A

AA

An Hawaiian term introduced into geological nomenclature by C.E. Dutton in 1883, and signifying the jagged, scoriaceous, blocky and exceedingly rough surface of some basic lava flows. Pronounced *ah-ah*.

aardvark *(Mammalia, Tubulidentata)*

African animals of peculiar form and ancient lineage, including an Ethiopian and a South African species. All are anteaters, feeding exclusively on ants and termites, nocturnal in habit, with acute hearing. The southern species has been called the ant bear. The aardvark is the only living representative of its order. The animal's spine, curved from neck to tail in a near-half circle, gives it a truly prehistoric appearance.

The aardvark is solitary. In daytime it sleeps curled up like a dog in one of its burrows, often beneath a termite hill. The animal moves almost entirely at night, when it seeks termite hills and destroys them to reach the interior chambers and tunnels alive with insects, which it rapidly licks up in lumps. Although usually silent, the animal can grunt like a hippopotamus. Life span is at least 10 years. In captivity, aardvarks become accustomed to keepers, but do not show great intelligence. See Fig. 1.

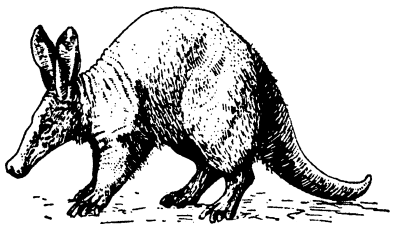

Fig. 1. The habitus or body definitely purveys a pig-like appearance.

aardwolf *(Mammalia, Carnivora)*

An African species, *Proteles cristatus,* superficially like the striped hyena, not common, nocturnal and sleeps by day under termite nests or in excavated or aardvark holes. Teeth reduced in number and size, and insect eater, but can chew very rotten meat or newly born animals. See also **Hyena.**

abalone *(Mollusca, Gasteropoda; Haliotis)*

Marine species, usually found in the Pacific and Indian Oceans. The single broad shallow shell has a richly colored iridescent inner surface and is an important source of mother-of-pearl and blister pearls for costume jewelry. The flesh is palatable. See Fig. 1.

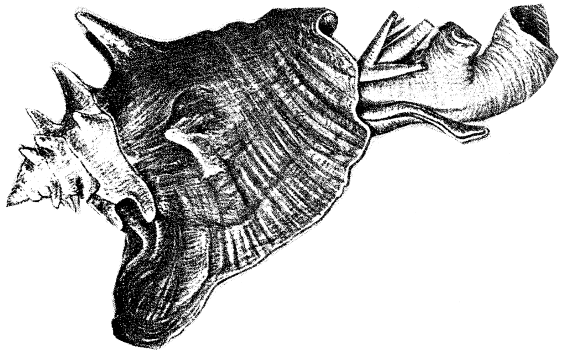

Fig. 1. Abalone *(Haliotis tuberculata lamellosa),* characterized by transverse shell ridges.

Abbe Condenser

A compound lens used for directing light through the object of a compound microscope. All the light enters the object at an angle with the axis of the microscope. See also **Microscope (Traditional-Optical).**

Abbe Sine Condition

The relationship

$$ny \sin\theta = n'y' \sin\theta',$$

where n, n' are refractive indices, y, y' are distances from optical axis, and θ, θ' are angles light rays make with the optical axis. A failure of an optical surface to satisfy the sine condition is a measure of the coma of the surface.

abdomen

The abdomen is the posterior division of the body in many arthropods. It is the *posterior* portion of the

trunk in vertebrates. In the vertebrates this region of the body contains most of the alimentary tract, the excretory system, and the reproductive organs.

aberration (optical)

The failure of an optical system to form an image of a point as a point, of a straight line as a straight line, and of an angle as an equal angle. See also **Astigmatism; Chromatic Aberration; Coma (Optics); Curvature of Field (Optics); Spherical Aberration.**

ablate

To carry away; specifically, to carry away heat generated by aerodynamic heating, from a vital part, by arranging for its absorption in a nonvital part, which may melt or vaporize, then fall away taking the heat with it. See also **Ablation.**

ablating material

A material, especially a coating material, designed to provide thermal protection to a body in a fluid stream through loss of mass. Ablating materials are used on the surfaces of some reentry vehicles to absorb heat by removal of mass, thus blocking the transfer of heat to the rest of the vehicle and maintaining temperatures within design limits. Ablating materials absorb heat by increasing in temperature and changing in chemical or physical state. The heat is carried away from the surface by a loss of mass (liquid or vapor). The departing mass also blocks part of the convective heat transfer to the remaining material in the same manner as transpiration cooling.

ablating nose cone

A nose cone designed to reduce heat transfer to the internal structure by the use of an ablating material.

ablation (geomorphology)

Essentially, the wasting away of rocks; the separation of rock material and formation of residual deposits, as caused by wind action or the washing away of loose and soluble materials.

ablation (glaciology)

The combined processes (sublimation, melting, evaporation) by which snow or ice is removed from the surface of a glacier or snowfield.

ablation (meteorite)

The direct vaporization of molten surface layers of meteorites and tektites during flight.

abrasion

All metallic and nonmetallic surfaces, no matter how smooth, consist of minute serrations and ridges that induce a cutting or tearing action when two surfaces in contact move with respect to each other. This wearing of the surfaces is termed abrasion.

abscess

A localized collection of pus within a cavity. An abscess may occur in many organs of the body.

abscission

This term is applied to the process whereby leaves, leaflets, fruits, or other plant parts become detached from the plant. Leaf abscission is a characteristic phenomenon of many species of woody dicots and is especially conspicuous during the autumn period of leaf fall. The onset of abscission seems to be regulated by plant hormones.

absolute

1. Pertaining to a measurement relative to a universal constant or natural datum, as absolute coordinate system, absolute altitude, absolute temperature.
2. Complete, as in absolute vacuum.

absolute altimeter

An instrument intended to give acceptably accurate, direct indications of absolute altitude.

absolute altitude

Altitude above the actual surface, either land or water, of a planet or natural satellite.

absolute coordinate system

An inertial coordinate system that is fixed with respect to the stars. In theory, no absolute coordinate system can be established because the reference stars are themselves in motion. In practice, such a system can be established to meet the demands of the problem concerned by the selection of appropriate reference stars.

absolute delay

The time interval between the transmission of sequential signals. Also called *delay.*

absolute magnitude *(symbol M)*

1. A measure of the brightness of a star equal to the magnitude the star would have at a distance of 10 parsecs from the observer.

   $M = m + 5 + 5 \log p$ where m is apparent magnitude, and p is the parallax of the star (in seconds of arc). Absolute magnitudes may be visual, photographic, etc., according to the way in which the apparent magnitude was measured.
2. The stellar magnitude any meteor would have if placed in the observer's zenith at a height of 100 kilometers.

absolute manometer

1. A gas manometer whose calibration, which is the same for all ideal gases, can be calculated from the measurable physical constants of the instrument.
2. A manometer that measures absolute pressure.

absolute motion

Motion relative to a fixed point. See also **Absolute Coordinate System.**

absolute pressure

1. In engineering literature, a term used to indicate pressure above the absolute zero value of pressure that theoretically obtains in empty space or at the absolute zero of temperature as distinguished from gage pressure.
2. In high-vacuum technology, pressure is understood to correspond to absolute pressure, not gage pressure, and therefore the term absolute pressure is rarely used. See also **Pressure.**

absolute space-time

A fundamental concept underlying Newtonian mechanics is that there exists a preferred reference system to which all measurements should be referred. This is known as absolute space-time. The assumption of such a system is replaced in relativistic mechanics by the principle of equivalence. See **Equivalence Principle; Relativity and Relativity Theory.**

absolute vacuum

A void completely empty of matter. Also called perfect vacuum. An absolute vacuum is not obtainable.

absolute zero

Conceptually that temperature where there is no molecular motion, no heat. On the Celsius scale, absolute zero is $-273.15\,^{\circ}$C, on the Fahrenheit scale, $-459.67\,^{\circ}$F; and zero Kelvin (0 K). The concept of absolute zero stems from thermodynamic postulations.

absorber

In general, a medium, substance or functional part that takes up matter or energy. In radiation and particle physics, an absorber is a body of material introduced between a source of radiation and a detector to (1) determine the energy or nature of the radiation; (2) to shield the detector from the radiation; or (3) to transmit selectively one or more components of the radiation, so that the radiation undergoes a change in its energy spectrum. Such an absorber may function through a combination of processes of true absorption, scattering and slowing-down.

absorption band

A range of wavelengths (or frequencies) in the electromagnetic spectrum within which radiant energy is absorbed by a substance. When the absorbing substance is a polyatomic gas, an absorption band actually is composed of a group of discrete absorption lines, which appear to overlap. Each line is associated with a particular mode of vibration or rotation induced in a gas molecule by the incident radiation. The absorption bands of oxygen and ozone are often referred to in the literature of atmospheric physics.

See also **Absorption Spectrum; Electromagnetic Phenomena; Electromagnetic Spectrum.**

absorption coefficient

In the most general use of the term, absorption coefficient, applied to electromagnetic radiation and atomic and subatomic particles, is a measure of the rate of decrease in intensity of a beam of photons or particles in its passage through a particular substance. One complication in the statement of the absorption coefficient arises from the cause of the decrease in intensity. When light, x-rays, or other electromagnetic radiation enters a body of matter, it experiences in general two types of attenuation. Part of it is subjected to scattering, being reflected in all directions, while another portion is absorbed by being converted into other forms of energy.

See also **Spectrochemical Analysis (Visible).**

absorption (energy)

The process whereby the total number of particles emerging from a body of matter is reduced relative to

the number entering as a result of interaction of the particles with the body. Also, the process whereby the kinetic energy of a particle is reduced while traversing a body of matter. This loss of kinetic energy or radiation is also referred to as moderation, slowing, or stopping. See also **Black Body.** The absorption of mechanical energy by dynamometers, which convert the mechanical energy to heat or electricity, has led to the use of the term "absorption dynamometer" to distinguish these machines. See also **Dynamometer.** In acoustics, absorption is the process whereby some or all of the energy of sound waves is transferred to a substance on which they are incident or which they traverse.

absorption (physiology)

The process by which materials enter the living substance of which the organism is composed. Materials including food and oxygen are taken into special organs by ingestion and respiration, but they must pass through the cell wall to become an integral part of the organism by absorption. The basic physical forces involved are those of osmosis and diffusion.

absorption spectrum

The spectrum of radiation that has been filtered through a material medium. When white light traverses a transparent medium, a certain portion of it is absorbed, the amount varying, in general, progressively with the frequency of which the absorption coefficient is a function. Analysis of the transmitted light may, however, reveal that certain frequency ranges are absorbed to a degree out of all proportion to the adjacent regions; that is, with a distinct selectivity. These abnormally absorbed frequencies constitute, collectively, the "absorption spectrum" of the medium, and appear as dark lines or bands in the otherwise continuous spectrum of the transmitted light.

abundance ratio

The proportions of the various isotopes that make up a particular specimen of an element. See **Chemical Elements.**

abyssal zone

The region of the ocean beyond the point of penetration of light, including the ocean floor in the deep areas. According to various investigators who have descended into the ocean depths, no light penetrates beyond about 1,500 feet (450 meters), and penetration may be much less if the water is murky with suspended particles. The water is always extremely cold in the abyssal zone and the pressure is very great. Still many forms of animal life are to be found at these great depths, feeding upon the organic matter that drifts down from the upper waters.

acacia trees

Of the family *Leguminosae* (pea family), the genus *Acacia* represents a large number of mostly evergreen trees and shrubs, particularly abundant in Africa and Australia. The trees like warmth and full sun. The small flowers are aggregated into ball-like or elongate clusters, which are quite conspicuous. The leaves are rather diverse in shape; quite commonly they are dissected into compound pinnate forms; in other instances, especially in the Australian species, they are reduced even to a point where only the flattened petiole, called a phyllode, remains. This petiole grows with the edges vertical, which some observers consider a protective adaptation against too intense sunlight on the surface. Some species, particularly those growing in Africa and tropical Asia, yield products of commercial value. Gum arabic is obtained from the *Acacia senegal*. A brown or black dye called clutch is obtained from *A. catechu*. Some acacias are used for timber. Shittinwood referred to in the scriptures: "And thou shalt make staves of shittinwood and overlay them with gold," (Exodus 26:26–37), is considered by authorities as wood from *Acacia seyal* (then referred to as the shittah tree).

Acarina

The order of *Arachnida* that includes the mites and ticks.

acceleration

The rate of change of the velocity with respect to the time is called acceleration. It is expressed mathematically by dv/dt, the vector derivative of the velocity, $\mathbf{v}$ with respect to the time, t. If the motion is in a straight line whose position is clearly understood, it is convenient to treat the velocity v and the acceleration dv/dt as scalars with appropriate algebraic signs; otherwise they must be treated by vector methods.

See also **Angular Velocity and Angular Acceleration.**

acceleration (due to gravity)

The universal character of the gravitational force for point masses or spherical bodies can be expressed by the equation

$$F = \frac{GM_1M_2}{R^2} \tag{1}$$

where

M_1, M_2 = masses of two bodies
R = distance between two bodies
G = a constant = 6.670×10^{-8} dyne cm^2 gm^{-2}

The constant G is independent of all properties of the particular bodies involved.

The weight of a body of mass M on the earth is the force with which it is attracted to the center of the earth. On the surface of the earth, the weight is given by

$$W = Mg \tag{2}$$

where the acceleration due to gravity is obtained from Equation (1):

$$\begin{aligned} g &= \frac{GM_E}{R_E^2} \\ &= 980.665 \text{ cm/(second)}^2 \\ &= 32.174 \text{ feet/(second)}^2 \\ &= 9.81 \text{ meters/(second)}^2 \end{aligned} \tag{3}$$

See also **Gravitation.**

accelerator (particle)

See **Particles (Subatomic).**

accelerometer

Acceleration is not measured directly, but is computed by measuring the force exerted by restraints that are placed on a mass to hold its position fixed in an accelerating body. The relationship between restraint and acceleration is defined by Newton's second law: $F = ma$ (force equals mass times acceleration). The device used to accomplish the foregoing requirement is known as an *accelerometer.* The accelerometer is the most common type of vibration sensor.

accommodation (ocular)

The mechanism whereby the equatorial diameter of the lens of the eye may be decreased and its thickness increased to focus clearly on the retina the image of a near object.

accretion (geology)

The process by which crystals and other solid bodies grow by the addition of material onto their surfaces. A concretion is a body that grows from the center outward in a regular manner by successive additions of material.

accuracy

In terms of instruments and scientific measuring systems, accuracy may be defined as the conformity of an indicated value to an accepted standard value, or true value. Accuracy is usually measured in terms of *inaccuracy* and expressed as *accuracy.* As a performance specification, accuracy should be assumed to mean *reference accuracy* unless otherwise stated.

acetaldehyde

CH_3CHO, formula weight 44.05, colorless, odorous liquid, mp $-123.5\,^\circ$C, bp $20.2\,^\circ$C, sp gr 0.783. Also known as *ethanal,* acetaldehyde is miscible with H_2O, alcohol, or ether in all proportions. Because of its versatile chemical reactivity, acetaldehyde is widely used as a commencing material in organic syntheses, including the production of resins, dyestuffs, and explosives. The compound also is used as a reducing agent, preservative, and as a medium for silvering mirrors. In resin manufacture, paraldehyde $(CH_3CHO)_3$ sometimes is preferred because of its higher boiling and flash points.

See also **Aldehydes.**

acetic acid

CH_3COOH, formula weight 60.05, colorless, acrid liquid, mp $16.7\,^\circ$C, bp $118.1\,^\circ$C, sp gr 1.049. Also known as ethanoic acid or vinegar acid, this compound is miscible with H_2O, alcohol, and ether in all proportions. Acetic acid is available commercially in several concentrations.

Acetic acid is required in the production of several synthetic resins and fibers, pharmaceuticals, photographic chemicals, flavorants, and bleaching and etching compounds.

acetone

$CH_3{\cdot}CO{\cdot}CH_3$, formula weight 58.08, colorless, odorous liquid ketone, mp $-94.6\,^\circ$C, bp $56.5\,^\circ$C, sp gr 0.792. Also known as dimethyl ketone or propanone, this compound is miscible in all proportions with H_2O, alcohol, or ether. Acetone is a very important solvent and is widely used in the manufacture of plastics and lacquers. For storage purposes, acetylene may be dissolved in acetone. A high-tonnage chemical, acetone is the starting ingredient or intermediate for numerous organic syntheses. Closely related, industrially important compounds are diacetone alcohol (DAA) $CH_3{\cdot}CO{\cdot}CH_2{\cdot}COH(CH_3)_2$ which is used as a solvent for cellulose acetate and nitrocellulose, as well as for various resins and gums, and as a thinner for lacquers and inking materials. Sometimes DAA is mixed with

castor oil for use as a hydraulic brake fluid for which its physical properties are well suited, mp −54 °C, bp 166 °C, sp gr 0.938. A product known as synthetic methyl acetone is prepared by mixing acetone (50%), methyl acetate (30%), and methyl alcohol (20%) and is used widely for coagulating latex and in paint removers and lacquers.

acetylene

CH:CH formula weight 26.04, mp −81.5 °C, bp −84 °C, sp gr 0.905 (air = 1.000). Sometimes referred to as *ethyne, ethine,* or *gaseous carbon* (92.3% of the compound is C), acetylene is moderately soluble in H_2O or alcohol, and exceptionally soluble in acetone (300 volumes of acetylene in 1 volume of acetone at 12 atmospheres pressure). The gas burns when ignited in air with a luminous sooty flame, requiring a specially devised burner for illumination purposes.

achene

A single-seeded, indehiscent fruit, in which the seed is free from the ovary wall except at the point of attachment. An example is the sunflower "seed."

achlorhydria

Lack of hydrochloric acid in the digestive juices in the stomach.

acidity

The amount of acid present, expressed for a solution either as the molecular concentration of acid, in terms of normality, molality, etc., or the ionic concentration (hydrogen ions or protons) in terms of pH (the logarithm of the reciprocal of the hydrogen ion concentration). The acidity of a base is the number of molecules of monoatomic acid which one molecule of the base can neutralize. See **Acids and Bases.**

acid number

A term used in the analysis of fats or waxes to designate the number of milligrams of potassium hydroxide required to neutralize the free fatty acids in 1 gram of substance. The determination is performed by titrating an alcoholic solution of the wax or fat with tenth or half-normal alkali, using phenolphthalein as indicator.

acidosis

A condition of excess acidity (or depletion of alkali) in the body, in which acids are absorbed or formed in excess of their elimination, thus increasing the hydrogen ion concentration of the blood, exceeding the normal limit of 7.4. The acidity-alkalinity ratio in body tissue normally is delicately controlled by several mechanisms, notably the regulation of carbon dioxide-oxygen transfer in the lungs, the presence of buffer compounds in the blood, and the numerous sensing areas that are a part of the central nervous system. Normally, acidic materials are produced in excess in the body, this excess being neutralized by the presence of free alkaline elements, such as sodium occurring in plasma. The combination of sodium with excess acids produces carbon dioxide which is exhaled. Acidosis may result from: (1) severe exercise, leading to increased carbon dioxide content of the blood, (2) sleep, especially under narcosis, where the elimination of carbon dioxide is depressed, (3) heart failure, where there is diminished ventilation of carbon dioxide through the lungs, (4) diabetes and starvation, in which organic acids, such as β-hydroxybutyric and acetoacetic acids, accumulate, (5) kidney failure, in which the damaged kidneys cannot excrete acid radicals, and (6) severe diarrhea, in which there is loss of alkaline substances. Nausea, vomiting, and weakness sometimes may accompany acidosis. See also **Blood; Kidney and Urinary Tract; Potassium and Sodium (In Biological Systems).**

acid rain

Acid rain can be simply described as rain that is more acidic than normal. Acid rain is a complicated problem. Caused by air pollution, acid rain's spread and damage involve weather, chemistry, soil, and the life cycles of plants and animals on the land and in the water.

Scientists have discovered that air pollution from the burning of fossil fuels is the major cause of acid rain. Acidic deposition, or acid rain, as it is commonly known, occurs when emissions of sulfur dioxide (SO_2) and oxides of nitrogen (NO_X) react in the atmosphere with water, oxygen, and oxidants to form various acidic compounds. This mixture forms a mild solution of sulfuric acid and nitric acid. Sunlight increases the rate of most of these reactions.

These compounds then fall to the earth in either wet form (such as rain, snow, and fog) or dry form (such as gas and particles). About half of the acidity in the atmosphere falls back to earth through dry deposition as gases and dry particles. The wind blows these acidic particles and gases onto buildings, cars, homes, and trees. In some instances, these gases and particles can eat away the things on which they settle. Dry deposited gases and particles are sometimes washed from trees and other surfaces by rain. When that happens, the

runoff water adds those acids to the acid rain, making the combination more acidic than the falling rain alone. The combination of acid rain plus dry deposited acid is called *acid deposition*. Prevailing winds transport the compounds, sometimes hundreds of miles, across state and national borders.

Electric utility plants account for about 70 percent of annual SO_2 emissions and 30 percent of NO_X emissions in the United States. Mobile sources (transportation) also contribute significantly to NO_X emissions. Overall, over 20 million tons of SO_2 and NO_X are emitted into the atmosphere each year.

Acid rain causes acidification of lakes and streams and contributes to damage of trees at high elevations (for example, red spruce trees above 2,000 feet in elevation). In addition, acid rain accelerates the decay of building materials and paints, including irreplaceable buildings, statues, and sculptures that are part of our nation's cultural heritage. Prior to falling to the earth, SO_2 and NO_X gases and their particulate matter derivatives, sulfates and nitrates, contribute to visibility degradation and impact public health.

Implementation of the Acid Rain Program under the 1990 Clean Air Act Amendments will confer significant benefits on the nation. By reducing SO_2 and NO_X, many acidified lakes and streams will improve substantially so that they can once again support fish life. Visibility will improve, allowing for increased enjoyment of scenic vistas across our country, particularly in National Parks. Stress to the forests that populate the ridges of mountains from Maine to Georgia will be reduced. Deterioration of historic buildings and monuments will be slowed. Finally, reductions in SO_2 and NO_X will reduce sulfates, nitrates, and ground level ozone (smog), leading to improvements in public health.

acids and bases

The conventional definition of an acid is that it is an electrolyte that furnishes protons, i.e., hydrogen ions, H^+. An acid is sour to the taste and usually quite corrosive. A base is an electrolyte that furnishes hydroxyl ions, OH^-. A base is bitter to the taste and also usually quite corrosive. These definitions were formulated in terms of water solutions and, consequently, do not embrace situations where some ionizing medium other than water may be involved. More generally, an acid is a proton donor and a base is a proton acceptor.

Acidification is the operation of creating an excess of hydrogen ions, normally involving the addition of an acid to a neutral or alkaline solution until a pH below 7 is achieved, thus indicating an excess of hydrogen ions. In *neutralization,* a balance between hydrogen and hydroxyl ions is effected. An acid solution may be neutralized by the addition of a base; and vice versa. The products of neutralization are a salt and water.

aclinic line (or dip equator; magnetic equator)

The line through those points on the earth's surface at which the magnetic inclination is zero. The aclinic line is a particular case of an isoclinic line.

Acoela

An order of free-living flatworms in which the alimentary tract is without a cavity.

acoustics

Broadly interpreted, *acoustics* is the science of sound and the technology which is associated with it.

acquired immune deficiency syndrome (AIDS)

Since the first descriptions of AIDS in 1981, a global pandemic consisting of thousands of separate epidemics in communities around the globe has expanded rapidly, especially in developing countries where more than 90% of HIV-infected people live. Since the early 1980's, more that 40 million individuals have contracted HIV (Human Immunodeficiency Virus), the causative agent of AIDS, and almost 12 million have died. In 1997, 2.3 million people including 460,000 children succumbed to the disease despite the introduction of powerful therapies which are able to slow the course of, although not cure, the disease. Although the number of deaths and HIV-related hospitalizations has begun to decline in the United States and other economically advantaged nations where these expensive therapies are available, HIV continues to spread rapidly in sub-Saharan Africa and in Southeast Asia. Unprotected heterosexual sex accounts for most of HIV's spread in Sub-Saharan Africa and the problem is compounded by contamination of the blood supply, one quarter of which is not routinely screened for the AIDS virus. In Southeast Asia, India and Thailand dominate the picture as the epidemic continues to spread rapidly in populations suffering from a lack of educational and economic opportunities. Indeed social marginalization, including the low social status of women who in many cases lack the power to insist upon safe-sex practices,

magnifies the risk throughout the developing countries as well as in population segments of the industrialized world.

HIV, the etiologic agent of AIDS, is a retrovirus (contains an enzyme reverse transcriptase allowing it to produce DNA copies of itself), its genetic material being RNA rather than DNA. Originally called human T-lymphotropic virus type lll/Lymphadenopathy-associated virus (HTLV-lll/LAV), a subcommittee of the International Committee for the Taxonomy of Viruses designated HIV as the appropriate nomenclature. In 1985, a second human retrovirus associated with AIDS was identified in West Africa, leading to the designation of HIV-1 for the original virus and HIV-2 for the West African form which has since been isolated from patients outside of West Africa. Biological differences in virulence and progression to AIDS between the two viruses have been described although patterns of transmission are similar. It is now known that both forms of HIV are highly mutable viruses that regularly undergo major changes in their genetic expression and surface characteristics. HIV is transmitted between humans by three principal routes: horizontally through sexual contact or parenteral inoculation of virus-containing blood and other body fluids and vertically from an infected mother to her offspring. In many respects, the epidemiology of AIDS appears to resemble that of hepatitis B. In developed countries, male-to-male sexual contact has accounted for the preponderance of sexual transmission, whereas in developing countries most sexual transmission of HIV is by heterosexual contact and in urban areas is frequently associated with prostitution. The relatively recent increase in heterosexual transmission in developed countries has occurred particularly among sexual partners of infected IV drug abusers and is facilitated by high-risk sexual activity associated with alcohol and illicit drug abuse. Transmission of HIV in transfused blood products is a particularly efficient route with up to 90% of recipients of infected blood becoming infected. However, the institution of serologic screening of donated blood has greatly reduced the incidence of transfusion-associated HIV infection in the countries that have implemented successful programs. The AIDS virus is a relatively fragile virus, and there is no evidence that it can be transmitted through casual contact or through mosquito bites.

With a vaccine still years away, prevention of infection with HIV through behavioral change, especially behaviors associated with sex and drug use, remains the primary way to control the AIDS epidemic in which 16,000 people become infected worldwide every day. Public health has focused upon encouraging the adoption of safer sexual practices, notably condom use.

acquisition

1. The process of locating the orbit of a satellite or trajectory of a space probe so that tracking or telemetry data can be gathered.
2. The process of pointing an antenna or telescope so that it is properly oriented to allow gathering of tracking or telemetry data from a satellite or space probe.

acrylic acid

CH_2:CH·COOH, formula weight 72.06, colorless liquid monocarboxylic acid, mp 12 °C, bp 141 °C, sp gr 1.062. Also called propenoic acid, this compound is miscible in all proportions with H_2O or alcohol. The acid forms esters and metallic salts and forms addition products. The compound is of particular interest because of the large number of synthetic plastics and resins which are made as the result of polymerizing various acrylic derivatives, notably the esters of acrylic acid. The anhydrous monomer, glacial acrylic acid, contains less than 2% H_2O. It yields esters when reacted with alcohol, including ethyl acrylate and methyl acrylate. See also **Fibers.**

ACTH

The adrenocorticotropic hormone of the anterior lobe of the pituitary gland, which specifically stimulates the adrenal cortex to secrete cortisone, and hence has effects identical with those of cortisone. See also **Adrenal Glands; Hormones; Pituitary Gland; Steroids.**

actin

One of the two proteins that makes up the myofibrils of striated muscles. The other protein is myosin. See also **Contractility and Contractile Proteins.**

actinide series

The chemical elements with atomic numbers 90 to 103, inclusively, commencing with 90 (thorium) and through 103 (lawrencium) frequently are termed, collectively, the Actinide Series. The term derives from actinium (at. no. 89) which is considered the anchor element of the series, also appearing in group 3 of the periodic table. This series of elements is somewhat analogous to the Lanthanide Series. See also **Lanthanide Series.**

actinometry

The science of measurement of radiant energy, particularly that of the sun, in its thermal, chemical, and luminous aspects.

action

The action of a dynamical system is the space integral of the total momentum of the system.

activation

1. The transformation of any material into a more reactive form, or into a form in which it functions more effectively, as in the regeneration of a metallic or inorganic catalyst, the transformation of an enzyme from inactive form to active form, and the treatment of various forms of finely divided silica or carbon to render them more adsorbent.
2. The transfer of a sufficient quantity of energy to an atomic or molecular system to raise it to an excited state in which it can participate in a process not possible when the system is in its ground state.
3. In nuclear physics, the process of inducing radioactivity through neutron bombardment or by other types of radiation.

activation energy

The excess energy over the ground state which must be acquired by an atomic or molecular system in order that a particular process may occur. Examples are the energy needed by the molecule to take part in a chemical reaction, by an electron to reach the conduction band in a semiconductor, and by a lattice defect to move to a neighboring site.

In the first example cited, the rate of an elementary chemical reaction can usually be expressed as a product of a function of the concentrations of the participants and of a rate constant. This latter can be written as $A \exp(-E_a/kT)$, where k is the Boltzmann constant; T, the absolute temperature; A, a frequency factor that varies slowly with the activation energy E_a, which appears in the exponential. It is the minimum height of the potential barrier that must be crossed when one follows the reaction coordinate from the reactants to the products. Figure 1 illustrates four typical situations. It is to be noted that it is only in case (**a**) that E_a is equal to the energy of the reaction.

activator

A substance that renders a material or a system reactive; commonly, a catalyst.

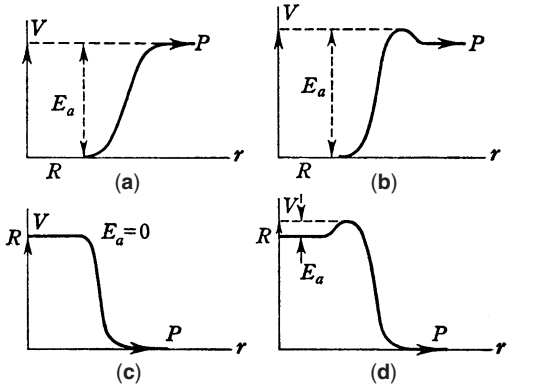

Fig. 1. Activation energy. Variation of the energy along the reaction coordinate for two endothermic (**a**) and (**b**) and two exothermic (**c**) and (**d**) reactions. E_a is the activation energy.

active center

Atoms which, by their position on a surface, such as at the apex of a peak, at a step on the surface or a kink in a step, or on the edge or corner of a crystal, share with neighboring atoms an abnormally small portion of their electrostatic field, and therefore have a large residual field available for catalytic activity or for adsorption.

active deposit

The name given to the radioactive material that is deposited on the surface of any substance placed in the neighborhood of a preparation containing any of the naturally occurring radioactive chains (uranium, thorium, or actinium chains). This deposit results from deposition of the nongaseous products of the gaseous radon nuclides that have escaped from the parent substance. An active deposit can be concentrated on a negatively charged metal wire or surface placed in closed vessels containing the radon. See also **Radioactivity.**

active transport (cell)

See **Cell (Biology).**

activity (radioactivity)

The activity of a quantity of radioactive nuclide is defined by the ICRU as $\Delta N/\Delta t$, where N is the number of nuclear transformations that occur in this quantity in time Δt. See **Radioactivity.**

adaptation (ecology)

The process of modification of a living organism as it adjusts to the conditions of its environment. Also, an inherited characteristic that enables the organism to meet certain environmental conditions.

All living things are adapted for a mode of life characteristic of their kind, under equally characteristic environmental conditions. They receive from previous generations a heritage that fits them for this mode of life, and all characters in the hereditary complex that are of definite use are adaptive. Wings, for example, are essential flight adaptation, and fins or other similar appendages are commonly found as adaptations for swimming.

Regardless of its adaptive heritage, however, each individual encounters some fluctuations in its environment to which it must adjust itself. The resulting changes in its body are adaptive, no less than its inherited structures. They are the acquired characters of biological literature, and have also been called individual adaptations. Human beings commonly experience two fine examples of this kind of adaptation in the calluses formed by the skin in response to friction, and the deposition of pigment, or tanning, as a protection against excessive ultraviolet light. A less evident result of exposure to ultraviolet light is a protective thickening of the epidermis, probably as important as the accompanying increase in pigmentation.

adaptation luminance

The average luminance (or brightness) of those objects and surfaces in the immediate vicinity of an observer. Also called *adaptation brightness, adaptation level, adaptation illuminance*. The adaptation luminance has a marked influence on an observer's estimate of the visual range because, along with the visual angle of the object under observation, it determines the observer's threshold contrast. High adaptation luminance tends to produce a high threshold contrast, thus reducing the estimated visual range. This effect of the adaptation luminance is to be distinguished from the influence of background luminance.

adaptive control system

A control system that continuously monitors the dynamic response of the controlled system and automatically adjusts critical system parameters to satisfy pre-assigned response criteria, thus producing the same response over a wide range of environmental conditions.

address (computer system)

An identification, represented by a name, label, or number, for a digital computer register, device, or location in storage. Addresses are also a part of an instruction word along with commands, tags, and other symbols. The part of an instruction that specifies an operand for the instruction may be an address.

adenine

A prominent member of the family of naturally occurring purines. Adenine occurs not only in ribonucleic acids (RNA), and deoxyribonucleic acids (DNA), but in nucleosides, such as adenosine, and nucleotides, such as adenylic acid, which may be linked with enzymatic functions quite apart from nucleic acids.

adenoma

A benign tumor consisting of an encapsulated overgrowth of epithelial cells of a glandular structure.

adhesion (physics)

The terms adhesion and cohesion designate intermolecular forces holding matter together. The tendency of matter to hold itself together or to cling to other matter is one of its most characteristic properties.

adiabatic process

Any thermodynamic process, reversible or irreversible, which takes place in a system without the exchange of heat with the surroundings. When the process is also reversible, it is called *isentropic,* because then the entropy of the system remains constant at every step of the process. (In older usage, isentropic processes were called simply adiabatic, or quasistatic adiabatic; the distinction between adiabatic and isentropic processes was not always sharply drawn.)

adiabatic wall

A perfect heat insulator. See **Diathermal Wall.**

adolescence (physiology)

The period of youth extending from the beginning of puberty to adulthood. For human beings, this period usually ranges between 12 and 20 years. Physical developments in adolescence of the American male are shown in Fig. 1.

Growth during the first 10 years of life proceeds at a fairly uniform rate. The child's desires usually keep pace with his ability to meet his needs. However, during the adolescent or teenage period, there is disharmony

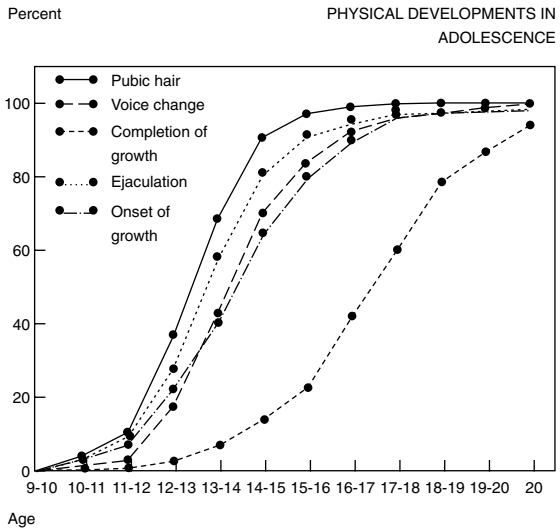

Fig. 1. This chart portrays the percentage of American males undergoing the indicated changes in physical development at various ages during adolescence.

between physiological development, growth, and emotional maturation. The teenager becomes a blend of maturity and immaturity in body, mind, and emotion.

Puberty, which refers to the sexual maturation of the individual, is only part of adolescence. Puberty and adolescence begin in the girl at 11 to 15 years of age. Boys lag about a year behind. The average age for puberty in girls in the United States is around 13.5 years and, in boys, 14.5 years. Adolescence in most American youth terminates at about 19 years of age.

The first half of adolescence is characterized by physical growth and change; the latter half brings more intellectual and emotional changes.

Obesity is often a problem in this period and may be a factor in delayed puberty. Whether the condition is the result of poor eating habits, of emotional instability, or of endocrine dysfunction, it merits careful investigation.

adrenal glands

Part of the endocrine system, the adrenal glands are two small bodies located at the upper end of each kidney. The right adrenal gland is somewhat triangular in shape; the left gland is more semilunar.

While the adrenal glands perform a number of functions, the two most important are: (1) Control of the body's adjustment to an upright posture; and (2) accommodation of the body to intermittent rather than constant intake of food.

advection

The process of transport of an atmospheric property solely by the mass motion of the atmosphere; also, the rate of change of the value of the advected property at a given point.

Regarding the general distinction (in meteorology) between advection and convection, the former describes the predominantly horizontal, large-scale motions of the atmosphere whereas convection describes the predominantly vertical, locally induced motions.

adventitious buds

Buds which appear elsewhere than in the leaf axils or above them. They may appear anywhere in the internode, or on roots or even on leaves, and develop either naturally or as a result of injury. See also **Bud; Budding.**

aeolian tones

The tones produced by a gas stream striking a stretched wire in a direction normal to the length of the wire.

aeration

A process of contacting a liquid with air, often for the purpose of releasing other dissolved gases, or for increasing the quantity of oxygen dissolved in the liquid. Aeration is commonly used to remove obnoxious odors or disagreeable tastes from raw water.

aerobe

An organism that utilizes atmospheric oxygen in its metabolic processes; i.e., the so-called aerobic bacteria, or aerobes, which use oxygen. See also **Anaerobe.**

aeroduct

A ramjet type of engine designed to scoop up ions and electrons freely available in the outer reaches of the atmosphere or in the atmospheres of other spatial bodies, and by a metachemical process within the duct of this engine, expel particles derived from the ions and electrons as a propulsive jetstream.

aerodynamics

Aerodynamics is the study of the *interaction between* (1) a *fluid,* most frequently air, that is stationary or in motion (wind), and (2) a *solid object* that (a) is essentially *stationary* (fixed), such as a building, chimney, bridge, or that (b) is in *motion,* such as an airborne or land-borne vehicle, a missile, a sporting object (ball, boomerang), et al. This interaction, when translated to practical engineering terms, is of great importance

in terms of designing structures and vehicles for maximum safety, performance, and efficiency. For example, in terms of fixed structures, a bridge must be designed to minimize the effects of high wind—to avoid undue swaying and possibly toppling under extreme conditions. (Bridges have been destroyed—e.g., the Tacoma Narrows Bridge, Washington, 1940.) For safety and other reasons, high rise buildings must be designed to minimize the effects of wind. Aerodynamics is probably most commonly associated with the design of all types of aircraft, but much attention is also given to land craft, such as automobiles, trucks, and even bicycles. The interest in drag, discussed later, as it affects land vehicles has been intensified since the energy crisis of a few years ago—because a significant consumption of fuel is consumed in overcoming drag. The aerodynamic characteristics of vehicles also affect performance (the smoothness and grace of operation) as well as efficiency; also safety, particularly at high speeds, can be affected by aerodynamically designing an auto or truck that "holds the road" so to speak. Aerodynamics is or should be a major consideration in the design of trailing vehicles so that they can be operated safely under windy conditions.

Aerodynamics is a complex, essentially mathematical and geometric science, but also one that has learned much from nature, rediscovering as it were the streamlining of birds, insects, and fast-moving land mammals.

aeroelasticity

The study of both the static and dynamic effects of aerodynamic forces on elastic bodies.

aerogel

A colloidal solution of a gaseous phase in a solid phase, obtained usually by replacement of the liquid in the dispersed phase by air or gas. Contrast with **Aerosol.**

aerology

1. As officially used in the U.S. Navy until early 1957, same as meteorology; this usage was more administrative than scientific.
2. As a subdivision of meteorology, the study of the free atmosphere through its vertical extend, as distinguished from studies confined to the layer of the atmosphere adjacent to the earth's surface.

aeronomy

The study of the upper regions of the atmosphere where ionization, dissociation, and chemical reactions take place.

aeropause

A region of indeterminate limits in the upper atmosphere, considered as a boundary or transition region between the denser portion of the atmosphere and space. From a functional point of view, it is considered to be that region in which the atmosphere is so tenuous as to have a negligible, or almost negligible, effect on humans and aircraft, and in which the physiological requirements of man become increasingly important in the design of aircraft and auxiliary equipment.

aerosol

A colloidal system in which a gas, frequently air, is the continuous medium, and particles of solids or liquid are dispersed in it. Aerosol thus is a common term used in connection with air pollution control.

See also **Colloid System; Pollution (Air).**

aerothermodynamic border

An altitude at about 100 miles, above which the atmosphere is so rarefied that the skin of an object moving through it at high speeds generates no significant heat.

aestivation

Summer dormancy, the antithesis of the more familiar hibernation.

affine tensor and free vector

A quantity that behaves like a tensor under a linear (affine) coordinate transformation, but not under a general coordinate transformation is called an affine tensor. From an affine tensor it is possible to construct a *free vector,* that is, a vector not related to a given point (nonlocalized vector).

african trypanosomiasis

An infection by the flagellate blood protozoan parasite *Trypanosoma brucei,* which causes a fatal neurological disease whose final stage in humans is *sleeping sickness*. There are two epidemiological and clinical variants of the parasite: *T. rhodesiense* and *T. gambiense,* which are carried by various species of tsetse fly (Glossinia) in Africa between latitudes 15 °N and 20 °S.

afterbody

1. A companion body that trails a satellite.
2. A section or piece of a rocket or spacecraft that enters the atmosphere unprotected behind the nose cone or other body that is protected for entry.
3. The afterpart of a vehicle.