

# A DICTIONARY OF GENETICS

FOURTH EDITION

Robert C. King

William D. Stansfield

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Northwestern University

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## PREFACE

Genetics is the most rapidly advancing of the life sciences, and no other field has stimulated so many diverse disciplines in both the natural and social sciences. The fact that genetics has attracted mathematicians, physicists, chemists, physicians, anthropologists, and other scientists of diverse backgrounds to contribute to its development is one of the chief reasons for its prodigious growth. Such growth is, of course, accompanied by a proliferation in terminology, and this terminology constitutes a problem both to beginning students and to scientists from other disciplines who read papers by geneticists.

Geneticists use many words and abbreviations that are not found in collegiate dictionaries or dictionaries of biology. This is so because various terms, especially from molecular genetics, are newly coined; others, like those used in quantitative genetics are from other sciences, such as statistics, geology, medicine, and physics. Thus, to be truly useful, a dictionary for students of genetics needs to define not only words like **balanced lethal system**, **crossing over**, **mutation**, and **operon**, but terms and abbreviations such as **chi-square test**, **continental drift**, **retinoblastoma**, and **rep**. Therefore, our dictionary is broader than its name implies, since we attempt to define both strictly genetic words and also a variety of nongenetic terms that are often encountered in the genetics literature.

Scientific papers are peppered with the taxonomic names of species and genera that are studied by geneticists, but the student often may have no idea whether the author is referring to a bacterium, fungus, grass, or insect. Even when informed that "*Oenothera* is a genus of angiosperms," a reader unsophisticated in taxonomy may not know where these species fit in the Plant Kingdom. Therefore, we have placed, in alphabetical order in the body of the dictionary, the scientific names of the species that have been investigated by geneticists. Each species is identified by a common name, and its economic importance is described, if appropriate. Often, an organism with little or no economic importance has been investigated because it has certain useful advantages for studying specific genetic problems. In such cases, a few sentences are given to elucidate these advantages. Then, in Appendix A, a classification of living organisms is presented in which are placed all of the species cited in the dictionary, and these species entries in turn are cross referenced to Appendix A. For example, the entry on *Chlamydomonas reinhardi* is cross

referenced so that the student can find it within the phylum Chlorophyta of the Kingdom Protocista in Appendix A. Appendix B gives a list of the scientific names of roughly 240 domesticated species, but groups them alphabetically by common name.

In earlier editions of our dictionary, we have provided in Appendix C a chronological listing of discoveries and inventions that led to advances in genetics, cytology, or the study of evolution. While we have added new entries to the Chronology, we have also tried to make it more useful by citing Appendix C entries within the definitions themselves. Thus, the definition of **electrophoresis** contains a reference to a 1933 entry describing the invention of the technique by Tiselius, and the definition of **heat shock puffs** cites the first report of the phenomenon by Ritossa in 1962.

The Fourth Edition has grown considerably. The number of definitions now stands at 7,100, with 20 percent of them new or updated. The number of illustrations has risen from 225 to 250. The number of entries in Appendix C has grown from 560 to 635, and the index now lists 1,010 of the scientists cited. The bibliography of major sources for the chronology now contains 91 references (40 percent of them new). The periodical list presented as Appendix D has grown from 393 to 452 entries.

Certain rules have been followed regarding the arrangement of definition entries. Each is placed in alphabetical order using the boldface title letter by letter, while ignoring spaces between words. Thus, **S phase** is placed between ***Sphaerocarpus*** and **spheroplast**. Identical alphabetical listings are entered so that lowercase letters precede uppercase letters. Thus, the **r** entry comes before the **R** entry. In titles beginning with a Greek letter, the letter is spelled out. Thus, **λ phage** is found under **lambda phage**. In titles starting with a number or containing numbers, the numbers are ignored in the alphabetical placement. Thus, **M5 technique** is treated as **M technique** and **T24 oncogene** as **T oncogene**. However, numbers are used to determine the order in the series, e.g., **4S**, **5S**, and **5.8S RNA**. When looking for a two-word term, if you don't find the definition listed under the first word, try the second. For example, definitions for **genetic recombination** and **beta thalassemia** occur under **recombination** and **thalassemias**, respectively.

The authors will welcome suggestions for any improvements, but are particularly anxious to receive advice concerning additional entries for Appendix C, so that these can be included subsequent editions.

**Acknowledgments:** Drs. Pamela Mulligan and Lynn Margulis were especially generous with advice and provided many useful definitions. They also made valuable suggestions as to scientific advances suitable for inclusion in the Chronology, and Drs. Susanne Gollin, Adam Wilkins, Eliot Spiess, Roger Melvold, Hans Noll, Robert Holmgren, Susan Pierce, and James Douglas Engel were also helpful in this regard.

*Evanston, Ill.  
San Luis Obispo, Calif.  
October 1989*

R.C.K.  
W.D.S.

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## A Dictionary of Genetics





# A

**A** 1. mass number of an atom; 2. haploid set of autosomes; 3. ampere; 4. adenine or adenosine.

**Å** Angstrom unit (*q.v.*).

**A<sub>2</sub>** See hemoglobin.

**A 23187** See ionophore.

**AA-AMP** amino acid adenylate.

**A, B antigens** mucopolysaccharides responsible for the ABO blood group system. The A and B antigens reside on the surface of erythrocytes, and differ only in the sugar attached to the penultimate monosaccharide unit of the carbohydrate chain. This minor chemical difference makes the macromolecule differentially active antigenically. The *I<sup>A</sup>* and *I<sup>B</sup>* genes presumably control the formation or functioning of the enzymes that add the specific sugar units to the carbohydrate chains in a pre-formed mucopolysaccharide molecule. The *I<sup>O</sup>* allele is inactive in this regard and when homozygous results in the O phenotype. Glycoproteins with properties antigenically identical to the A, B antigens are ubiquitous, having been isolated from bacteria and plants. Every human being more than 6 months old possesses those antibodies of the A, B system that are not directed against its own blood-group antigens. These "preexisting natural" antibodies probably result from immunization by the ubiquitous antigens mentioned above. The *I* alleles reside on autosome 9. See Appendix C, 1901, Landsteiner; 1925, Bernstein; blood group, H substance, secretor gene.

**aberrations** See chromosomal aberration, radiation-induced chromosomal aberration.

**ABM paper** aminobenzyloxy methyl cellulose paper, which when chemically activated, reacts covalently with single-stranded nucleic acids.

**ABO blood group system** a system of alleles residing on human chromosome 9 that specifies certain red cell antigens. See AB antigens, blood groups, Bombay blood group.

**abortive transduction** failure of a transducing exogenote to become integrated into the host chromosome, but rather existing as a nonreplicating

particle in only one cell of a clone. See transduction.

**abortus** a dead fetus born prematurely, whether the abortion was artificially induced or spontaneous.

**absolute plating efficiency** the percentage of individual cells that give rise to colonies when inoculated into culture vessels. See relative plating efficiency.

**absorbance (also absorbency)** a measure of the loss of intensity of radiation passing through an absorbing medium. It is defined in spectrophotometry by the relation:  $\log(I_0/I)$ , where *I<sub>0</sub>* = the intensity of the radiation entering the medium and the *I* = the intensity after traversing the medium. See Beer-Lambert law, OD<sub>260</sub> unit.

**abundance** in molecular biology, the average number of molecules of a specific mRNA in a given cell, also termed *representation*. The abundance, *A* = *NR*/*M*, where *N* = Avogadro's number, *R* = the RNA content of the cell in grams, *f* = the fraction the specific RNA represents of the total RNA, and *M* = the molecular weight of the specific RNA in daltons.

**abzymes** catalytic antibodies. A class of monoclonal antibodies that bind to and stabilize molecules in the transition state through which they must pass to form products. See enzyme.

**acatalasemia** the hereditary absence of catalase (*q.v.*) in man; inherited as an autosomal recessive.

**acatalasia** synonym for acatalasemia (*q.v.*).

**acceleration** See heterochrony.

**accelerator** an apparatus that imparts kinetic energy to charged subatomic particles to produce a high-energy particle stream for analyzing the atomic nucleus.

**acceptor stem** the double-stranded branch of a tRNA molecule to which an amino acid is attached (at the 3', CCA terminus) by a specific aminoacyl-tRNA synthetase. See transfer RNA.

**accessory chromosomes** See B chromosomes.

**accessory nuclei** bodies resembling small nuclei that occur in the oocytes of most Hymenoptera and those of some Hemiptera, Coleoptera, Lepidoptera, and Diptera. Accessory nuclei are covered by a double membrane possessing annulate pores. They are originally derived from the oocyte nucleus, but they subsequently form by the amitotic division of other accessory nuclei.

**Ac, Ds system** Activator-Dissociation system (*q.v.*).

**ace** See symbols used in human cytogenetics.

**acentric** designating a chromatid or a chromosome that lacks a centromere. See **chromosome bridge**.

**Acer** the genus of maple trees. *A. rubrum*, the red maple, and *A. saccharum*, the sugar maple, are studied genetically because of their commercial importance.

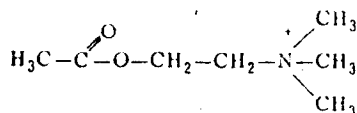
**Acetabularia** a genus of large, unicellular green algae. Grafting experiments between species of this genus have provided information on the nuclear control of cytoplasmic differentiation.

**Acetobacter** a genus of aerobic bacilli which secure energy by oxidizing alcohol to acetic acid.

**aceto-carmin** a stain used in the preparation of chromosome squashes consisting of a 5% solution of carmine in 45% acetic acid. Largely supplanted by aceto-orcein.

**aceto-orcein** a fluid consisting of 1% orcein (*q.v.*) dissolved in 45% acetic acid, used in making squash preparations of chromosomes. See **Appendix C**, 1925, Bernstein; **salivary gland squash preparation**.

**acetylcholine** a biogenic amine that plays an important role in the transmission of nerve impulses across synapses and from nerve endings to the muscles innervated. Here it changes the permeability of the sarcolemma and causes contraction. Acetylcholine is evidently a very ancient hormone, since it is present even in protists.



**acetylcholinesterase** the enzyme that catalyses the hydrolysis of acetylcholine (*q.v.*) into choline and acetate. Also called *cholinesterase*.

**acetyl-coenzyme A** See **coenzyme A**.

**acetyl serine** See **N-acetyl serine**.

**achiasmate** referring to meiosis without chiasmata. In those species in which crossing over is limited to one sex, the achiasmate meiosis generally occurs in the heterogametic sex.

**achondroplasia** a hereditary dwarfism due to retarded growth of the long bones. In humans it is inherited as an autosomal dominant trait. Homozygotes die at an early age. See **bovine achondroplasia**, **fowl achondroplasia**.

**achromatic figure** the mitotic apparatus (*q.v.*).

**A chromosomes** See **B chromosomes**.

**acid fuchsin** an acidic dye used in cytochemistry.

**acidic amino acid** an amino acid (*q.v.*) having a net negative charge at neutral pH. Those universally found in proteins are aspartic acid and glutamic acid, which bear negatively charged side chains in the pH range generally found in living systems.

**acidic dye** an organic anion that binds to and stains positively charged macromolecules.

**Acinonyx jubatus** the cheetah, a carnivore that has the distinction of being the world's fastest land animal. Cheetahs are of genetic interest because, while most other species of cats show heterozygosity levels of 10–20%, cheetahs have levels close to zero. This high degree of homozygosity is correlated with low fecundity, high mortality of cubs, and low disease resistance.

**Acoelomata** a subdivision of the Protostomia containing species in which the space between the epidermis and the digestive tube is occupied by a cellular parenchyma. See **classification**.

**acquired characteristics, inheritance of** inheritance by offspring of characteristics that arose in their parents as responses to environmental influences and are not the result of gene action. See **Lamarckism**.

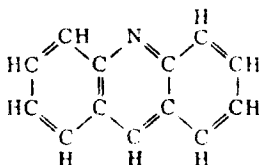
**acquired immunodeficiency syndrome** See **AIDS**, **HIV**.

**Acraniata** a subphylum of Chordata containing animals without a true skull. See **Appendix A**.

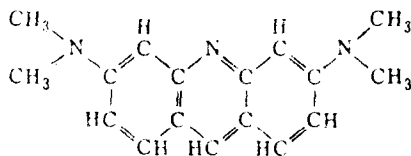
**acrasin** a chemotactic agent produced by *Dictyostelium discoideum* that is responsible for the aggregation of the cells. Acrasin has been shown to be cyclic AMP (*q.v.*).

**Acrasiomycota** the phylum containing the cellular slime molds. These are prototists that pass through a unicellular stage of amoebae that feed on bacteria. Subsequently these amoebae aggregate to form a fruiting structure that produces spores. The two most extensively studied species from this phylum are *Dictyostelium discoideum* and *Polysphondylium pallidum*.

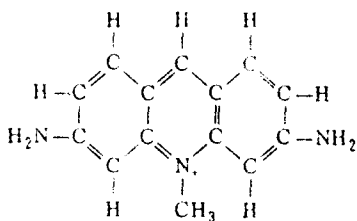
**acridine dye** any of a class of organic molecules that bind to DNA and in bacteriophages act as mutagenic agents by causing additions or deletions in the base sequences.



**acridine orange** an acridine dye that functions both as a fluorochrome and a mutagen.



**acriflavin** an acridine dye that produces reading frame shifts (*q.v.*).



**acritarchs** spherical bodies thought to represent the earliest eukaryotic cells, estimated to begin in the fossil record about 1.6 billion years ago. Most acritarchs were probably thick-walled, cyst-forming protists. *See* Proterozoic.

**acrocentric** designating a chromosome or chromatid with a nearly terminal centromere. *See* telocentric chromosome.

**acromycin** *See* tetracycline.

**acron** the anterior nonsegmented portion of the embryonic arthropod that produces eyes and antennae. *See* maternal polarity mutants.

**acrosome** an apical organelle in the sperm head that is secreted by the Golgi material and that digests the egg coatings to permit fertilization.

**acrostical hairs** one or more rows of small bristles along the dorsal surface of the thorax of *Drosophila*.

**acrosyndesis** telomeric pairing by homologs during meiosis.

**acrotrophic** *See* meroistic.

**acrylamide** *See* polyacrylamide gel.

**ACTH** adrenocorticotrophic hormone (*q.v.*).

**actidione** cycloheximide.

**actin** a protein that is the major constituent of the 7-nm-wide microfilaments of cells. Actin microfilaments (F actin) are polymers of a globular subunit (G actin) of Mr 42,000. Each G actin molecule has a defined polarity, and during polymerization the subunits align "head to tail," so that all G actins point in the same direction. F actin grows by the addition of G actin to its ends, and cytochalasin B (*q.v.*) inhibits this process. All the actins that have been studied, from sources as diverse as slime molds, fruit flies, and vertebrate muscle cells, are similar in size and amino acid sequence, suggesting that they evolved from a single ancestral gene. In mammals and birds, there are four different muscle actins.  $\alpha_1$  is unique to skeletal muscle;  $\alpha_2$ , to cardiac muscle;  $\alpha_3$ , to smooth vascular muscle; and  $\alpha_4$ , to smooth enteric muscle. Two other actins ( $\beta$  and  $\gamma$ ) are found in the cytoplasm of both muscle and nonmuscle cells. *See* alternative splicing, contractile ring, fibronectin, isoforms, myosin, spectrin, stress fibers, tropomyosin, vinculin.

**actin genes** genes encoding the various isoforms of actin. In *Drosophila*, for example, actin genes have been localized at six different chromosomal sites. Two genes encode cytoplasmic actins, while the other four encode muscle actins. The amino acid-encoding segments of the different actin genes have very similar compositions, but the segments specifying the trailers (*q.v.*) differ considerably in nucleotide sequences.

**actinomycete** any prokaryote placed in the phylum actinobacteria (*see* Appendix A). Actinomycetes belonging to the genus *Streptomyces* produce a large number of the antibiotics, of which actinomycin D (*q.v.*) is an example.

**actinomycin D** an antibiotic produced by *Streptomyces chrysomallus* that prevents the transcription of messenger RNA. See RNA polymerase.

**activated macrophage** a macrophage that has been stimulated (usually by a lymphokine) to enlarge, to increase its enzymatic content, and to increase its nonspecific phagocytic activity.

**activating enzyme** an enzyme that catalyzes a reaction involving ATP and a specific amino acid. The product is an activated complex that subsequently reacts with a specific transfer RNA.

**activation analysis** a method of extremely sensitive analysis based on the detection of characteristic radionuclides produced by neutron activation.

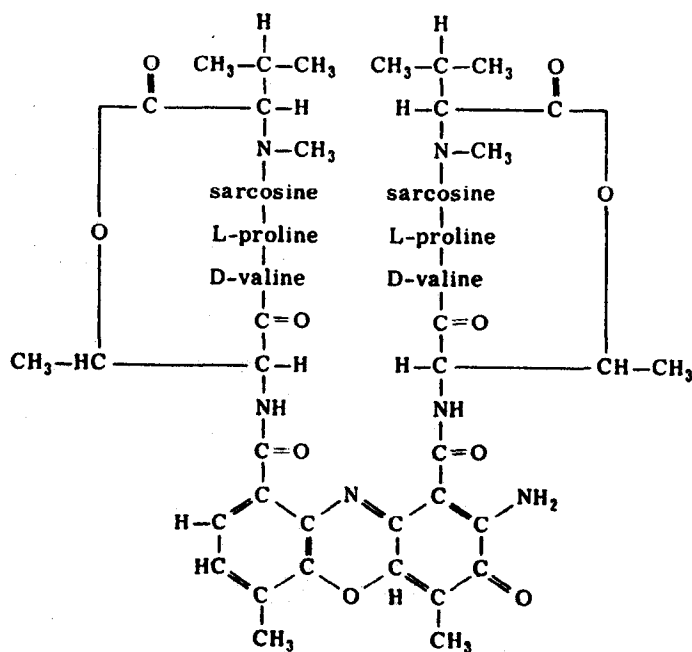
**activation energy** the energy required for a chemical reaction to proceed. Enzymes (*q.v.*) combine transiently with a reactant to produce a new complex that has a lower activation energy. Under these circumstances the reaction can take place at the prevailing temperature of the biological system. Once the product is formed, the enzyme is released unchanged.

**activator** a molecule that converts a repressor into a stimulator of operon transcription; e.g., the repressor of a bacterial arabinose operon becomes an activator when combined with the substrate.

**Activator-Dissociation system** controlling elements in maize. *Ac* is an *autonomous* element that is inherently unstable. It has the ability to excise itself from one chromosomal site and to transpose to another. *Ac* is detected by its activation of *Ds*. *Ds* is *nonautonomous* and is not capable of excision or transposition by itself. *Ac* need not be adjacent to *Ds* or even on the same chromosome in order to activate *Ds*. When *Ds* is so activated, it can alter the level of expression of neighboring genes, the structure of the gene product, or the time of development when the gene expresses itself, as a consequence of nucleotide changes inside or outside of a given cistron. An activated *Ds* can also cause chromosome breakage, which may yield deletions or generate a bridge-breakage-fusion-bridge cycle (*q.v.*). See Appendix C, 1950, McClintock; **transposable elements**.

**active center** in the case of enzymes, a flexible portion of the protein that binds to the substrate and converts it into the reaction product. In the case of carrier and receptor proteins, the active center is the portion of the molecule that interacts with the specific target compounds.

**active immunity** immunity conferred on an organism by its own exposure and response to antigen. In the case of immunity to disease-causing agents, the antigenic pathogens may be adminis-



Actinomycin D.

tered in a dead or attenuated form. *See also* passive immunity.

**active site** that portion(s) of a protein that must be maintained in a specific shape and amino acid content to be functional. Examples: 1. in an enzyme, the substrate-binding region; 2. in histones or repressors, the parts that bind to DNA; 3. in an antibody, the part that binds antigen; 4. in a hormone, the portion that recognizes the cell receptor.

**actomyosin** *See* myosin.

**acute transfection** infection of cells with DNA for a short period of time.

**acylated tRNA** a transfer RNA molecule to which an amino acid is covalently attached. Also referred to as an activated tRNA, a charged tRNA, or a loaded tRNA.

**adaptation** 1. the process by which organisms undergo modification so as to function more perfectly in a given environment. 2. any developmental, behavioral, anatomical, or physiological characteristic of an organism that, in its environment, improves its chances for survival and of leaving descendants.

**adaptive enzyme** an enzyme that is formed by an organism in response to an outside stimulus. The term has been replaced by the term *inducible enzyme*. The discovery of adaptive enzymes led eventually to the elucidation of the mechanisms that switch gene transcription on and off. *See* Appendix C, 1937, Karström; **regulator gene**.

**adaptive landscape** a three-dimensional graph that shows the frequencies of two genes, each present in two allelic forms (aA and bB in the illustration) plotted against average fitness for a given set of environmental conditions, or a comparable con-

ceptual plot in multidimensional space to accommodate more than two loci.

**adaptive norm** the array of genotypes (compatible with the demands of the environment) possessed by a given population of a species.

**adaptive peak** a high point (perhaps one of several) on an adaptive landscape (*q.v.*), from which movement in any planar direction (changed gene frequencies) results in lower average fitness.

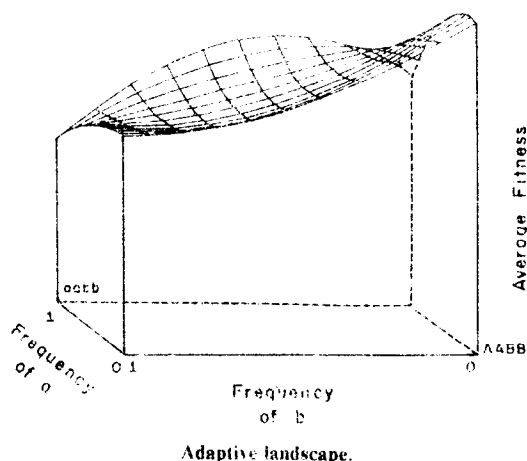
**adaptive radiation** evolution from a generalized, primitive species of diverse, specialized species, each adapted to a distinct mode of life.

**adaptive surface, adaptive topography** synonyms for adaptive landscape (*q.v.*).

**adaptive value** the property of a given genotype when compared with other genotypes that confers fitness (*q.v.*) to an organism in a given environment.

**adaptor** a short, synthetic DNA segment containing a restriction site that is coupled to both ends of a blunt-ended restriction fragment. The adaptor is used to join one molecule with blunt ends to a second molecule with cohesive ends. The restriction site of the adaptor is made identical to that of the other molecule so that when cleaved by the same restriction enzyme both DNAs will contain mutually complementary cohesive ends.

**adaptor hypothesis** the proposal that polynucleotide adaptor molecules exist that can recognize specific amino acids and also the regions of the RNA templates that specify the placement of amino acids in a newly forming polypeptide. *See* Appendix C, 1958, Crick; **transfer RNA**.



**ADCC** antibody-dependent cellular cytotoxicity; also known as antibody-dependent cell-mediated cytotoxicity. Cell-mediated cytotoxicity requires prior binding of antibody to target cells for killing to occur. It does not involve the complement cascade. *See* K cells.

**additive factor** one of a group of non-allelic genes affecting the same phenotypic characteristics and each enhancing the effect of the other in the phenotype. *See* quantitative inheritance.

**additive gene action** 1. a form of allelic interaction in which dominance is absent; the heterozygote is intermediate in phenotype between homozygotes for the alternative alleles. 2. the cumulative contribution made by all loci (of the kind described above) to a polygenic trait.

**additive genetic variance** genetic variance attributed to the average effects of substituting one allele for another at a given locus, or at the multiple loci governing a polygenic trait. It is this component of variance that allows prediction of the rate of response for selection of quantitative traits. *See* quantitative inheritance.

**adduct** the product of a chemical reaction that results in the addition of a small chemical group to a relatively large recipient molecule. Thus the alkylating agent ethyl methane sulfonate (*q.v.*) can add ethyl groups to the guanine molecules of DNA. These ethylated guanines would be examples of DNA adducts.

**adenine** *See* bases of nucleic acids.

**adenine deoxyriboside** *See* nucleoside.

**adenohypophysis** the anterior, intermediate, and tuberal portions of the hypophysis, which originate from the buccal lining in the embryo.

**adenohypophysis hormone** *See* growth hormone.

**adenosine** *See* nucleoside.

**adenosine phosphate** any of three compounds in which the nucleoside adenosine is attached through its ribose group to one, two, or three phosphoric acid molecules. They are illustrated below.

AMP, ADP, and ATP are interconvertible. ATP upon hydrolysis yields the energy used to drive a multitude of biological processes (muscle contraction, photosynthesis, bioluminescence, and the biosynthesis of proteins, nucleic acids, polysaccharides and lipids).

**adenovirus** any of a group of spherical DNA viruses characterized by a shell containing 252 capsomeres. Adenoviruses infect a number of mammalian species including man; some are oncogenic. Alternative splicing (*q.v.*) was discovered in adenovirus-2.

**adenylcyclase** the enzyme that catalyzes the conversion of adenosine triphosphate (ATP) into cyclic adenosine monophosphate (AMP). Also called adenylate cyclase.

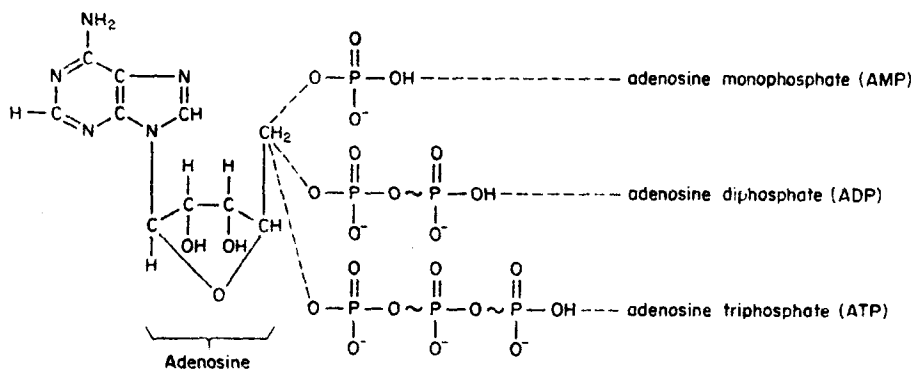
**adenylic acid** *See* nucleotide.

**adhesion plaques** *See* vincullin.

**adjacent disjunction, adjacent segregation** *See* translocation heterozygote.

**adjuvant** a mixture injected together with an antigen that serves to intensify unspecifically the immune response. *See* Freund's adjuvant.

**adoptive immunity, adoptive transfer** the transfer of an immune function from one organism to another through the transfer of immunologically active or competent cells.



**ADP** adenosine diphosphate. *See* adenosine phosphate.

**adrenal corticosteroid** a family of steroid hormones formed in the adrenal cortex. There are more than 30 of these hormones, and all are synthesized from cholesterol by cortical cells that have been stimulated by the adrenocorticotrophic hormone (*q.v.*).

**adrenocorticotrophic hormone** a single-chain peptide hormone (39 amino acids long) stimulating secretion by the adrenal cortex. It is produced by the adenohypophysis of vertebrates. Abbreviated ACTH. Also called *corticotropin*.

**Adriamycin** an antibiotic produced by *Streptomyces peucetius* that interacts with topoisomerase. DNA isolated from Adriamycin-poisoned cells contains single- and double-strand breaks. *See* gyrase.

**advanced** in systematics, the later or derived stages or conditions within a lineage that exhibits an evolutionary advance; the opposite of primitive.

**adventitious embryony** the production by mitotic divisions of an embryonic sporophyte from the tissues of another sporophyte without a gametophytic generation intervening.

**Aedes** a genus of mosquitoes containing over 700 species, several of which transmit important human diseases. *A. aegypti*, the vector of yellow fever, has a diploid chromosome number 6, and about 60 mutations have been mapped among its three linkage groups. Among these are genes conferring resistance to insecticides such as DDT and pyrethrins (*both of which see*).

**Aegilops** a genus of grasses including several species of genetic interest, especially *A. umbellulata*, a wild Mediterranean species resistant to leaf rust. A gene for rust resistance has been transferred from *A. umbellulata* to *Triticum vulgare*.

**aerobe** a cell that lives in air and utilizes oxygen. A strictly aerobic cell cannot live in the absence of oxygen.

**aestivate** to pass through a hot, dry season in a torpid condition. *See also* hibernate.

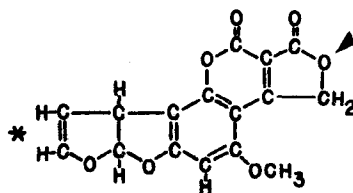
**afferent** leading toward the organ or cell involved. In immunology, the events or stages involved in activating the immune system.

**affinity** in immunology, the innate binding power of an antibody combining site with a single antigen binding site. *Compare with* avidity.

**affinity chromatography** a technique for separating molecules by their affinity to bind to ligands (e.g., antibodies) attached to an insoluble matrix (e.g., Sepharose). The bound molecules can subsequently be eluted in a relatively pure state.

**afibrinogenemia** an inherited disorder of the human blood-clotting system characterized by the inability to synthesize fibrinogen; inherited as an autosomal recessive.

**aflatoxins** a family of toxic compounds synthesized by *Aspergillus flavus* and other fungi belonging to the same genus. Aflatoxins bind to purines, making base pairing impossible, and they inhibit both DNA replication and RNA transcription. These mycotoxins are highly toxic and carcinogenic, and they often are contaminants of grains and oilseed products that are stored under damp conditions. The structure of aflatoxin G<sub>1</sub> is shown.



Aflatoxin B<sub>1</sub> has a CH<sub>2</sub> substituted for the O at the position marked by the arrow. Aflatoxin B<sub>2</sub> and G<sub>2</sub> are identical to B<sub>1</sub> and G<sub>1</sub>, except that the ring labeled with an asterisk lacks a double bond.

**African bees** *Apis mellifera scutellata*, a race of bees, originally from South Africa, that was accidentally introduced into Brazil in 1957 and has spread as far as Mexico. It threatens to invade the southern United States. African bees are poor honey producers and tend to sting much more often than European bees. Because of daily differences in flight times of African queens and European drones, hybridization is rare. *See* *Apis mellifera*.

**African Eve** *See* mtDNA lineages

**African green monkey** *See* *Cercopithecus aethiops*.

**agamete** a haploid, asexual reproductive cell resulting from meiosis in an agamont. Agametes disperse and grow into gamonts (*q.v.*).

**agammaglobulinemia** the inability in humans to synthesize certain immunoglobulins. The most common form is inherited as an X-linked recessive trait, and plasma cells are absent. *See* antibody.

**agamogony** the series of cellular or nuclear divisions that generates agamonts.

**agamont** the diploid adult form of a protoctist that also has a haploid adult phase in its life cycle. An agamont undergoes meiosis and produces agametes. *See gamont.*

**agamospermy** the formation of seeds without fertilization. The male gametes, if present, serve only to stimulate division of the zygote. *See apomixis.*

**Agapornis** a genus of small parrots. The nest building of various species and their hybrids has provided information on the genetic control of behavior patterns.

**agar** a polysaccharide extract of certain seaweeds used as a solidifying agent in culture media.

**agarose** a linear polymer of alternating D-galactose and 3,6-anhydrogalactose molecules. The polymer, fractionated from agar, is often used in gel electrophoresis because few molecules bind to it, and therefore it does not interfere with electrophoretic movement of molecules through it.

**agar plate count** the number of bacterial colonies that develop on an agar-containing medium in a petri dish seeded with a known amount of inoculum. From the count the concentration of bacteria per unit volume of inoculum can be determined.

**age-dependent selection** selection in which the values for relative fitness of different genotypes vary with the age of the individual.

**agglutination** the clumping of viruses or cellular components in the presence of a specific immune serum.

**agglutinin** any antibody capable of causing clumping of erythrocytes, or more rarely other types of cells.

**agglutininogen** an antigen that stimulates the production of agglutinins.

**aggregation chimera** a mammalian chimera made through the mingling of cells of two embryos. The resulting composite embryo is then transferred into the uterus of a surrogate mother where it comes to term.

**agonistic behavior** any social interaction between members of the same species that involves aggression or threat and conciliation or retreat.

**agouti** the grizzled color of the fur of mammals resulting from alternating bands of light (phaeomelanin) and dark (eumelanin) pigments in the individual hairs. It is also the name given to the genes (usually dominant to the dark color genes) responsible for the insertion of the light pigment bands into the hairs. *See melanin.*

**agranular reticulum** endoplasmic reticulum devoid of attached ribosomes.

**agranulocytes** white blood cells whose cytoplasm contains few or no granules and that possess an unlobed nucleus: mononuclear leucocytes including lymphocytes and monocytes.

**agriculturally important species** *See Appendix B.*

**Agrobacterium tumefaciens** the bacterium responsible for crown gall disease in a wide range of dicotyledonous plants. The bacterium enters only dead, broken plant cells and then may transmit a tumor-inducing plasmid into adjacent living plant cells. This infective process is a natural form of genetic engineering. Strains of *A. tumefaciens* carrying the plasmid may be artificially genetically engineered to introduce foreign genes of choice into plant cells, and then by growing the cells in tissue culture, whole plants can be regenerated, every cell of which contains the foreign gene. *See Appendix C, 1907, Smith; Ti plasmid.*

**Agropyron elongatum** a weed related to crabgrass noted for its resistance to stem rust. Genes conferring rust resistance have been transferred from this species to *Triticum aestivum*.

**AHF** antihemophilic factor. *See blood clotting.*

**AI, AID, AIH** *See artificial insemination.*

**AIA** anti-immunoglobulin antibodies, produced in response to foreign antibodies introduced into an experimental animal.

**AIDS** the acquired immunodeficiency syndrome, a disease caused by the human immunodeficiency virus (HIV). This virus attacks lymphocytes of helper T subclass and macrophages. The depletion of these cells makes the patient susceptible to pathogens that would easily be controlled by a healthy immune system. The infection is transmitted by sexual intercourse, by direct contamination of the blood (as when virus-contaminated drug paraphernalia is shared), or by passage of the virus from an infected mother to her fetus or to a suckling baby. *See HIV, lymphocyte, retroviruses.*

**akinetik** acentric (*q.v.*).

**ala** alanine. *See amino acid.*

**albinism** 1. deficiency of chromoplasts in plants. 2. the inability to form melanin (*q.v.*) in the eyes, skin and hair, due to a tyrosinase deficiency. In humans, the condition is inherited as an autosomal recessive. Amelanic melanocytes are present in the skin of albinos. In a wide variety of animals, the albino gene has pleiotropic effects on the visual path-



ways, resulting in nystagmus and crossed eyes. *See* **ocular albinism**.

**albino** 1. a plant lacking chloroplasts. 2. an animal lacking pigmentation.

**albamaculatus** referring to a variegation consisting of irregularly distributed white and green regions on plants resulting from the mitotic segregation of genes or plastids.

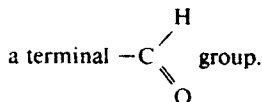
**albumin** a water-soluble 70 kd protein that represents 40–50% of the plasma protein in adult mammals. It is important both as an osmotic and as a pH buffer and also functions in the transport of metal ions and various small organic molecules. Albumin is synthesized and secreted by the liver. In the mouse the albumin gene resides on chromosome 5, separated from the alpha fetoprotein gene by a DNA segment about 13.5 kb long. In humans, these two genes are in the long arm of chromosome 4. *See* **Appendix C**, 1967, Sarich and Wilson: **alpha fetoprotein**.

**alcaptoauria** alkaptonuria (*q.v.*).

**alcohol** any hydrocarbon that carries one or more hydroxyl groups. The term is often used to refer specifically to ethyl alcohol, the product of yeast-based fermentations. Hereditary differences in alcohol preference are known to exist in mice. *See* **Appendix C**, 1962, Rodgers and McClearn.

**alcohol dehydrogenase** (ADH) a zinc-containing enzyme found in bacteria, yeasts, plants, and animals that reversibly oxidizes primary and secondary alcohols to the corresponding aldehydes and ketones. In the case of yeast, ADH functions as the last enzyme in alcoholic fermentation. In *Drosophila melanogaster*, ADH is a dimeric protein. By suitable crosses between null activity mutants it is possible to generate heteroallelic individuals that exhibit partial restoration of enzyme activity. This is often due to the production of a heterodimer with improved functional activity. *See* **allelic complementation**.

**aldehyde** any of a class of organic compounds having the general formula  $C_nH_{2n}O$  and containing



**aldosterone** an adrenal corticosteroid hormone that controls the sodium and potassium balance in the vertebrates.

**aleurone** the outer layer of the endosperm of a seed.

**aleurone grain** a granule of protein occurring in the aleurone.

**Aleutian mink** an autosomal recessive mutation in *Mustela vison* producing diluted pigmentation of the fur and eyes. The homozygotes show a lysosomal defect similar in humans to the Chédiak-Steinbrinck-Higashi syndrome (*q.v.*).

**alga** (*plural* **algae**) any of a large group of aquatic, chlorophyll-bearing organisms ranging from single cells to giant seaweeds. *See* **Appendix A**: Cyanobacteria, Dinoflagellata, Euglenophyta, Xanthophyta, Bacillariophyta, Phaeocophyta, Rhodophyta, Gamophyta, Chlorophyta.

**alien addition monosomic** a genome that contains a single chromosome from another species in addition to the normal complement of chromosomes.

**alien substitution** replacement of one or more chromosomes of a species by those from a different species.

**aliphatic** designating molecules made up of linear chains of carbon atoms.

**aliquot** a part, such as a representative sample, that divides the whole without a remainder. Two is an aliquot of six because it is contained exactly three times. Loosely used for any fraction or portion.

**alkali metal** any of five elements in Group IA of the periodic table: lithium (Li), sodium (Na), potassium (K), rubidium (Rb), and cesium (Cs).

**alkaline earth** any element of Group IIA of the periodic table: beryllium (Be), magnesium (Mg), calcium (Ca), strontium (Sr), barium (Ba), and radium (Ra).

**alkaline phosphatase** an enzyme that removes 5'-P termini of DNA and leaves 5'-OH groups.

**alkaloids** a group of nitrogen-containing organic substances found in plants; many are pharmacologically active (e.g., caffeine, cocaine, nicotine).

**alkapton** 2,5-dihydroxyphenylacetic acid. *See* **homogentisic acid**.

**alkaptonuria** (*also* **alcaptonuria**) a relatively benign hereditary disease in man due to an autosomal recessive gene. Alkaptonurics cannot make the liver enzyme homogentisic acid oxidase. Therefore, homogentisic acid (*q.v.*) is not broken down to simpler compounds but is excreted in the urine. Since the colorless homogentisic acid is readily oxidized to a black pigment, the urine of alkaptonurics darkens when exposed to air. This disease enjoys the historic distinction of being the first metabolic disease studied *See* **Appendix C**, 1909, Garrod.