:354e; table 356

Tithonius Lacus, feature of the Valles Marineris canyon system on the planet Mars. As the accompanying photograph returned in 1972 by the space probe Mariner 9 shows, Tithonius Lacus, located at latitude -5° , longitude 85° , consists of a great chasm (Tithonium Chasma), larger and deeper than the Earth's Grand Canyon. Measurements of the amount of atmosphere between the Martian soil and the space probe have determined that

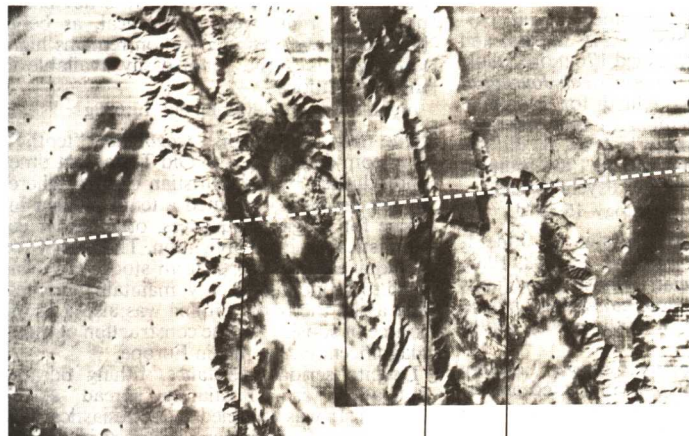
and are active during the day. They use their tails for balance while moving about and intertwine their tails while resting together in trees. Titit eat fruit, bird eggs, insects, and small birds. Breeding is not seasonal. The single offspring clings to the male except when being fed.

- social tail-twining 4:1013d; illus. 1015

Titian 18:457, full name TIZIANO VECELLIO (b. 1488/90, Pieve di Cadore, Italy—d. Aug. 27, 1576, Venice), painter of the Venetian school whose mastery of colour and the techniques of oil painting earned for him recognition as one of the greatest artists of the Renaissance. His observant portraits, poignant religious compositions, and joyous mythological subjects account for his status as one of the giants of Western art.

At age nine Titian was apprenticed to a mosaicist in Venice. He then worked under the Venetian painter Giovanni Bellini and collaborated with Giorgione, whose influence shows particularly in Titian's early works. The merit of his mature works resulted in patronage by Italian nobles, the Venetian Republic, the Habsburgs (who knighted him), and Pope Paul III. Titian travelled to Ferrara, Bologna, Rome, and Milan, and outside Italy to Augsburg. After 1551, however, he lived in Venice.

- TEXT BIOGRAPHY COVERS:
- Early life and works 18:457h
- Mythological paintings 458f



Part of the great chasm in Tithonius Lacus; the jagged line at the bottom represents pressure measurements taken by an ultraviolet camera that have been translated into depths

By courtesy of the National Aeronautics and Space Administration

the lowest point of the surface is about 2,900 metres (9,500 feet) below the surrounding levels. The chasm is about 500 kilometres (300 miles) long and 120 kilometres wide. The erosion seen in the side canyons may have been caused by water but is more likely to have been the result of winds in the Martian atmosphere.

titi (shrub): see buckwheat tree.

titi, also called TEETEE (*Callicebus*), arboreal monkey, family Cebidae, found in South American rain forests, especially along the Amazon and other rivers. Titit, of which there are three species, have long, soft, glossy fur and rather flat, high faces set in small, round heads. They are about 25–60 centimetres (10–24 inches) long, excluding the furry tail that measures 25–55 centimetres. Titit may be dark brown, gray, reddish, or blackish, depending on the species, and have patterned or differently coloured underparts, face, limbs, and tail. They live in small territorial groups

- Religious paintings 458g
- Portraits 459a
- Travels and commissions 459d
- Last years in Venice 460a

REFERENCES in other text articles:

- "Bacchanal, The," oil painting, illus., 19:Visual Arts, Western, Plate 10
- Charles V portrait illus. 4:48
- El Greco's use of colour 8:306e
- light and shade techniques in drawing 5:1000d
- loosening of technique in later works 13:878f
- Philip II oil painting illus. 14:228
- Poussin's exposure to Renaissance art 14:934a
- stylistic development and influence 19:402d
- Tintoretto as student and rival 18:433h *passim* to 436b
- Velázquez' technique adaptations 19:54f
- "Venus and the Lute Player," oil painting, illus., 13:Painting, Art of, Plate 4

Titicaca, Isla de, also called ISLA DEL SOL, island in Lake Titicaca, western Bolivia. The island, 7 mi (11 km) long and 2 mi wide, is an

archaeological site of Inca and pre-Inca civilizations.

16°01' S, 69°10' W

- Inca ruins and associated beliefs 18:462c

Titicaca, Lake 18:461, Spanish LAGO TITICACA, the world's highest lake navigable by large vessels. The lake lies 12,500 ft (3,810 m) above sea level in the Andes Mountains of South America, astride the Peru-Bolivia border. It is the second largest lake in South America and it has an area of 3,200 sq mi (8,300 sq km).

The text article covers the lake's physiography, hydrography, fish and animal life, peoples, resources, and navigation.

15°50' S, 69°20' W

REFERENCES in other text articles:

- age and fauna peculiarities 1:1032g
- Andes location and distinction 1:857e; illus. 856
- elevation and navigability 14:127h
- Inca conquest of surrounding area 1:848g; map 840
- maps
- Bolivia 3:3
- Peru 14:129
- origin and physiography 17:80d; illus. 85
- oxygen deficiency due to altitude 15:752f
- structural formation in Andean plateau 14:527f
- water utilization proposal 3:7d

Titisee, village, Baden-Württemberg Land (state), southwestern West Germany, in the Black Forest (Schwarzwald), at the northeastern tip of the Titisee (Lake Titi), southeast of Freiburg im Breisgau. The village is a noted climatic health resort (altitude 2,795 ft [852 m]), winter-sports centre, and tourist resort, offering a wide variety of year-round activities. Pop. (1970) 2,047.

47°54' N, 8°08' E

Titius (TIETZ), Johann Daniel (b. Jan. 2, 1729, Konitz, Prussia, now Chojnice, Poland—d. Dec. 11, 1796, Wittenberg, Saxony, now in East Germany), astronomer who first published (1772) the empirical expression of planetary distances from the Sun. The expression, later refined by J.E. Bode, is known as Bode's law, or the Titius-Bode rule.

- discovery of Bode's law 14:389b

Titius-Bode rule (astronomy): see Bode's law.

titlark (bird): see pipit.

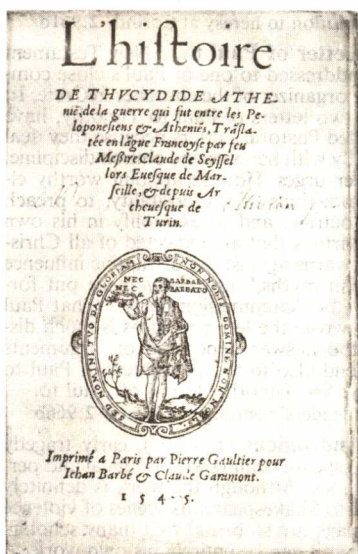
title, in property law, evidence of the right to possession of certain property. There are several degrees of right: the most imperfect degree of title is naked possession, consisting of no more evidence than the occupation of the property; the highest degree of title exists when the right of possession is joined with the right of property ownership.

- bills of lading and warehouse receipts 4:992d
- feudal methods of land conveyance 4:998g
- French and German civil codes on title transfer validity 4:663g *passim* to 664h
- Greek legal transfer concept 8:401a
- insurance coverage and rationale 9:650b
- land reform and tenure 10:635h
- marital-property systems 7:170d
- Roman and medieval law principles 6:1119g
- vesting of property rights 15:55b

title page, in typography, first page of a book on which are printed the title, the author's name, and optional additional material that may include the name of the publisher, the place of publication, and a description of the work. The title page was the result of the invention of printing and had not existed before it. Commissioned manuscript books prepared by scribes were presented to their owners unbound, with no cover or cover sheet, no title, and no pagination. Most usually, the text began on the first page and was introduced by some version of the phrase "here begins . . ."

Within the first decades of printing, medieval craftsmen adopted the practice of scribes who often added their signatures at the end of

their work. Such colophons, in the hands of the printer, were expanded from the scribe's name and, occasionally, place of work and a short prayer, to become, first, short advertisements for the edition at hand, short attacks on other publisher's editions, and, ultimately, brief essays.



Title page of a translation of Thucydides, published in Paris by Claude Garamond, 1545

Courtesy of The Newberry Library, Chicago

At the same time, an expanding market for printed material made it practical to print additional copies of a work on speculation, as it were; and it soon became common practice to cover the pages of a volume with a blank sheet to protect the text from soiling until it could be sold. Faced with the necessity of a quick method of identifying various printed materials in the same shop and informing prospective purchasers of the contents of such volumes, the 15th-century printer moved the colophon to the blank cover sheet and, in fact, created the first title page. Peter Schöffer, Gutenberg's successor at Mainz, Ger., introduced and almost immediately discarded the first title page. The device was revived in Cologne in 1470 and was firmly established by 1500.

origins and early use 18:816h

titmouse (bird): see tit.

Tito 18:462 (b. JOSIP BROZ, May 7, 1892, Kumrovec, now in Yugoslavia—d. May 4, 1980, Ljubljana), effective head of the Yugoslav state from 1943 and its elective president from 1953. Determined to maintain the independence of his country, he led the Yugoslav Partisans against the German invaders in World War II, and in 1948 he became the first Communist national leader to successfully defy the Soviet Union.

Abstract of text biography. Tito, a mechanic by trade and a World War I hero (at the Carpathian front), was a Communist Party member from the early 1920s. For his party activities he was punished with several jail terms, and from 1934 he lived as an underground revolutionary. He rose to power after Joseph Stalin's Soviet purge in 1937. During World War II he proved to be an exceptional commander of guerrilla forces. As Yugoslavia's leader in the 1950s, '60s, and '70s, he adopted a policy independent of both the Soviet and Western blocs and established ties with other nonaligned nations in Africa, Asia, and Latin America.

REFERENCES in other text articles:

- authoritarian disputes with Stalin 17:316b
- break with Soviets 4:1023f
- Marxism adapted to Yugoslav Communism 11:560b
- popular front organization 2:636d

- Soviet ideology non-conformism 16:82b
- Stalin's reaction to defection 17:578g
- World War II foreign aid 19:985h
- Yugoslavia's development since 1945 19:1098g

Titograd, capital city of Montenegro, Yugoslavia, situated near the confluence of the Ribnica and Morača rivers. The first recorded settlement was Birsinium, a caravan stop in Roman times, though it probably was an Illyrian tribal centre earlier. As a feudal state capital in the early Middle Ages, it was known as Ribnica; it was called Podgorica from 1326. It fell to the Turks in 1474 but was restored to Montenegro in 1878. In 1916 it was occupied by the Austrians, in 1941 by the Italians, and in 1943 by the Germans. Only the Turkish clock tower (late 18th century), a mosque, and several houses survived the destruction of the old city in World War II. The city's bloody history is portrayed through an impressive number of war memorials.

In 1946 Podgorica became Titograd in honour of the Yugoslav leader Marshal Tito. Almost a completely new town, it has one-seventh of its area devoted to parks and recreational facilities. It has a university, theatre, museum, and sports centre. Manufactures are mainly consumer items. Pop. (1971) 54,822. 42°26' N, 19°14' E

map, Yugoslavia 19:1101

Titov, Gherman Stepanovich (b. Sept. 11, 1935, near Barnaul, Russian S.F.S.R.), cosmonaut who piloted the Vostok 2 spacecraft, launched on Aug. 6, 1961, on the first manned space flight of more than a single orbit.

An athletic youth, Titov was accepted in 1953 for aviation cadet training, graduating in 1957 as a jet fighter pilot from the Stalingrad Flying Academy. In 1960 he entered cosmonaut training, during the course of which he received the Order of Lenin for an engineering proposal that is still secret.

During the Vostok 2 flight of 25 hours, 18 minutes, Titov was assigned the communications code name Eagle. His radio identification, "I am Eagle," was spoken with intense excitement and made an impression on listeners around the world. An autobiography written in English with Martin Caidin, *I Am Eagle!*, appeared in 1962.

manned space flight, table 3 17:366

Titovo Užice, town, Serbia, Yugoslavia, on the Djetinja River and the Sarajevo-Cačak-Belgrade railway line. A medieval town of strategic importance, Užice became headquarters for the partisan army and the seat of the Free Republic of Užice during World War II; it was renamed in 1946. The town is a centre for a nonferrous metals and machinery industry and also for a livestock-breeding and fruit-growing region. Pop. (1971) 34,555.

43°51' N, 19°51' E

map, Yugoslavia 19:1101

Titov Veles, Turkish KÖPRÜLÜ, town, Macedonia, Yugoslavia, on the Vardar River. It is linked to Skopje by road and electrified railway. Varied industrial activity produces silk textiles, tobacco products, processed fruits and vegetables, wine, poppy oil and opium, bricks, metalware, and porcelain. Pop. (1971) 35,980.

41°41' N, 21°48' E

map, Yugoslavia 19:1101

titration, process of chemical analysis in which the quantity of some constituent of a sample is determined by adding to the measured sample an exactly known quantity of another substance with which the desired constituent reacts in a definite, known proportion. The process is usually carried out by gradually adding a standard solution (i.e., a solution of known concentration) of titrating reagent, or titrant, from a burette, essentially a long, graduated measuring tube with a stopcock and a delivery tube at its lower end. The addi-

tion is stopped when the equivalence point is reached.

The equivalence point, or end point, of a titration is that point at which an exactly chemically equivalent amount of titrant has been added to the sample. It is a theoretical quantity that the analyst strives to determine as nearly as possible by means of some signal. This signal can be the colour change of an indicator (see indicator, chemical) or a change in some electrical property that is measured during the titration. The experimental point at which the completion of the reaction is marked by the signal is called the end point. The difference between the end point and the equivalence point is the titration error, which is kept as small as possible by proper choice of end point signal and method for detecting it.

For many titration reactions it is possible to find a suitable visual colour indicator that will signal the end point at, or very close to, the equivalence point. Such titrations, classified according to the nature of the chemical reaction occurring between the sample and titrant, include: acid-base titrations, precipitation titrations, complex formation titrations, and oxidation-reduction (redox) titrations. In acid-base titration (i.e., the titration of an acid with a base, or vice versa) the indicator is a substance that can exist in two forms, an acid form and a basic form, which differ in colour.

For example, litmus is blue in alkaline solution and red in acid solution. Phenolphthalein is colourless in acid solution and red in alkaline solution. A wide choice of acid-base indicators is available, varying not only in the colours of the two forms but also in their sensitivity toward acid or base.

Precipitation titrations may be illustrated by the example of the determination of chloride content of a sample by titration with silver nitrate, which precipitates the chloride in the form of silver chloride. The presence of the first slight excess of silver ion (i.e., the end point) can be marked by the appearance of a coloured precipitate. One way this can be done is by using potassium chromate as indicator. Potassium chromate reacts with silver ion at just the right concentration to form the red-coloured precipitate silver chromate. Another method is by the use of an adsorption indicator, the indicator action being based on the formation on the surface of the precipitate of an adsorbed layer of silver indicator salt, which forms only when an excess of silver ion is present.

The most important titrations based upon complex formation reactions are those involving the titration of metal ions with the reagent disodium ethylenediaminetetraacetate (EDTA). The indicators are dyes that have the property of forming a coloured complex with the metal ion. As the titration proceeds, the reagent reacts first with uncomplexed metal ions, and, finally, at the end point it reacts with the metal-indicator complex. The colour change corresponds to the conversion of the metal-dye complex into the free dye.

In oxidation-reduction (redox) titrations the indicator action is analogous to the other types of visual colour titrations. In the immediate vicinity of the end point, the indicator undergoes oxidation or reduction, depending upon whether the titrant is an oxidizing agent or a reducing agent. The oxidized and reduced forms of the indicator have distinctly different colours.

Alternatively, for many titrations the end point can be detected by electrical measurements. These titrations may be classified according to the electrical quantity that is measured. Potentiometric titrations involve the measurement of the potential difference between two electrodes of a cell; conductometric titrations, the electrical conductance or resistance; amperometric titrations, the electric

current passing during the course of the titration; and coulometric titrations, the total quantity of electricity passed during the titration. In the four titrations mentioned above, except coulometric titrations, the end point is indicated by a marked change in the electrical quantity that is being measured. In coulometric titrations the quantity of electricity required to carry out a known reaction is measured, and from Faraday's law, the quantity of material present is calculated.

·blood typing tests and techniques 2:1145d
·chemical reaction analysis procedure 4:146g
·inorganic quantitative analysis 4:80c
·organic halogen compound analysis 13:693c
·protein electrometric titration 15:87c
·seawater salinity determination 18:850f

Ti-ts'ang, in Chinese Buddhism, the overlord of hell, the *bodhisattva* ("Buddha-to-be") specially committed to delivering the dead from the torments of hell. His name is a translation of the Sanskrit Kṣitigarbha (*q.v.*, "womb of the earth").

Ti-ts'ang seeks to deliver the souls of the dead from the punishments inflicted by the 10 judges, or kings of hell (the fifth, Yen-lo Wang, is the Chinese manifestation of the Indian lord of death, Yama). The judges are always represented standing when in the presence of Ti-ts'ang, as a mark of their deference to him.

His previous lives included an existence as a Brahmin maiden who secured the release of her impious mother from hell by devoted prayers to the Buddha. Legends concerning Ti-ts'ang, emphasizing the virtue of filial piety, are recounted in the Chinese scripture, *Ti-ts'ang pen-yüan Ching* ("Scripture on Ti-ts'ang's Vows"). The mountain Chiu-hua in Anhwei province is sacred to Ti-ts'ang and is a favourite place of pilgrimage for Chinese Buddhists. In Japan, as Jizō, popular belief has given him additional roles as guardian of roads, helper in childbirth, and special protector of children who die.

·Buddhist underworld bodhisattva cult 3:422b

Ti-ts'ang pen-yüan Ching (Chinese: "Scripture on Ti-ts'ang's Vows"), Japanese JIZŌ-HONGAN-GYŌ, one of the latest *sūtras* in the Chinese Buddhist canon, portraying in elaborate detail the anguish of the underworld and describing the work, through endless eons, of the compassionate *bodhisattva* (Buddha-to-be) Ti-ts'ang (Sanskrit Kṣitigarbha) in rescuing the miserable spirits dwelling there. The present text makes frequent appeals to construct images of Ti-ts'ang and to make offerings before them—deeds that will also secure abundant benefits in this life.

ti tsu, Chinese horizontal flute.

·k'un ch'ü opera usage 12:675d

Tittāgarh (India): see Tittāgarh.

Titulescu, Nicolae (b. Oct. 4, 1883, Craiova, Romania—d. March 17, 1941, Cannes, Fr.), Romanian statesman who, as foreign minister (1927; 1932–36) for his country, was one of the leading advocates of European collective security.

A professor of civil law, Titulescu entered politics in 1912 and was appointed minister of finance in 1917. After World War I, he attended the peace negotiations at Paris and signed the Treaty of Trianon (1920). Again appointed finance minister in 1920, his unpopular fiscal reforms helped topple the government in December 1921. From 1922–26 and again from 1928–32, he served as Romanian minister plenipotentiary in London. As foreign minister he championed Romania's accession to the French-sponsored Little Entente of Czechoslovakia and Yugoslavia, engineered its attachment to the Balkan Entente (1934), consisting of Greece, Yugoslavia, and Turkey, and pursued a policy of friendship with France and the U.S.S.R. His difficulties with

the king, Carol II, and the impending breakdown of collective security, however, led eventually to his dismissal (August 1936). He was also Romanian delegate to the League of Nations and the author of several works on law and finance.

Tituli Asiae Minoris (1901–), a comprehensive collection of inscriptions from Asia Minor.

·sponsorship and area coverage 6:924d

titulus, also called *VINCULUM*, in mathematics, a straight horizontal mark placed over two or more symbols to indicate a compound quantity.

·numerals and numeral systems 11:647g

Titus, full name **TITUS FLAVIUS VESPASIANUS** (b. Dec. 30, AD 39—d. Sept. 13, 81), Roman emperor, conqueror of Jerusalem in 70. His lavish public spending earned him great popularity during his brief (79–81) reign. Generous with his personal fortune as well as with public funds, he sent aid to Campania after the eruption of Vesuvius (79) that destroyed Pompeii, Herculaneum, and Stabiae, and he helped rebuild Rome after the fire of 80. He completed construction of the Flavian Amphitheatre, better known as the Colosseum, begun by his father, emperor Vespasian, and opened it with ceremonies lasting more than 100 days.

After service in Britain and Germany, Titus commanded a legion under his father in Judaea (67). Following Nero's death (68), he promoted the imperial succession of Vespasian who, upon gaining the office, gave Titus charge of the Jewish war. His campaign, in which a million Jews were reputed to have died, culminated in the capture and destruction of Jerusalem. The arch of Titus (81), standing at the entrance to the Roman Forum, commemorated his victory.

Returning to Rome in 71, Titus received command of Vespasian's imperial troops, the Praetorian Guard. Granted the privileges of a tribune, he became his father's colleague in the censorship of 73 and in several consulships. As the military arm of Vespasian's principate, Titus incurred some unpopularity, worsened by keeping the sister of Herod Agrippa II, Berenice, as his mistress—for the Romans remembered Cleopatra, and marriage to an Eastern queen was repugnant to popular opinion. Twice he reluctantly dismissed her.

In 79 Titus suppressed a conspiracy, probably concerned with the succession; but, when his father died (June 23), he acceded promptly and peacefully. Handsome, cultivated, and affable, he was, according to Suetonius, "the darling of the human race." His brother Domitian, however, thought otherwise and is thought to have conspired in Titus' death.

·destruction of Jerusalem 17:951a

·Jerusalem and temple destruction 10:139h

·military record and popularity 15:1112h

·Vespasian's succession and cooperation 19:96d

Titus, Saint (fl. 1st century AD—d. traditionally Crete), like St. Timothy, a disciple of St. Paul the Apostle, for whom he was secretary; traditional first bishop of Crete. Known from New Testament allusions in Acts of the Apostles and the Pauline Letters, he was a Christian convert whom Paul, unlike in Timothy's case, refused to allow to be circumcised (Gal. 2: 1) at Jerusalem when the conservative party demanded this concession to religious feeling. In I and II Corinthians he then appears in connection with the Corinthian Church, where he was lauded by Paul.

Titus was specially entrusted with organizing the alms collection for poor Christians of Judaea and evidently acted as a commissioner of Paul at Corinth, where he replaced Timothy. According to II Timothy 4:10, he made a subsequent mission to Dalmatia, but the Letter of Paul to Titus, which contains the rule of episcopal life, implies that he superintended a zealous apostolate in Crete as Paul's delegate.

Later tradition made him bishop of Crete, charging that Paul had ordained him for that purpose. His feast day in the Greek and Syrian churches is August 25, and February 6 in the Western Church, as designated by Pope Pius IX. His remains are reputedly enshrined at St. Mark's Cathedral, Venice, Italy.

·Paul's guidance of the Corinthians 13:1093a

·Paul's solution to heresy at Corinth 2:961d

Titus, Letter of Paul to, a New Testament writing addressed to one of Paul's close companions, organizer of the churches in Crete. It, and the two letters of Paul to Timothy, have been called Pastoral Letters because they deal principally with heresies and church discipline. The letter urges Titus to appoint worthy elders to positions of responsibility, to preach sound doctrine, and to exemplify in his own life the virtues that are expected of all Christians. It warns against the disruptive influence of "Jewish myths," especially those put forward by the "circumcision party." That Paul actually wrote the letter to Titus is much disputed, the answer depending on arguments that extend also to the two letters of Paul to Timothy. See Timothy, letters of Paul to.

·Church leaders' instruction purpose 2:966b

Titus Andronicus (1593/94), early tragedy by Shakespeare dealing with political and personal crimes. Although the work is definitely ascribed to Shakespeare, its scenes of violence and carnage are so brutal that many scholars doubt that it can be entirely his own work.

·Brook's successful direction 5:827h

·popularity, style, and authenticity 16:621c

Titus Annii Milo: see Milo, Titus Annii.

Titus Aurelius Fulvius Boionius Arrius Antoninus: see Antoninus Pius.

Titus Calpurnius Siculus: see Calpurnius Siculus, Titus.

Titus Flavius Clemens: see Clement of Alexandria, Saint.

Titus Flavius Domitianus: see Domitian.

Titus Flavius Vespasianus (emperor of Rome, AD 69–79): see Vespasian.

Titus Flavius Vespasianus (emperor of Rome, AD 69–81): see Titus.

Titus Larcius: see Larcius, Titus.

Titus Livius: see Livy.

Titus Lucretius Carus: see Lucretius.

Titus Maccius Plautus: see Plautus.

Titus Pomponius Atticus: see Atticus, Titus Pomponius.

Titus Quinctius Flamininus: see Flamininus, Titus Quinctius.

Titus Tatius, traditionally the Sabine king who ruled with Romulus, the founder of Rome. It is doubtful that either Titus Tatius or Romulus were historical personages. According to the legend, the conflict between the Romans and the Sabines began when Romulus invited the Sabines to a festival and abducted their women. Titus Tatius then seized Rome's Capitoline Hill by bribing Tarpeia, daughter of the commander of the Roman guard. In the ensuing battle, fought in the valley between the Capitoline and Palatine hills, the Sabine women rushed into the fray and stopped the fighting. A formal treaty was drawn up uniting the Romans and Sabines under a dual kingship of Titus Tatius and Romulus. The community continued to be called Rome, but, as a concession to the Sabines, its citizens were known as Quirites (from Cures, the principal town of the Sabines). The dual kingship survived for only a few years before Titus Tatius was killed by a mob.

By about the 5th century BC the Romans had come to view the reign of Titus Tatius and Romulus as the prototype of their own dual magistracies; they found in Titus the eponym of both the Titienses (one of the three original

Roman tribes) and the religious brotherhood called the *soldados Titii*.

Titusville, city, seat of Brevard County, central Florida, U.S., linked to the John F. Kennedy Space Center on north Merritt Island via a causeway across the Indian River (lagoon). It was originally founded (1867) as Sand Point by Col. Henry T. Titus, for whom it was renamed in 1874. When incorporated as the Town of Titusville in 1886, it was a port served by a mule-drawn railway that carried freight as far as Sanford, 35 mi (56 km) inland. In 1887 the Jacksonville, Tampa, and Key West Railroad was extended to Titusville, which developed as a citrus shipping point and commercial fishing port. It attained city status in 1946 and consolidated with Indian River City and Whispering Hills Golf Estate in 1963. After the mid-1950s its economy was increasingly dominated by tourism and the nearby aerospace research and industrial complex. Pop. (1960) 6,410; (1980) 31,910. 28°37' N, 80°49' W

·map, United States 18:908

Titusville, city, Crawford County, northwestern Pennsylvania, U.S., on Oil Creek. Founded in 1796 by Jonathan Titus, a surveyor, it developed as a lumbering and agricultural centre. On Aug. 27, 1859, the first successful oil well was drilled just outside the city limits by "Col." Edwin L. Drake, marking the beginning of the state's oil boom. The nation's first oil refinery, blasting torpedo, casing-head gasoline plant, and gasoline engine for pumping were installed there, and the first extensive natural gas industry was developed (c. 1872) in the area. On June 5, 1892, Oil Creek flooded, wrecking many oil tanks; a film of oil covering the water caught fire and caused extensive damage to life and property. The last refinery closed in 1950 and oil is no longer the city's economic mainstay; alloy steel forgings, plastic and petroleum products, textiles, and electronic components are now the major products.



Replica of the original Drake oil well, Titusville, Pa.
Milt and Joan Mann from CameraMann

A regional campus of the University of Pittsburgh is in Titusville. A replica of the original well house and derrick and a museum are in the Drake Well Park. A monument (1902) to Col. Drake is in Woodlawn Cemetery, his burial site. Inc. borough, 1847; city, 1866. Pop. (1980) 6,884. 40°38' N, 79°41' W

titira, any of three species of tropical American birds in the genus *Tityra* of the cotinga family (Cotingidae, order Passeriformes). The masked titira, (*Tityra semifasciata*) is common in woods and open country from Mexico to Bolivia and Brazil, the black-tailed titira (*T. cayana*) occurs throughout tropical South

America, and the black-crowned titira (*T. inquisitor*) ranges from Mexico to Argentina. The males of all three species are about 20 centimetres (8 inches) long and are pale gray with black on the head, wings, and tail; the females are similar but browner in hue. The



Masked titira (*Tityra semifasciata*)
Drawing by Murrell Butler

bill is stout and slightly hooked. Tityras utter froglike sounds and nest in holes, which, in the case of the masked titira, may be usurped from a toucan or woodpecker by stuffing leaves into the hole until it is abandoned by the owner.

Tiv, Nigerian people living on both sides of the Benue River in the northern region; they speak a Benue-Congo language of the Niger-Congo family.

The Tiv are subsistence farmers whose main crops are yams, millet, and sorghum. Men make soil mounds in which yams are planted by both men and women; women plant additional crops on the side of the mounds, weed the fields, and harvest the crops. The next year the field is planted with millet, the following year with a cash crop; the land then lies fallow for several years until it has regained fertility. Although goats and chickens are plentiful, few cattle are kept because of the tsetse fly. Organized markets serve as a place to exchange goods, to discuss and decide political issues, to settle disputes, and to have fun.

The polygynous Tiv family occupies a cluster of round huts surrounding a reception hut; brothers usually live next to one another. Tiv social organization is based on patrilineages. Genealogies go back many generations to a single ancestor; the descendants (through the male line) of each person in the genealogy form a territorial kinship group. The lineages are organized on the principle of segmental opposition: any two segments of the lineage—such segments may be individuals or small lineages within a larger one—are of equal authority. The balance of power between equivalent segments provides the basis for political activities such as law enforcement and military protection. The force of patrilineal descent, while dominant in Tiv institutions, is somewhat balanced by other organizations, such as age grades (groups of men of about the same age who provide mutual assistance and allies against lineage pressure), cooperative groups, and institutionalized friendships. Although traditionally the Tiv had no chiefs—political decisions were made by lineage elders—the British administration established a paramount chief in 1948.

Some Tiv have converted to Christianity or Islām; but the tribal religion, based on the manipulation of forces (*akombo*) entrusted to man by a creator god, remains strong. The *akombo* are manifested in certain symbols or

emblems and in diseases that they create. An organization of elders who have the ability to manipulate these forces meets at night to repair those manifestations of *akombo* (e.g., epidemics) that affect the group; these phenomena require human sacrifice or its metaphorical equivalent.

·kinship residence structure 10:482a
·Nigerian peoples composition and cultures 13:90f; illus.
·visual art forms 1:261e

Tivaouane, town, Thiès région, Senegal, lies northeast of Dakar, the national capital, on a main railroad line. It is in an agricultural and livestock raising area. Local mineral deposits include phosphates of lime. Latest pop. est. 7,900.

14°57' N, 16°49' W

·map, Senegal 16:532

·mineral resource statistics 16:535c

Tiverton, borough, Devon, England, at the confluence of the Rivers Lowman and Exe. Twyfyrd (the double ford) is mentioned c. 880 in Domesday Book (1086), the record of the land survey ordered by William I the Conqueror. The community was noted as being crown property, but Henry I (reigned 1100–35) gave it to the Redvers family of feudal landowners. The castle was founded c. 1105 and the borough established between 1193 and 1217, being incorporated in 1615. The Chantry Chapel (1517) is noteworthy for its external carvings of ships. Peter Blundell, a merchant enriched by the kersey (homespun local woollen-cloth) trade, founded a large school in 1604. The cloth trade failed in 1816; but the tradition continues in contemporary manufacture of elastic net, woven nylon, and lace. Pop. (1971 prelim.) 15,548. 50°55' N, 3°29' W

·map, United Kingdom 18:866

Tivoli, ancient TIBUR, town and episcopal see, Roma province, Lazio (Latium) region, central Italy, picturesquely situated on the western slopes of the Monti (mountains) Sabini, on the Aniene River where it enters the Campagna di Roma, just east of Rome. Commanding the principal natural route eastward from Rome, that followed by the Via Tiburtina Valeria and the railways to Sulmona and Pescara, the site has been continuously occupied since prehistoric times. Originally an independent member of the Latin League (communities that cooperated in political and social matters) and a rival of Rome, Tibur passed within the Roman orbit in the 4th century BC,



Hadrian's Villa, Tivoli, Italy
SCALA, New York

received Roman citizenship in 90 BC, and attained prosperity as a summer resort under the late republic and early empire. After suffering during the barbarian invasions, the town recovered by the 10th century, became an imperial free city, and maintained its autonomy to some degree until 1816. Among the remains of wealthy Roman residences in the immediate neighbourhood, the most important are those of the one that was subsequent-

ly acquired by the emperor Hadrian in the 1st century to become the nucleus of his famous villa. Tivoli is an important landmark in the history of architecture, and its monuments are among the most impressive to survive from antiquity; their excavation since the 16th century played a considerable part in shaping successive generations of classicizing taste. Among other surviving Roman monuments are two small temples and the great temple of Hercules Victor (Ercole Vincitore) within the town, as well as remains of aqueducts and of the poet Horace's Sabine farm nearby. There are also notable medieval landmarks including the castle (now a prison), built in 1458–64 by Pope Pius II; and the Villa d'Este, begun in 1550 by Pirro Ligorio for Cardinal Ippolito d'Este. The latter's gardens, a magnificent example of Renaissance landscape architecture, are unrivalled in the wealth and fantasy of their fountains. Tivoli's famous waterfalls of the Aniene, 354 ft (108 m) high, have been diminished in volume by hydroelectric projects and other diversions, and indiscriminate building has robbed the old town of much of its former charm.

Paper making and light industry are carried on. Pop. (1978 est.) mun., 45,480.

41°58' N, 12°48' E

·Hadrian's artistic craftsmanship 8:540g

·Hadrian's theatre construction 18:237b

·map, Italy 9:1089

Tiw (Germanic god): *see* Tyr.

Tiwat (Luwian), Hattian **ESTAN**, Hittite **IS-TANU**, Hurrian **SHIMEGI**, in the religions of ancient Asia Minor, the sun god.

·Anatolian representation in robes of kings 2:191c

Tiwi, Aboriginal people of Australia.

·geographic distribution map 2:425

·status through economic success 2:425c

Tiwi, resort town, Albay province, Luzon, Philippines, on Lagonoy Gulf of the Philippine Sea. The town lies in a bed of volcanic vents through which live steam pours continuously, and Tiwi Hot Springs National Park is nearby. There are local handicraft industries utilizing abaca and clay. Pop. (1975) 24,257. 13°28' N, 123°41' E

Tiy (c. 1397–60 BC), queen of Egypt, wife of Amenhotep III and mother of Akhenaton. Her mummy (in the Egyptian Museum, Cairo) was identified in 1976.

·Akhenaton's family background 1:402a

·God's Wife of Amon principle 6:473g

Tizi n'Test, pass in the Haut Atlas mountains of Morocco.

30°50' N, 8°20' W

·Atlas Mountain caravan route 2:306f

Tizi-Ouzou, *wilāyah* (governorate), north central Algeria. With an area of 1,450 sq mi (3,756 sq km), it is bordered on the north by the Mediterranean and on the south by the Grande Kabylie (Djurdjura Mountains). The main towns are Tizi-Ouzou (the capital; *q.v.*), Dellys, and Azeffoun. Pop. (1978 est.) 875,075.

·map, northern Algeria 1:561

Tizi-Ouzou, capital of Tizi-Ouzou *wilāyah* (governorate), Algeria, in the Grande Kabylie. It lies in a narrow valley of the Oued Tizi-Ouzou, separated from the Oued Sébaou Valley by Djebel Belloua. Named for the flowering broom that grows in the pass connecting the two valleys, Tizi-Ouzou was built by the Turks and enlarged by the French. The town is a regional trade centre. Olives, figs, and grapes are processed there. Pop. (1974 est.) 108,000.

36°42' N, 4°03' E

·Atlas Mountains people migration 2:306b

·map, northern Algeria 1:561

Tiznit, town, Agadir province, southwestern Morocco, near the Atlantic coast and the Tachilla and Ouarzemimene mountains of the Anti-Atlas. A former military centre (the town was not pacified by the French until 1934), it now has irrigated orchards; dates, vegetables, and barley are cultivated locally. There are iron deposits in the mountains. Pop. (1971) 11,391.

29°43' N, 9°44' W

·economic aspects 12:448a

·map, Morocco 12:447

tjale, Swedish word for frozen, especially permanently frozen, ground. *See also* permafrost.

·world climates and their distribution 4:727d

tjandi, in Indonesia, type of religious structure.

·Javanese architectural styles 17:265g

Tjekker, one of the Sea Peoples of the ancient Middle East.

·location of settlements 17:941g

tjengdjeng, Balinese musical instrument.

·Balinese dance pattern coordination 17:237d

Tjilatjap, also spelled **CILACAP** or **CHILACHAP**, port, Djawa Tengah (Central Java) province, Indonesia, on the southern coast of Java. Its harbour is formed by a long, narrow island that affords protection from the monsoon seas and swells of the Indian Ocean. Wharves accommodate vessels drawing up to 23 ft (7 m). The harbour was used as a base for the Allied fleet during the latter stages of the Battle of the Java Sea in February 1942. Tjilatjap has road and rail connections to the rest of Java. Main exports are copra, rubber, tea, and cassava. Pop. (1971) mun., 1,187,427. 7°44' S, 109°00' E

·map, Indonesia 9:460

Tjirebon, also spelled **CIREBON** or **CHEREBON**, city and district in northeast Djawa Barat (West Java) province, Indonesia, on the Java Sea. For centuries the centre of Islām in western Java, the district generated much of the opposition to Dutch rule. Much of the northern half of the district is flat and marshy, while the southern half is mountainous. Southwest of the city the volcano Gunung Tjiremaj (Charemai) rises to 10,098 ft (3,078 m), with sulfur and hot springs on its slopes. Tea, rice, tobacco, essential oils, sugarcane, cinchona, cassava, peanuts, and pulses are grown in the district, and cigars, machine tools, chemicals, and textiles are manufactured. Kuningan, famous for a breed of horses, is a hill resort at 2,200 ft (670 m).

The city has a good open roadstead, quays, and warehousing and is a railway hub with a small airport. In November 1946 the Dutch-Indonesian pact recognizing the original Republic of Indonesia was drafted at Linggadjadi, a resort village just south of Tjirebon. Pop. (1971) district, 1,041,874; city, 178,529. 6°44' S, 108°34' E

·map, Indonesia 9:460

Tjokroaminoto, **Omar Said** (b. Aug. 16, 1882, Desa Bakur, Madiun, Java—d. Dec. 17, 1935, Jogjakarta), highly influential leader of the early Indonesian nationalist movement, closely linked with the Sarekat Islām (*q.v.*; Islāmīc Association), which he shaped as a political force.

The Sarekat Dagang Islām (Association of Islāmīc Traders), established in 1911 to promote the interests of Indonesian traders faced with growing Chinese competition, was reorganized as Sarekat Islām the following year by Tjokroaminoto. He broadened the focus of the group, greatly expanding its appeal, and organized it along Western lines. There were, however, substantial non-Western elements.

Tjokroaminoto, who had a powerful personality, became widely popular among Javanese peasants. By 1914 he had become the central figure of a messianic movement, and the Sare-

kat Islām had taken on strong mystical overtones. He was not a strong leader, however, and he failed to reinforce his popular appeal with a clear, consistent policy. His concern for the need for unity against Dutch rule led him to make compromises, while other groups with more coherent programs were politically more effective.

In the early years of Sarekat Islām, Tjokroaminoto came into contact with a number of young nationalists, among whom was Sukarno, who became the first president of Indonesia. Tjokroaminoto tutored Sukarno, who also married his daughter. After 1920 Tjokroaminoto's fortunes declined. He was jailed by the Dutch in 1921 on a charge of perjury. Also Sukarno, who had ended his marriage, had broken politically with Tjokroaminoto by 1923 and adopted a more radical position. They were later reconciled, and in 1926 Sukarno wrote for *Bandera Islām* ("Flag of Islām"), a journal edited by Tjokroaminoto after his release from prison. But his passive and conciliatory positions prevented Tjokroaminoto from ever regaining his early power and influence.

·Sukarno's early relationship 17:783d

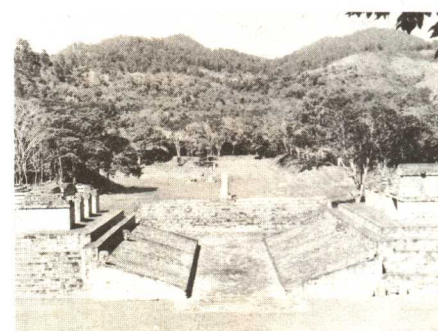
tjurunga (religion): *see* churinga.

Tkachev, **Pyotr Nikitich** (1844–85), Russian Narodnik (Populist) theorist who advocated the formation of an elite, professional revolutionary party, composed of members of the intelligentsia, who would overthrow the Russian autocracy and then rule dictatorially until the masses became enlightened enough to govern themselves.

·populist influence on Lenin 4:1020e

Tl, symbol for the chemical element thallium (*q.v.*).

tlachtli, Aztec name of the ball court used for the ritual ball game played throughout pre-Columbian Meso-America. Possibly originating among the Olmecs (La Venta culture, c. 800–c. 400 BC) or even earlier, the game spread to subsequent cultures, among them those of Monte Albán and El Tajín; the Maya (as *pok-ta-pok*); and the Toltec, Mixtec, and Aztec. In Aztec times, *tlachtli* was a nobles' game and was often accompanied by heavy betting. Various myths mention the ball game, sometimes as a contest between day and night deities. It is still played in isolated regions.



Mayan *pok-ta-pok* ball court, at Copán, Honduras. c. AD 775

Irmgard Groth

The ball court, shaped like a capital I with serifs and oriented north-south or east-west, represented the heavens. Players, wearing heavy padding, used elbows, knees, and hips to knock a solid rubber ball into the opponent's end of the court; in post-Classic times (after c. AD 900), the object was to hit the ball through one of two vertical stone rings (placed on each side of the court). The ball represented the sun (or moon or stars), and the rings, the sunrise and sunset or the equinoxes. Extremely violent, the game often caused serious injury and, occasionally, death.

·Classic Central Veracruz tradition 11:941d

·Mayan religious practices 11:722d

Tlaelquarni (Aztec goddess): *see* Tlazolteotl.

Tláhuac, town and seat of Tláhuac delegation, southeastern Federal District, central Mexico. In the basin of the former Lake Chalco, one of the five interlocking lakes of Anáhuac, it is the commercial and manufacturing centre of an agricultural and pastoral hinterland. Where the ground is firm, corn (maize), beans, alfalfa, and chili peppers are cultivated, and cattle, goats, sheep, and pigs are raised. Fruits and flowers are grown on floating gardens in the two small remaining lakes (Tláhuac and Mixquic). Mexico City to the north-northwest can be reached by highway. Pop. (1970) 13,850. 19°16' N, 99°00' W

Tlalchitonatuih (Aztec god): *see* Tonatuih.

Tlalnepantla, in full TLALNEPANTLA DE COMONFORT, city, northeastern México state, central Mexico. At an altitude of 7,474 ft (2,278 m) above sea level on the Río Tlalnepantla, it was founded by the Otomi Indians and conquered by the Aztecs; archaeological remains have been found on the site, and two Aztec pyramids are nearby. The city's church was begun in 1583. Originally an agricultural and livestock-raising centre, Tlalnepantla has become virtually a northwestern industrial suburb of Mexico City. It is an important transportation hub, receiving and servicing the railroad lines running to Nuevo Laredo, Guadalajara, Pachuca, and Veracruz. Among the city's varied industries are iron and bronze foundries, basic chemical plants, and factories manufacturing mosaics, instruments, machinery, and electrical equipment. Pop. (1970) 45,575. 19°33' N, 99°12' W

Tlaloc, the Aztec rain god; his name means He Who Makes Things Sprout. Representations of a rain god wearing a peculiar mask, with large round eyes and long fangs, date at least to the Teotihuacán culture of the highlands (3rd to 8th centuries AD). His characteristic features were strikingly similar to those of the Maya rain god Chac of the same period.



Tlaloc, detail of reconstructed wall painting from Tepatlil, Teotihuacán culture, 1st to 6th century AD
Hamlyn Group Picture Library

During Aztec times (14th to 16th centuries), Tlaloc's cult was apparently considered extremely important and had spread throughout Mexico. In the divinatory calendars, Tlaloc was the eighth ruler of the days and the ninth lord of the nights.

Five months of the 18-month ritual year were dedicated to Tlaloc and to his fellow deities, the Tlaloque, who were believed to dwell on the mountaintops. Children were sacrificed to Tlaloc on the first month, Atlcaualo, and on the third, Tozoztontli. During the sixth month, Etzalcualiztli, the rain priests ceremonially bathed in the lake; they imitated the cries of waterfowl and used magic "fog bells" (*ayauhchicauaztli*) in order to obtain rain. The 13th month, Tepeilhuitl, was dedicated to the mountain Tlaloque; small idols made of amaranth paste were ritually killed and eaten. A similar rite was held on the 16th month, Atemoztli.

Tlaloc had been one of the main deities of the agricultural tribes of central Mexico for many centuries, until the warlike northern

tribes invaded that part of the country, bringing with them the astral cults of the sun (Huitzilopochtli) and the starry night sky (Tezcatlipoca). Aztec syncretism placed both Huitzilopochtli and Tlaloc at the head of the pantheon. The Teocalli (Great Temple) at Tenochtitlán, the Aztec capital, supported on its lofty pyramid two sanctuaries of equal size: one, dedicated to Huitzilopochtli, was painted in white and red, and the other, dedicated to Tlaloc, was painted in white and blue. The rain god's high priest, the Quetzalcóatl Tlaloc Tlamacazqui (Feathered Serpent, Priest of Tlaloc) ruled with a title and rank equal to that of the sun god's high priest.

Tlaloc was not only highly revered, but he was also greatly feared. He could send out the rain or provoke drought and hunger. He hurled the lightning upon the earth and unleashed the devastating hurricanes. The Tlaloque, it was believed, could send down to the earth different kinds of rain, beneficent or crop-destroying. Certain illnesses, such as dropsy, leprosy, and rheumatism, were said to be caused by Tlaloc and his fellow deities. Although the dead were generally cremated, those who had died from one of the special illnesses or who had drowned or who had been struck by lightning were buried. Tlaloc bestowed on them an eternal and blissful life in his paradise, Tlalocan.

Associated with Tlaloc was his companion Chalchiuhtlicue (She Who Wears a Jade Skirt), also called Matlalcueye (She Who Wears a Green Skirt), the goddess of freshwater lakes and streams.

·Aztec religious origins and deities 2:549c
passim to 552a

·jaguar association in Olmec art 12:166d

·Teotihuacán worship 11:941a

Tlalpan, city and seat of Tlalpan delegation, central Federal District, central Mexico. At 1,425 ft (2,294 m) above sea level in the Valley of Mexico, it is on the northeastern slopes of the extinct Cerro Ajusco volcano. In the region are remains of a pre-Columbian town, and 1½ mi (2½ km) west of Tlalpan is the Cuicuilco Pyramid, considered to be the oldest man-made structure on the North American continent (dating from 7000 to 8000 BC). During the colonial era the settlement was called San Agustín de las Cuevas, after the church of the same name (1532). Given city status in 1827, Tlalpan served as capital of México state from 1827 to 1830. It retains a traditional and tranquil atmosphere, with large residences, health-care institutions, and rehabilitation centres. Because of its proximity to central Mexico City, approximately 12½ mi (20 km) to the north-northeast, Tlalpan is easily accessible by highway, railroad, and air. Pop. (1970) 22,128. 19°17' N, 99°10' W

Tlapacoya, archaeological site southeast of Mexico City.

·Meso-American radiocarbon dating 11:936a;
map 935

Tlapanec, an Indian people of Mexico and also their language.

·Hokan or Oto-Manguean affiliations 11:960b

·linguistic group filiation 11:954g; distribution
map 955

·Meso-American languages table 11:958e;
map 957

Tlaquepaque, city, north central Jalisco state, west central Mexico. Formerly known as San Pedro Tlaquepaque, the city lies in the temperate Guadalajara valley, approximately 5,400 ft (1,650 m) above sea level. A suburb of Guadalajara (q.v.), the state capital, 7 mi (11 km) southeast, Tlaquepaque is primarily a handicrafts centre, known especially for its pottery, textiles, and hand-blown glass. The city is also the commercial and manufacturing centre for the surrounding agricultural region, which yields wheat, corn (maize), peanuts (groundnuts), sugarcane, tobacco, and various fruits and vegetables. Because of its prox-

imity to Guadalajara, the city is easily accessible by highway, railroad, and air. Pop. (1970) 59,760.

20°39' N, 103°19' W

Tlatelolco, originally the twin city of the Aztec capital of Tenochtitlán, now part of Mexico City.

·Aztec temples and government system 11:953f

tlatoani, also known as TLATOQUE, Aztec head of a state.

·succession, powers, and rituals 11:952d

Tlaxcala, inland plateau state, central Mexico, bordered by the states of Puebla on the northeast, east, and south, by México on the west, and by Hidalgo on the northwest. The smallest Mexican state, its 1,511-sq-mi (3,914-sq-km) territory has a mean altitude of 7,000 ft (2,100 m) and a cool, healthful climate. It occupies roughly the same area as the Indian principality of Tlaxcala, which refused to surrender to the Aztec confederation and joined Hernán Cortés as his principal Indian ally in the conquest of Mexico (1519-21). Continued loyalty to Spain brought the Tlaxcalans many privileges.

Almost exclusively agricultural, the state produces cereals and has numerous handicrafts, notably the weaving of serapes and woollen cloth. Railways and highways traverse the state, linking Tlaxcala, the state capital, to Mexico City to the west and to Puebla to the south. Pop. (1970) 420,635.

·area and population, map and table 12:71

Tlaxcala, in full TLAXCALA DE XICHTÉNCATL, capital, Tlaxcala state, east central Mexico, on the Río Zahuapan at the northwest foot of La Malinche volcano, 7,388 ft (2,252 m) above sea level. In the region inhabited by the Tlaxcalan Indians, the designation "de Xicóhténcatl" commemorates a chieftain who vigorously opposed his people's aid to the Spanish conquistador Hernán Cortés. In 1519 Cortés conquered the city, where two years later he established the first Christian church (San Francisco) in the Americas. The Sanctuary of Ocotlán and archaeological ruins are nearby. The area produces corn (maize), beans, lima beans, and livestock. The textile industry is well developed in the city, producing cotton, wool, and synthetic fibres. Tlaxcala can be reached by highway from



San Francisco church in Tlaxcala city, Mex.

A. Harlap—Black Star