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# THE CONCISE COLUMBIA ENCYCLOPEDIA

Edited by Judith S. Levey and Agnes Greenhall with the Staff of *The Columbia Encyclopedia* 

Columbia University Press New York Guildford, Surrey

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### **PREFACE**

In *The Concise Columbia Encyclopedia* we have sought to create an up-to-date one-volume general encyclopedia of convenient size presenting a substantial body of information in compact form. It contains more than a million words in 15,000 entries made accessible by arrangement in a single alphabetical sequence. The articles cover a broad range of subjects of both contemporary and historical interest; about one-third of them are biographies. They are written to be both succinct and easy to understand.

As its name implies, The Concise Columbia Encyclopedia is firmly within the tradition established by previous Columbia Encyclopedias, including The Columbia-Viking Desk Encyclopedia. Although the articles have been prepared especially for the Concise encyclopedia, much of the information derives from its predecessors—especially The New Columbia Encyclopedia. In preparing these condensed articles, we have made scrupulous efforts to avoid distortion and to maintain readability without sacrificing grace of expression. The articles are up to date as of January 1, 1983.

Many of our articles reflect the enormous changes that have taken place worldwide during the past few years. Five years ago, for example, most of us had barely heard of Alzheimer's disease, gentrification, money market funds, Sandra Day O'Connor, Lech Walesa, John Irving, or videotex, while today these people and topics are frequently mentioned in all the media. The Concise encyclopedia is shorter than other general encyclopedias we have published, but it covers a diverse range of subjects: art, architecture, literature, music, dance, theater and motion pictures, language and linguistics, mythology, geography, history, politics and political science, economics, archaeology, anthropology, sociology, psychology, education, philosophy, theology and religion, medicine, biology and botany, chemistry, physics, astronomy, technology, computer science, and many more.

In designing *The Concise Columbia Encyclo-pedia* we established certain principles appropriate to a comprehensive yet condensed reference work. We did not include articles that would be simply definitions available in a dictionary, nor certain survey articles, such as "American literature," on sub-

jects whose depth and breadth preclude adequate treatment in a short-entry encyclopedia. Articles on many specific aspects of these broad topics, however, can be found, including articles on literary figures and forms, such as Emily Dickinson and Ernest Hemingway, the novel and satire, as well as movements such as transcendentalism. In some instances, when the more specific aspects of a broad topic might not be apparent, a list of cross-references is provided under a general heading, for example, "modern art" and "education."

While attempting to be precise and unbiased, we sometimes found that subjects of approximately equal importance required different treatment. Some people, for example, have led particularly complex lives or have made contributions in a variety of areas, while others of comparable distinction have been noted for achievement in a single field. Also, explanations in some detail proved to be necessary for an understanding of certain technical subjects, and some controversial topics required mention of several points of view. In short, the length of an article does not necessarily indicate the importance of a subject.

To aid our efforts toward conciseness, we have made considerable use of cross-references, tables, maps, and illustrations. Cross-references (which appear in SMALL CAPITALS throughout the book) permit us to avoid repeating the same information in several articles and indicate to the reader where additional related information can be found. Tables also allow much information to be presented in an abbreviated form, enabling the reader to see at a glance related facts and information that would otherwise be either scattered throughout the book or, because of space limitations, not included at all (they range from geologic eras to national parks to vitamins, from popes to dancers and dance companies). We have also provided a separate section, at the center of the book, of topographical and political color maps of the world, its continents, and the Atlantic and Pacific Ocean floors. Black and white maps accompany articles on major countries and some important regions (such as the Middle East and Southeast Asia). Line drawings help to explain certain subjects that are more easily understood through illustrations and diagrams than words, such as architectural structures, systems of the body, musical instruments, sports fields, and certain technical topics (e.g., electric circuit and artificial satellite).

In The Concise Columbia Encyclopedia we have selectively used the pinyin system for the transliteration of Chinese names. Pinvin was officially adopted by the Chinese government (People's Republic of China) in 1979 and is used in this book to transliterate names of officials and citizens of China who were alive at the time of the changeover to pinyin or who have achieved prominence since that time, e.g., Deng Xiaoping. Traditional transliterations have been retained for earlier Chinese and for persons not associated with the People's Republic of China. Pinyin is also used for all places in China, excluding cities, regions, and physical features that are better known in an earlier form, such as Peking, Canton, Tibet, and the Yangtze River.

Pronunciation is given for proper names that may be difficult to pronounce, and for languages and language families. For the most recent population figures available, we have relied primarily on official census figures, the United Nations, the Population Reference Bureau, Inc., and the consulates of some countries. Metric equivalents are given for measurements in English standard units.

We wish here to express our gratitude to the many people who helped prepare The Concise Columbia Encyclopedia. John D. Moore, director of Columbia University Press, constantly provided us with enthusiastic support and helpful advice, and Walter Meade, president of Avon Books, had confidence in our project from its inception. Henry H. Wiggins, vice president of Columbia University Press, graciously shared his experience on earlier Columbia encyclopedias with us, as did Gerard S. Mayers, the Press's production manager, who, with his staff, provided many helpful and sensible suggestions. We also had the benefit of advice and direction from a distinguished group of consultants, many of them on the faculty of Columbia University. In addition, staff members at Columbia's many excellent libraries generously offered patient and invaluable assistance. Special thanks are due Sidney Feinberg, the designer, who supplied innovative solutions to a wide variety of design problems. We are also grateful to the cartographer, George Colbert, the artist, Frank Ronan, and Rocappi, the computerized composition division of Lehigh Press, Inc. Finally, we offer our deep appreciation to the staff of the encyclopedia for their energy, competence, and devotion to the project.

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### KEY TO PRONUNCIATION

```
ə
     sofa (sō'fə), item (ī'təm), easily (ē'zəlē).
                                                         ŏ
                                                              hot (hŏt), body (bŏd'ē)
        cannon (kăn'ən), circus (sûr'kəs)
                                                         ō
                                                              over (ō'vər), hope (hop), grow (gro)
ă
     act (ăkt), bat (băt)
                                                         ô
                                                              orbit (ôr'bit), fall (fôl), saw (sô)
ā
     ape (ap), fail (fal), day (da)
                                                         ŏŏ
                                                              foot (foot), wolf (woolf), put (poot),
â
     air (âr), care (kâr)
                                                                 pure (pyoor)
ä
     art (ärt), father (fä'thər)
                                                         \overline{00}
                                                              boot (boot), lose (looz), drew (droo),
b
     back (bak), labor (laber), cab (kab)
                                                                 true (troo)
ch
     chin (chin), hatchet (hăch'ət), rich (rich)
                                                         oi
                                                              oil (oil), royal (roi'əl), boy (boi)
d
     dock (dŏk), lady (lā'dē), sad (săd)
                                                         ou
                                                              out (out), crowd (kroud), how (hou)
ĕ
     end (ĕnd), steady (stěďē), met (mět)
                                                              pipe (pīp), happy (hăp'ē)
                                                         р
ē
     eve (ev), clear (kler), see (se)
                                                              road (rod), appeared (əpērd'),
f
     fat (făt), phase (faz), cough (kôf)
                                                                carpenter (kär'pəntər)
     get (gět), bigger (bǐg'ər), tag (tǎg)
g
                                                              so (sō), cite (sīt), baste (bāst)
h
     hand (hand), ahead (əhed')
                                                         sh
                                                              shall (shal), sure (shoor), nation (na'shan)
hw
     wheel (hwel), which (hwich)
                                                              tight (tīt), better (běťər), talked (tôkt)
                                                         t
ĭ
     it (ĭt), pill (pĭl), mirror (mĭr'ər)
                                                         th
                                                              thin (thǐn), bath (băth)
ī
     iron (ī'ərn), eye (ī), buyer (bī'ər)
                                                         th
                                                              then (then), father (fä'ther), bathe (bath)
i
     jam (jam), ginger (jin'jər), edge (ĕi)
                                                         ŭ
                                                              but (but), flood (flud), some (sum)
k
     kit (kit), tackle (tak'əl), cook (kook)
                                                         û
                                                              curl (kûrl), girl (gûrl), fern (fûrn),
١
     little (lĭt'əl), holly (hŏl'ē), pull (pŏol)
                                                                worm (wûrm)
m
     man (măn), hammer (hăm'ər), climb (klīm)
                                                              vest (věst), trivial (trĭv'ēəl), eve (ēv)
n
     new (noo), known (non), winner (win'er)
                                                         w
                                                              wax (wăks), twins (twinz), coward
     singing (sing'ing), finger (fing'gər),
                                                                (kou'ərd)
        sang (săng), sank (săngk)
                                                              you (yoo), onion (un'yən)
                                                         У
                                                              zipper (zĭp'ər), ease (ēz), treads (trědz)
                                                         Z
                                                         zh pleasure (plezh'ər), rouge (roozh)
```

### Foreign

- ö as in French peu (pö), German Goethe (gö'tə)
- Sounds ü as in French Cluny (klüne')
  - kh as in German ach (äkh), ich (ĭkh); Scottish loch (lŏkh)
  - N this symbol indicates that the preceding vowel is nasal as in French cinq (saNk), un (öN), sans (saN), tombe (tôNb), en (aN)

### Accents and Hyphen's

- primary accent, written after accented vowel or syllable: Nebraska (nəbrās'kə), James Buchanan (byoōkă'nən)
- ' secondary accent: Mississippi (mis"əs-sip'ē)
- dash, replacing obvious portion of pronunciation: hegemony (hijem'əne, he-, hej'əmo"ne, heg'ə-)
- hyphen, to prevent ambiguity in syllabification: Erlanger (ûr'lăng-ər), dishearten (dĭs-här'tən)

## HOW TO USE THE CONCISE COLUMBIA ENCYCLOPEDIA

The Concise Columbia Encyclopedia is easy to use. All articles are arranged alphabetically, with article heads in **boldface**. The headings of biographical articles are inverted and alphabetized by the subject's name, e.g., the American composer Stephen Foster appears as **Foster**, **Stephen Collins**. Exceptions to this rule are made for some figures from history and folklore, e.g., the black American folk hero John Henry is listed as **John Henry**.

Generally, articles with the same heading are alphabetized in order of persons, places, and things, so that **Washington**, **George** comes before **Washington** (state), which in turn comes before **Washington**, **Treaty of**. The order of alphabetization for persons is determined by rank: saints, popes, emperors, monarchs, followed by titled nobility. Monarchs of the same name are listed alphabetically by country and numerically within the country; thus all kings Charles of France appear before any kings Charles of Spain.

The method of alphabetization disregards word breaks. Capetians, for example, appears before Cape Town, and arthropod before art nouveau. The following special cases of alphabetization should also be noted: (1) Names with von, de, and similar prefixes are alphabetized using the most common form of the name: Van Gogh, Vincent, but Bismarck, Otto von. (2) Names beginning with Mc and Mac are treated as though they begin with Mac; thus McDougall, William appears before Macedon. (3) Abbreviations in article headings are treated as though they were spelled out: St. Bernard appears before Saint Catharines. (4) Japanese names are listed in the traditional Japanese order, surname first, without a comma, e.g., Kawabata Yasunari; Americans of Japanese descent are listed in the Western style, e.g., Noguchi, Isamu.

Family Articles. In an effort to save space, we have combined similarly named rulers of certain empires and nations into a single article; thus all 18 kings of France named Louis appear as easily recognizable entries under the heading "Louis, kings of France." Likewise, members of the same family are sometimes grouped together: for example, the Rockefellers appear under the heading "Rockefeller, family of American industrialists, philanthro-

pists, and bankers." When a family member has been particularly prominent outside the family tradition, however, he or she has a separate entry, as does former U.S. Vice President Nelson Rockefeller.

Some related subjects have also been covered under a single article: for example, air and water pollution have been included in the article **pollution**, and a discussion of the Bill of Rights can be found under the entry **Constitution of the United States**.

Titles of Foreign Works. The titles of works of literature, art, music, and dance are given in English unless the work is well known under the original foreign title. The dates accompanying such works are the dates of original publication, exhibition, or performance.

Cross-references. To utilize space efficiently, whenever possible, information included in one article is not repeated in another. Instead, cross-references are used extensively to lead the reader to articles containing additional material relevant to the entry he or she is consulting. These articles may expand upon the subject at hand, provide background (including important people), or supply clues to other aspects of the subject and to related topics. Because it provides immediate access to pertinent information, this network of cross-references also replaces an index. All cross-references appear in SMALL CAPITALS.

Basically there are four types of cross-references. The first type comprises those found within the text of an article, as at the beginning of the article solar energy:

. . . any form of ENERGY radiated by the SUN, including light, radio waves, and X rays. Solar energy is needed by green plants for the process of PHOTOSYNTHESIS, which is the ultimate source of all food. The energy in fossil fuels (e.g., COAL and PETROLEUM) and other organic fuels (e.g., WOOD) is derived from solar energy.

The second type of cross-reference consists of those found at the end of an article, referring the reader to related subjects, including biographies.

### For example:

computer . . . See also analog-to-digital conversion; artificial intelligence; baud; boolean algebra; digital-to-analog conversion; programming language; videotex.

philosophy . . . The many rigorous systems of Eastern philosophy are founded in religion (see BUDDHISM; CONFUCIANISM; HINDUISM; ISLAM; JAINISM; SHINTO; TAOISM; VEDANTA). See also names of individual philosophers, e.g., NIETZ-SCHE, FRIEDRICH; SCHOPENHAUER, ARTHUR; TEILHARD DE CHARDIN, PIERRE.

Cross-references also refer the reader to tables that combine a variety of facts directly relevant to the article being consulted. For example, at the end of the article on the element **argon**, the following cross-references appear: See ELEMENT (table); PERIODIC TABLE.

The third type of cross-reference appears as a boldface entry within the alphabetical sequence. It may be an acronym (COBOL: see PROGRAMMING LANGUAGE); an alternate spelling (Mao Zedong: see MAO TSE-TUNG) or name (infantile paralysis: see POLIOMYELITIS); a real name when a person is known under a pseudonym (Clemens, Samuel Langhorne: see TWAIN, MARK); a topic discussed under an entry other than its own name (alto: see VOICE); or it may

direct the reader to a number of related articles (firearm: see ARTILLERY; GUN; MORTAR; SMALL ARMS).

A special category of cross-reference, somewhat different from the three previously mentioned, consists of those referring to a boldface sub-entry under a main heading. Such cross-references can occur within an article or as a separate entry; often, for clarity, the words "see under" are used. An example of such a cross-reference in the text of an article is that to John Wilkes Booth in the article **Lincoln**, **Abraham**: "... he was shot by the actor John Wilkes Booth (see under BOOTH, JUNIUS BRUTUS)." Two examples of these cross-references as separate entries are: **Richard Lion-Heart** (Richard I): see under RICHARD, kings of England; and **Pass-over**: see under JEWISH HOLIDAYS.

Abbreviations. Although abbreviations have been kept to a minimum, some have been adopted to save space. They usually appear in special constructions designed to convey important information at a glance—as can be seen, for example, in the first sentence of the article on the Churchill River: "Churchill, river, NE Canada, called the Hamilton R. until renamed (1965) for Sir Winston CHURCHILL." Common abbreviations include those for compass points, the months of the year, the states of the United States, and such words as Corporation (Corp.) and graduated (grad.). Other, less familiar abbreviations appear in the list entitled "Abbreviations."

### **ABBREVIATIONS**

Å = angstrom	h = hour(s)	oz = ounce(s)
abbr. = abbreviation(s), abbreviated	Hab. = Habakkuk	P.E.I. = Prince Edward Island
A.D. = anno Domini [in the year of	Hag. = Haggai	Pers. = Persian
the Lord]	Heb. = Hebrew; Hebrews (New	Philip. = Philippians
Adm. = Admiral	Testament)	pl. = plural
Afrik, = Afrikaans	H.M.S. = His (Her) Majesty's Ship; His	Pol. = Polish
alt. = altitude	(Her) Majesty's Service	pop. = population
Alta. = Alberta	Hon. = the Honorable	Port. = Portuguese
Arab. = Arabic	hr = hour(s)	Pres. = President
AU = astronomical unit(s)	Hung. = Hungarian	Prime Min. = Prime Minister
AV = Authorized Version (King James	Hz = hertz or cycle(s) per second	Prov. = Proverbs
Version)	Icel. = Icelandic	prov(s) = province(s)
b. = born, born in	i.e. = id est [that is]	pseud. = pseudonym
B.C. = before Christ	in. = inch(es)	Pss. = Psalms
B.C. = British Columbia	inc. = incorporated	pt = pint(s)
Brig. Gen. = Brigadier General	Isa. = Isaiah	pt. = part(s)
Bulg. = Bulgarian	Ital. = Italian	pub. = published
C = Celsius (centigrade)	j = joule(s)	qt = quart(s)
c. = circa [about]	Jap. = Japanese	Que. = Quebec
cal = calorie(s)	Jer. = Jeremiah	R. = river
Cant. = Canticles (Song of Solomon)	K = Kelvin	r. = reigned
Capt. = Captain	kg = kilogram(s)	Rep. = Representative
cc = cubic centimeter(s)	km = kilometer(s)	Rev. = Revelation; the Reverend
cent. = century, centuries	kW = kilowatt(s)	Rom. = Romans
Chin. = Chinese	Lam. = Lamentations	rpm = revolution(s) per minute
Chron. = Chronicles	Lat. = Latin	RSV = Revised Standard Version
cm = centimeter(s)	lat. = latitude	Rum. = Rumanian
$cm/sec^2 = centimeter(s)$ per second	Lev. = Leviticus	Rus. = Russian
per second	Lib. = Library	RV = Revised Version
	lim = limit	S = south, southern
Co. = Company; County Col. = Colonel; Colossians	Lith. = Lithuanian	s = second(s)
Coll. = Collection		Sam. = Samuel
	long. = longitude Lt. = Lieutenant	
Comdr. = Commander		Sask. = Saskatchewan
Cor. = Corinthians	m = meter(s)	sec = second(s)
Cpl. = Corporal	m = minute(s)	Secy. = Secretary
cu = cubic	m/sec <sup>2</sup> = meters per second per	Sen. = Senator
d. = died, died in	second	Sgt. = Sergeant
Dan. = Daniel; Danish	Mac. = Maccabees	Skt. = Sanskrit
Deut. = Deuteronomy	Mal. = Malachi	Song = Song of Solomon
dist. = district	Man. = Manitoba	Span. = Spanish
Du. = Dutch	Mat. = Matthew	sq = square
E = east, eastern	MEV = million electron volts	S.S. = Steamship
Eccles. = Ecclesiastes	Mex. = Mexican	SSR = Soviet Socialist Republic
Ecclus. = Ecclesiasticus	mg = milligram(s)	Swed. = Swedish
e.g. = exempli gratia [for example]	mi = mile(s)	Thess. = Thessalonians
Eng. = English	min = minute(s)	Tim. = Timothy
Eph. = Ephesians	mm = millimeter(s)	tr. = translation
est. = established; estimated	Mod. = Modern	Turk. = Turkish
eV = electron volts	mph = miles per hour	Ukr. = Ukrainian
Ex. = Exodus	Msgr = Monsignor	UN = United Nations
Ezek. = Ezekiel	Mt. = Mount, Mountain	uninc. = unincorporated
F = Fahrenheit	Mus. = Museum	U.S. = United States
Finn. = Finnish	N = north, northern	U.S.S. = United States Ship
fl. = floruit [flourished]	N.B. = New Brunswick	USSR = Union of Soviet Socialist
Fr. = French	Neh. = Nehemiah	Republics
ft = foot, feet	N.F. = Newfoundland	$v_{\cdot} = \text{versus}$
$ft/sec^2 = feet per second per second$	Nor. = Norwegian	V = volt(s)
g = gram	N.S. = New Style; Nova Scotia	var. = variety (in botany)
Gal. = Galatians	Num. = Numbers	Vice Pres. = Vice President
gal. = gallon(s)	N.Y.C. = New York City	vol. = volume(s)
Gall. = Gallery	Obad. = Obadiah	W = west, western; watt(s)
Gen. = General; Genesis	O.E. = Old English	wt. = weight
Ger. = German	O.N. = Old Norse	yd = yard(s)
Gov. = Governor	Ont. = Ontario	Zech. = Zechariah
Gr. = Greek	O.S. = Old Style	Zeph. = Zephaniah
	•	•

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Aachen (ä'khən) or Aix-la-Chapelle, city (1980 est. pop. 242,700), North Rhine-Westphalia, W West Germany. It is an industrial center producing textiles, machinery, and other manufactures. Its mineral baths have been famous since Roman times. CHARLEMACNE made it his northern capital, building a palace and cathedral there, and the city was (936-1531) the coronation place of German kings. Later it was taken by France (1801) and Prussia (1815). After WORLD WAR I Aachen was occupied by the Allies, and two thirds of it was destroyed during WORLD WAR II.

Aakjaer, Jeppe (ôk'yâr), 1866-1930, Danish poet. His lyric gift is apparent in Songs of the Rye (1906) and Heimdal's Wanderings (1924). He also wrote novels, mostly about his na-

tive Jutland, e.g., The Peasant's Son (1899).

Aalto, Alvar (all'to), 1896-1976, Finnish architect. His work adapts Finnish building traditions to modern European technology. Among his buildings are the Maison Carré in Paris and Baker House in Cambridge, Mass. (1947-48). He was also famous for his designs for laminated-wood furniture.

aardvark, nocturnal MAMMAL (genus Orycteropus) found in Africa. About 6 ft (180 cm) long, it has a long snout, large, erect ears, a body almost devoid of hair, and a long tail. It claws open ant and termite nests with its forefeet and uses

its long, sticky tongue to capture insects.

Aaron, in the BIBLE, the first high priest, the brother of MOSES, and his spokesman. Through him Jehovah performed miracles, although Aaron had made the GOLDEN CALF and allowed its worship. His descendants became temple priests.

Aaron, Hank (Henry Louis Aaron), 1934-, American baseball player; b. Mobile, Ala. A right-handed batter, he spent most of his 23-year career with the Braves, in Milwaukee (1956–74); he also played with the Milwaukee Brewers (1975–76). In 1974 Aaron broke Babe RUTH's

755. He set major-league career records for runs batted in, extra-base hits, and total bases.

**abacus,** an ancient computing device using movable beads strung on a number of parallel wires within a frame. Each wire represents a decimal place: ones, tens, hundreds, and so on. The beads are grouped to form numbers and shifted in specified patterns to add, subtract, multiply, or divide.

lifetime record of 714 home runs, finishing his career with

Abadan, city (1976 pop. 296,081), Khuzestan prov., SW Iran, on Abadan Island, in the SHATT AL ARAB delta, at the head of the PERSIAN GULF. After the discovery (1908) of oil nearby, Abadan became the terminus of major oil pipelines and an important oil-refining and shipping center. Its major oil refinery was heavily damaged by Iraqi forces in their invasion of Khuzestan in 1980.

abalone, marine GASTROPOD mollusk (genus Haliotis), covered by a single ear-shaped shell perforated with respiratory holes on one side. The abalone is hunted for its large, edible muscular foot and the iridescent MOTHER-OF-PEARL lining of its shell, used for buttons. It feeds by scraping the sub-

strate with its rasping tongue (radula).

Abbas I (Abbas the Great), 1557-1629, shah of PERSIA (1587-1628), of the Safavid dynasty. He broke the power of the tribal chiefs, ended the threat of the Uzbeks, and extended his domain at the expense of the Turks and Portuguese.

Abbasid or Abbaside, Arabic family descended from Abbas, d.653, the uncle of MUHAMMAD. They rose to power by massacring the ruling Umayyad family and held the CALIPHATE from 749 to 1258. Prominent Abbasid caliphs include almansur and HARUN AR-RASHID, under whom the caliphate reached its greatest power and splendor. The long Abbasid decline culminated in their overthrow by the Seljuk Turks in the 13th cent.

Abbey Theatre: see THEATER (table).

Abbott, George, 1889-, American theatrical director and playwright; b. Forestville, N.Y. He was a master of FARCE and MUSICALS, and his hits include *Three Men on a Horse* (1935), *Damn Yankees* (1955), and *Fiorello!* (1960; Pulitzer).

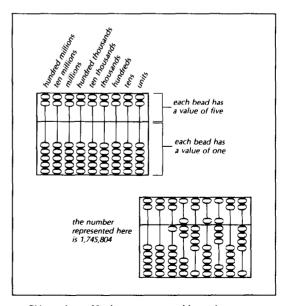
abbreviation, in writing, arbitrary shortening of a word, usually by cutting off letters from the end, as in U.S. and Gen. (General). Contraction serves the same purpose but is understood strictly to be the shortening of a word by cutting out letters in the middle, the omission sometimes being indicated by an apostrophe, as in the word don't. Most abbreviations are followed by a period. Usage, however, differs widely, and recently omission of periods has become common, as in NATO and UN. A period is never used when apostrophes appear. A list of abbreviations used in this encyclopedia may be found at the front of the book.

Abd al-Hamid, sultans of the OTTOMAN EMPIRE (Turkey). Abd al-Hamid I, 1725-89 (r.1774-89), witnessed the decline of Turkey and the rise of Russia as the foremost power in the area. Abd al-Hamid II, 1842-1918 (r.1876-1909), suspended (1876) the constitution and ruled as an absolute monarch. The last RUSSO-TURKISH WAR was a disaster, resulting in a great loss of Turkish lands. He was eventually deposed by

the Young Turks.

Abd ar-Rahman, Muslim rulers of Spain. Abd ar-Rahman, d. 732, governor of Spain (721-32), fought the Franks and was defeated by CHARLES MARTEL. Abd ar-Rahman I, d.788, first Umayyad emir of Córdoba (756-88), escaped after his family's massacre by the Abbasid and fled to Spain. There he defeated (756) the emir of Córdoba and established himself firmly in power. Abd ar-Rahman III (891-961), Umayyad emir and first caliph (929-61) of Córdoba, regained lands lost by his predecessors, maintained a powerful military force, and made Córdoba one of the greatest cities in the West.

Abdias: see OBADIAH.



Chinese abacus: Numbers are represented by moving beads to the central crossbar.

abdomen, in vertebrates, portion of the trunk between the diaphragm and lower pelvis. In humans the abdominal cavity is lined with a thin membrane, the peritoneum, which encloses the STOMACH, intestines, LIVER, and GALL BLADDER. The PANCREAS, KIDNEYS, urinary bladder, and, in the female, reproductive organs are also located within the abdominal cavity. In insects and some other invertebrates the term ab-

domen refers to the rear portion of the body

Abdul-Jabbar, Kareem, 1947-, American basketball player; b. N.Y.C. as Ferdinand Lewis (Lew) Alcindor. He led the Univ. of California, Los Angeles, to three national titles (1967-69) and became the dominant center in professional basketball with the Milwaukee Bucks (1969-75) and Los Angeles Lakers (from 1975). The towering Abdul-Jabbar (7 ft 2 in./218 cm), who frequently won most-valuable-player honors, scored a total of 28,088 points through the 1981-82 season (second only to Wilt CHAMBERLAIN) and averaged 27.8 oints per game

Abdullah, 1882-1951, emir of Transjordan (1921-46) and king of JORDAN (1946-51). In the first ARAB-ISRAELI WAR he commanded the Arab Legion and annexed those portions of

Palestine not assigned to Israel.

Becket, Thomas: see THOMAS À BECKET, SAINT,

Abe Kobo, 1924-, Japanese novelist and dramatist. Often compared to KAFKA, he treats the contemporary human predicament in a realistic yet symbolic style. His minute descriptions of surrealistic situations often lend his works a nightmarish quality. Among Abe's novels are Woman in the Dunes (tr. and film 1964) and Secret Rendezvous (tr. 1979). His plays include Friends (tr. 1969)

Abel, in the BIBLE, son of ADAM and EVE. A shepherd, he was

killed by his brother CAIN. Gen. 4.1-8.

Abel, I(orwith) W(ilbur), 1908-, American labor leader; b. Magnolia, Ohio. He went to work in a Canton rolling mill at 17 and in 1937 was appointed staff representative of the organization that evolved into the United Steelworkers of America. He was an Ohio district director of the union (1942-52) before becoming its secretary-treasurer in 1953. From 1965 to 1977 he served as the Steelworkers' president.

Abel, Niels Henrik, 1802-29, Norwegian mathematician. One of the greatest mathematicians of the 19th cent., he pioneered in the theory of elliptic functions, investigated generalizations of the binomial theorem, and proved the impossibility of representing a solution of a general equation of fifth degree or higher by a radical expression.

Abelard, Peter (ab'əlard), 1079-1142, French philosopher. Because his fame as a dialectician attracted so many students, he is usually regarded as the founder of the Univ. of Paris. His secret marriage to a pupil, Heloïse, ended when her uncle, Canon Fulbert of Notre Dame, hired ruffians to attack and emasculate him. Becoming a monk, he eventually built a hermitage and monastery, the Paraclete, which he later presented to Heloïse, who had become an abbess. Abelard's first theological work had been burned (1121) as heretical; in 1140 the mystic St. BERNARD OF CLAIRVAUX secured his condemnation by the council of Sens, and he retired in submission to Cluny. Following PLATO in theology, Abelard espoused the method of ARISTOTLE's dialectic, holding that the system of LOGIC could be applied to the truths of faith. His view of universals anticipated the conceptualism of St. THOMAS AQUINAS. His most influential and controversial work, Sic et non, collected contradictory writings of the Church fathers.

Abell, Kjeld (ä'běl), 1901-61, Danish playwright, an innovator in stage technique. His plays, concerned with justice and social protest, include Anna Sophie Hedvig (1939), The

Queen Walks Again (1943), and The Cry (1961)

Aberdeen, George Hamilton-Gordon, 4th earl of, 1784-1860, British statesman. He served in the cabinets of WEL-LINGTON and PEEL as foreign secretary (1828-30; 1841-46). In 1842 he settled the Northeast Boundary Dispute with the U.S. by the WEBSTER-ASHBURTON TREATY. As prime minister (1852-55) he was quite successful in home affairs, but he resigned after failing to prevent British involvement in the unpopular CRIMEAN WAR

Aberhart, William, 1878-1943, premier of ALBERTA (1935-43). He helped to organize (c.1932) the SOCIAL CREDIT movement to make direct payments to all citizens and headed the first Social Credit government

aberration, in optics, condition that causes a blurring and loss of clearness in the images produced by lenses or mirrors. Spherical aberration is the failure of a LENS or MIRROR of spherical section to bring parallel rays of light to a single focus; it can be prevented by using a more complex parabolic section. Chromatic aberration, the blurred coloring at the edge of an image, arises because some colors of light are bent, or refracted, more than others after passing through a lens; it can be cured by using a corrective lens.

aberration of starlight, angular displacement, caused by the earth's orbital motion, of the apparent path of light from a star, resulting in a displacement of its apparent position

from its true position.

Abidjan, city (1978 est. pop. 1,100,000), capital of Ivory Coast, on the Gulf of Guinea. It is the largest city and administrative center of Ivory Coast. Its port is centered on an island connected with the rest of the city by two bridges. Coffee, cocoa, timber, pineapples, and plantains are the chief exports. Processed food, textiles, automobiles, and chemicals are among the leading manufactures. An international airport is nearby, and tourism is growing. Abidjan became (1934) the capital of France's Ivory Coast colony. Today it is one of Africa's most modern cities.

**Abilene,** city (1980 pop. 98,315), seat of Taylor co., west-central Texas, inc. 1882. First settled (1881) by buffalo hunters, it grew as a cattle-shipping point. Abilene is a center of industry (e.g., petroleum, aircraft, electronics) and agriculture (e.g., cattle, cotton, sorghum), and serves as headquarters for regional oil interests. It is the site of Abilene Christian College, Hardin-Simmons Univ., and McMurry College.

ablative: see CASE

ablaut [Ger., = off-sound], in INFLECTION, vowel variation (as in English sing, sang, sung, song) caused by former differences in syllabic accent. In a prehistoric period the corresponding forms of the language (known through scientific reconstruction) had differences in accent, not differences in vowel. See UMLAUT.

ABM (antiballistic missile): see MISSILE, GUIDED.

abolitionists, in U.S. history, especially from 1830 to 1860, advocates of the compulsory emancipation of black slaves. Abolitionists are to be distinguished from free-soilers, who opposed the extension of SLAVERY. The active campaign had its mainspring in the revival (1820s) in the North of evangelical religion, with its moral urgency to end sinful practices. It reached crusading stage in the 1830s, led by Theodore D. Weld, the brothers Arthur and Lewis Tappan, and William Lloyd GARRISON. The American Anti-Slavery Society, established in 1833, flooded the slave states with abolitionist literature and lobbied in Washington, D.C. Writers like J.G. WHITTIER and orators such as Wendell PHILLIPS lent strength to the cause. Despite unanimity on their goal, abolitionists were divided over the method of achieving it, Garrison advocating moral suasion, others direct political action. Uncle Tom's Cabin, by Harriet B. STOWE, became an effective piece of abolitionist propaganda, and the KANSAS question aroused both North and South. The culminating act of abolitionism was John BROWN's raid on Harpers Ferry. Abolitionist demands for immediate freeing of the slaves after the outbreak of the CIVIL WAR resulted in Pres. Lincoln's Emancipation Proclamation. The abolitionist movement was one of high moral purpose and courage; its uncompromising temper hastened the demise of slavery in the U.S.

abominable snowman or yeti, manlike creature associated with the Himalayas. Known only through tracks ascribed to it and alleged encounters, it is supposedly 6 to 7 ft (1.8 to 2.1 m) tall and covered with long hair. While many scholars dismiss it as a myth, others claim that it may be a kind of

abortion, expulsion of the embryo or fetus before it is viable outside the uterus, i.e., before the 28th week after conception, in humans (see REPRODUCTION). Spontaneous abortion, or miscarriage, may be caused by death of the fetus due to abnormality or disease or by trauma to the expectant mother. Abortion may also be induced, the fetus removed from the uterus by such procedures as vacuum suction, dilation and curettage, intrauterine saline injection, and hysterotomy (surgical incision of the uterus). Abortion was long practiced as a form of BIRTH CONTROL until pressure from the Roman Catholic Church and changing opinion led in the 19th cent. to the passage of strict antiabortion laws (e.g., in England and the U.S.). Attitudes toward abortion have generally become more liberal in the 20th cent. By the 1970s, abortion had been legalized in most European countries, the USSR, and Japan; in the U.S., according to a 1973 Supreme Court ruling (see ROE V. WADE), abortions are permitted during the first six months of pregnancy. Abortion remains a controversial issue in the U.S., however, and in 1977 Congress barred the use of Medicaid funds for abortion except for therapeutic reasons and in certain other specified instances.

Abraham or Abram, progenitor of the Hebrews. He is an example of the man devoted to God, as in his willingness to sacrifice his son ISAAC. Revered by several religions, he is principally important as the founder of JUDAISM. He received the promise of CANAAN for his people, who are descended from Isaac. Gen. 11–25. Through another son, ISHMAEL, he is considered by Muslims an ancestor of the Arabs.

Abram: see ABRAHAM

Abrams, Creighton Williams, 1914-74, U.S. military officer; b. Springfield, Mass. He served with distinction in World War II, in Korea (1953-54), and in West Germany (1960-62). In 1964 he was promoted to the rank of general. After serving as deputy commander of the U.S. forces in the VIETNAM WAR under Gen. William C. WESTMORELAND, he was commanding general (1968-72). He was also U.S. army chief of staff (1972-74).

abrasive, material used to grind, smooth, cut, or polish another substance. Natural abrasives include SAND, PUMICE, CO-RUNDUM, and ground QUARTZ. Carborundum (SLICON CAR-BIDE) and ALUMINA (aluminum oxide) are major synthetic abrasives. The hardest abrasives are natural or synthetic DIAMONDS, used in the form of dust or minuscule stones.

Abravanel or Abarbanel, Judah, c.1460-c.1523, Jewish philosopher, also known as Leone Ebreo; b. Lisbon. He was influenced by the scholars of the Platonic Academy of Florence, and by MAIMONIDES and IBN GABIROL. His *Philosophy of Love* (pub. posthumously, 1535), a classic exposition of platonic love, had a profound effect on philosophers of the 16th and 17th cent., notably BRUNO and SPINOZA.

Absalom (ăb'səlöm), beloved son of DAVID. He murdered his brother AMNON and fled. After being forgiven by David, Absalom stirred up a rebellion, in which he died 2 Sam 13-19.

salom stirred up a rebellion, in which he died. 2 Sam. 13-19. Abscam, scandal resulting from an investigation begun in 1978 by the U.S. FEDERAL BUREAU OF INVESTIGATION. The term Abscam is a contraction of "Abdul scam," derived from Abdul Enterprises Ltd., a business created by the FBI as a front. FBI agents, posing as associates of an Arab sheik, met with selected public officials and offered them money or other considerations in exchange for special favors. The meetings, which were videotaped, resulted in the indictments (1980) of several officials, including one senator (Harrison Williams of New Jersey) and six congressmen. The senator and four of the congressmen indicted were eventually found guilty on charges that included bribery and conspiracy, and one was convicted on lesser charges. The FBI's tactics in the case raised serious questions about entrapment of the defendants, and in 1982 the conviction of Richard Kelly, congressman from Florida, was overturned.

abscess, accumulation of pus in tissues as a result of infection. Characterized by inflammation and painful swelling, it may occur in various parts of the body, e.g., skin, gum, eyelid (sty), and middle ear (mastoid infection). Many abscesses respond to treatment with ANTIBIOTICS; others re-

quire surgical drainage.

**absolute value,** magnitude of a mathematical expression, disregarding its sign; thus the absolute value is always positive. In symbols, if |a| denotes the absolute value of a number a, then |a| = a for a > 0 and |a| = -a for a < 0.

**absorption**, taking of molecules of one substance directly into another substance. Absorption may be either a physical or a chemical process. Physical absorption depends on the solubility of the substance absorbed, and chemical absorption involves chemical reactions between the absorbed substance and the absorbing medium. See also ADSORPTION.

abstract art: see ABSTRACT EXPRESSIONISM.

abstract expressionism, movement in painting that emerged in New York City in the mid-1940s and attained prominence in American art in the following decade; also called action painting and the New York School. Given impetus by the work of Arshile GORKY, abstract expressionism is marked by an attention to surface qualities, i.e., brushstroke and texture; the use of huge canvases; the harnessing of accidents that occur while painting; and the glorification of the act of painting itself. The first important school in American painting to declare independence from European styles and to influence art abroad, abstract expressionism enormously affected the many kinds of art that followed it, especially in the use of color and material. Its energy has transmitted an enduring excitement to American art. Major artists in the movement include Jackson POLLOCK, Willem DE KOONING, Hans HOFMANN, Robert MOTHERWELL, Franz KLINE, and Mark ROTHKO

**Abu al-Ala al-Maari,** 973-1057, Arabic poet. He was blind from childhood. Brilliantly original, he discarded classicism for intellectual urbanity. Later he favored ascetic purity and wrote more stereotypical poetry.

**Abu al-Faraj Ali of Ésfahan,** 897-967, Arabic scholar. He is mainly known for his poetic anthology *Kitab al-Aghani* [book of songs], an important source for information on medieval Islamic society.

Abu Bakr, 573-634, 1st caliph, father-in-law and successor of MUHAMMAD. He was probably the Prophet's first outside convert. During his critical two-year caliphate (632-634), ISLAM began the phenomenal growth that was to make it a world religion.

Abu Dhabi, city (1978 est. pop. 250,000), capital of the

UNITED ARAB EMIRATES

Abuja, designated federal capital of Nigeria. Plans to move the capital from LAGOs were approved in 1976, and a 3,000-sq mi (7,770-sq km) capital territory was created near the old town of Abuja (now renamed Sulaija). The site, near the center of the country, has a good climate and is sparsely populated. The move is to be completed about 1986.

Abu Nuwas, d. c.810, Arabic poet. A favorite of the caliphs HARUN AR-RASHID and Amin, he spent much time in Baghdad. His exquisite poetry echoes the extravagance of court life.

Abu Said ibn Abi al-Khair, 967–1049, Persian poet, a Sufi and a DERVISH. He was the first to write rubaiyat (quatrains) in the Sufistic strain that OMAR KHAYYAM made famous.

**Abu Simbel** or **Ipsambul**, village, S Egypt, on the NILE R. Its two temples, hewn (c.1250 B.C.) out of rock cliffs in the reign of RAMSES II, were dismantled and raised over 200 ft (61 m) to avoid rising waters caused by construction of the ASWAN HIGH DAM. With UNESCO aid, the project was completed in 1966.

Abu Tammam Habib ibn Aus, c.805-c.845, Arabic poet, compiler of the HAMASA. Often describing historical events, his poems of valor are important as source material.

Abyssinian cat: see under CAT.

Ac, chemical symbol of the element actinium.
AC: see ELECTRICITY; GENERATOR; MOTOR, ELECTRIC

acacia, plant (genus Acacia) of the PULSE family, mostly tropical and subtropical thorny shrubs and trees. Some have a feathery foliage composed of leaflets; others have no leaves but have flattened leaflike stems containing chlorophyll. Various species yield lac (for shellac), catechu (a dye), gum arabic, essential oils, tannins, and hardwood timber.

academic freedom, right of scholars to study, inquire, teach, and publish without control or restraint from the institutions that employ them. The concept is based on the notion that truth is best discovered through open investigation of all data. Its less clearly developed corollary is the obligation to pursue open and thorough inquiry regardless of personal considerations. Initiated during the ENLIGHTENMENT by scholars outside the university, academic freedom gained general acceptance only after university education was secularized.

Acadia (akā'dēa), region and former French colony, centered on NOVA SCOTA, but including also PRINCE EDWARD ISLAND

on NOVA SCOTIA, but including also PRINCE EDWARD ISLAND and much of the mainland coast from Quebec to Maine. In 1605 the French founded Port Royal (now ANNAPOLIS ROYAL), the first and chief town. During the FRENCH AND INDIAN

WARS, the Peace of Utrecht (1713) gave Britain possession of the Nova Scotian peninsula, and, by the Treaty of PARIS (1763), all of Acadia fell to Britain. Doubting the loyalty of the French inhabitants (called Acadians), the British expelled many of them in 1755 and 1758. Most were scattered among the British colonies to the south, many of them later returning to the area. Other exiles found havens elsewhere, notably the Cajuns of S Louisiana, who still preserve a separate folk culture. The sufferings of the expulsion are depicted in LONGFELLOW's poem Evangeline.

Acadia National Park: see NATIONAL PARKS (table).

acanthus, common name for the Acanthaceae, a family of chiefly perennial herbs and shrubs, mostly tropical. Many members have decorative spiny leaves and are cultivated as ornamentals, e.g., bear's breech, whose ornate leaves provided a motif often used in Greek and Roman art and architecture. In Christian art, the acanthus symbolizes heaven.

Acapulco, city (1979 est. pop. 462,144), winter resort on the tropical Pacific coast of S Mexico, known for its fine beaches, luxury hotels and villas, and deep-sea fishing facilities. Founded on a natural harbor in 1550, it was a base for Spanish explorers and was once important in trade with the Philippines. It became a favored haunt of wealthy vacationers in the 1920s.

acceleration: see MOTION.

accelerator: see PARTICLE ACCELERATOR.

accent, in speech, emphasis given a particular sound, called prosodic systems in LINGUISTICS. There are three basic accentual methods: stress, tone, and length. No language uses all three methods. Words may have a single primary stressed syllable, as in the English weath'er, and may also have syllables of secondary stress, as in el' e va" tor. In writing, accent may be used to show syllable stress, as in the Italian pietà, but often merely signals specific pronunciation.

accounting, classification, analysis, and interpretation of the financial, or bookkeeping, records of an enterprise, used to evaluate the progress or failures of a business and to recognize the factors that determine its true condition. In the U.S. qualified accountants who pass a required examination are granted the title Certified Public Accountant (CPA). An important branch of accounting is auditing, the examination of accounts by persons who have had no part in their preparation. Annual audits are required for all publicly held

Accra, city (1970 est. pop. 636,067), capital of Ghana, a port on the Gulf of Guinea. The nation's largest city and its administrative and economic center, Accra is linked by road and rail with KUMASI, in the interior, and with the seaport of Tema. Manufactures include processed food, timber, and textiles. The city became (1876) the capital of the British Gold Coast colony and grew economically after completion (1923) of a railroad to the interior. Riots in the city (1948) led to the movement for Ghana's independence. Today Accra is a sprawling, modern city with wide avenues; points of interest include a 17th-cent. Danish castle.

accusative: see CASE.

acetone, dimethyl ketone, or 2-propanone (CH<sub>3</sub>COCH<sub>3</sub>), colorless, flammable liquid. Acetone is widely used in industry as a solvent for many organic substances and is a component of most paint and varnish removers. It is used in making synthetic RESINS and fillers, smokeless powders, and

many other organic compounds.

acetylcholine, organic compound containing carbon, hydrogen, oxygen, and nitrogen, essential for the conduction of nerve impulses in animals. It is found in highest concentrations on neuron surfaces and is liberated at nerve cell endings. There is strong evidence that acetylcholine is the transmitter substance that conducts impulses from one cell to another in the parasympathetic nervous system, and from nerve cells to smooth muscle, skeletal muscle, and exocrine glands.

acetylene or ethyne (HC=CH), a colorless gas and the simplest alkyne (see HYDROCARBON). Explosive on contact with air, it is stored dissolved under pressure in ACETONE. It is used to make neoprene RUBBER, PLASTICS, and RESINS. The oxyacetylene torch mixes and burns oxygen and acetylene to produce a very hot flame—as high as 6300°F (3480°C)—that can cut steel and weld iron and other metals.

Achaea (akě'a), region of ancient GRECE, in the N Peloponnesus on the Gulf of Corinth, home of the Achaeans, the ruling class in the PELOPONNESUS from c.1250 B.C. Before the 5th cent. B.C. the Achaean cities joined in the First Achaean League, which was dissolved after it opposed (338 B.C.) PHILLP II of Macedon. The Second Achaean League, formed in 280 B.C., almost drove MACEDON from Achaea but was stopped by SPARTA. In 198 B.C., with Roman aid, the league won power. Later, suspecting pro-Macedonian sympathies, Rome deported many Achaeans (168 B.C.) to Italy. In 146 B.C. Achaea waged a suicidal war against Rome, which easily won, dissolved the league, and ended Greek liberty.

Achaemenids (ăk"amen'īdz), dynasty of ancient PERSIA. The Achaemenid rulers (c.550-330 B.C.) included CYRUS THE GREAT, Cambyses, DARIUS I, Xerxes I, and ARTAXERXES I. The

dynasty ended with DARIUS III.

Achebe, Chinua, 1930-, Nigerian novelist. Writing in English, he depicted Ibo society and the impact of colonialism in such novels as *Things Fall Apart* (1958) and *A Man of the People* (1966). A former broadcaster and diplomat for BIAFRA, he has also published poetry, e.g., *Christmas in Biafra* (1973).

Acheson, Dean Gooderham, 1893-1971, U.S. secretary of state (1949-53); b. Middletown, Conn. Serving Pres. TRUMAN, he established the policy of containment of Communist expansion. He also helped to establish the NORTH AT-

LANTIC TREATY ORGANIZATION.

Achilles, in Greek mythology, foremost hero of the TROJAN WAR; son of Peleus and Thetis. Thetis attempted to make him immortal by bathing him in the river STYX, but the heel she held remained vulnerable. Knowing Achilles was fated to die at Troy, Thetis disguised him as a girl and hid him at Skyros. He was found by ODYSSEUS, who persuaded him to go to war. At Troy he quarreled with AGAMEMNON and sulked in his tent until his friend Patroclus was killed by HECTOR. Filled with grief and rage, Achilles slew Hector and dragged his body to the Greek camp. He was later killed by PARIS, who wounded his heel.

acidophilus milk: see FERMENTED MILK.

acid rain, form of precipitation (rain, snow, sleet, or hail) containing high levels of sulfuric or nitric acids (pH below 5.5-5.6). Produced when sulfur dioxide and various nitrogen oxides combine with atmospheric moisture, acid rain can contaminate drinking water, damage vegetation and aquatic life, and erode buildings and monuments. It has been an increasingly serious problem since the 1950s, particularly in the NE U.S., Canada, and W Europe, especially Scandinavia. Automobile exhausts and the burning of high-sulfur industrial fuels are thought to be the main causes, but natural sources, e.g., volcanic gases and forest fires, may also be significant. See also ECOLOGY; POLLUTION; WASTE DISPOSAL.

acid rock: see ROCK MUSIC

acids and bases, two related classes of chemicals; the members of each class have a number of common properties when dissolved in a solvent, usually water. Acids in water solutions exhibit the following common properties: they taste sour; turn LITMUS paper red; and react with certain metals, such as zinc, to yield hydrogen gas. Bases in water solutions exhibit these common properties: they taste bitter; turn litmus paper blue; and feel slippery. When a water solution of acid is mixed with a water solution of base, a SALT and water are formed; this process, called neutralization, is complete only if the resulting solution has neither acidic nor basic properties. When an acid or base dissolves in water, a certain percentage of the acid or base particles will break up, or dissociate, into oppositely charged ions. The Arrhenius theory of acids and bases defines an acid as a compound that can dissociate in water to yield hydrogen ions (H+) and a base as a compound that can dissociate in water to yield hydroxyl ions (OH-). The Brönsted-Lowry theory defines an acid as a proton donor and a base as a proton acceptor. The Lewis theory defines an acid as a compound that can accept a pair of electrons and a base as a compound that can donate a pair of electrons. Each of the three theories has its own advantages and disadvantages; each is useful under certain conditions. Strong acids, such as HYDROCHLORIC ACID, and strong bases, such as potassium hydroxide, have a great tendency to dissociate in water and