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- e** 1. The base of natural logarithms; a constant, equal to 2.7183. . . . 2. Electron. 3. Eukaryotic, as in eIF (eukaryotic initiation factor).
- E** 1. Enzyme. 2. Energy. 3. Extinction. 4. Reduction potential. 5. Glutamic acid. 6. Equivalent. 7. Exa.
- E₀** See standard electrode potential.
- E⁰** See standard electrode potential.
- E_h** See standard electrode potential.
- E_{1cm}^{1%}** The extinction coefficient of a 1% solution, the absorbance of which is measured in a cuvette having a light path of 1 cm.
- E_a ; E_A** Activation energy.
- EAA** Essential amino acids.
- E_a antigens** A group of alloantigens in mouse erythrocytes.
- Eadie-Hofstee plot** A single reciprocal plot of the Michaelis-Menten equation in which $v/[S]$ is plotted versus v ; v is the velocity of the reaction and $[S]$ is the substrate concentration. *Aka* Eadie plot; Eadie-Scatchard plot.
- EAG** Electroantennogram.
- early enzyme** A virus-specific enzyme that is transcribed from an early gene.
- early gene** A viral gene that is transcribed early after the infection of a host cell by the virus. *Aka* early function gene.
- early protein** A virus-specific protein that is transcribed from an early gene; early proteins are typically viral enzymes, as distinct from late proteins which are structural proteins of the virus.
- early RNA** A virus-specific RNA that is synthesized by RNA polymerase shortly after the infection of the host cell by the virus.
- earthy group** A group of compounds that have high melting points and that are believed to have occurred in the original gas dust of the solar nebula. *See also* gaseous group; icy group.
- EBV** Epstein-Barr virus.
- EB virus** Epstein-Barr virus.
- EC** Electron capture.
- E.C.** Enzyme Commission; in the listing of an enzyme, the abbreviation is followed by four numbers indicating the classification of the enzyme according to main division, subclass, sub-subclass, and serial number in the sub-subclass.
- EC₅₀** Effective concentration; the concentration of a compound at which a specified effect is observed under the test conditions in a specified time in 50% of the organisms being tested.
- ECC** End carbon chain.
- eccrine gland** A sweat gland.
- ecdysone** A steroid hormone that stimulates molting of caterpillars, pupa formation, and emergence from the pupa in insects.
- ECF** Extracellular fluid.
- ECG** Electrocardiogram.
- ECGF** Endothelial cell growth factor. *See* fibroblast growth factor.
- echovirus** A virus that belongs to the enterovirus subgroup of picornaviruses and that is similar to the polio virus in its physical parameters; the name echovirus is derived from enteric cytopathogenic human orphan virus. Echoviruses occur in the respiratory and intestinal tracts of healthy people and are not associated with any human diseases.
- ECL** Equivalent chain length.
- eclipse** 1. The time interval between the infection of a bacterial cell by a phage and the appearance of intracellular infective phage particles. 2. The time interval in bacterial transformation during which the transforming DNA cannot be extracted from the cell in a form that retains its activity for transformation.
- eclipsed antigen** An antigen that is effectively common to both a parasite and its host. The antigen of the parasite is so similar to that of the host that it does not elicit an immune response in the host.
- eclipsed conformation** The conformation of a molecule in which, in a Newman projection, a large number of the atoms are either partially or completely concealed from view by other atoms. In such a conformation, interatomic distances are relatively small and interatomic interactions are maximized; as a result, an eclipsed conformation is less stable than a staggered one.
- eclipsing strain** TORSIONAL STRAIN.
- eclosion hormone** An insect polypeptide hormone that appears at the end of molting and aids in the shedding of the old cuticle.
- E. coli** *Escherichia coli*.
- ecological system** ECOSYSTEM.
- ecology** The study of the interrelations between organisms and the interrelations between organisms and their external environments.
- economic species** A desirable species; a spe-

cies, such as humans, that uses chemicals to eliminate other, undesirable species.

economic toxicology The branch of toxicology that deals with human use of chemicals to selectively affect tissue function or to selectively eliminate uneconomic species.

ecosystem The system of interrelated organisms and nonliving components in a particular environment.

ecotropic virus A virus that can replicate in cells from its host species but cannot replicate in cells from other species. *See also* amphotropic virus.

ECTEOLA-cellulose Epichlorohydrin triethanolamine cellulose; an anion exchanger.

ectochemistry The chemistry of the surface of either a cell or an organism.

ectocrine ECTOHORMONE.

ectoderm The outermost of the three germ layers of an embryo from which the epidermis, nervous tissue, and sense organs develop.

ectoenzyme An enzyme that is an integral protein of the cell membrane but has its active site located on the outside surface of the cell so that its activity is directed outward.

ectohormone A chemical, such as a pheromone, that is produced by one organism and that exerts an effect on another organism.

-ectomy Combining form meaning surgical removal.

ectopic hormone syndrome The aberrant synthesis and secretion of polypeptide hormones by nonendocrine malignant tissues.

ectopic protein A protein produced by a neoplasm that is derived from a tissue that is not normally engaged in the synthesis of that protein.

ectopic tumor A tumor of some organ that synthesizes and secretes a polypeptide hormone, normally synthesized and secreted by an endocrine gland.

ectoplasm The layer of the cytoplasm near the periphery of the cell that is more rigid than that in the interior of the cell. *See also* endoplasm.

ectotherm A cold-blooded animal; a poikilothermic organism.

ED₅₀ Median effective dose.

eddy diffusion The irregularity in the diffusion of solute molecules that occurs in a porous chromatographic support. The phenomenon is due to the fact that (a) the pathlength for some solute molecules is either shorter or longer than that for the bulk of the molecules; and (b) the rate of solvent flow varies in different regions of the porous support.

eddy migration The irregularity in the electrophoretic mobility of solute molecules that

occurs in a porous support. The phenomenon is due to the fact that (a) the pathlength for some solute molecules is either shorter or longer than that for the bulk of the molecules; and (b) the rate of solvent flow varies in different regions of the porous support.

edema An abnormal accumulation of interstitial fluids in the tissues so that they become puffy.

editing PROOFREADING.

editing function PROOFREADING FUNCTION.

Edman degradation A method for the stepwise removal of amino acids from peptides and proteins that allows a determination of both the N-terminal amino acid and the amino acid sequence. The method is based on the reaction of the Edman reagent, phenylisothiocyanate, with the free alpha amino group of amino acids, peptides, or proteins, and on the removal of the N-terminal amino acid in the form of a phenylthiohydantoin derivative. These steps are then carried out repetitively. *See also* subtractive Edman degradation.

Edmundson wheel A diagrammatic representation for assessing the stabilizing effect of nonpolar amino acid side chains on alpha-helical segments in a protein; prepared by projecting the helix onto a flat surface, looking down on the helix axis. Consecutive amino acid residues are depicted as segments of a circle; nonpolar residues can be distinguished from polar ones by shading or coloring the corresponding segments.

ED pathway Entner-Doudoroff pathway.

EDS Energy-dispersive spectrometry.

EDTA 1. Ethylenedinitrotetraacetic acid. 2. Ethylenediaminetetraacetic acid.

eEF Eukaryotic elongation factor. *See* elongation factor.

EEG Electroencephalogram.

EELS Electron energy loss spectroscopy.

EF 1. Extrinsic factor. 2. Elongation factor.

EFA Essential fatty acids.

E-face *See* fracture faces.

effective concentration *See* EC₅₀.

effective contact The formation of a specific donor-recipient pair in the course of plasmid DNA transfer.

effective half-life The half-life of a radioactive isotope in a biological system that is equal to the product of the biological half-life and the radioactive half-life.

effective lethal phase The stage in the development of an organism carrying a lethal gene at which that gene generally brings about the death of the organism.

effective mean residue rotation REDUCED MEAN RESIDUE ROTATION.

effector A metabolite that, when bound to an allosteric enzyme, alters the catalytic activity of the enzyme. The effector generally alters either the Michaelis constant of the enzyme or the maximum velocity of the reaction. An effector that functions as an activator and leads to an increase in the binding of the substrate and other effectors is known as a positive effector; an effector that functions as an inhibitor and leads to a decrease in the binding of the substrate and other effectors is known as a negative effector. An effector may likewise bind to a nonenzymatic, allosteric protein and lead to a change in the properties of the protein. *See also* Britten-Davidson model.

effector cell A lymphocyte in peripheral lymphoid tissue that is actively engaged in making an immunological response; T effector cells carry out cell-mediated responses while B effector cells secrete antibodies.

effector sequence *See* Britten-Davidson model.

effluent 1. Leading or conveying away from a cell or an organ. 2. Of, or pertaining to, the stages involved in the response of the sensitized immune system. *See also* afferent.

efficiency of infection The ratio of the number of viral particles in a group of animals, cell cultures, or other test units to the number of infective test units produced.

efficiency of plating 1. The proportion of animal cells that give rise to colonies. 2. The ratio of the plaque count in a plaque assay under a given set of conditions to that under standard conditions. *Abbr* EOP.

efflorescence The giving up of water by a substance when it is exposed to air under ordinary conditions of temperature, pressure, and moisture.

effluent ELUATE.

efflux Outward flow, as that out of a cell.

EF-G Elongation factor G; translocase.

EF hand A characteristic structure that is frequently involved in ion-binding sites of a protein such as those for Ca^{2+} ; it is composed of 6 to 8 oxygen atoms, derived from aspartic and glutamic acid side chains and from backbone carbonyl groups of the protein. These various oxygen atoms interact simultaneously with the ion.

EF-T Elongation factor T.

EF-Ts *See* elongation factor.

EF-Tu *See* elongation factor.

egest To discharge material, such as waste, from either a cell or a body.

EGF Epidermal growth factor.

EGF-Uro Epidermal growth factor-urogastrone.

egg white injury The condition of biotin deficiency in humans or animals that results

from an excessive intake of raw egg white; the condition is due to the protein avidin that is present in egg white and that combines tightly with biotin.

egg white injury factor BIOTIN.

Ehlers-Danlos syndrome A group of clinical disorders, characterized by structural laxity or defects in connective tissue, resulting from defects in the structure of collagen. All of the disorders are genetically inherited metabolic defects; for some types, the specific lesions are known, for others they are unknown.

Ehrlich ascites tumor A tumor, derived from a mouse carcinoma, that grows in the peritoneal cavity and that has been kept alive in tissue culture.

Ehrlich reaction A colorimetric reaction for tryptophan and other compounds containing the indole ring; based on the production of a red color upon treatment of the sample with *p*-dimethylaminobenzaldehyde and concentrated hydrochloric acid.

Ehrlich's reagent 1. A reagent that contains *p*-dimethylaminobenzaldehyde and that gives a red color with porphobilinogen, δ -aminolevulinic acid, and related compounds. 2. A reagent that contains diazotized sulfanilic acid and that gives a blue color with bilirubin in the Van den Bergh reaction.

Ehrlich's receptor theory An early selective theory of antibody formation that was formulated by Ehrlich in 1900. The theory proposed that cells were covered with antibody-like receptors that contained haptophore side chains with which the antigens combined. The receptors were then thought to be liberated from the cells and to enter the blood stream as circulating antibodies. *Aka* Ehrlich's side chain theory.

EHTP Equivalent height of a theoretical plate.

EI Enzyme-inhibitor complex.

EIA Enzyme immunoassay.

eicosanoids Collective term for arachidonic acid and all of the compounds derived from it; includes prostaglandins, thromboxanes, prostacyclin, and leukotrienes. Eicosanoids are ubiquitous and have a variety of potent effects. *See also* prostanoids.

eIF Eukaryotic initiation factor. *See* initiation factor.

eIF-2 stimulating protein *See* hemin-controlled repressor.

EI-MS Electron ionization mass spectrometry.

einstein A mole of photons; Avogadro's number of photons.

Einstein law of photochemical equivalence FIRST LAW OF PHOTOCHEMISTRY.

Einstein-Sutherland equation An equation relating Brownian motion and diffusion; specifically, $D = RT/Nf$, where D is the diffusion

coefficient, R is the gas constant, T is the absolute temperature, N is Avogadro's number, and f is the frictional coefficient.

EIS Enzyme-inhibitor-substrate complex.

EKG Electrocardiogram.

elaidinization The cis-trans isomerization of mono- or polysaturated fatty acids. The term is derived from the isomerization of oleic acid (cis) to elaidic acid (trans).

elaioplast A lipid-rich plastid.

elastase An enzyme that catalyzes the hydrolysis of the peptide bonds of elastin and other peptide bonds which are formed by neutral amino acids.

elastic collision A collision in which there is no loss of kinetic energy; the sum of the kinetic energies of the colliding particles before and after the collision is the same; the kinetic energy is conserved.

elastin A major scleroprotein of connective tissue, especially of the elastic tissue of tendons and arteries.

elastomer A natural or a synthetic polymer that possesses rubber-like properties.

ELDOR Electron-electron double resonance.

elective enrichment ENRICHMENT CULTURE.

elective theory SELECTIVE THEORY.

electric 1. Of, or pertaining to, electricity. 2. Pertaining to the motion, emission, and behavior of currents of free electrons in passive elements such as wires, resistors, and inductors. *Aka* electrical.

electrical synapse The direct electrical coupling between two neurons which occurs at a number of sites in the nervous systems of many different species.

electric birefringence The birefringence produced by molecules that have become oriented as a result of the application of an electric field. *Aka* electrical birefringence.

electric dichroism The dichroism that occurs when polarized light is absorbed by molecules, the orientation of which is affected by the direction of an applied electric field. *Aka* electrical dichroism.

electric dipole DIPOLE.

electric double layer IONIC DOUBLE LAYER.

electric field The space surrounding electrical charges in which a mechanical force will be exerted on a charge introduced into it.

electride A new class of crystalline materials, derived from cesium, potassium, and other alkali metals, in which a lattice of positively charged atoms, caged in neutral molecules, is held together by trapped clouds of free-floating electrons. The electronic and optical properties of electrides range from those of nonmetals to those of metals.

electroantennogram An electrophysiological measurement of pheromone activity that is

based on the nerve impulse generated by isolated receptor organs. A standard solution of pheromone is blown over isolated antennae in a stream of air, and the resulting cell potential is measured with a recorder and a set of microelectrodes.

electroblotting *See* blotting.

electrochemical potential The free energy change for the transport of a charged solute either up or down a concentration gradient; equal to the sum of the free energy changes due to the concentration gradient and due to the electrical potential.

electrochemistry The branch of chemistry that deals with the interrelations and the transformations of chemical and electrical energy.

electrochromatogram ELECTROPHEROGRAM.

electrochromatography 1. Any electrophoretic procedure in which the separation of solute particles does not depend solely on the mobilities of the particles, but is also significantly affected by the sorptive interactions between the solute particles and the solid support. 2. ZONE ELECTROPHORESIS. 3. CONTINUOUS FLOW ELECTROPHORESIS.

electrochromatophoresis ZONE ELECTROPHORESIS.

electrochromic effect A change in absorbance that is induced by changes in the electric field. *Aka* electrochromism.

electrocortin ALDOSTERONE.

electrode A device, frequently a wire or a plate, by which an electric current passes into, or out of, an electric cell, a solution, an apparatus, or a body.

electrodecantation A technique for the separation and fractionation of proteins by means of electro dialysis. During this process, the protein molecules move toward the electrodes and tend to form zones of high protein concentration at those portions of the retaining membrane that are near the electrodes. These zones are gravitationally unstable and tend to move downward in the container, carrying the protein molecules along. Thus, in the absence of stirring, there is a gradual decrease in the concentration of protein molecules in the top layers of the solution, and a gradual increase in their concentration in the lower layers.

electrode couple HALF-REACTION.

electrode potential 1. A measure of the tendency of an oxidation-reduction half-reaction to occur by either loss or gain of electrons. The electrode potential measuring electron loss is known as an oxidation potential and that measuring electron gain is known as a reduction potential; the two are numerically equal, but of opposite sign, and are denoted E . The electrode potential at pH 7.0 is the biochemical electrode potential and is denoted E' . *See*

also standard electrode potential. 2. The potential across a chemically reactive electrode that participates either in the formation of ions from atoms or in the formation of atoms from ions.

electrodialysis A technique for the removal of ions from a solution in which dialysis of the solution is carried out with the simultaneous application of an electric field across the dialysis bag.

electrodifffusion The spreading of a spot or a zone in electrophoresis as a result of diffusion; may occur when an electrophoretic component is present as a number of rapidly interconvertible forms that have different mobilities.

electroelution The elution of compounds, separated by electrophoresis on agarose or acrylamide gels, that is brought about by subjecting the gel, under appropriate conditions, to an electric field; the compounds move by electrophoresis through, and out of, the separation gel.

electroencephalogram The recording of the potential changes of the brain. *Abbr* EEG.

electroendosmosis ELECTROOSMOSIS.

electrofocusing ISOELECTRIC FOCUSING.

electrofusion A technique (developed by Zimmerman) for promoting the fusion of cells in tissue culture by electrical means. The method involves exposing the cells to a nonuniform alternating electric field which brings the cells into close contact, and then subjecting them to a short, direct, current pulse of high intensity. This pulse introduces a reversible breakdown in the area of membrane-membrane contact; micropores are opened and permeability properties of the membrane are altered so that the cytoplasm can mix and cell fusion may follow. The changes in cell permeability may be such as to allow DNA fragments the size of genes to enter the cell. This is referred to as gene transfer by electroporation. *Aka* Zimmerman method. *See also* electroporation.

electrogenic carrier A carrier (transport agent) that leads to an alteration in the preexisting membrane potential.

electrogenic pump A pump that generates a gradient of electrochemical potential in the course of its operation. This results from the fact that either (a) the movement of one ion across the membrane is not linked to the movement of another ion in the opposite direction, or (b) the charges of one ion moved in one direction do not balance the charges of another ion moved in the opposite direction.

electroimmunodiffusion ROCKET ELECTROPHORESIS.

electrokinetic phenomenon One of four phe-

nomena that describe either the electrical forces produced by the relative motion of solids and liquids, or the relative motion of solids and liquids produced by electrical forces. The four phenomena are electrophoresis, electroosmosis, streaming potential, and sedimentation potential.

electrokinetic potential ZETA POTENTIAL.

electrolysis The decomposition of a substance by the action of an electric current.

electrolyte A substance that dissociates, partly or entirely, into two or more ions in water; solutions of electrolytes conduct an electric current.

electrolyte balance The reactions and factors involved in maintaining a constant internal environment in the body with respect to the distribution of electrolytes between the various fluid compartments.

electrolytic Of, or pertaining to, electrolytes or electrolysis.

electrolytic desalting The removal of ions from a solution by means of electrolysis.

electromagnetic spectrum The entire range of either the wavelengths or the frequencies of electromagnetic radiations, from the shortest cosmic rays to the longest radio waves.

electromechanochemical coupling hypothesis A modified form of the conformational coupling hypothesis. *Abbr* EMC hypothesis.

electrometer An instrument for measuring electrical potential, electrical charge, or electrical current.

electrometric titration A titration in which electromotive force is measured as a function of titrant added.

electromigration 1. ZONE ELECTROPHORESIS. 2. ISOTACHOPHORESIS.

electromotive force The directly measurable electrical energy that can be derived from an electrical cell composed of two half-cells. *Abbr* EMF.

electromyogram The recording of the potential changes of a muscle. *Abbr* EMG.

electromyography The study of the electrical properties of muscle by means of recordings of its action potential.

electron 1. The elementary particle of nature that has a charge of minus one and a mass of 0.000549 amu (9×10^{-28} g). 2. The elementary particle of nature that has a mass of 0.000549 amu and a charge of either plus one or minus one. *Sym* e. *See also* elementary particles.

electron acceptor A substance that is being reduced; an oxidant; an oxidizing agent.

electron affinity The tendency of a substance to accept electrons and to function as an oxidizing agent.

electron capture A mode of radioactive decay

in which an orbital electron is attracted to the nucleus of an atom and combines with a proton in that nucleus. The electron is generally derived from the K shell of the atom and its combination with the proton leads to the formation of a neutron and to the emission of energy in the form of x rays. *Abbr* EC.

electron carrier A substance that serves as a donor and acceptor of either electrons or electrons and protons in an electron transport system. *See also* electron transfer protein.

electron configuration The arrangement of the electrons about an atomic nucleus.

electron dense Descriptive of a substance, such as a heavy metal ion or concentrated macromolecular matter, that has the capacity to scatter impinging electrons and to prevent their passage through it.

electron-dense label An atom or a compound that is electron dense and that is frequently used as a marker in electron microscopy. *See also* ferritin-labeled antibody.

electron-density map The three-dimensional representation of the structure of a molecule that is based on x-ray diffraction data and that is prepared by superimposing layers that correspond to electron densities of various planes in the molecule.

electron diffraction The diffraction of a beam of electrons that results from the wavelike nature of the electrons.

electron donor A substance that is being oxidized; a reductant; a reducing agent.

electronegative 1. Describing the tendency of an atom or a group of atoms to gain electrons. 2. Having a negative charge; having an excess of electrons.

electron-electron double resonance A spin-label technique used for evaluating rotational correlation times; involves the induction of saturation at one point in the spectrum by a first microwave source, and an investigation of the effect of this saturation at other points in the spectrum by means of a second microwave source. Such saturation-transfer spectroscopy is a function of the resonant conditions of the system. *Abbr* ELDOR.

electron energy loss spectroscopy A technique for the study of surfaces in which the energy loss of low-energy electrons, reflected from a surface, is used to determine vibrational modes of molecules adsorbed on the surface. *Abbr* EELS.

electron equivalent A measure of reducing power that is equivalent to one electron.

electroneutral symport A symport mechanism which results in no net movement of charge across the membrane (no change in membrane potential), sometimes because the charges of the two transported species cancel

each other.

electron-exchange resin A resin that contains groups that are capable of undergoing reversible oxidation and reduction; such resins can be used as insoluble oxidizing and reducing agents in column chromatography.

electron hole The energy level, in either the ground state or a deexcited state, of an atom or a molecule that has lost an electron and that has a great tendency to recapture an electron. *See also* hole.

electronic Pertaining to the motion, emission, and behavior of currents of free electrons in vacuum tubes, gas tubes, semiconductors, and superconductors.

electronic transition The transition of electrons of an atom or a molecule from one atomic orbital to another. Electronic transitions require large amounts of energy and can be induced by visible light, ultraviolet light, and x rays.

electron ionization mass spectrometry A mass spectrometric technique that requires volatilization of the sample (generally in the form of volatile derivatives) prior to ionization, and that is especially useful for ions smaller than those in the molecular region. The sample is ionized by means of a beam of electrons usually produced by an incandescent filament. *Abbr* EI-MS. *Aka* electron impact ionization mass spectrometry.

electron magnetic resonance *See* electron paramagnetic resonance; electron spin resonance.

electron micrograph The photographic record of a pattern observed in an electron microscope.

electron microscope A microscope in which beams of electrons are focused by means of magnetic fields onto a fluorescent screen or onto a photographic film. The electron microscope has great resolving power because of the short wavelengths that are associated with electrons. *Aka* transmission electron microscope.

electron microscope radioautography The use of electron microscopy in conjunction with radioautography.

electron-nuclear double resonance Resonance spectroscopy that combines features of both electron spin resonance and nuclear magnetic resonance; a technique in which electron spins and nuclear spins are irradiated simultaneously. The method is useful for determining whether particular types of nuclei are interacting with free radicals; that is, whether the unpaired electron of the free radical has appreciable density on magnetic nuclei. *Abbr* ENDOR.

electron pair bond COVALENT BOND.

electron paramagnetic resonance A method for

studying the interaction of unpaired electrons in a substance with the environment of these electrons. A substance containing unpaired electrons has a permanent magnetic moment (i.e., it is paramagnetic) as a result of the magnetic properties of its spinning electrons and will tend to orient itself in an applied magnetic field; the magnetic field of the unpaired electron may be either parallel or antiparallel to that of the applied field. A transition from one state to the other is associated with an energy difference and occurs when the applied field is of sufficient strength and the transition is accompanied by absorption of electromagnetic radiation; the relative magnitude of this radiation and that of the applied magnetic field are interpreted in terms of the electron's interaction with its environment. *Abbr* EPR. *See also* electron spin resonance.

electron pressure The tendency of a substance to donate electrons and to function as a reducing agent.

electron probe microanalysis A method for *in situ* chemical analysis of microvolumes in a specimen. After obtaining an image of the specimen by means of transmission or scanning electron microscopy, the electron beam is adjusted to a "probe" which is restricted to a microregion of the specimen. The x rays excited by this beam are then analyzed spectroscopically.

electron projection function A three-dimensional representation of molecular electron distributions obtained by integration of molecule electron densities.

electron sink An electronegative atom or a group of atoms that captures an electron from other components of the system.

electron spin echo spectroscopy A form of electron paramagnetic resonance in which a number of pulses are applied to the sample in succession and the spin echo, emitted by the sample, is recorded and analyzed. *Abbr* ESE.

electron spin resonance The common name for electron paramagnetic resonance when it is applied to compounds that are characterized by *g* values close to that of the free electron, such as most organic free radicals. *Abbr* ESR.

electron-stimulated desorption ion angular distribution A technique for the study of surfaces in which molecules, adsorbed to the surface, are ionized by electron impact. Measurement of the trajectories of the ions thus formed provides information about the orientation of the parent molecules on the surface. *Abbr* ESDIAD.

electron transfer chain ELECTRON TRANSPORT SYSTEM.

electron transfer flavoprotein An electron carrier that serves as a link between the reduced form of fatty acyl coenzyme A dehydrogenase and the electron transport system. An extra flavoprotein of the electron transport system that is involved in the oxidation of fatty acids. *Abbr* ETF.

electron transfer potential The free energy change per mole for an oxidation-reduction reaction.

electron transfer protein A protein that serves as a donor and acceptor of either electrons or electrons and protons in oxidation-reduction reactions. Six types of electron transfer proteins have been identified: flavoproteins, proteins containing reducible disulfide groups, cytochromes, iron-sulfur proteins, cuproproteins, and molybdoproteins.

electron transfer system ELECTRON TRANSPORT SYSTEM.

electron transport chain ELECTRON TRANSPORT SYSTEM.

electron transport particle 1. RESPIRATORY ASSEMBLY. 2. SUPERMOLECULE.

electron transport system 1. The group of biological oxidation-reduction substances that are present in mitochondria and that act sequentially in the transport of either electrons or electrons and protons. The electrons and protons are abstracted from metabolites in glycolysis, the citric acid cycle, beta oxidation, and other metabolic reactions. Each oxidation-reduction substance, or electron carrier, is capable of oxidizing a preceding one in the sequence and the oxidation proceeds from a metabolite to molecular oxygen as the ultimate oxidizing agent. Two modes of electron transport occur, which differ in the initial sequence of electron carriers. One consists of metabolite-NAD⁺-FMN-FeS-CoQ-; the other consists of succinate-FAD-FeS-CoQ-. From CoQ on, the two modes utilize the same sequence of electron carriers, specifically, CoQ-Cyt *b*-FeS-Cyt *c*₁-Cyt *c*-Cyt oxidase-oxygen. The reduction potential of the electron carriers becomes progressively more positive from metabolite to oxygen. The free energy change corresponding to the potential difference between metabolite and oxygen is utilized for the synthesis of ATP from ADP, a reaction that is coupled to the electron transport system at various sites. 2. Any group of electron carriers such as that functioning in photosynthesis. *Abbr* ETS.

electron trap ELECTRON SINK.

electronvolt A unit of energy equal to the energy acquired by an electron in passing through a potential gradient of 1 V. *Sym* eV.

electroosmosis The movement of a charged liquid, relative to a fixed medium carrying the opposite charge, under the influence of an

electric field; an electrokinetic phenomenon that is the reverse of streaming potential.

electropherogram Variant spelling of electrophoregram.

electrophile An atom or a group of atoms that is electron pair seeking.

electrophilic Of, or pertaining to, either an electrophile or a reaction in which an electrophile participates.

electrophilic catalysis Catalysis in which the catalyst abstracts a pair of electrons from a reactant.

electrophilic displacement A chemical reaction in which an electrophilic group attacks and displaces a susceptible group in a compound and then binds covalently to the compound at that site. *Aka* electrophilic substitution.

electrophoregram The record of a zone electrophoresis pattern, either in the form of the electrophoretic support itself or in the form of a tracing thereof.

electrophoresis To cause a compound or a mixture of compounds to move by electrophoresis.

electrophoresis The movement of charged particles through a stationary liquid under the influence of an electric field. Electrophoresis is a powerful tool for the separation of particles and for both preparative and analytical studies of macromolecules. The particles are separated primarily on the basis of their charge and to a lesser extent on the basis of their size and shape. Moving boundary or free electrophoresis refers to electrophoresis performed in solution, while zone electrophoresis refers to electrophoresis performed in a porous medium.

electrophoretic Of, or pertaining to, electrophoresis.

electrophoretic carrier A carrier (transport agent) that transports an ion across a membrane under the driving force of a constant, imposed potential.

electrophoretic effect The decrease in the electrophoretic mobility of a protein that is brought about by the movement of hydrated counterions in the opposite direction; this migration of counterions constitutes, effectively, a flow of solvent in the opposite direction. *See also* asymmetry effect.

electrophoretic injection *See* iontophoresis.

electrophoretic mobility The velocity with which a charged particle moves in electrophoresis divided by the electric field strength that is applied across the support; generally expressed in units of $\text{cm}^2/(\text{s})(\text{V})$.

electrophoretic retardation ELECTROPHORETIC EFFECT.

electrophoretogram ELECTROPHOREGRAM.

electrophorogram Variant spelling of electrophoregram.

electroplax A flat plate in the electric organ of some fish that, when stacked, allows for the generation of a large potential difference.

electroporation A technique for introducing foreign macromolecules into cells; based on subjecting cells to a controlled electrical impulse which leads to reversible formation of nanometer-sized pores in the cell membrane, thus permitting transfection or cell fusion. The technique permits, for example, the introduction of DNA into animal cells and plant protoplasts. *See also* electrofusion.

electropositive 1. Describing the tendency of an atom or a group of atoms to lose electrons. 2. Having a positive charge; having a deficiency of electrons.

electrosorptive spreading The spreading of a spot or zone in electrophoresis that occurs if the moving particle is strongly adsorbed to the support.

electrostatic Pertaining to electrical charges that are not in motion.

electrostatic bond IONIC BOND.

electrostatic catalysis Catalysis in which charge distributions around the active site of an enzyme serve to stabilize the transition state and/or guide a polar substrate to its binding site.

electrostatic interactions The attractive and repulsive electrical forces between atoms, and/or groups of atoms, and/or molecules that are caused both by the presence of ionized species and by the electropositive and electronegative properties of the atoms. *See also* ion-ion interaction.

electrostriction The decrease in the apparent volume occupied by a charged molecule in water as compared to the volume occupied by an uncharged molecule that has the same empirical formula as the charged one. The difference in volume is due to the strong attraction of water molecules to, and their resultant compression and close packing around, the charged groups of the solute molecule.

electroviscous effect The dependence of the viscosity of a polymer on the electrical charge of the polymer.

element A fundamental form of matter that has special properties and that is not decomposable by ordinary chemical means; it consists of atoms that are of one type and that have the same atomic number.

elementary analysis The quantitative chemical analysis of the relative amounts of the different elements in a compound.

elementary forces A group of four fundamental

forces that are believed to govern the interactions of matter; these are gravity, electromagnetism, weak force, and strong force. These four forces vary in range and strength; the ranges are infinite, infinite, less than 10^{-16} cm, and less than 10^{-13} cm, respectively. All the forces are conveyed by force particles. The force particles for the forces listed are graviton, photon, boson, and gluon, respectively. *See also* elementary particles.

elementary particle 1. SUPERMOLECULE. 2. RESPIRATORY ASSEMBLY. 3. F_0F_1 -ATPase. *See also* elementary particles.

elementary particles Fundamental, structureless, and indivisible particles of matter. According to current theory, there are 12 such particles which fall into two groups: 6 leptons and 6 quarks; the six members of each group are called flavors. The leptons include the electron, the muon, the tau, and three neutrinos (electron neutrino, muon neutrino, and tau neutrino). The first three leptons carry an identical charge of -1 but differ in their mass. The neutrinos are electrically neutral and two of them (electron neutrino and muon neutrino) are nearly massless. The quarks are designated up, down, charm, strange, top, and bottom. These particles carry fractional charges and have varying masses. Different combinations of quarks result in hadrons, which are subnuclear particles that are not elementary particles and that vary in mass, charge, spin, and other properties. Protons, neutrons, and mesons are examples of hadrons. For each elementary particle (lepton or quark) there is a corresponding antiparticle. Antiparticles have the same mass and spin as their respective particles but carry opposite values for other properties such as charge. Collision of a particle and an antiparticle leads to mutual annihilation. The antiparticle of the electron, for example, is the antielectron, or positron. *See also* elementary forces.

elementary step The simplest possible chemical reaction that involves the conversion of reactants to products without the formation of any, chemically stable, intermediate. An elementary step is a reaction that proceeds in a single step and one for which the rate equation can be deduced directly from the stoichiometry of the reaction. *Aka* elementary reaction.

elements of symmetry The centers, axes, and planes of symmetry of either a molecule or a body.

oleostearic acid An unsaturated fatty acid that contains 18 carbon atoms and three double bonds.

eliminase PECTATE LYASE.

elimination reaction A chemical reaction in

which there is a decrease in the number of groups attached to carbon atoms so that the molecule becomes more unsaturated.

ELISA Enzyme-linked immunosorbent assay.
ellipsoid of revolution A geometrical solid formed by the rotation of an ellipse about one of its axes. The ellipsoid of revolution is called oblate or prolate depending on whether the rotation occurred about the minor or the major axis of the ellipse. *See also* equivalent ellipsoid of revolution.

elliposome A compartment in the retinal cones of certain fish that contains a cytochrome-like pigment.

elliptically polarized light Light that is composed of left and right circularly polarized light components of unequal amplitude.

ellipticity 1. The angle whose tangent is the ratio of the minor axis to the major axis of an ellipse. 2. MOLAR ELLIPTICITY.

Ellman's reagent 5,5'-Dithiobis(2-nitrobenzoic acid); a reagent for the determination of sulfhydryl groups in proteins.

elongation The stage in the polymerization of amino acids during protein synthesis that covers all of the steps between the initiation and the termination of the polypeptide chain. *See also* elongation cycle.

elongation cycle The set of repetitive reactions that occur during the elongation stage of protein synthesis. These reactions are (a) the attachment of the incoming aminoacyl-tRNA to the aminoacyl site on the ribosome; (b) the peptidyl transferase-catalyzed formation of a peptide bond between the incoming amino acid and the growing polypeptide chain; and (c) the translocase-catalyzed shifting of the peptidyl-tRNA from the aminoacyl site to the peptidyl site on the ribosome with a simultaneous shift of the messenger RNA by one codon.

elongation factor One of at least two protein factors that function in the elongation of polypeptide chains during protein synthesis and that are designated as T and G (EF-T, EF-G) in prokaryotes and as eEF-1 and eEF-2 (EF-1, EF-2) in eukaryotes. Elongation factor T is required for the binding of aminoacyl-tRNA to the ribosome and is dissociable into a stable and an unstable subunit referred to as T_s and T_u (EF-T_s, EF-T_u); elongation factor G is the translocase. In eukaryotes, there are four elongation factors that roughly correspond in function to the prokaryotic factors as follows: EF-1 α (EF-T_u), EF-1 β (EF-T_s), EF-1 γ , EF-2 (EF-G).

eluant 1. Variant spelling of eluent. 2. The solute that is being separated on, and eluted from, a chromatographic column.

eluate The liquid that is collected by elution

from a chromatographic column.

eluent The liquid that is used for the elution of substances from a chromatographic column.

eluent strength The solvent adsorption energy per unit surface area of a fully activated adsorbent.

elutropic series A group of solvents arranged in the order of their relative eluting strength for a given chromatographic adsorbent.

elute To remove and collect a solute from the stationary phase in chromatography by means of elution with a solvent.

eluting agent ELUENT.

elution The process whereby a solute is removed and collected from the stationary phase in chromatography by passage of a solvent over the chromatographic support.

elution analysis ELUTION CHROMATOGRAPHY.

elution band A zone of separated sample components that is obtained in column chromatography.

elution centrifuge A centrifuge in which a cylindrical holder, containing a separation column, revolves about the center of the apparatus and simultaneously rotates about its own axis; both feed and return tubes for the solutions are led through the center of the holder.

elution chromatography A chromatographic technique in which the sample is applied to a column and the sample components are separated into bands or zones that can be eluted and collected. *Aka* elution development.

elution profile A plot of some property of a column eluate, such as absorbance or radioactivity, as a function of either the eluate fraction number or the cumulative volume of the collected eluate.

elution time RETENTION TIME.

elution volume The volume of eluate collected in column chromatography from the time of sample application to the time at which a given component is eluted at maximal concentration.

elutriation 1. The separation of suspended particles according to their size by washing, decantation, and settling. 2. CENTRIFUGAL ELUTRIATION.

EMB agar A solid medium used to distinguish between members of the enterobacteriaceae; contains two dyes (eosin and methylene blue), peptone, lactose, and agar.

Embden ester A mixture of D-glucose-6-phosphate and D-fructose-6-phosphate, both of which are intermediates in glycolysis.

Embden-Meyerhof-Parnas pathway GLYCOLYSIS.

Embden-Meyerhof pathway GLYCOLYSIS.

embolus (*pl* emboli). A blood clot, or some other mass of undissolved material, that is carried by the blood and forced from one

blood vessel into a smaller one, thus causing an obstruction. *See also* thrombus.

embryo 1. The unborn or unhatched young vertebrate during the early stages of its development. The developing human is considered to be an embryo up to the beginning of the third month of pregnancy, and a fetus subsequently. 2. The rudimentary plant within a seed.

embryology The science that deals with the development of an organism.

embryonated egg An egg (usually a hen's or duck's egg) that contains a live embryo; used for preparing tissue cultures and viral vaccines.

embryonic induction MORPHOGENIC INDUCTION.

EMC hypothesis Electromechanochemical coupling hypothesis.

emergency hormone CATECHOLAMINE.

emergency hypothesis The hypothesis that the catecholamines constitute the principal regulatory mechanism of an animal in an emergency situation, and that this mechanism allows the animal to mobilize to meet physical or emotional challenges.

Emerson enhancement effect *See* enhancement effect.

EMF 1. Electromotive force. 2. Erythrocyte maturation factor.

EMG Electromyogram.

-emia 1. Combining form meaning the presence of a substance in blood. 2. Combining form meaning the presence of excessive amounts of a substance in blood.

emission The discharge of energy in the form of radiation.

emission spectrum A plot of the emission of electromagnetic radiation by a molecule as a function of either the wavelength or the frequency of the radiation.

emit To discharge energy in the form of radiation.

emphore A protein that is not an enzyme, but that specifically binds a ligand and thereby involves the ligand in biological activity.

empirical formula The chemical formula of a compound that indicates the number and the types of the different atoms in the compound but not the manner in which they are linked together.

EMP pathway Embden-Meyerhof-Parnas pathway.

empty calorie Descriptive of a calorie that is unassociated with nutritive proteins, minerals, and vitamins; a source of energy (usually sugar) that is largely devoid of nutritive value. The calories in alcohol and many types of soft drinks are examples.

empty capsid The viral capsid without the nucleic acid that it normally encloses.

EMS Ethylmethane sulfonate.

emulsification The formation of an emulsion.

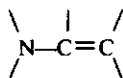
emulsifying agent A substance, such as a surface-active agent, that stabilizes an emulsion by coating the droplets of the dispersed phase, thereby preventing their coalescence. *Aka* emulsifier.

emulsion A colloidal dispersion of one liquid in another, immiscible or partially miscible, liquid.

emulsion fractionation A chromatographic technique in which the stationary phase is the surface of droplets and the mobile phase is the liquid that flows between the droplets. *See also* foam fractionation.

enamel The calcified covering of dentine at the exposed portion of a tooth.

enamine An organic compound that contains the grouping



enantiomer One of two optical isomers of a compound that are nonsuperimposable mirror images of each other.

enantiomorph ENANTIOMER.

enantiotopic Descriptive of either the atoms or the groups of atoms in a molecule that bear an enantiomeric relation to each other; the two identical substituents of a meso carbon atom are an example of enantiotopic groups. *See also* diastereotopic.

encapsidate To enclose the viral nucleic acid with a capsid. *Aka* encapside.

encapsulated Having a capsule.

encephalitis Inflammation of the brain.

encephalitogenic protein MYELIN BASIC PROTEIN.

encephalovirus ARBOVIRUS.

encode Code for; thus, a DNA gene is said to encode a specific mRNA or protein molecule.

end absorption The intense absorbance of saturated compounds at and below wavelengths of 200 nm.

end carbon chain The number of carbon atoms in a fatty acid methyl ester molecule from the terminal methyl group of the carbon chain to the center of the double bond nearest this methyl group. The length of the end carbon chain is important in determining the retention of fatty acid methyl esters in gas chromatography. *Abbr* ECC.

endemic Of, or pertaining to, a disease that has a low, and more or less constant, incidence in a particular locality or region.

endergonic reaction A chemical reaction that requires the input of energy; an uphill reaction with a positive free energy change.

end-group analysis The determination of both

the type and the number of the terminal groups in a polymer; used as an assessment of purity and for calculations of minimum molecular weights. The Sanger reaction is used for end-group analysis of proteins and exhaustive methylation is used for end-group analysis of carbohydrates.

end labeling The attachment of a radioactive or nonradioactive chemical group to the end of a polymer; used specifically for the attachment of a ^{32}P -labeled group to the end of a polynucleotide strand.

endo- Combining form meaning within or internal.

endo conformation *See* puckered conformation.

endocrine gland A ductless gland of internal secretion that produces one or more hormones which are secreted directly into the circulation.

endocrine hormones Hormones produced by specialized cells, clustered together in endocrine glands, and secreted into the blood stream from these glands. Endocrine hormones act on cells distant from their site of release.

endocrine system The endocrine glands.

endocrinology The science that deals with the structure, the function, and the products of the endocrine glands and of other specialized secretory cells.

endocrinopathy A pathological condition resulting from endocrine dysfunction. Such disease states can be grouped into three major categories: (a) excessive production of a hormone; (b) insufficient production of a hormone; (c) decreased target-tissue sensitivity to a hormone.

endocytic vesicle ENDOSOME; RECEPTOSOME.

endocytosis The process whereby cells take up fluids and particles by pinching off of the plasma membrane. The uptake of large particles is known as phagocytosis and that of small particles, solutes, and fluids is known as pinocytosis.

endocytotic vesicle ENDOSOME; RECEPTOSOME.

endoderm The innermost of the three germ layers of an embryo from which the epithelial lining of the intestine and all of the out-growths of the intestine develop.

endoenzyme 1. An enzyme that catalyzes a reaction involving internal parts of a polymer, rather than the ends of the polymer. 2. An enzyme that is released inside the cell.

endergonic reaction ENDERGENIC REACTION.

endogenote The genetic complement of the recipient cell that combines with a genetic fragment from a donor cell in bacterial transformation. *See also* exogenote; merozygote.

endogenous Originating within the organism.

endogenous metabolism The level of metabolism in the absence of added nutrients.

endogenous minimum MINIMUM PROTEIN (NITROGEN) REQUIREMENT.

endogenous opiates 1. OPIOIDS. 2. OPIOID PEPTIDES.

endogenous virus An inactive virus that has become integrated into the DNA of germ-line cells. Such viral genomes are transmitted from parent to offspring like other cellular genes. Endogenous viruses may often be activated by chemical, physical, or immunological mechanisms.

endohormone An unused term for a hormone that is active within the organism producing it, in contrast to an ectohormone.

endohydrolase *See* endonuclease; endopeptidase.

endolysin PHAGE LYSOZYME.

endomembrane system ENDOPLASMIC RETICULUM.

endometrium The mucous membrane that lines the uterus.

endomitosis A process in which the chromosomes in a nucleus replicate but the nucleus does not divide.

endonexin *See* calectrin.

endonuclease An enzyme that catalyzes the hydrolysis of a polynucleotide strand at internal positions of the strand, rather than at the ends. *See also* restriction enzyme.

endopeptidase An enzyme that catalyzes the hydrolysis of a polypeptide chain at internal positions of the chain, rather than at the ends.

endoplasm The portion of the cytoplasm in the interior of the cell that is more fluid than that near the periphery of the cell. *See also* ectoplasm.

endoplasmic reticulum The cytoplasmic network that consists of cisternae, vesicles, and tubules, and that is frequently continuous with the cell membrane and the nuclear membrane. Part of the endoplasmic reticulum has ribosomes attached to it and serves as a transport system for the proteins synthesized on the adhering ribosomes. *Abbr* ER. *See also* RER; SER.

ENDOR Electron-nuclear double resonance.

endorphin A term that is derived from endogenous morphines and that, at first, was used to describe all of the opioid peptides. Currently, the term endorphin is applied only to those opioid peptides (such as α -, β -, and γ -endorphin) that are derived from the processing of proopiomelanocortin.

endoskeleton The internal skeleton of an organism, such as the bony skeleton of vertebrates.

endosmosis The osmotic movement of fluid toward the inside of a cell or a vessel.

endosome A vesicle, derived from the cell membrane, that can fuse with lysosomes; it is composed of many vacuolar and tubular elements and is probably identical to a receptosome. *Aka* CURL.

endosperm The nutritive tissue surrounding and nourishing the embryo in most flowering plants.

endospore A spore formed within a cell, as that formed in a bacterium.

endosymbiotic infection A viral infection in which the infected cells multiply for several generations even though they continue to release virus particles. The phenomenon applies particularly to animal viruses and is due to differences in the rates of cell and virus multiplication rather than to lysogeny.

endosymbiont hypothesis The hypothesis that eukaryotic cells started out in evolution without mitochondria or chloroplasts and later established endosymbiotic relationships with bacteria (that is, the bacteria penetrated the eukaryotic cells). These symbiotic bacteria are postulated to have developed into mitochondria and chloroplasts at a later stage in evolution.

endothelial cells The cells that form the lining of blood vessels.

endotherm A warm-blooded animal; a homoiothermic organism.

endothermic reaction A chemical reaction that requires the input of heat; a reaction with a positive enthalpy change.

endotoxin A toxic lipopolysaccharide that is released from the cell wall of gram-negative bacteria upon destruction of the cell by autolysis or by other means.

end plate The base plate of a T-even phage. *See also* T-even phage.

end point The experimental point in a titration that corresponds to the theoretical equivalence point.

end-point method A virus assay in which a fixed volume of a serially diluted virus sample is inoculated into a number of animals, cell cultures, or other test units.

end-point mutation A mutation that is expressed in an organism after a period of growth following exposure of the organisms to a mutagen.

end product The chemical compound that represents a final substance formed in a sequence of chemical reactions.

end-product inhibition FEEDBACK INHIBITION.

end product repressible Descriptive of a biosynthetic enzyme, the level of which is regulated in response to the presence or absence of the end product of the reaction.

end-product repression COORDINATE REPRESSION.

end-to-end conservative replication A mode of replication for double-stranded DNA (now considered obsolete) in which the parental molecule breaks into two halves so that each daughter molecule consists of one-half of the parental duplex and one-half of a newly synthesized duplex.

end-to-end distance The distance between the ends of a folded polymer as distinct from the contour length of the extended polymer. *See also* root-mean-square end-to-end distance.

end window counter A Geiger-Mueller counter in which either a thin window or a membrane separates the sample from the detector.

enediol An organic compound that contains two hydroxyl groups attached to the two carbon atoms of a double bond.

energetically coupled reactions *See* coupled reactions.

energized conformation ORTHODOX CONFORMATION.

energy The capacity to do work. *Sym E.*

energy barrier 1. The difference between the bond energy at which a molecule dissociates and the energy of the ground state of the molecule. 2. The difference between the ground state energy of the activated complex of a reaction and the sum of the ground state energies of the reactants. 3. A highly endergonic step in a metabolic pathway.

energy charge A measure of the availability of high-energy phosphate bonds in the ATP-ADP-AMP system. It is equal to the expression $([ATP] + \frac{1}{2}[ADP])/([AMP] + [ADP] + [ATP])$ and has a value of 1.0 if all of the adenine nucleotide is present as ATP, and a value of zero if all of the adenine nucleotide is present as AMP. The energy charge is the mole fraction of ATP or its equivalent in the total adenylate pool; ADP is considered to be half-charged since it contains only one high-energy bond while ATP contains two. *See also* phosphate potential.

energy coupling 1. The synthesis of ATP that is linked to the operation of the electron transport system. 2. COUPLED REACTIONS. 3. ENERGY TRANSDUCTION.

energy diagram 1. POTENTIAL ENERGY DIAGRAM. 2. The diagrammatic representation of the energy content of various states such as those of (a) reactants, activated complex, and products in a reaction, (b) the nuclear energy levels of an atom, and (c) the electronic energy levels of an atom.

energy dispersive spectrometry An analytical x-ray technique for the detection of elements in a sample; based on exciting the sample with a high-energy source and analyzing the emitted x-ray photons which are characteristic of the elements present in the sample.

energy fluence The energy carried by the photons in photon fluence; the energy fluence rate is the energy carried by the photons in photon fluence rate.

energy of activation *See* activation energy.

energy-poor compound LOW-ENERGY COMPOUND.

energy-regenerating system ATP REGENERATING SYSTEM.

energy-rich bond HIGH-ENERGY BOND.

energy-rich compound HIGH-ENERGY COMPOUND.

energy sink A molecule or a group of atoms in a molecule that readily accepts energy transferred to it from other components of the system.

energy transduction *See* transduction (2).

energy transfer The transfer of excitation energy from one chromophore or one molecule to another by a radiationless process. The energy may then be dissipated in a number of ways, such as through fluorescence. Energy transfer is strongly dependent on the distance between the chromophores and is useful for studying structural relations among groups of atoms in a macromolecule.

energy well *See* potential energy well.

engram A memory trace; a postulated protoplasmic change in neural tissue that accounts for the persistence of memory.

enhancement 1. The prolongation of the life of a transplant in a recipient by injection of killed tissue from the donor into the recipient prior to implantation of the transplant. 2. The increase in the rate of growth of a tumor that occurs in an animal that has been immunized with antigens of the tumor. 3. The increased binding of a monoclonal antibody to the epitope of a soluble antigen that is brought about by the binding of a second monoclonal antibody to a second epitope of the same antigen. The second antibody is termed the enhancing antibody.

enhancement effect The increase in photosynthetic efficiency (quantum yield) of chloroplasts that occurs when light of longer wavelengths (above 700 nm) is supplemented with light of shorter wavelengths (680 nm).

enhancer A base sequence in DNA that increases the rate of transcription of genes present on the same molecule but does not have promoter activity. An enhancer can be moved upstream, downstream, and to the other side of the promoter without significant loss of activity; it can also be spliced into the DNA of other cells. The distinguishing feature of an enhancer is the fact that it can be cut out from its site and reinserted in reverse orientation with respect to the promoter, without loss of activity.

enkephalin One of two pentapeptides that bind to opioid receptors in the brain; an opioid peptide. The enkephalins have the same amino acid sequence for the first four amino acids and differ only in their C-terminal amino acid. Met-enkephalin has the sequence Tyr-gly-gly-phe-met and Leu-enkephalin has the sequence Tyr-gly-gly-phe-leu. The enkephalin amino acid sequence also occurs in other compounds. Thus, Met-enkephalin occurs in β -lipotropin and Leu-enkephalin occurs in dynorphin.

enniatin See depsipeptide antibiotics.

enol The tautomer of a ketone in which the carbonyl group has been converted to an alcoholic hydroxy group that is attached to a double bond.

enolase The enzyme that catalyzes the formation of the high-energy compound, phosphoenolpyruvic acid, from 2-phosphoglyceric acid in glycolysis.

enol-keto tautomerism See keto-enol tautomerism.

enology The science of wine and wine making.

enriched food Food to which nutrients have been added after naturally occurring ones have been removed; enrichment does not replace all of the lost nutrients.

enriched medium MAXIMAL MEDIUM.

enrichment 1. PURIFICATION (2). 2. The selective growth of bacteria by means of an enrichment culture. 3. The increase in the concentration of a stable isotope above its natural abundance.

enrichment culture A culture used for the selection of specific bacterial strains from among a mixture; such a culture favors the growth of the desired bacteria under the conditions used.

enrichment medium A liquid selective medium of such a composition that it favors the growth of a specific bacterial strain over others in a mixed bacterial population.

entatic Pertaining to a chemical bond that is strained.

entatic site hypothesis The hypothesis that in reactions catalyzed by metalloenzymes, a metal ion-enzyme complex is formed prior to the formation of an enzyme-substrate or enzyme-inhibitor complex. The metal ion-enzyme complex is believed to be characterized by distorted geometries of the metal coordination sites so that the enzyme is in a state of tension, and the metal ion is in a state that approximates its transition state for the particular reaction. Such an activated metal ion-enzyme complex would serve to lower the activation energy of the reaction.

enteric Of, or pertaining to, the intestine.

enteric virus A virus, the target organ of which

is the intestine.

enterobacteriaceae A family of gram-negative, facultatively anaerobic bacteria that are widespread as parasites or pathogens of humans, other animals, and plants; includes the intestinal bacteria *E. coli* and *Proteus vulgaris*.

enterobactin A cyclic siderophore of the phenol-catechol type that appears to be common to all enteric bacteria.

enterocrinine A gastrointestinal hormone, present in the intestinal mucosa, that controls the secretion of intestinal juice.

enterogastrones Substances produced in the gastrointestinal tract that inhibit the secretion of gastric acid and pepsin, and that inhibit gastric motility.

enteroglucagon A peptide or peptides, found in the small intestine, that cross-react with antiglucagon antisera; believed to contain the complete structure of glucagon and may be related to pancreatic precursor forms of glucagon. The actions of enteroglucagon are similar to, but less striking than, those of glucagon. *Aka* glucagon-like immunoreactivity.

enterohepatic circulation The circulatory system that connects the intestine and the liver by way of the bile and the portal blood. The system transports, for example, cholesterol and bile acids; these are excreted from the liver to the intestine by way of the bile and are reabsorbed from the intestine and returned to the liver by way of the portal blood.

enterokinase ENTEROPEPTIDASE.

enteropeptidase A proteolytic enzyme, secreted by the intestine, that catalyzes the activation of trypsinogen to trypsin. The enzyme was originally known as enterokinase.

enterotoxin An exotoxin which, when ingested or produced within the intestine (for example, by *Staphylococcus aureus*), is absorbed by the intestine and affects its function, inducing nausea, cramps, diarrhea, and vomiting.

enterovirus 1. A virus that belongs to a subgroup of picornaviruses which includes polio virus, coxsackievirus, and echovirus; enteroviruses infect the gastrointestinal tract of humans and some also cause acute respiratory infections. 2. ENTERIC VIRUS.

enthalpy Heat content; the thermodynamic function H in $H = E + PV$, where E is the internal energy of the system, P is the pressure exerted on the system, and V is the volume of the system.

enthalpy change The difference between the enthalpy of formation of the products and that of the reactants in a chemical reaction. *Sym* ΔH .

Entner-Doudoroff pathway An anaerobic catabolic pathway for the production of ATP from glucose that is found in some microorganisms,

especially *Pseudomonas* species, which lack some of the glycolytic enzymes. The pathway entails the conversion of glucose to glyceraldehyde-3-phosphate by alternate reactions and the conversion of glyceraldehyde-3-phosphate to pyruvate by the regular reactions of glycolysis. *Abbr* ED pathway.

entoderm ENDODERM.

entomology The study of insects.

entropic doom The terminal equilibrium state of the universe at which the free energy is at a minimum and the entropy is at a maximum; this state is predicted on the basis of the first and second laws of thermodynamics which imply that the universe is progressing toward a state of increased randomness and disorder.

entropic strain The concept that a good substrate, when bound to an enzyme, is restricted in its rotation and is in a conformation that approximates its conformation in the activated complex. A poor substrate, on the other hand, is considered to be able to rotate more freely about critical bonds, so that it will achieve the correct conformation only occasionally and at random.

entropy The thermodynamic function that is a measure of that part of the energy of a system that cannot perform useful work; the degree of randomness or disorder of a system. *Sym* S. *See also* second law of thermodynamics.

entropy change The difference between the entropy of the products and that of the reactants in a chemical reaction. *Sym* ΔS .

entropy compensation The increase in entropy that may accompany the formation of an enzyme-substrate complex as a result of conformational changes of the enzyme.

entropy stabilization The stabilization of a structure due to an increase in entropy associated with the formation of the structure.

entropy trap A concept in enzymology according to which the binding of the substrate to the enzyme results in a loss of translational and rotational entropy of the substrate; the substrate becomes more ordered, less random, hence the decrease in entropy. This decrease helps to overcome the energy of activation barrier of the reaction.

entropy unit A unit of entropy equal to 1 cal/(deg)(mol). *Abbr* eu.

entry site AMINOACYL SITE.

enucleated Without a nucleus.

envelope 1. The two nuclear membranes of a eukaryotic cell. 2. The membrane surrounding some viruses and consisting of lipid, carbohydrate, and protein. 3. The bacterial cell membrane, cell wall, and capsule. 4. A specific conformation of the furanose ring of monosaccharides.

envelope conformation The conformation of

furanoses in which the ring is not planar; four atoms of the ring, including the ring oxygen, are coplanar, but the fifth atom of the ring is outside this plane. *See also* twist conformation.

enveloped nucleocapsid A nucleocapsid surrounded by a membrane.

Enz Enzyme.

enzymatic Of, or pertaining to, enzymes.

enzymatic activity 1. The catalytic activity of an enzyme. 2. The rate of reaction of a substrate that may be attributed to catalysis by an enzyme and that is expressed in terms of katal.

enzymatic reversion DEADAPTATION.

enzyme A protein molecule, produced by living cells, that functions as a catalyst of biochemical reactions. The number and the types of reactions catalyzed by an enzyme are determined by the specificity of the enzyme. Enzymes are classified into the six main divisions of oxidoreductases, transferases, hydrolases, lyases, isomerases, and ligases. *Abbr* Enz; E. *See also* enzyme classification; ribozyme.

enzyme I A soluble bacterial enzyme that is part of the phosphotransferase system for the transport of sugars across the cell membrane. The enzyme catalyzes the reaction P-enolpyruvate + HPr \rightarrow pyruvate + P-HPr, where HPr is a heat-stable, low molecular weight protein, and P designates phosphate.

enzyme II A membrane-bound bacterial enzyme that is part of the phosphotransferase system for the transport of sugars across the cell membrane. The enzyme catalyzes the reaction P-HPr + sugar \rightarrow sugar-P + HPr, where HPr is a heat-stable, low molecular weight protein, and P designates phosphate. The enzyme is responsible for the specificity of the transport with respect to the sugar and functions in some systems in conjunction with another protein (factor III).

enzyme III A third enzyme required in the bacterial phosphotransferase system for the transport of some, but not all, sugars across the cell membrane.

enzyme adaptation ENZYME INDUCTION.

enzyme amplification A technique for enhancing the speed and sensitivity of enzyme assays; involves using the enzyme in a primary system to provide a trigger substance for a secondary system that can generate a large quantity of product. As an example, the enzyme of the primary system may generate NAD^+ which then feeds into a redox cycle (two coupled half-reactions) to generate a large amount of product. The technique is particularly useful for enhancing enzyme immunoassays, such as ELISA. In these systems, the immunoassay (primary system) is coupled to a secondary

system that yields a large amount of colored product.

enzyme analogue SYNZYME.

enzyme assay The measurement of enzymatic activity that is based on a determination of either the rate or the extent of the formation of a product or the disappearance of a reactant.

enzyme-bridge complex See bridge complex.

enzyme cascade CASCADE MECHANISM.

enzyme classification The systematic arrangement and the naming of enzymes that is based on the 1972 recommendations of the Enzyme Commission of the International Union of Biochemistry. Each enzyme is denoted by a number composed of four figures. The first figure denotes one of the six main divisions: oxidoreductases, transferases, hydrolases, lyases, isomerases, ligases. The second figure denotes the subclass and the third figure denotes the sub-subclass. The last figure denotes the serial number of the enzyme in its sub-subclass. The enzyme number is preceded by the abbreviation E.C.

Enzyme Commission A special commission of the International Union of Biochemistry that made recommendations for the classification and naming of enzymes and for the definitions of the mathematical constants used in enzymology. The recommendation were first published in 1964 and were published in revised form in 1972, 1978, and 1984. *Abbr* E.C.

enzyme complex MULTIENZYME SYSTEM.

enzyme concentration See concentration of enzymatic activity.

enzyme conservation equation See conservation equation.

enzyme deletion hypothesis See deletion hypothesis.

enzyme electrode An electrode that incorporates an enzyme into its design and that is specific for measuring the concentration of a reactant or a product of the reaction catalyzed by the enzyme. The enzyme is frequently trapped within a gel matrix around the electrode or trapped within a liquid film in a celophane membrane.

enzyme engineering See genetic engineering; enzyme therapy; biotechnology.

enzyme fractionation Protein fractionation applied to an enzyme preparation.

enzyme graph A graphical representation of an enzyme reaction in the form of a network; enzyme species are located at the nodes of the network and are connected by means of arrows. The latter indicate the direction of the reaction and are designated by the corresponding rate constants. *Aka* enzyme network.

enzyme immunoassay An immunoassay that in-

volves the use of an enzyme, specifically an assay in which antigens have been labeled with an enzyme. *Abbr* EIA. See also immunoenzymometric assay; enzyme amplification.

enzyme induction The process whereby an inducible enzyme is synthesized in response to an inducer. The inducer combines with a repressor and thereby prevents the blocking of an operator by the repressor. The operator controls the structural gene of the enzyme and the active, unblocked operator permits the transcription of that gene.

enzyme-inhibitor complex The complex that consists of an enzyme and an inhibitor that is bound either to the catalytic site of the enzyme or to some other site on the enzyme. *Abbr* EI.

enzyme interconversion See covalently modified enzyme.

enzyme intermediates ENZYME SPECIES.

enzyme kinetics The kinetics of enzyme-catalyzed reactions; includes derivations of rate equations and graphical analysis of experimental data for all types of enzyme reactions such as single or multiple substrate reactions, uninhibited or inhibited reactions, equilibrium- or steady-state systems.

enzyme labeling A method for locating antigens or antibodies in tissues; based on binding the antigen or the antibody to an enzyme and then determining the location of the enzyme in the tissues by making use of the known properties of the enzyme.

enzyme-linked immunosorbent assay An immunoenzymometric assay based on the use of antigens that have been adsorbed to a solid surface and antibodies that have been labeled with a specific enzyme; combines the virtues of solid phase technology and enzyme-labeled immunoreagents. The antigen-antibody complex is determined by means of an enzyme assay, involving incubation of the complex with an appropriate substrate of the enzyme. *Abbr* ELISA. See also enzyme amplification.

enzyme modulation See covalently modified enzyme.

enzyme multiplicity The occurrence of two or more forms of the same enzyme, all of which catalyze the same reaction.

enzyme multiplicity feedback inhibition Feedback inhibition in which two or more forms of an enzyme, all of which catalyze the same reaction, are inhibited to different degrees and by different end products.

enzyme network ENZYME GRAPH.

enzyme nomenclature See Enzyme Commission.

enzyme pH electrode An enzyme electrode that incorporates in its design a conventional glass

electrode which is sensitive to hydrogen ions.

enzyme replacement therapy The treatment of a genetic disease by administration of the enzyme that is either missing entirely or present in defective form. Some approaches include delivery of the enzyme by coupling it to a carrier, use of an encapsulated enzyme, organ transplantation, and introduction of the required gene into recipient cells. *See also* enzyme therapy.

enzyme repression The process whereby the synthesis of a repressible enzyme is decreased in response to either a repressor or a repressor-corepressor complex. The repressor or the repressor-corepressor complex binds to and blocks an operator and thereby prevents the transcription of the structural gene of the enzyme which is controlled by that operator.

enzyme species All of the isomeric forms of an enzyme and all of the covalent and noncovalent complexes formed between an enzyme and a substrate and/or a product and/or an effector. *Aka* enzyme intermediates.

enzyme-specific electrode ENZYME ELECTRODE.

enzyme specificity *See* specificity (1).

enzyme-substrate complex The complex that consists of an enzyme and the substrate that is bound to the enzyme noncovalently at its catalytic site. *Abbr* ES.

enzyme-substrate compound The enzyme-substrate complex in which the substrate is covalently linked to the enzyme. *Aka* enzyme-substrate intermediate.

enzyme-substrate intermediate 1. The unstable intermediate, formed in some reactions, in which the substrate is linked covalently to the enzyme. *Aka* enzyme-substrate compound.
2. SUBSTITUTED ENZYME (1).

enzyme system MULTIENZYME SYSTEM.

enzyme therapy Any therapeutic approach that is based on the use of an enzyme; includes cancer chemotherapy, treatment of genetic diseases (*see* enzyme replacement therapy), dissolution of blood clots, and treatment of toxic reactions. *See also* gene therapy.

enzyme unit The amount of enzyme that, under defined conditions, will catalyze the transformation of 1 μmol of substrate per minute, or, where more than one bond of each substrate molecule is attacked, 1 μeq of the group concerned per minute. *Sym* U. *See also* katal.

enzyme variant *See* variant (1); multiple forms of an enzyme; isozyme.

enzymic ENZYMIC.

enzymoblotting The blotting of enzymes to nitrocellulose paper and their subsequent detection by reactions with specific substrates. The method has been used for detection of proteinases and their zymogens. *See also* blotting.

enzymoelectrophoresis An electrophoretic technique for the detection and determination of isozymes by the combined use of electrophoresis and an enzyme assay. The technique is used specifically for the isozymes of lactate dehydrogenase which are first separated by gel electrophoresis and are then assayed by covering the gel with another gel that contains substrate and coenzyme; the paired gels are then scanned spectrophotometrically.

enzymology The study of enzymes and enzyme-catalyzed reactions.

enzymolysis Hydrolysis by means of enzymes.

enzymopathy A disturbance of enzyme function, including the genetic deficiency of a specific enzyme.

eobiogenesis The first instance of the formation of living matter from nonliving matter.

eobiont A primitive prototype of a living cell.

Eoff process The formation of glycerol from dihydroxyacetone phosphate by yeast under alkaline conditions.

EOP Efficiency of plating.

eosin Tetrabromofluorescein; a red dye and fluorochrome.

eosinophil *See* polymorphonuclear leukocyte.

eosome A fundamental molecule of the ribosome; a molecule of ribosomal RNA or a molecule of ribosomal protein.

EP Enzyme-product complex.

Epa antigens Mouse alloantigens that are specific to epidermal cells.

epidemic Of, or pertaining to, a disease that has widespread incidence that is significantly above the endemic level.

epidemic hepatitis *See* hepatitis.

epidemiology The study of diseases in populations.

epidermal growth factor A polypeptide mitogen (MW 6400) that stimulates the proliferation of epidermal and epithelial tissues. *Abbr* EGF. *Aka* epithelial growth factor. *See also* urogastrone.

epidermal growth factor-urogastrone Name given to human epidermal growth factor which appears to be identical to urogastrone.

epigenesis The concept that an organism develops through the appearance and diversification of structures and functions that are not present in the egg. *See also* preformation.

epigenetics The study of the mechanisms that result in the expression of the phenotypic effects of genes during differentiation and development.

epimer One of two optical isomers that differ from each other only in the configuration about one asymmetric carbon atom (the epimeric carbon).

epimerase An enzyme that catalyzes the inter-

conversion between two optical isomers, each of which contains only one asymmetric center. *See also* racemase.

epimeric carbon The asymmetric carbon atom of two optical isomers (epimers) that differ from each other only in the configuration about this carbon atom.

epimerization The formation of one epimer from another.

epinephrine A catecholamine hormone that is secreted by the adrenal medulla. Epinephrine raises the level of blood sugar by increasing the breakdown of glycogen, stimulates the mobilization of free fatty acids, and has various effects on the cardiovascular system and on muscular tissue. *Aka* adrenaline.

epiphysis PINEAL GLAND.

episome A plasmid that can become integrated reversibly into the chromosome of the bacterial host; phage lambda and the F factor are two examples. A plasmid may behave as an episome (replicating with the bacterial chromosome) in one cell and as a regular plasmid (replicating independently of the bacterial chromosome) in another cell.

epistasis The interaction between nonallelic genes such that one gene interferes with, or prevents, the expression of the other gene.

epistatic gene A gene, the expression of which suppresses or reduces the expression of another, nonallelic gene.

epithelial body PARATHYROID GLAND.

epithelial cell A cell of the epithelium.

epithelial growth factor EPIDERMAL GROWTH FACTOR.

epithelioma A malignant tumor derived from epithelial cells.

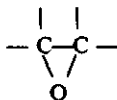
epithelium The sheet of cells, consisting of one or more layers, that covers surfaces and lines tubes of animal tissue.

epitope ANTIGENIC DETERMINANT.

epitope A family of related epitopes.

EPO Erythropoietin.

epoxide A cyclic, 3-membered ether; a compound containing the structure below. Epoxides are highly reactive compounds as a result of the strain in the ring; they have been implicated as mutagens, cytotoxins, and teratogens.



EPPS *N*-(2-Hydroxyethyl)piperazine-*N'*-3-propanesulfonic acid; used for the preparation of biological buffers in the pH range of 7.3 to 8.7. *Aka* HEPPS. *See also* biological buffers.

EPR Electron paramagnetic resonance.

epsilon Denoting the fifth carbon atom from

the carbon atom that carries the principal functional group of the molecule. *Sym* ϵ .

epsilon chain The heavy chain of the IgE immunoglobulins.

Epstein-Barr virus A herpesvirus that is the causal agent of infectious mononucleosis and that has been implicated in the etiology of Burkitt's lymphoma. *Abbr* EBV.

eq Equivalent.

Equal *See* aspartame.

equation of state An equation that relates the volume, pressure, temperature, and mass of a substance.

equator The line in an x-ray diffraction pattern that passes through the zero point and that is perpendicular to the axis of the fiber that is being studied; the direction that is perpendicular to the meridian and that bisects the film when the latter is considered to be wrapped cylindrically about the fiber axis. *Aka* zero layer line.

equatorial bond A bond in a molecule having a ring structure that is roughly in the plane of the ring.

equatorial reflection An x-ray diffraction spot that lies on the equator.

equatorial substituent A substituent attached to an equatorial bond.

equilibrium (*pl* equilibria) The state of a system in which no further change is occurring and in which the free energy is at a minimum. At equilibrium, the rate of the forward reaction is equal to the rate of the reverse reaction so that a small change in one direction is balanced by a small change in the opposite direction. *See also* steady state.

equilibrium banding DENSITY GRADIENT SEDIMENTATION EQUILIBRIUM.

equilibrium constant The constant K that is characteristic of a given chemical reaction at a specified temperature and that is based on the activities of all of the reactants and all of the products at equilibrium. The equilibrium constant is generally written using molar concentrations, rather than activities (thus, actually an apparent equilibrium constant); for the reaction $aA + bB \rightleftharpoons cC + dD$, the equilibrium constant is given by

$$\frac{[C]^c[D]^d}{[A]^a[B]^b}$$

Sym K ; K_{eq} *See also* apparent equilibrium constant.

equilibrium dialysis A method for measuring the binding of low molecular weight ligands to macromolecules. The macromolecules are placed inside a dialysis bag, the ligands are placed outside the bag, and dialysis is allowed

to proceed until equilibrium is established. From the known concentration of macromolecules, the expected distribution of ligands across the dialysis membrane in the absence of binding, and the initial and final concentrations of ligand on either side of the dialysis membrane, it is possible to calculate the average number of ligand molecules that are bound per macromolecule. The method permits a determination of the number of binding sites per macromolecule for a given ligand and a determination of the intrinsic association constant that governs that binding. *See also* forced dialysis.

equilibrium potential The membrane potential that arises from the differences in the concentrations of ions across a membrane and that exactly balances the tendency of these ions to diffuse from the more concentrated to the more dilute solution.

equilibrium thermodynamics The branch of thermodynamics that deals with changes between equilibrium states of closed systems; that change from one equilibrium state to another may be either a reversible or an irreversible process.

equimolar Containing an equal number of moles and, hence, an equal number of molecules.

equine Of, or pertaining to, horses.

equivalence point 1. The point in a titration where a chemically equivalent amount of a compound has been added to the compound being titrated. 2. EQUIVALENCE ZONE.

equivalence rules BASE PAIRING RULES.

equivalence zone A zone in the precipitin curve of the antigen-antibody reaction in which maximum precipitation of the antigen-antibody complex occurs.

equivalent GRAM-EQUIVALENT WEIGHT.

equivalent chain length The number of carbon atoms, generally a nonintegral number, that is derived for an organic compound on the basis of its retention time in gas chromatography. The number is obtained by interpolation of a semilogarithmic plot of retention time versus the number of carbon atoms in the chain for a series of saturated, straight-chain organic compounds. *Abbr* ECL.

equivalent ellipsoid of revolution The ellipsoid of revolution that has the same volume as the actual hydrodynamic unit in the solution; the hydrodynamic unit consists of the macromolecule together with tightly bound solvent.

equivalent height of a theoretical plate *See* height equivalent to a theoretical plate.

equivalent thickness The thickness, in centimeters, of an absorbing material that is equivalent to a thickness of 1 cm of air with respect to absorption of alpha particles, multi-

plied by the density of the absorbing material in grams per cubic centimeter.

ER Endoplasmic reticulum.

E₁ reaction A unimolecular elimination reaction closely analogous to an S_N1 reaction.

E₂ reaction A bimolecular elimination reaction closely analogous to an S_N2 reaction.

eRF Eukaryotic release factor; *see* release factor.

erg A unit of work that is equal to the work done when a force of 1 dyne acts through a distance of 1 cm; 1 erg = 10⁻⁷ J.

ergastoplasm ROUGH-SURFACED ENDOPLASMIC RETICULUM.

ergocalciferol A compound that has vitamin D activity and that is obtained by ultraviolet irradiation of ergosterol. Previously called calciferol and denoted vitamin D₂.

ergosome POLYSOME.

ergosterol A sterol that yields ergocalciferol (calciferol) upon irradiation with ultraviolet light.

Ergot alkaloid One of a group of indole alkaloids obtained from fungi of the genus *Claviceps*; includes lysergic acid derivatives and clavine derivatives. Ergot alkaloids stimulate smooth muscle contraction and are used to control hemorrhage after childbirth; some specific compounds are ergotamine, ergotoxine, and ergometrine.

erosion model RELIC MODEL.

error The difference between a measured value of a quantity and either the true or the expected value.

error catastrophe A model for biological aging according to which there is a decrease in the fidelity of protein synthesis with aging. As a result, errors in protein synthesis increase and accumulate with time to a point where cell death ensues.

error curve NORMAL DISTRIBUTION.

error function NORMAL DISTRIBUTION.

error of the first kind TYPE I ERROR.

error of the second kind TYPE II ERROR.

error-prone repair SOS REPAIR.

error theory A theory of aging according to which aging is due to the occurrence of errors in the biosynthesis of proteins; the accumulation of the partially active, or the inactive, proteins that are produced in this fashion then leads to the death of cells. *See also* error catastrophe.

erythorbic acid ISOASCORBIC ACID.

erythroblastosis fetalis Hemolytic disease of the newborn; *see* Rh blood group system.

erythrocin ERYTHROMYCIN.

erythro configuration The configuration of a compound in which two asymmetric carbon atoms have identical substituents on the same side, as is the case in erythrose.

erythrocrucorin A hemoglobin-like respiratory pigment of invertebrates that has a molecular weight of about 4×10^5 to 6.7×10^6 and contains 30 to 400 heme groups per molecule.

erythrocyte A mature red blood cell that is no longer engaged in the synthesis of hemoglobin and that derives its energy primarily from anaerobic glycolysis and from the phosphogluconate pathway.

erythrocyte ghost See ghost (1).

erythrocyte maturation factor VITAMIN B₁₂.

erythrocytosis POLYCYTHEMIA.

erythromycin A macrolide antibiotic, produced by *Streptomyces erythreus*, that binds to the 50S ribosomal subunit and prevents formation of the 70S ribosome in prokaryotic protein synthesis.

erythron The sum of the circulating erythrocytes and the total mass of erythropoietic cells from which erythrocytes are derived.

erythropoiesis The formation of red blood cells.

erythropoietic Of, or pertaining to, erythropoiesis.

erythropoietic porphyria A congenital porphyria that is caused by an excessive formation of heme precursors in the developing red blood cells of the bone marrow; due to a deficiency of the enzyme ferrochelatase.

erythropoietin A glycoprotein mitogen and hormone (MW 23,000) that is produced by the kidneys and that stimulates the formation of erythrocytes. *Abbr* EPO.

erythrose A four-carbon aldose that is an intermediate in the phosphogluconate pathway.

erythrosome An artificially prepared subcellular fraction consisting of red blood cell ghosts that are cross-linked with glutaraldehyde and coated with phospholipids.

ES Enzyme-substrate complex.

escape synthesis The constitutive synthesis of a group of enzymes, coded for by bacterial genes closely linked to the prophage genome, that results from the induction of prophage lambda in *E. coli*.

Escherichia coli A bacterium that is normally present in the intestine and that is widely used in biochemical and genetic research. *Abbr* *E. coli*. *Aka* colon bacillus.

ESDIAD Electron-stimulated desorption ion angular distribution.

ESE Electron spin-echo spectroscopy.

ESI Enzyme-substrate-inhibitor complex.

E site A postulated third site on the ribosome (in addition to the A and P sites) that is introduced into the 70S ribosome by the 50S subunit. The site is specific for deacylated tRNA and characterized by relatively weak and reversible binding; hence, it is regarded as an "exit" site.

ESP Abbreviation for eIF-2 stimulating protein; see hemin-controlled repressor.

ESR 1. Electron spin resonance. 2. Erythrocyte sedimentation rate.

essential amino acid An amino acid that is required by an organism for normal growth and functioning, but that cannot be synthesized by the organism; such an amino acid must be obtained through the diet. Leucine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine are essential amino acids for positive nitrogen balance in adult humans. *Abbr* EAA.

essential amino acid index The chemical score of the essential amino acids of a protein. *Abbr* EAA index.

essential enzyme An enzyme without which a cell or an organism cannot grow or survive.

essential fatty acid A fatty acid that is required by an organism for normal growth and functioning, but that cannot be synthesized by the organism; such a fatty acid must be obtained through the diet. The polyunsaturated fatty acids, linoleic acid and linolenic acid, are essential fatty acids in humans. *Abbr* EFA.

essential gene A gene that codes for an essential enzyme.

essential hypertension Hypertension for which no cause can be found; hypertension without preexisting renal disease or other pathological conditions.

essential metabolite A metabolite required for the growth of cells or the growth of an organism.

essential nutrient A nutrient that is required by an organism for normal growth and functioning, but that cannot be synthesized by the organism; such a nutrient must be obtained through the diet.

essential oil An oil that is produced by a plant and that has a characteristic odor and flavor. Essential oils are rich in terpenes and in oxygenated compounds such as alcohols, aldehydes, ketones, acids, and esters; the oxygenated compounds are most responsible for the odors and flavors of the essential oils. Some essential oils, obtained by extraction with organic solvents, contain waxes and paraffins which make them insoluble in dilute alcohol. These are called concrete oils. Removal of the insoluble components from concrete oils yields absolute oils.

established cell line A cell line that appears to be capable of unlimited in vitro propagation. The cell culture can be subcultured indefinitely; the cells grow and divide indefinitely. *Aka* established cell strain. See also crisis (2).

established tissue culture A long-term tissue culture.

established tumor A tumor that has been trans-

planted and that has been allowed to grow in the new host.

ester An organic compound formed from an alcohol and an acid by splitting out a molecule of water; the water is formed from the H of the alcohol and from the OH of the acid.

esterase An enzyme that catalyzes the hydrolysis of an ester.

esterification The formation of an ester.

ester interchange An interesterification reaction in which two esters react with each other to produce two new esters.

esterolytic protease A proteolytic enzyme that catalyzes the hydrolysis of ester bonds in appropriate substrates at a faster rate than it catalyzes the hydrolysis of natural peptide bonds.

ester value The number of milligrams of potassium hydroxide that are required to saponify the esters in one gram of a fat or an oil; identical to the saponification number if the sample does not contain free fatty acids.

estolide An intermolecular lactone of hydroxy fatty acids.

17- β -estradiol A steroid hormone, secreted by the ovaries, that is a major sex hormone and that is responsible for regulation of feminine characteristics and for regulation of the menstrual-ovulatory cycle. *Aka* β -estradiol; estradiol.

estrane The parent ring system of the estrogens.

estrogen An 18-carbon steroid that is a female sex hormone or one of its metabolites; the major estrogens are estrone and 17- β -estradiol. *See also* female sex hormone.

estrone A major female sex hormone.

estrophilin An estrogen receptor protein in the cytosol of target tissues; also designated as estrophilin I in contrast to the estrogen-receptor complex which is designated as estrophilin II.

estrous cycle The sequence of endocrine-related events from the beginning of one estrus to the beginning of the next.

estrus 1. The period of reproductive activity in an animal. 2. ESTROUS CYCLE.

Et Ethyl group.

ETC Electron transport chain.

ETF Electron-transfer flavoprotein.

ether 1. An organic compound derived from an alcohol by replacing the hydrogen of the hydroxyl group with an organic radical. 2. Diethyl ether; ethyl ether.

ethereal sulfate One of a group of phenolic, sulfur-containing compounds that are excreted in the urine.

etherification The formation of an ether.

ethidium bromide A planar, fluorescent molecule that intercalates with DNA and thereby

decreases its density. Covalently closed circles cannot bind as much ethidium bromide as other DNA forms (linear or nicked circles) and therefore show a smaller decrease in density. Consequently, they can be separated from the other DNA forms by density gradient centrifugation.

ethionine An amino acid analogue that can be incorporated into protein during protein synthesis.

ethology The scientific study of animal behavior, particularly, the study of the biological processes underlying animal behavior.

ethylenediaminetetraacetic acid ETHYLENEDINITROLOTETRAACETIC ACID.

ethylenedinitroloctetraacetic acid A chelating agent. *Abbr* EDTA.

ethylenimine An aziridine mutagen.

N-ethylmaleimide A reagent for sulfhydryl groups in proteins. *Abbr* NEM.

ethylmethane sulfonate A mutagenic, alkylating agent that commonly reacts with guanine. In that reaction, an ethyl group is linked to guanine so that the latter hydrogen bonds with thymine, resulting in a transition-type mutation. *Abbr* EMS.

etiology The study of causes, specifically the causes of disease. British: aetiology.

ETP Electron transport particle.

ETS Electron transport system.

ETS particle Electron transport system particle; *see* electron transport particle.

eu 1. Enzyme unit; the abbreviation U is now preferred. 2. Entropy unit.

eubacteria A term used originally to denote "true" bacteria as opposed to other microorganisms; now used to designate all bacteria other than archaeobacteria.

eucaryon The nucleus of a eukaryotic cell.

eucaryote Variant spelling of eukaryote.

euchromatin Chromatin, or chromosome regions, having normal staining properties that are characteristic of the bulk of the chromosomal complement. Euchromatin is relatively uncoiled and stains weakly during interphase but is condensed and stains strongly during metaphase.

euchrysin ACRIDINE ORANGE.

eugenic Related to, or aimed at improving, the genetic qualities of a race or a breed. *See also* dysgenic.

eugenics The science that deals with the improvement of the genetic qualities of a race or a breed through alteration of its genetic makeup.

Euglena A genus of unicellular photosynthetic flagellates that are used for genetic studies and that are classified as either green algae or protozoa.

euglobulin A water-insoluble globulin.

eukaryon Variant spelling of eucaryon.

eukaryote A higher organism (unicellular or multicellular) that consists of cells that possess a true nucleus; the nucleus is surrounded by a nuclear membrane and contains the genetic material within multiple chromosomes. *See also* prokaryote.

eukaryotic Of, or pertaining to, eukaryotes.

eumelanin One of a group of brown or black pigments that are widespread in skin, hair, and feathers of animals and in cuticles of insects; they are cross-linked polymers derived from tyrosine.

euploid state The state of a cell or an organism having a chromosome number that is an exact multiple of the haploid number. *Aka* euploidy.

euroxic Descriptive of organisms exhibiting a wide range of oxygen tolerance.

euthenics The science that deals with the improvement of the human race through control and alteration of its physical, biological, and social environments.

eutrophication The process whereby a body of water becomes deficient in oxygen.

eutrophic lake A shallow lake, having a depth of 10 m or less, that is murky due to dense growth of planktonic algae and that has a high rate of nutrient supply in relation to its volume of water. In such a lake, both plant biomass and productivity are high and the bottom layers of the lake frequently contain low concentrations of dissolved oxygen at the end of the summer. *See also* mesotrophic lake; oligotrophic lake.

eV Electron volt.

evagination An outpocketing.

Eve *See* mitochondrial Eve.

evenly labeled UNIFORMLY LABELED.

even-numbered fatty acid A fatty acid molecule that has an even number of carbon atoms; refers to the total number of carbon atoms, those in the hydrocarbon portion of the molecule plus that in the carboxyl group. *Aka* even-carbon fatty acid.

eversible Capable of being turned inside out.

eversion theory A theory of aging according to which aging is due to changes in the structures of macromolecules.

everted sac technique A technique for studying the absorption of substances across the intestinal wall by means of *in vitro* experiments performed on small segments of the intestine, turned inside out.

evocation The process whereby a morphogenetic effect is brought about by an evocator.

evocator A chemical substance that is morphogenetically active and that is emitted by an organizer.

evolution 1. DARWINIAN EVOLUTION. 2. The pro-

cess of continuous change by which something complex develops from something simpler.

3. The liberation of a gas during a chemical reaction.

evolutionary clock The rate at which mutations accumulate in a specific gene.

evolutionary tree PHYLOGENETIC TREE.

evolve To undergo evolution.

exa- Combining form meaning 10^{18} and used with metric units of measurement. *Sym* E.

EXAFS Extended x-ray absorption fine structure.

exchange diffusion The passive transport of two solutes across a biological membrane such that one solute moves in one direction while an equimolar amount of the second solute moves in the opposite direction. A form of antiport; the movement of two substances, in opposite directions across a membrane as a result of simple diffusion.

excimer An excited dimer; a complex between an excited molecule and an identical, but unexcited, molecule.

excinuclease A nuclease that makes two nicks in a polynucleotide strand, thereby allowing excision of a specific segment.

excision 1. The enzymatic removal of a nucleotide segment, particularly a thymine dimer, from a nucleic acid strand. 2. Removal of the prophage from the host bacterial DNA (prophage excision); requires the action of two enzymes, integrase and excisionase.

excisionase An enzyme required for the excision of the prophage from the bacterial chromosome; it works in conjunction with the enzyme integrase. *Abbr* Xis. *Aka* integration host factor (IHF).

excision repair A repair mechanism for damaged DNA. First, the damaged nucleotide segment of a DNA strand is removed by two nuclease-catalyzed incisions on either side of the damaged segment. Second, the correct segment is synthesized by means of DNA polymerase with the second strand of the DNA serving as a template. Last, the newly synthesized segment is joined to the existing strand by means of DNA ligase. This mechanism occurs, for example, in *E. coli* and serves to remove and repair lesions containing thymine dimers. *Aka* cut and patch repair. *See also* patch and cut repair.

excitability The capacity of living matter to respond to an external stimulus.

excitation 1. The transition of an atom or a molecule from a lower to a higher energy level as that brought about by the raising of electrons from lower to higher energy orbitals. 2. The process whereby an external stimulus brings about changes in living matter, such

as the changes in a muscle fiber that are initiated by a nerve impulse.

excitatory autacoid See autacoid.

excited state Any state of a nucleus, an atom, or a molecule that is of a higher energy level than that of the ground state.

exciton A quantum of excitation energy; a photon.

exciton transfer RESONANCE ENERGY TRANSFER.

excluded site binding An extreme case of anti-cooperative binding in which the binding of a ligand to one site excludes the binding of other ligands at the nearest adjacent sites. Such a binding model can account for the intercalation of a dye with DNA when a maximum of one dye molecule is intercalated per two base pairs (4 nucleotides); that is, the dye fills every other potential site in the DNA. See also nearest-neighbor cooperative model.

excluded volume 1. COVOLUME. 2. The volume of solvent that is required to elute a component in gel filtration when that component is neither adsorbed to, nor permeates into, the gel bed.

exclusion chromatography GEL FILTRATION CHROMATOGRAPHY.

exclusion diagram RAMACHANDRAN PLOT.

exclusion limit The molecular weight of the largest molecules of a particular shape that can be effectively fractionated by a specific gel in gel filtration. Molecules of similar shape but higher molecular weights will not penetrate the gel particles and will move right through the column without being fractionated.

exclusion limit chromatography GEL FILTRATION CHROMATOGRAPHY.

exclusion reaction The prevention of further phage infection of a phage-infected bacterium that is brought about by strengthening the cell envelope when the phage-infected cell is heated.

exergonic reaction A chemical reaction that is accompanied by a release of energy; a downhill reaction with a negative free energy change.

exhaustion theory A theory of aging according to which aging is due to the exhaustion of an essential nutrient.

exhaustive methylation Maximal methylation; in carbohydrate chemistry this refers to the formation of a methyl ether at every free hydroxyl group on the carbohydrate. The hydrolysis of an exhaustively methylated carbohydrate, followed by separation, identification, and quantification of the components, is used as an aid in determining the structure of the carbohydrate.

EX₂ mechanism A type of deuterium exchange in which the rate-limiting step is the opening up of the protein structure.

EX₂ mechanism A type of deuterium exchange in which the rate-limiting step is the exchange reaction between hydrogen and deuterium atoms.

exo- Combining form meaning outside or external.

exobiology The study of extraterrestrial life.

exocellular Descriptive of an enzyme or a structure that is external to the cell membrane but still attached to it.

exo conformation See puckered conformation.

exocrine gland A gland of external secretion that discharges its secretion by means of a duct.

exocyclic Pertaining to an atom or a bond that occurs in a ring compound but that does not constitute part of the ring structure itself.

exocytosis The process whereby fluids and particles are discharged from a cell; involves the endoplasmic reticulum, the Golgi apparatus, and secretory granules.

exoenzyme 1. An enzyme that catalyzes a reaction involving the end of a polymer rather than internal positions. 2. An enzyme that is released outside the cell.

exoergic reaction EXERGONIC REACTION.

exogenote The genetic fragment of the donor cell that is transferred to a recipient cell in bacterial transformation. See also endogenote; merozygote; exosome.

exogenous Originating outside the organism.

exogenous metabolism The level of metabolism due to added nutrients.

exogenous virus A virus that undergoes vegetative replication but is not subject to vertical transmission via the gametes.

exohydrolase See exonuclease; exopeptidase.

exon A coding sequence in the DNA of eukaryotic genes. Such sequences are transcribed into RNA and are subsequently translated into protein. The term is also used for the translatable RNA sequence. Exons and introns (nontranslated, intervening sequences) make up split genes.

exon shuffling The linking together of DNA fragments, which serve as exons, by means of intron-mediated recombination. The DNA fragments can be genes that, previously, specified different proteins or different segments of the same protein. The linked DNA fragments constitute a new gene that codes for a new protein. Exon shuffling, intron intrusion, and junctional sliding have been proposed to help explain the evolutionary diversification of genes.

exonuclease An enzyme that catalyzes the sequential hydrolysis of nucleotides from one end of the polynucleotide strand. See also 3' → 5' exonuclease; 5' → 3' exonuclease; proofreading function.

3' → 5' exonuclease PROOFREADING FUNCTION.

5' → 3' exonuclease An exonuclease activity associated with DNA polymerases I and III. The catalytic site for this enzyme is distinct from the polymerization center on the enzyme molecule. The 5' → 3' exonuclease activity removes nucleotides from the 5'-end of a polynucleotide strand; it thus moves in the same direction as the polymerase activity. The main function of this exonuclease activity is to remove the RNA primers in the discontinuous replication of DNA. *See also* nick translation.

exonuclease III An exonuclease from *E. coli* that catalyzes the removal of nucleotides from the 3'-ends of both strands in duplex DNA.

exonuclease IV An enzyme that catalyzes the degradation of single-stranded DNA to oligonucleotides; it initiates hydrolysis at both the 3'- and 5'-ends of the DNA.

exonuclease V A complex, multifunctional, enzyme in *E. coli* that catalyzes the ATP-dependent hydrolysis of both linear duplex and single-stranded DNA. The enzyme also has helicase activity.

exopeptidase An enzyme that catalyzes the sequential hydrolysis of amino acids from one end of the polypeptide chain.

exophthalmic goiter GRAVE'S DISEASE.

exophthalmos-producing substance An uncharacterized substance, thought to be a hormone that functions in the production of bulging eyes.

exorphins Opioid peptides present in partial enzymatic digests of proteins derived from food stuffs. These peptides are called exorphins because of their exogenous origin and their morphine-like activities.

exoskeleton A protective external covering, such as the scales of fish or the horny structure of insects and crustaceans.

exosmosis The osmotic movement of fluid toward the outside of a cell or a vessel.

exosome A genetic fragment that is transferred to a recipient cell in bacterial transformation and that is not readily integrated into the recipient chromosome but can remain unintegrated and can replicate, be transcribed, and express biochemical function in this state. *See also* endogenote.

exospore A spore formed by budding, as that generally formed by a fungus.

exosporium A loose outer layer that frequently covers a spore.

exothermic reaction A chemical reaction that is accompanied by a release of heat; a reaction with a negative enthalpy change.

exotoxin A toxic protein that is discharged from a bacterial cell. Exotoxins are generally produced by gram-positive bacteria and can be demonstrated in a bacterial culture in which no appreciable autolysis has occurred.

experimental error The error that results from

the inability to reproduce precisely the experimental conditions in an otherwise carefully and accurately performed analysis.

expire To exhale.

explant The tissue or organ fragment that is excised and used to start an in vitro culture in tissue culture experiments.

exponential A function obtained by raising the constant e to a power; the exponential of x is e^x , where e is the base of natural logarithms and x is a variable.

exponential curve A curve that is described by an equation of the form $Y = ab^x$.

exponential decay The mode of radioactive decay that can be described by the equation $N = N_0e^{-\lambda t}$, where N is the number of radioactive atoms present at time t , N_0 is the number of radioactive atoms originally present, e is the base of natural logarithms, and λ is the decay constant.

exponential density gradient A density gradient in which the density increases exponentially from one end of the gradient to the other. It is described by the equation $c = a + b e^{-dV}$, where V is the volume of the gradient, c is the concentration, e is the base of natural logarithms, and a , b , and d are constants. *See also* concave exponential gradient; convex exponential gradient.

exponential growth The growth of cells in which the number of cells (or the cell mass) increases exponentially and the growth at any time is proportional to the number of cells (or the cell mass) present.

exponential growth rate constant The reciprocal of the doubling time, expressed as the number of generations per hour.

exponential phase The phase of growth of a bacterial culture in which the number of cells (or the cell mass) increases exponentially so that a plot of the logarithm of the number of cells (or the cell mass) as a function of time yields a straight line.

exponential survival curve A survival curve that indicates an exponential loss of active units as a function of increasing dose. Such data will yield a straight line when they are replotted in terms of the logarithm of the surviving fraction as a function of the dose.

export *See* protein export.

exposure The rate of irradiation per unit area, perpendicular to the beam of radiation, and multiplied by the time interval of irradiation.

exposure dose The intensity of a dose that is based on the ionizations produced by the radiation in air; generally expressed in terms of roentgens. *See also* radiation absorbed dose.

expression vector A cloning vehicle that promotes the expression of a gene inserted into it; typically, a restriction fragment that carries a

regulatory sequence for the particular gene.

expressor protein A protein, produced by a regulator gene, that is required for the expression of one or more other genes.

exsanguinate To drain of blood.

extant Living or existing at the present time, as opposed to extinct.

extended x-ray absorption fine structure A method for obtaining highly accurate structural information of biological samples. Involves measurements of the absorption of x rays by an amorphous solid or a solution as a function of wavelength at energies just above the absorption transition of a particular atom. Under these conditions, a series of rapid oscillations in absorbance is observed due to interference by neighboring atoms. An analysis of these oscillations provides information on the number, types, and distances of neighboring atoms. *Abbr* EXAFS.

extensin A protein, rich in hydroxyproline, that is attached to cellulose fibrils in plant cell walls.

extension peptides Polypeptide segments at both the amino and carboxyl termini of procollagen molecules that are removed prior to conversion of procollagen to collagen.

extensive property A property of a system, such as volume or energy, that can be defined only by specifying the precise amounts of all of the substances involved. *See also* intensive property.

external indicator An indicator that is outside the titration vessel and to which is added a drop of the liquid that is being titrated.

external monooxygenase A monooxygenase in which the cosubstrate that incorporates the second oxygen atom is not itself a product of the reaction.

external quenching The stoppage of secondary and subsequent ionizations in an ionization detector that is caused by a momentary reduction in the applied potential.

external respiration *See* respiration (1).

external-sample scintillation counter A scintillation counter in which radiation from an external source interacts with a solid fluor that is coupled to a photomultiplier.

external standard A standard that is treated separately from the sample.

external suppression INTERGENIC SUPPRESSION.

extinct Not living or existing at the present times, as opposed to extant.

extinction ABSORBANCE.

extinction angle The angle between the plane of polarization and the cross of isocline in flow birefringence.

extinction coefficient ABSORPTIVITY.

extinction coefficient $\epsilon(P)$ A molar absorptivity

used for nucleotides and nucleic acids, the concentration of which is expressed in terms of moles of phosphorus per liter; specifically. $\epsilon(P) = A/cd$, where $\epsilon(P)$ is the extinction coefficient, A is the absorbance, c is the concentration in terms of gram-atoms of phosphorus per liter, and d is the length of the lightpath in centimeters.

extinction dilution The dilution of a bacterial or a viral sample to such an extent that the diluted preparation is no longer infectious.

extinction point The critical oxygen tension for a green plant below which aerobic fermentation occurs as part of the metabolism of the plant, and above which aerobic respiration occurs exclusively.

extra- Prefix meaning outside.

extra arm *See* arm.

extracellular enzyme EXOENZYME.

extracellular titer The titer of phage particles that is obtained after the infected cells are removed by centrifugation; a measure of the phage particles that have been released by the host cells. *See also* intracellular titer.

extrachromosomal inheritance CYTOPLASMIC INHERITANCE.

extracistronic suppression INTERGENIC SUPPRESSION.

extract 1. CRUDE EXTRACT. 2. A preparation that serves as a source of vitamins and coenzymes for microbiological media and that is prepared from meat, yeast, or other materials by destruction of the cells.

extraction The removal of a substance from a solid or a liquid mixture by dissolving it in a solvent.

extraction ratio The fraction of a substance that is reabsorbed by the kidneys from the glomerular filtrate.

extragenic suppression INTERGENIC SUPPRESSION.

extranuclear inheritance CYTOPLASMIC INHERITANCE.

extrapolation The process of extending a graph from a region containing experimental data to one that is devoid of data.

extrapolation number The extrapolated value for a multitarget survival curve that may or may not correspond to the actual number of sensitive targets per irradiated unit.

extremophile A bacterium that grows under extreme environmental conditions; a thermophile and a psychrophile are two examples.

extrinsic blood coagulation EXTRINSIC PATHWAY.

extrinsic Cotton effect A Cotton effect that is caused by a small molecule which is bound to the protein, and not by the protein itself.

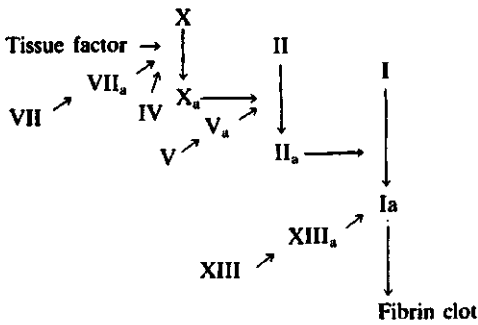
extrinsic factor VITAMIN B₁₂.

extrinsic fluorescence Fluorescence that is caused by a small molecule which is bound to

the protein, and not by the protein itself. See also autofluorescence.

extrinsic heterogeneity The heterogeneity of antibodies that results from extrinsic factors, such as the large number of antigenic determinants in any particular antigen.

extrinsic pathway The series of reactions in blood clotting that involve factors normally present in the circulation plus tissue factors, with the latter serving as initiators of the sequence of reactions. The pathway proceeds in the form of a cascade mechanism, with each stage involving protease activation of a zymogen to its enzymatically active form. Major steps of the pathway are as follows (Roman numerals indicate factor numbers; the subscript "a" indicates the active form of the factor):



The sequence from factor X_a on is common to both the extrinsic and the intrinsic pathways. The common names of the factors are listed under factor. *Aka* extrinsic system.

extrinsic proteins PERIPHERAL PROTEINS.

extrinsic system EXTRINSIC PATHWAY.

extrinsic thromboplastin THROMBOPLASTIN.

extrude To remove material by extrusion.

extrusion The process of expelling or thrusting out, as the expelling of an adsorbent from a chromatographic column.

extrusome A vacuole, excreted by parasitic protists, that contains substances used for penetration of the host cells.

eye structure 1. The DNA structure formed by two replicating forks moving in opposite directions (bidirectional replication) in linear double-stranded DNA, as is the case for eukaryotic DNA. 2. D-LOOP.

F

- f** 1. Frictional coefficient. 2. Femto.
- f₀** The frictional coefficient of a sphere that has the same volume as the macromolecule being studied.
- F** 1. Degree Fahrenheit. 2. Fertility factor. 3. Faraday. 4. Farad. 5. Fluorine. 6. Fick unit. 7. Force. 8. Phenylalanine. 9. Folic acid. 10. Formality.
- F⁺** A male, or donor, bacterial strain.
- F⁻** A female, or recipient, bacterial strain.
- F₀** See F₀F₁-ATPase.
- F'** See F' factor.
- F₁** See F₀F₁-ATPase.
- FA** 1. Fatty acid. 2. Folic acid. 3. Filtrable agent.
- Fab fragment** The fragment of the IgG immunoglobulin molecule that is obtained by treating the molecule with the enzyme papain. The fragment consists of an intact light chain and the Fd fragment of one heavy chain, held together by means of a disulfide bond. Two Fab fragments are obtained per IgG molecule, and each fragment contains one antigen binding site.
- Fab' fragment** The fragment of the IgG immunoglobulin molecule that is obtained by treating the molecule with the enzyme pepsin, followed by reduction. The fragment consists of an intact light chain and the Fd' fragment of one heavy chain, held together by means of a disulfide bond. Two Fab' fragments are obtained per IgG molecule, and each fragment contains one antigen binding site. An Fab' fragment is slightly larger than an Fab fragment.
- F(ab')₂ fragment** The fragment of the IgG immunoglobulin molecule that is obtained by treating the molecule with the enzyme pepsin without subsequent reduction. The fragment is a dimer of two Fab' fragments, held together by means of two disulfide bonds. The F(ab')₂ fragment contains both of the antigen binding sites of the molecule.
- FAB-MS** Fast atom bombardment mass spectrometry.
- Fabry's disease** A genetically inherited metabolic defect in humans that is associated with kidney failure and that is due to a deficiency of the enzyme trihexosyl ceramide α -galactosylhydrolase.
- facilitated diffusion** MEDIATED TRANSPORT.
- facilitation** The phenomenon that a second nerve impulse will often be transmitted through a synapse more effectively than the first; the phenomenon may be related to the nature of memory.
- facilitator** TRANSPORT AGENT.
- F-actin** The polymerized, fibrous form of actin that consists of a double helix of G-actin monomers.
- factor** A component that is not yet completely identified; frequently the term is retained after the factor has been fully identified.
- factor I** FIBRINOGEN.
- factor II** PHOTHROMBIN.
- factor III** 1. THROMBOPLASTIN. 2. A protein that functions in conjunction with enzyme II in some systems.
- factor IV** The calcium ions that function in blood clotting.
- factor V** PROACCELERIN.
- factor VI** Factor Va (accelerin) was once called factor VI but, according to current terminology, there is no factor VI among the blood clotting factors.
- factor VII** PROCONVERTIN.
- factor VIII** ANTIHEMOPHILIC FACTOR.
- factor IX** CHRISTMAS FACTOR.
- factor X** STUART FACTOR.
- factor XI** PLASMA THROMBOPLASTIN ANTECEDENT.
- factor XII** HAGEMAN FACTOR.
- factor XIII** FIBRIN STABILIZING FACTOR.
- factor XIV** Protein C; a zymogen which, when activated by thrombin, inactivates Factors V and VIII in the extrinsic and intrinsic pathways of blood clotting. Factor XIV is the inactive precursor of a serine protease.
- factor F** INITIATION FACTOR.
- factor G** TRANSLOCASE (2).
- factorial** A function of a positive integer n that is denoted $n!$ and that is equal to the product of all the integers between 1 and n ; thus, $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$.
- factor IF** INITIATION FACTOR.
- factor R** RELEASE FACTOR.
- factor T** ELONGATION FACTOR T.
- factor theory** The theory according to which blood clotting proceeds by a cascade mechanism, involving a large number of components.
- factor X** 1. VITAMIN B₁₂. 2. BIOTIN.
- factor Y** PYRIDOXINE.
- factory** A cytoplasmic region in poxvirus-infected animal cells that is actively engaged

in the replication of the viral DNA.

facultative Capable of living under more than one set of conditions.

facultative aerobic FACULTATIVE ANAEROBE.

facultative anaerobe An organism or a cell that can grow either in the absence or in the presence of molecular oxygen; the cell or the organism is aerobic but has the ability to grow anaerobically.

facultative water excretion The urinary excretion of water that is greater than that required for the elimination of waste products.

FAD Flavin adenine dinucleotide.

FADH₂ Reduced flavin adenine dinucleotide.

F agent FERTILITY FACTOR.

Fahrenheit temperature scale A temperature scale on which the freezing and boiling points of water at 1 atm of pressure are set at 32 and 212, respectively, and the interval between these two points is divided into 180 degrees.

fall curve The decrease in color intensity of a sample solution as a function of time; used in reference to determinations with an autoanalyzer.

falling sphere viscometer An instrument for measuring the viscosity of a solution from the time required for a sphere to fall through a known column height of the solution. *Aka* falling ball viscometer.

fallout The radioactive substances that are produced by nuclear explosions and that fall through the atmosphere onto the earth's surface.

familial Transmitted in families.

familial goiter A genetically inherited metabolic defect in humans that is characterized by an excessive loss of iodinated tyrosines from the thyroid gland and that is due to a deficiency of the enzyme iodotyrosine dehalogenase.

familial high-density lipoprotein deficiency TANGIER DISEASE.

familial hypercholesterolemia A genetically inherited metabolic defect in humans that is characterized by elevated levels of plasma cholesterol and by accelerated atherosclerosis; it is caused by a deficiency of functional low-density lipoprotein (LDL) receptors on cells and surfaces. Due to this deficiency, the entry of cholesterol into cells is impaired, intracellular feedback on cholesterol biosynthesis is lacking, and cholesterol synthesis in the liver and other tissues is excessive. The genetic defects are of three types: (a) lack of receptors for LDL and hence no binding of LDL; (b) decreased binding of LDL to the receptors; and (c) normal binding of LDL to the receptors but no internalization of LDL.

familial lysosomal lipase deficiency WOLMAN'S DISEASE.

familial methemoglobinemia METHEMOGLOBINEMIA.

family antigen An antigen that is common to a group of viruses that constitute a family.

Fanconi's anemia A genetically inherited metabolic defect in humans involving defective DNA repair and characterized by chromosomal aberrations and a decrease of all types of white blood cells.

Fanconi's syndrome A genetically inherited metabolic defect in humans that is characterized by an increased excretion of amino acids.

farad A unit of electrical capacitance, equal to the capacitance of a capacitor that requires 1 C to raise its potential by 1 V. *Abbr* fd.

faraday The quantity of electricity that is transported per gram-equivalent-weight of an ion; 96,500 C/eq; 23,060 cal/(V)(eq). *Sym* F.

Faraday effect The exhibition of optical rotatory power by an optically inactive substance that is placed in a magnetic field.

Farber's disease A genetically inherited metabolic defect in humans that is due to a deficiency of the enzyme ceramidase. A sphingolipidosis that is characterized by respiratory difficulty, arthritis, and painful movement. *Aka* Farber's lipogranulomatosis.

farnonquinone Vitamin K₂.

far-red drop The decrease in photosynthetic activity that occurs in the far red region (above 700 nm) despite the fact that the light is still absorbed. The decrease can be reversed by supplementing the long wavelength light with light of shorter wavelengths (enhancement effect).

Farr test A radioimmunoassay for determining the antigen binding capacity of an antiserum. The antiserum is treated with radioactively labeled antigen, and the labeled antigen-antibody complex is precipitated with 50% saturated ammonium sulfate; the radioactivity of the precipitate is then determined.

FAS system Fatty acid synthetase system.

fast-assembly end *See* actin filament.

fast atom bombardment mass spectrometry A mass spectrometric technique (similar to SIMS) that involves the transfer of kinetic energy from a beam of highly energetic atoms, such as argon or xenon atoms, to a matrix, such as glycerol, and then to the sample. The sample need not be volatile and does not require prior derivatization. Nonvolatile polar substances usually give intense peaks in the molecular ion region and a high intensity of fragment ions can be maintained for prolonged periods of time. *Abbr* FAB-MS.

fast component 1. The sample component that, in electrophoresis, moves the greatest distance in a given time. 2. The fraction of DNA that renatures first in reassociation kinetics; it consists of highly repetitive DNA.

fast hemoglobin A hemoglobin that, after electrophoresis, is located closer to the anode than is normal, adult hemoglobin.

fast protein, peptide, and polynucleotide liquid chromatography A modified form of HPLC in which high pressures are replaced by high flow rates. Separation techniques frequently involve ion exchange chromatography and are capable of both high capacity and high resolution. A variety of chromatographic support materials can be used. *Abbr* FPLC.

fast reaction A reaction, or a step in a reaction sequence, that has a very large rate constant and that proceeds very rapidly; special techniques are required for analysis of such reactions.

fast-sweep polarography A sensitive polarographic technique in which a hanging mercury drop electrode is used.

fast-twitch muscle WHITE MUSCLE.

fat 1. NEUTRAL FAT. 2. The oily and greasy material of adipose tissue.

fat body A structure that contains storage fat and that occurs in insects, reptiles, and amphibians.

fat-soluble A A fraction of fat-soluble vitamins prepared from egg yolk.

fat-soluble vitamin One of a diverse group of vitamins, including vitamins A, D, E, and K, that is soluble in organic solvents and insoluble in water.

fat solvent A nonpolar organic solvent, such as chloroform, that will extract lipids from tissues.

fat-splitting The hydrolysis of fats to free fatty acids that is produced by water at elevated temperatures.

fatty acid A long-chain carboxylic acid that occurs in lipids; may be branched or unbranched, and saturated or unsaturated.

fatty acid activating enzyme THIOKINASE.

fatty acid activation The conversion of a fatty acid to a fatty acyl coenzyme A ester which is the first step in the reactions of beta oxidation. The fatty acyl coenzyme A ester can be formed in a reaction catalyzed by a thiokinase or in a reaction catalyzed by a thiophorase.

fatty acid CoA ligase THIOKINASE.

fatty acid oxidation 1. BETA OXIDATION. 2. Any set of reactions whereby a fatty acid is oxidized in metabolism.

fatty acid synthetase system A cytoplasmic, multienzyme complex that catalyzes a cyclic set of reactions whereby a fatty acid is synthe-

sized entirely from acetyl-S-CoA; the complex consists of six enzymes and the acyl carrier protein. The synthesis proceeds by condensation of acetyl-acyl carrier protein (acetyl-ACP), formed from acetyl-S-CoA, with successive molecules of malonyl-ACP, also formed from acetyl-S-CoA. *Abbr* FAS system.

fatty acid thiokinase THIOKINASE.

fatty acyl group The acyl group of a fatty acid; the grouping



fatty alcohol One of a group of long-chain, aliphatic, monohydroxy alcohols that contain 10-20 carbon atoms and that occur as components of waxes.

fatty degeneration The degeneration of a tissue due to the formation of fat globules in the cytoplasm of the affected cells; the fat of these globules is derived from the cells themselves. *See also* fatty infiltration.

fatty infiltration The degeneration of a tissue due to the formation of fat globules in the cytoplasm of the affected cells; the fat of these globules is derived from outside the cells. *See also* fatty degeneration.

fatty liver A liver that is characterized by fatty degeneration and/or fatty infiltration and that may develop due to various conditions such as diabetes, chemical poisoning of the liver, or a deficiency of lipotropic agents.

favism A severe type of hemolytic anemia that occurs in individuals suffering from a hereditary glucose-6-phosphate dehydrogenase deficiency upon eating broad beans.

FB elements Feedback elements

FBP Fructose-1,6-bisphosphate.

FCCP Carbonylcyanoide *p*-trifluoromethoxy phenylhydrazone; an uncoupling agent.

Fc fragment The fragment of the IgG immunoglobulin molecule that is obtained by treating the molecule with the enzyme papain. The fragment consists of two heavy chain fragments joined by means of two disulfide bonds.

Fc receptor A structure on the surface of many cells of the immune system to which the Fc fragment of the immunoglobulin molecule becomes bound.

fd Farad.

Fd Ferredoxin.

FDA Food and Drug Administration; an agency of the U.S. Public Health Service.

Fd fragment The fragment of the IgG immunoglobulin molecule that is obtained by treating the molecule with the enzyme papain, followed by reduction. The fragment consists

of that portion of the heavy chain that is joined to an intact light chain in the Fab fragment. Two Fd fragments are obtained per molecule of IgG.

Fd' fragment The fragment of the IgG immunoglobulin molecule that is obtained by treating the molecule with the enzyme pepsin, followed by reduction. The fragment consists of that portion of the heavy chain that is joined to an intact light chain in the Fab' fragment. Two Fd' fragments are obtained per molecule of IgG.

FD-MS Field desorption mass spectrometry.

FDNB 1-Fluoro-2,4-dinitrobenzene; the Sanger reagent.

FDP Fructose-1,6-diphosphate now designated fructose-1,6-bisphosphate.

F-duction SEXDUCTION.

Fe Iron.

FEBS Federation of European Biochemical Societies.

feedback 1. A process in which part of the output of a system is returned to the input of the same system in such a fashion that it affects the subsequent output by the system. *See also* negative feedback; positive feedback. 2. That part of the output of a system that is returned to the input in a feedback process.

feedback deletion hypothesis A modification of the deletion hypothesis of cancer according to which cancer results from the loss of a repression mechanism that restrains DNA synthesis in normal cells. The loss of the repression mechanism may be due to a number of factors such as lack of repressor synthesis or segregation of the repressor in a part of the cell.

feedback inhibition A negative feedback mechanism in which a distal product of an enzymatic reaction inhibits the activity of an enzyme that functions in the synthesis of this product. Feedback inhibition may be concerted, cumulative, or sequential. *Aka* poisoning.

feedback loop The cyclic system of components that participate in a feedback mechanism.

feedback repression A negative feedback mechanism in which a metabolite regulates the amount of an enzyme through enzyme repression.

feeder cell An irradiated cell that is metabolically active but that cannot multiply; such cells are used to provide growth factors for unirradiated cells.

feeder layer A layer of feeder cells that is used in tissue culture.

feeder pathway A metabolic pathway that provides metabolites for another, major pathway.

feed-forward activation The activation of an enzyme by means of an initial reactant of the

reaction; the activation of aspartate transcarbamoylase by ATP and the activation of glycogen synthetase by glucose-6-phosphate are two examples.

Fehling's test A test for reducing sugars that is based on the reduction of cupric ions by a reducing sugar when an alkaline solution of the sugar is treated with copper sulfate.

Felderstruktur The structure of muscle fibers that is characterized by an incomplete separation of the thick myofibrils.

feline Of, or pertaining to, cats.

female hormone Any one of the three related compounds, estradiol, estrone, and estriol.

female protein VITELLOGENIN.

female sex hormone An estrogen that affects the estrous cycle, the reproductive cycle, and the development of secondary sex characteristics in the female; the female sex hormones are produced primarily by the ovaries and the placenta.

FeMo protein *See* nitrogenase.

femto- Combining form meaning 10^{-15} and used with metric units of measurement. *Sym* f.

Fenton chemistry The generation of powerful oxidizing species from the reduction of peroxides by metal ions; includes, but not limited to, reactions brought about by Fenton's reagent.

Fenton's reagent A ferrous ion-hydrogen peroxide mixture; a strong oxidizing agent that can oxidize most organic compounds.

F episome FERTILITY FACTOR.

Fe protein *See* nitrogenase.

Ferdinand model A model, proposed by Ferdinand, according to which cooperative interactions can be ascribed to kinetic considerations. Specifically, the model applies to a random single displacement mechanism of a bisubstrate enzyme reaction.

Ferguson equation An equation that relates the mobility of a protein in polyacrylamide gel electrophoresis to the concentration of the gel. Specifically, $\log R = -kT + \log R_0$, where R is the relative mobility of the protein, R_0 is the relative mobility of a small molecule that encounters no sieving effect, k is the retardation coefficient, and T is the total gel concentration (acrylamide + cross-linker).

Ferguson plot A plot of the relative electrophoretic mobility of a protein in gel electrophoresis as a function of the concentration of the gel. From such a plot, the parameters k and R_0 of the Ferguson equation can be determined.

ferment 1. n An early term for enzyme. 2. v To process by means of fermentation.

fermentation 1. The energy-yielding, metabolic

- breakdown of organic compounds by microorganisms that generally proceeds under anaerobic conditions and with the evolution of gas.
2. The energy-yielding, metabolic breakdown of organic compounds in an organism that proceeds in the absence of molecular oxygen and with the use of organic compounds both as oxidizing agents and as oxidizable substrates. *See also* anaerobic respiration.
- fermentor** An apparatus for the growth of microorganisms in liquid media and for the study of microbial metabolism, including fermentation. *Var sp* fermenter.
- ferredoxin** One of a group of low molecular weight, nonheme, iron-sulfur proteins that have low reduction potentials and that serve as early electron acceptors in both photosynthesis and nitrogen fixation. *Abbr* Fd. *See also* spinach ferredoxin.
- ferredoxin-NADP-oxidoreductase** A flavoprotein that accepts electrons from ferredoxin and transfers them to NADP (thereby reducing it to NADPH) in the operation of photosystem I of chloroplasts. *Aka* ferredoxin-NADP reductase.
- ferredoxin reducing substance** An electron carrier, possibly a chlorophyll or a quinone, that is the immediate acceptor for the electrons from pigment P₇₀₀ in photosystem I of chloroplasts; the compound transfers an electron to ferredoxin, thereby reducing it. *Abbr* FRS.
- ferric** Designating iron that has a valence of three; Fe³⁺; Fe(III).
- ferrichrome** A cyclic hexapeptide, composed of three residues each of glycine and hydroxyornithine, that is complexed with a ferric atom and occurs in fungi; a siderophore of the hydroxamic acid type.
- ferricytochrome** A cytochrome in which the iron is in the ferric form.
- ferriheme** A heme in which the iron is in the ferric form.
- ferrihemochrome** A hemochrome in which the iron is in the ferric form.
- ferrimycin** A sideromycin produced by *Actinomyces*.
- ferrioxamine** A sideramine produced by *Streptomyces*.
- ferriphore** SIDEROPHORE.
- ferriporphyrin** A protoheme in which the iron is in the ferric form.
- ferritin** A conjugated and electron-dense protein that is composed of a protein shell, apoferritin, which surrounds four discrete micelles of ferric hydroxide-phosphate salts. Ferritin functions in the absorption of iron through the intestinal mucosa and serves as a storage protein for iron in the liver, the spleen, and other animal tissues. *See also* ferritin-labeled antibody.
- ferritin-labeled antibody** An antibody to which ferritin has been linked covalently; the electron-dense ferritin provides a suitable label for localizing the antibody in electron microscope preparations. Antigens or other proteins may be labeled with ferritin in an analogous manner.
- ferrochelataase** The enzyme that catalyzes the final step in the biosynthesis of heme whereby an iron atom (Fe²⁺) is inserted into the ring system of protoporphyrin IX. *Aka* heme synthetase.
- ferrocyclochrome** A cytochrome in which the iron is in the ferrous form.
- ferroflavoprotein** A complex flavoprotein that contains iron in the form of a heme or in some other form, in addition to containing either FMN or FAD.
- ferroheme** A heme in which the iron is in the ferrous form.
- ferrohemochrome** A hemochrome in which the iron is in the ferrous form.
- ferroprotoporphyrin** A protoheme in which the iron is in the ferrous form; ferroprotoporphyrin IX is the prosthetic group of hemoglobin, myoglobin, catalase, peroxidase, and cytochrome *b*.
- ferrous** Designating iron that as a valence of two; Fe²⁺; Fe(II).
- ferrous wheel mechanism** A postulated mechanism for the enzyme aconitase according to which a molecule of *cis*-aconitate is bound to the enzyme at three sites and is bound to the essential Fe(II) at the active site. The stereospecific addition of water to *cis*-aconitate, to form either citrate or isocitrate, is achieved by a partial rotation of this ferrous wheel.
- ferroxidase** A serum enzyme that catalyzes the oxidation of iron from the ferrous to the ferric form. Ferroxidase I is also known as ceruloplasmin; ferroxidase II appears to be the major serum component responsible for the oxidation of iron.
- fertility factor** The bacterial episome that enables a bacterium to function as a male in bacterial conjugation; the male bacterium serves as a donor of DNA and produces an F-pilus through which the DNA is transferred to the recipient female cell. *Sym* F.
- fertility vitamin** VITAMIN E.
- FeS** Iron-sulfur protein.
- Fe-S protein** Iron-sulfur protein.
- fetal** Of, or pertaining to, the fetus.
- fetal hemoglobin** The hemoglobin that occurs during the development of the fetus and that diminishes rapidly after birth; consists of two alpha and two gamma chains. *Sym* HbF.
- α-fetoprotein** *See* alpha fetoprotein.
- fetuin** A glycoprotein that constitutes about

- 50% of the plasma proteins in the bovine fetus; it is absent in the adult animal.
- fetus** The unborn or unhatched young vertebrate during the later stages of its development. The developing human is considered to be a fetus after the beginning of the third month of pregnancy and an embryo prior to that. *See also* embryo.
- Feulgen reaction** A staining reaction that is specific for DNA and that is based on converting the DNA to apurinic acid and treating the apurinic acid with Schiff's reagent for aldehydes.
- fever blisters** HERPES SIMPLEX.
- f/f_0** Frictional ratio; f is the frictional coefficient of the molecule being studied and f_0 is the frictional coefficient of a sphere that has the same volume as the molecule.
- FFA** Free fatty acids.
- F factor** FERTILITY FACTOR.
- F' factor** An augmented F factor; a fertility factor that has an additional chromosomal segment attached to it; it contains genes obtained from the bacterial chromosome in addition to the plasmid genes.
- F_0F_1 -ATPase** A proton-translocating ATPase that functions in mitochondria, chloroplasts, and bacteria; consists of two oligomeric components, designated F_0 and F_1 . The F_0 component is embedded in the lipid bilayer of the membrane and serves as a proton channel; the F_1 component carries the ATPase active site and leads to synthesis of ATP. It is also known as mitochondrial ATPase or coupling factor 1. *See also* H^+ -ATPase.
- FFF** Field flow fractionation.
- $(F_1 + F_2)$ fragment** HEAVY MEROMYOSIN.
- F_1 fragment** The globular head portion of the myosin molecule.
- F_2 fragment** The central tail fragment of the myosin molecule.
- F_3 fragment** LIGHT MEROMYOSIN.
- FGAR** Formylglycinamide ribonucleotide; an intermediate in the biosynthesis of purines.
- F-genote strain** F' STRAIN.
- FGF** Fibroblast growth factor.
- FH₂** Dihydrofolic acid.
- FH₄** Tetrahydrofolic acid.
- FIA** Fluoroimmunoassay.
- fiber** 1. A threadlike structure, as that of a muscle or a nerve, that consists of bundles of fibrils. 2. DIETARY FIBER.
- fiber diagram** The x-ray diffraction pattern that a fibrous material yields when it is analyzed by the rotating crystal method.
- fiber optics probe** A flexible probe consisting of fine glass or of fine plastic fibers that are optically aligned to transmit an image and/or to transmit light.
- fibril** A fine threadlike structure, bundles of which constitute a fiber; the myofibrils of a muscle and the neurofibrils of a nerve are two examples.
- fibril ghost** A myofibril that has lost its myosin.
- Fibrillenstruktur** The structure of muscle fibers that is characterized by a relatively uniform distribution of well-separated myofibrils.
- fibrils long spacing** An artificially prepared assembly of collagen molecules that is characterized by having long periodicities of about 2500 Å when examined in the electron microscope; produced from neutral solutions of collagen in the presence of either glycoproteins or excess mucopolysaccharides. *Abbr* FLS. *Aka* fibrous long spacing. *See also* segment long spacing.
- fibrin** The protein that is formed from fibrinogen by the action of thrombin and that is polymerized to form the blood clot; the monomeric, soluble form is denoted fibrin-s, and the polymerized, insoluble form is denoted fibrin-i. *See also* hard clot; soft clot.
- fibrinase** FIBRIN-STABILIZING FACTOR.
- fibrin monomer** The monomeric fibrin that is formed from fibrinogen by the action of the enzyme thrombin.
- fibrinogen** The serum protein that gives rise to two fibrinopeptides and fibrin when it is acted upon by the enzyme thrombin during blood clotting; the fibrin is subsequently polymerized to form the blood clot.
- fibrinolligane** FACTOR XIII.
- fibrinolysin** PLASMIN.
- fibrinolysis** The dissolution of fibrin in blood clots, brought about by the hydrolytic action of plasmin.
- fibrinopeptide** One of two peptides, denoted A and B, that are removed from fibrinogen during its conversion to fibrin by the action of thrombin.
- fibrin polymer** The polymerized fibrin molecules that form the basis of the blood clot.
- fibrin-stabilizing factor** The zymogen of a plasma transglutaminase which covalently links fibrin monomers of the soft clot to form a hard clot during blood clotting; the enzyme catalyzes the joining of the γ -carboxyl groups of glutamic acid residues to the ϵ -amino groups of lysine residues. *Aka* fibrinase.
- fibroblast** A specialized cell of connective tissue which synthesizes fibrous proteins such as collagen. Human fibroblasts have a definite life span in culture that is somewhat related to the potential life expectancy of the individual from whom the cells are obtained.
- fibroblast growth factors** Two polypeptides (MW 13,400) that are endothelial cell growth factors (mitogens), bind heparin, and promote angiogenesis. *Abbr* FGF.
- fibroin** *See* silk fibroin.

fibroma A benign tumor derived from fibrous connective tissue.

fibronectin A large peripheral membrane protein that occurs at the surface of many animal cells; a major noncollagenous glycoprotein in the extracellular matrix and basement membranes. Fibronectin has strong adhesive properties and mediates the attachment of fibroblasts to collagen; it is believed to function in cell-cell interaction (contact inhibition) and cell-substratum adhesion. Fibronectin is either lost or greatly reduced in many cells upon malignant transformation. *Aka* LETS protein. *See also* cold-insoluble globulin.

fibrosome An artificial liposome-like vesicle, prepared by layering purified human plasma fibronectin molecules on an agar-coated substrate.

fibrous Consisting either laggely, or entirely, of fibers.

fibrous actin F-ACTIN.

fibrous lamina A thick filamentous layer that reinforces the inner membrane of the nucleus of many cells.

fibrous long spacing FIBRILS LONG SPACING.

fibrous protein A protein in which the polypeptide chains are either extended or coiled in one dimension. The polypeptide chains in such a protein are held together largely by interchain hydrogen bonds and form sheets or fibers. Fibrous proteins serve principally as structural proteins. *See also* globular protein.

FICA technique Fluoroimmunoctoadherence; a method for the identification, enumeration, and isolation of antigen-binding cells. Based on column chromatographic fractionation of cell suspensions using antigen-coated Sephadex beads.

ficin An endopeptidase of broad specificity.

Fick's first law The law that relates the flow of material in translational diffusion to the concentration gradient and that may be expressed as $dm/dt = -DA(dc/dx)$, where dm is the mass transferred in time dt through a cross-sectional area A , D is the diffusion coefficient, and dc/dx is the concentration gradient. The negative sign indicates that the transfer of material occurs from a region of higher to one of lower concentration.

Fick's second law The law that relates the flow of material in translational diffusion to the concentration gradient and to the change of this gradient with time. The law may be expressed as a differential equation, and the equation can be solved for the concentration gradient; this yields a normal distribution which describes the diffusion pattern.

Fick unit A unit of the diffusion coefficient equal to 10^{-7} cm²/s. *Sym* F.

ficoll A synthetic water-soluble copolymer of sucrose and epichlorohydrin that has a weight average molecular weight of about 400,000 and that is used for the preparation of density gradients.

FID Flame ionization detector.

fideliy The degree to which replication, transcription, or translation proceeds without errors.

fideliy group A group of four proteins (designated S4, S5, S11, and S12) in the 30S subunit of *E. coli* ribosomes that are involved in the streptomycin response of the ribosome and that affect the fidelity of translation.

field desorption mass spectrometry A mass spectrometric technique in which the sample does not require prior derivatization since it is being ionized concurrently with its desorption from an activated emitter wire in a high electric field; the heated sample is desorbed as an ion from the surface of one of the electrodes. The mass spectrum is dominated by ions representing the intact molecule; hence, the method is useful for molecular weight determinations. *Abbr* FD-MS.

field effect ELECTROSTATIC INTERACTIONS.

field flow fractionation A group of techniques for the analysis of high molecular weight polymers and particles in suspension. The essence of all such techniques involves the application of a force field (thermal, flow, electrical, or centrifugal) across a long, flat, ribbon-like channel containing a liquid sample. The polymers or particles become layered toward one wall, due to the applied force field. A liquid is then passed through the channel and the separated components are eluted in the manner of chromatography. The method has been termed "one-phase chromatography" since the applied field takes over the role played by the stationary phase in ordinary chromatography. *Abbr* FFF.

field inversion gel electrophoresis A technique of agarose gel electrophoresis in which the applied electric field is periodically inverted. This causes the molecules to make, on an alternating basis, large movements forward and small ones backward. Under these conditions, large DNA molecules can be separated from other ones of similar size that, in standard gel electrophoresis, all migrate at the same rate. *Abbr* FIGE. *See also* Reptation; PFG.

field ionization mass spectrometry A mass spectrometric technique that requires volatilization of the sample (generally in the form of derivatives) prior to ionization. The latter is achieved by placing the volatilized sample in a strong electric field between two electrodes. *Abbr* FI-MS.

field ion microscope A microscope for the analysis of surface structures in which the sample serves as the source of radiation, in the form of ions. As a result, no lenses are required. An imaging gas, usually an inert gas, is allowed to cover the sample which is a single crystal held in an electric field exceeding 10^8 V/cm. The enhanced potential of the atoms at the surface of the sample leads to ionization of the gas atoms. These ions then travel to a fluorescent screen and their emission pattern provides information about the arrangement of surface atoms in the sample. *See also* scanning tunneling microscope.

FIGE Field inversion gel electrophoresis.

fight hormones Epinephrine and norepinephrine.

figure eight An intermediate in genetic recombination that consists of two connected, double-stranded, circular DNA molecules.

figure of merit A measure of the ability of a liquid scintillation fluid to permit counting of materials that either are not miscible with the organic solvent system used or highly quench the system; defined as $(E)(H)$, where E is the efficiency of counting and H is the percentage of the total sample that is aqueous. The greater the figure of merit, the better the fluid fulfills the above requirements.

filaggrin One of a group of cationic structural proteins that associate specifically with intermediate filaments and not with other types of cytoskeletal proteins.

filament 1. A very thin, threadlike structure. 2. MYOFILAMENT.

filamentous phage *See* minute phage.

filamin A long, fibrous protein with a molecular weight of about 500,000. It consists of two subunits of identical size and links actin filaments together to form a random, filamentous, three-dimensional network. Filamin occurs in many cells, including smooth muscle cells and fibroblasts.

filiform Filamentous; threadlike.

film badge A photographic film holder that is worn by an individual and that is used for approximate measurements of the radiation to which the individual has been exposed.

film diffusion The rapid diffusion of ions in an ion-exchange resin such that the exchange rate is controlled by the speed at which the ions diffuse through the solution surrounding the resin particles.

filter 1. A porous material used for the collection of either a precipitate or suspended matter. 2. A light-absorbing material that transmits only selected wavelengths of light.

filterable agent An early designation of a phage that mediates transduction in *Salmonella*.

filterable virus An early term for virus.

filter affinity transfer A method for the in situ characterization of proteins in polyacrylamide gels. Based on coupling an affinity ligand of the protein to a chemically derivatized and activated cellulose filter paper which is then overlaid on the gel containing the separated proteins. Proteins that interact with the affinity ligand are transferred from the gel to the paper.

filter fluorometer A fluorometer in which filters are used to select the desired excitation and emission wavelengths.

filter hybridization The hybridization of nucleic acids that is carried out on a nitrocellulose filter; only hybrid, double-stranded, molecules remain on the filter after washing. *See also* liquid hybridization.

filter paper chromatography *See* paper chromatography.

filter photometer A photometer in which filters are used for the isolation of bandwidths.

filtrable Variant spelling of filterable.

filtrable calcium FREE CALCIUM.

filtrate The liquid that has passed through a filter.

filtration enrichment A method for the isolation of fungal auxotrophs by growing either wild-type or mutagenized fungal spores on a minimal medium. Since on this medium only normal spores will germinate and develop mycelia, they can be removed by filtration, and the remaining auxotrophic spores can then be supplied with an enriched medium to permit their germination and growth.

filtration fraction The fraction of plasma that is filtered through the glomeruli of the kidney and that is equal to the glomerular filtration rate divided by the renal plasma flow; frequently taken as being equal to the ratio of inulin clearance to *p*-aminohippuric acid clearance.

FIM Field ion microscopy.

fimbrin An actin-binding protein.

FI-MS Field ionization mass spectrometry.

fine control The control of biochemical systems that is achieved by regulating the activity of an enzyme, as in the case of allosteric enzymes.

finest Very small particles; a very finely divided solid.

fine structure The splitting of a spectral peak into a number of peaks, as that which occurs in nuclear magnetic resonance and in electron paramagnetic resonance.

fine-structure genetic mapping The determination of the relative positions of the mutable sites on a chromosome in terms of intervals of decreasing size and, ultimately, in terms of nucleotides.

finger nucleases Nucleases that are present in the skin of the fingers. Due to the presence of these enzymes, special care must be exercised when handling nucleic acid solutions.

fingerprint 1. A pattern of spots that is obtained when a partial hydrolysate of either a protein or a peptide is subjected to paper chromatography in one dimension and to paper electrophoresis in the second dimension. The term fingerprint is likewise applied to a similar two-dimensional map of a hydrolysate of either a nucleic acid or a nucleotide, as well as to maps obtained by modified procedures, involving other support media and/or other separation techniques. 2. The infrared absorption spectrum of a molecule.

fingerprint region The complex middle region of the infrared spectrum that is of most use for determinations of molecular structure because both group frequency bands and skeletal bands occur in this region; covers the wavelength range of about 7×10^{-4} to 1.6×10^{-3} cm.

firome Proposed term to designate a substance, of either intra- or extracellular origin, that can increase the probability of replicon misfiring. Tumor promoters could represent one class of firomes. *See also* replicon misfiring.

first law of cancer biochemistry The principle, enunciated by Warburg in 1930, that cancer cells carry out glycolysis virtually universally, whether under aerobic or anaerobic conditions. The principle has been restated to mean that shifting of the metabolism of a cell to the anaerobic state is the main biochemical difference between a tumor and a normal cell.

first law of photochemistry The law that light must be absorbed by a molecule before that molecule can undergo a photochemical reaction. *Aka* Draper's law; Grotthus-Draper law.

first law of thermodynamics The principle of conservation of energy: the total energy of a system plus its surroundings is constant and is independent of any transformation that they may undergo; energy can neither be created nor destroyed by chemical means. In view of the interconversion of mass and energy, according to the theory of relativity, the modern version of the first law is as follows: the sum of energy and mass remains constant, but energy may change from one form to another, and energy may be converted to mass and vice versa.

first messenger The external signal that turns a multicyclic cascade system on or off; the chemical (such as acetylcholine, adrenalin, glucagon, and growth factors) that binds to a specific receptor on the external surface of the

cell membrane. The binding sets off a series of transduction reactions by which the signal is transmitted to the inner surface of the membrane and leads to activation of an amplifier enzyme, located in the inner surface of the membrane, which then converts a precursor to a second messenger. The second messenger (such as cyclic AMP, diacyl glycerol, and inositol triphosphate) then acts on the first interconvertible enzyme of the multicyclic cascade system.

first-order kinetics The kinetics of a first-order reaction.

first-order reaction A chemical reaction in which the velocity of the reaction is proportional to the concentration of one reactant.

first-set rejection The sequence of events that leads to the rejection of an initial transplant by an unprimed individual.

first-step-transfer DNA A DNA fraction of T5 phage that is injected into the bacterial host during the first few minutes of infection and that controls the breakdown of the host DNA and the injection of the remainder of the phage DNA. *Abbr* FST-DNA.

Fischer formula 1. A straight-chain, planar projection of carbohydrates. *Aka* Fischer projection. 2. A simplified, planar formulation of porphyrins.

Fischer-MacDonald degradation A degradative procedure for aldoses whereby the sugar is converted to the next lower aldose; based on the removal of the anomeric carbon by treatment with ethyl mercaptan.

Fiske-SubbaRow method A colorimetric procedure for the determination of phosphate in biological materials that is based on the production of a blue color by treatment of the sample with ammonium molybdate and 1-amino-2-naphthol-4-sulfonic acid.

fission *See* nuclear fission; binary fission.

Fitzgerald factor HIGH MOLECULAR WEIGHT KININOGEN.

fixation 1. The chemical reactions whereby an atmospheric gas is converted to either an inorganic or an organic compound. *See also* carbon dioxide fixation; nitrogen fixation. 2. The preparation of tissues for cytological or histological study by converting cellular substances to insoluble components with as little alteration of the original biological structures as possible.

fixative A protein-denaturing solution that is used for the fixation of biological tissues.

fixed-angle rotor A centrifuge rotor in which the tubes are kept at a constant angle during centrifugation as opposed to a swinging bucket rotor where the tubes change their orientation during the centrifugation.

fixed time assay DISCONTINUOUS ASSAY.

fixed virus A virus that is obtained by passage through an organism or by cultivation in tissue culture. *See also* street virus.

fixer A chemical reagent that removes the unexposed and unredded silver halide grains from a photographic film.

flagellar Of, or pertaining to, flagella.

flagellin The monomeric protein of flagella.

flagellum (*pl* flagella) A threadlike, cellular extension that functions in the locomotion of bacterial cells and of unicellular eukaryotic organisms; flagella are longer and less numerous than cilia.

flame emission spectrophotometer A spectrophotometer used for flame photometry.

flame ionization detector An ionization detector that is used in gas chromatography for the detection of organic compounds and that converts these compounds into ions by means of a flame. *Abbr* FID.

flame photometry The determination of elements in solution from the emission spectrum that is produced when the solution is sprayed into a flame. The electrons of the atoms are excited by the flame and emit the excitation energy as light when they fall back to lower energy levels.

flanking DNA Segments of DNA immediately adjacent to the two ends of a DNA region under consideration.

flash evaporator An apparatus for the removal of solvent from a solution; the solvent is evaporated from a thin film of solution, formed by the rotation of a round-bottom flask that is submerged in a water bath.

flash photolysis A technique for studying short-lived primary or subsequent photochemical intermediates; based on increasing the concentration of these intermediates by irradiating the sample with light pulses of short duration and great intensity. The light transmitted by the sample is then separated into its component wavelengths by means of a spectrograph and allowed to expose a photographic film.

flat-bed chromatography Chromatography, such as paper or thin-layer chromatography, in which a flat layer of chromatographic support is used.

flat-bed electrophoresis Electrophoresis, such as paper or thin-layer electrophoresis, in which a flat layer of electrophoretic support is used.

flat spectrum counting A counting method, used in liquid scintillation, that minimizes the effects of quenching.

Flaujeac factor HIGH MOLECULAR WEIGHT KINNOGEN.

flavanone *See* bioflavonoid.

flavin adenine dinucleotide The flavin nucleotide, riboflavin adenosine diphosphate, which is a coenzyme form of the vitamin riboflavin and which functions in dehydrogenation reactions catalyzed by flavoproteins; abbreviated as FAD in its oxidized form and as FADH₂ in its reduced form.

flavin enzyme *See* flavoprotein.

flavin-linked dehydrogenase A dehydrogenase that contains a flavin nucleotide as a prosthetic group.

flavin mononucleotide The flavin nucleotide, riboflavin-5'-monophosphate, which is a coenzyme form of the vitamin riboflavin and which functions in dehydrogenation reactions catalyzed by flavoproteins; abbreviated as FMN in its oxidized form and as FMNH₂ in its reduced form.

flavin nucleotide A collective term for flavin mononucleotide and flavin adenine dinucleotide.

flavocoenzyme FLAVIN NUCLEOTIDE.

flavodoxin One of a group of flavoproteins that are similar to ferredoxins in their properties and that can replace ferredoxins in many reactions; flavodoxins differ from ferredoxins in that they contain FMN instead of iron. *See also* bioflavonoids.

flavone *See* bioflavonoid.

flavonoid *See* bioflavonoid.

flavonol *See* bioflavonoid.

flavoprotein A conjugated protein in which the nonprotein portion is a flavin nucleotide, such as the dehydrogenases that use either FMN or FAD as a coenzyme. FMN is linked noncovalently to the protein, while FAD may be linked either covalently or noncovalently. Some flavoproteins are more complex and may also contain either metal ions or heme in addition. *Abbr* FP.

flavor Whimsical name for the quality that distinguishes the electron from its neutrino, the up-quark from the down-quark, and so on. *See also* elementary particles.

Fletcher factor PREKALLIKREIN.

flexible active site An active site that can undergo conformational changes in the course of a reaction. *See also* induced-fit theory.

flexible polymer A polymer that can assume a number of different conformations of essentially identical energy but that is not a free-draining polymer.

flexion The degree of flexibility; used, for example, to describe changes in the conformation of phospholipid molecules in a bilayer that do not involve lateral diffusion, rotation, or flip-flop.

flickering cluster model A model for the structure of water according to which the water

structure results primarily from cooperative-type hydrogen bonding between the water molecules, such that short-lived clusters of extensively hydrogen-bonded molecules form and break repeatedly.

flight hormones Epinephrine and norepinephrine.

flip See spin flip.

flip-flop 1. The transverse diffusion of a molecule through the lipid bilayer of a biological membrane; involves a rotation of the molecule through the plane of the lipid bilayer so that it moves from one monolayer to the other. 2. A model proposed to explain the anticooperative effects of certain oligomeric enzymes. It assumes that the subunits of the enzyme exist in two different conformational states and move back and forth between these two conformations. *Aka* half-of-the-sites reactivity. 3. Any other oscillatory mechanism, involving two molecular forms, such as the interconversion between the caldesmon-calmodulin and the caldesmon-F-actin complexes.

flip-flop chromatography A column chromatographic technique in which a number of polar and nonpolar solvents are used as eluents in order of alternating polarity beginning with the most extreme polar and nonpolar solvents. As a result, the tail ends of the polarity distribution of the sample are successively extracted, leaving behind material with a more restricted polarity range which increases the selectivity of subsequent eluents. The polar solvents are passed through the column in one direction and the nonpolar solvents are passed through the column in the opposite direction.

floating beta lipoprotein A lipoprotein that occurs in some conditions of hyperlipoproteinemia and that has an unusually low density due to its high content of triglycerides.

floating receptor model MOBILE RECEPTOR MODEL.

flocculation The precipitation of finely divided particles in the form of fleecy masses.

flocculation reaction The flocculation that is obtained in a precipitin reaction when soluble antigen-antibody complexes are formed in both the antigen excess zone and the antibody excess zone.

Florisl Trademark for a magnesium silicate adsorbent that is used in the column chromatography of lipids.

Flory-Huggins lattice theory A theory used in calculating the chemical potential of relatively concentrated polymer solutions.

flotation The movement of molecules in solution under the influence of a centrifugal field and toward the center of rotation. Such systems lead to the formation of inverted peaks

in the schlieren optical system, and the peaks rise from the bottom of the cell toward the meniscus as centrifugation proceeds.

flotation coefficient The analogue of the sedimentation coefficient for molecules that undergo flotation; a negative sedimentation coefficient. *Sym* s_f . See also standard flotation coefficient.

flow birefringence The birefringence that is caused by the orientation of asymmetric molecules in a solution that is subjected to flow and shear; used for determining rotational diffusion coefficients, and commonly measured by placing the solution between two concentric cylinders, of which the outer one is being rotated, and by passing polarized light through the solution.

flow cell A small container, such as a cuvette, that has an inlet and an outlet so that liquid can flow through it; permits the analysis of liquids as a function of time and/or of changing composition.

flowchart FLOWSHEET.

flow dichroism The dichroism that results from the orientation of asymmetric macromolecules when a non-Newtonian liquid, which contains the macromolecules, is subjected to shear.

flowering hormone A hormone that is synthesized in the leaves of plants and that is involved in the formation of flowers. So far, the hormone has been demonstrated physiologically but has not yet been isolated or chemically characterized.

flower model The viral RNA coding for the coat protein of MS-2 phage; so called because it has a double-stranded "stem" terminating in a set of double-stranded "petal" loops.

flow method See rapid flow technique; stopped flow technique.

flow potential STREAMING POTENTIAL.

flow quenching A rapid flow technique in which the enzyme and the substrate are mixed in the usual manner, but the mixture then flows into a second mixing chamber rather than into an observation cell. The enzymatic reaction is stopped rapidly in the second chamber by mixing a chemical quenching reagent with the enzyme and the substrate. A reactant or a product of the reaction is then determined by any convenient method.

flowsheet A chart, involving symbols and abbreviations, that is used to outline the steps, and the order in which they are to be performed, for the synthesis of a compound, the purification of an enzyme, the isolation of a protein, or some other multistep process. *Aka* flowchart; road map.

FLS Fibrils long spacing.

fluctuation analysis A study of voltage-gated channels that is based on the fluctuations in

- current, produced by the nonperfect opening and closing of the channels; the fluctuations are produced by channels that do not open or close smoothly, or by channels that do not operate in perfect unison. *Aka* noise analysis.
- fluctuation spectroscopy** An analysis of the spectrum of fluctuations of a given system such as the fluctuations in reactant concentration of a chemical reaction or the fluctuations in electric current of an excitable membrane.
- fluctuation test** A statistical analysis for proving that selective variants, such as phage- or drug-resistant mutants, arise spontaneously and not as a result of exposure to the phage, drug, or other agent.
- fluctuation theory** 1. A theory, proposed by Linderstrom-Lang, according to which proteins fluctuate continuously between a large number of closely related conformational states. *Aka* motility model. 2. A theory of light scattering by solutions that is based on the fluctuations in the concentrations of solute and solvent molecules in small volume elements of the solution.
- fluence** *See* photon fluence; energy fluence.
- fluid compartment** The total amount of fluid in the body that either is located in a particular type of tissue or has a particular composition. The two major fluid compartments are the intracellular fluid and the extracellular fluid; the extracellular fluid consists of several sub-compartments such as interstitial fluid, cerebrospinal fluid, blood plasma, and lymph.
- fluidity** The reciprocal of viscosity.
- fluidity gradient** The increase in the range of motion of the fatty acyl chains of the phospholipids in biological membranes toward the methyl ends of the chain, that is, toward the center of the bilayer.
- fluid mosaic model** A model of biological membranes in which amphipathic lipids and globular proteins are arranged in an alternating mosaic pattern throughout the membrane. The phospholipids and glycolipids are arranged primarily in the form of a lipid bilayer. Integral proteins are "dissolved" in the bilayer. Some proteins are located at one or the other of the two surfaces of the lipid bilayer. Other proteins are embedded in the hydrophobic matrix of the bilayer while still others may extend throughout the membrane, from one side to the other. The lipids, as well as some of the proteins, possess a degree of fluidity that allows some lateral movement within the lipid matrix of the membrane. *Aka* lipid-globular protein mosaic model.
- fluor** 1. A liquid or a solid that is used in scintillation counters and that emits a flash of light when it is excited by radioactive or other radiation 2. FLUOROCROME.
- fluoresce** To exhibit fluorescence.
- fluorescein** A yellow dye, chemically related to eosin, that is used as a fluorochrome in immunofluorescence.
- fluorescence** The emission of radiation by an excited molecule that occurs as a result of an electronic transition whereby the molecule returns from the excited state to the ground state. The emitted radiation is usually of a different and longer wavelength than that of the exciting radiation, and the time interval between excitation and emission is of the order of 10^{-9} to 10^{-7} s. *See also* phosphorescence.
- fluorescence depolarization** Fluorescence in which the exciting light is polarized and the emitted light is partially depolarized; the degree of depolarization of the emitted light is then measured.
- fluorescence enhancement** A method for studying the binding of fluorescent ligands to antibodies by determining the difference between the fluorescence of the free ligands and that of the antibody-bound ligands.
- fluorescence microphotolysis** A technique for studying the translational diffusion of membrane proteins and lipids, and the transport of solutes through membranes and within cells. The principle of the method involves equilibrating cells with a fluorescent solute, illuminating the cells with an attenuated laser beam, and measuring the fluorescence with a fluorescence microscope. The intensity of the laser beam is then suddenly increased so that intracellular solutes are photolysed and rendered nonfluorescent. As fresh, nonphotolysed chromophores move into the cells from the outside, the fluorescence inside the cells increases and is monitored. *Aka* fluorescence photobleaching recovery (FPR); fluorescence recovery after photobleaching (FRAP).
- fluorescence microscope** A microscope in which structures are illuminated with ultraviolet light, or short-wave visible light, and are made visible by fluorescence.
- fluorescence microscopy** A type of microscopy in which the specimen is fluorescent and emits light rather than transmitting or reflecting it; used for tissues stained with a fluorochrome and for immunofluorescence studies.
- fluorescence photobleaching recovery** FLUORESCENCE MICROPHOTOLYSIS.
- fluorescence polarization** Fluorescence in which the exciting light is not polarized and the emitted light is partially polarized; the degree of polarization of the emitted light is then measured.
- fluorescence quenching** A method for studying the binding of haptens to antibodies. The aromatic amino acids of the antibody are first

excited and caused to fluoresce; subsequently the fluorescence is decreased when the antibody is allowed to combine with the hapten and an energy transfer takes place from the excited antibody to the hapten. The method can likewise be used to study binding reactions with other proteins.

fluorescence recovery after photobleaching
FLUORESCENCE MICROPHOTOLYSIS.

fluorescent antibody An antibody that is covalently linked to a fluorescent dye, such as fluorescein or rhodamine, and that has retained its immunochemical activity.

fluorescent antibody technique A technique for locating either antigens or antibodies in a microscopic preparation of cells or tissues by treating the preparation with the corresponding fluorescent antibodies or fluorescent antigens. *See also* direct fluorescent antibody technique; indirect fluorescent antibody technique; anticomplement fluorescent antibody technique.

fluorescent antigen An antigen that is covalently linked to a fluorescent dye, such as fluorescein or rhodamine, and that has retained its immunochemical activity.

fluorescent screen A plate coated with a material, such as calcium tungstate or zinc sulfide, which fluoresces upon irradiation.

fluoridation The addition of fluoride to water supplies in an attempt to decrease dental caries; the final fluoride concentration is usually 1 mg/L.

fluorimeter Variant spelling of fluorometer.

fluorimetry Variant spelling of fluorometry.

fluorine An element that is essential to humans and animals. Symbol, F; atomic number, 9; atomic weight, 18.9984; oxidation state, -1; most abundant isotope, ^{19}F .

fluorochrome A substance that, when irradiated with light of a certain wavelength, emits light of a longer wavelength; a fluorescent compound, particularly one used to stain biological specimens.

1-fluoro-2,4-dinitrobenzene *See* Sanger reaction.

fluorography *See* solid scintillation fluorography.

fluoroimmunoassay An immunoassay employing antigens labeled with a fluorochrome. *Abbr* FIA.

fluorometer An instrument for the measurement of fluorescence that contains both a light source for supplying the excitation energy and a light detector for measuring the emission energy; filter fluorometers and spectrofluorometers are the two basic types.

fluorometry The measurement of fluorescence that may include a determination of one or more of the following: (a) the concentration

of a fluorescent compound; (b) the relative efficiencies of various exciting wavelengths to cause fluorescence; (c) the relative intensities of various wavelengths in the emitted fluorescent light; and (d) the probability that an absorbed photon will generate an emitted photon in fluorescence.

fluorophenylalanine An amino acid analogue of phenylalanine that can be incorporated into protein during protein synthesis.

fluorophore A potentially fluorescent group of atoms in a molecule.

fluorosis A condition caused by excessive intake of fluorine, usually derived from drinking water, and characterized by the occurrence of mottled teeth.

5-fluorouracil A pyrimidine analogue that is used in cancer chemotherapy; an antitumor agent that inhibits the enzyme thymidylate synthetase. *Abbr* FU.

flush ends *See* restriction enzyme.

flu virus INFLUENZA VIRUS.

flux 1. The metabolic rate with respect to a particular substrate in a given tissue; equal to AV/K_m where A is the substrate concentration in the tissue, V is the maximum velocity, and K_m is the Michaelis constant. 2. The rate of flow of either matter or radiation; equal to the number of particles (or the mass) or the number of photons that pass through a unit area per unit time. *See also* glycolytic flux.

flux ratio method A technique that is useful for the interpretation of complexities in enzyme mechanisms. It resembles a product inhibition technique but, rather than examining effects on initial rates, it examines the fate of individual product molecules participating in inhibitory reactions. Thus, for the reaction $A + B \rightleftharpoons P + Q$, the ratio of two fluxes, one involving the conversion $P \rightarrow A$ and the other that of $P \rightarrow B$ can be determined and plotted as a function of the concentration of A or B , respectively. The resulting curves can be interpreted as supporting a random or an ordered mechanism.

F-mediated transduction SEXDUCTION.

fMet-tRNA *N*-Formylmethionyl tRNA.

FMN Flavin mononucleotide.

FMNH₂ Reduced flavin mononucleotide.

Fm protease A proteolytic enzyme, isolated from *Flavobacterium meningosepticum*, that cleaves peptide bonds in which the carbonyl group is donated by proline or methionine.

FNPA 4-Fluoro-3-nitrophenyl azide; a photoaffinity labeling compound that selectively binds to the active sites of protein molecules in antibodies and in acetylcholine binding sites on intact membranes.

foam The colloidal dispersion of a gas in a liquid.

foam cells Lipid-swollen cells found in atherosomas. Such cells have been enlarged with droplets of cholesterol esters so that their cytoplasm appears vacuolated.

foam fractionation A chromatographic technique in which the stationary phase is the surface of bubbles and the mobile phase is the liquid flowing between the bubbles. *See also* emulsion fractionation.

Foerster's theory A theory for the dipole-dipole transfer of electronic excitation energy between a fluorescent energy donor and a suitable energy acceptor; the theory postulates that the rate of energy transfer depends on the inverse sixth power of the distance between the donor and the acceptor.

folacin 1. A generic descriptor for all folates and related compounds that exhibit qualitatively the biological activity of tetrahydropteroylglutamic acid. 2. FOLIC ACID.

folate A generic descriptor for the family of compounds that contain the pteronic acid nucleus.

folate coenzyme Tetrahydrofolic acid or one of its derivatives.

Folch method A method for the isolation of lipids from either tissues or fluids by extraction with chloroform/methanol/water mixtures.

foldback DNA DNA in which a single-stranded segment has folded back upon itself to form a hydrogen-bonded region. The intrastrand hydrogen bonding results from the occurrence of inverted repeats (palindromes). Simple inverted repeats result in a structure known as hairpin DNA; interrupted inverted repeats result in a structure known as stem-and-loop DNA. In the latter, the loop represents the segment between the inverted repeats and constitutes a non-hydrogen-bonded region. When either hairpin or stem-and-loop structures form in double-stranded DNA, they extend outward from the double helix and, since they are formed by both strands, give rise to cross-shaped configurations known as cruciform DNA.

foldback elements Transposable elements in *Drosophila* that contain extensive amounts of foldback DNA.

folded chromosome Bacterial DNA that has been isolated by gentle techniques so that DNA breakage and protein denaturation have been avoided; a compact structure containing protein and supercoiled DNA.

foldings *See* protein folding.

fold purification *See* purification (2).

folic acid Pteroylglutamic acid; a widely distributed vitamin of the vitamin B complex. The coenzyme forms of folic acid are derivatives of tetrahydrofolic acid and they function in the

metabolism of one-carbon fragments. *Abbr* F.

folic acid coenzyme FOLATE COENZYME.

folic acid conjugate One of a group of folic acid derivatives that contain from two to seven glutamyl residues per molecule.

folic acid reductase The enzyme tetrahydrofolate dehydrogenase.

Folin-Ciocalteu reaction A colorimetric reaction for tyrosine that is used for the quantitative determination of proteins; based on the production of a blue color upon treatment of the sample with a complex phosphomolybdotungstic acid reagent.

folinic acid *N*⁵-Formyltetrahydrofolic acid; a reduced and formylated derivative of folic acid that is more stable to air oxidation than is the parent compound.

Folin method LOWRY METHOD.

Folin reaction A colorimetric reaction for amino acids that is based on the production of a red color by treatment of an alkaline solution of the sample with 1,2-naphthoquinone-4-sulfonate.

Folin-Wu method One of a group of analytical procedures for the determination of glucose or other components in blood. In the case of glucose determination, the proteins are precipitated with tungstic acid and the protein-free filtrate is heated with an alkaline copper tartrate solution, followed by treatment with phosphomolybdic acid.

follicle-stimulating hormone The gonadotropic protein hormone, secreted by the anterior lobe of the pituitary gland, that stimulates the growth of ovarian follicles and the secretion of estradiol in the female and spermatogenesis in the male. *Abbr* FSH. *Aka* follitropin.

follicle-stimulating hormone releasing hormone The hypothalamic hormone that controls the secretion of the follicle-stimulating hormone. *Abbr* FSHRH; FRH. *Aka* follicle-stimulating hormone releasing factor (FSHRF; FRF).

follitropin FOLLICLE-STIMULATING HORMONE.

following strand LAGGING STRAND; *see* DNA replication.

food additive A substance that is added to, and not naturally present in, a food; includes those substances that are added in the preparation of a fortified food exclusive of sugar, salt, and vinegar.

food chain A sequence of organisms that feed one upon the other in succession and that provide for the transfer of food energy from the simpler to the more complex organisms.

food groups The four basic categories of nutrients that are recommended for daily inclusion in the diet: (a) milk group, (b) meat group, (c) vegetable and fruit group; and (d) bread and cereal group.

food web A system of interlocking food chains.

footprinting A technique for identifying protein-binding regions in DNA; based on the principle that such regions, when protein is bound to them, are protected against endonuclease action. The DNA is allowed to bind a specific protein and is then subjected to brief endonuclease action, so that each DNA molecule receives not more than one single-strand break (nick); these nicks are made only in the unprotected regions. After denaturation, the resulting single-stranded segments are separated according to their size by gel electrophoresis, yielding a series of bands. A control DNA sample, without the bound protein, is subjected to the same treatment and the two distributions of bands are compared. For every susceptible phosphodiester bond, a band will be found in both the sample and the control gels. But the sample gel will lack certain bands, corresponding to phosphodiester bonds in the protected region. The missing bands in the sample gel define the size of the DNA segment that had been protected by interaction with the specific protein. See also DNase protection; photofootprinting; dimethyl sulfate protection.

Forbe's disease GLYCOGEN STORAGE DISEASE TYPE III.

forbidden clone hypothesis The hypothesis of autoimmunity according to which the normal tolerance of an animal to self antigens is due to the death, in fetal life, of the clones that are responsible for the synthesis of the corresponding autoantibodies. If, as a result of a mutation, such normally forbidden clones reemerge during the adult life of the animal, they would then lead to the synthesis of autoantibodies and produce autoimmunity.

forbidden transition A transition between energy states of either an atom or a molecule that is forbidden on the basis of the quantum mechanical selection rules; in practice this means that the transition occurs at a negligibly small rate.

forced dialysis A variant of equilibrium dialysis in which solvent, containing free ligand, is forced through the protein-containing compartment, and the effluent is then analyzed for the concentration of residual free ligand.

forced diffusion The diffusion that takes place when free diffusion is modified by the application of an external force such as an electrical or a centrifugal force.

force-feeding The feeding of experimental animals by forcing food into them; frequently performed by insertion of a tube through the nose into the stomach.

forescattering See forward scattering.

formal electrode potential The electrode potential of a solution that contains equal concentrations of both the oxidized and the reduced forms of the substance of interest, and that contains all other substances at specified concentrations. *Aka* formal potential.

formalin An aqueous 37% (w/v) solution of formaldehyde that is used as a fixative in microscopy and as a reagent for reacting with the amino groups of proteins and nucleic acids.

formality The concentration of a solution expressed in terms of the number of formula weights of solute in one liter of solution. *Sym* F.

formal solution A solution that contains one formula weight of solute per liter of solution.

formamide The amide of formic acid that reacts with the free amino group of adenine. In double-stranded DNA, this leads to disruption of A-T base pairs and denaturation of the DNA.

formation constant The equilibrium constant for the formation of a metal ion-ligand complex.

formation reaction A chemical reaction, frequently hypothetical, in which a compound is considered to be formed from its constituent elements; useful for calculating various thermodynamic quantities.

formazan A sugar derivative formed by the reaction of a carbohydrate phenylosazone with a diazo compound.

formed elements A collective term for the erythrocytes, leukocytes, and thrombocytes of blood. When applied to urine, the term also includes crystals, bacteria, ova, and parasites.

forme fruste An atypical, mild, or incomplete form of a pathological condition, such as an abnormality, a disease, or a syndrome.

formic fermentation MIXED ACID FERMENTATION.

formylimino group The grouping $-\text{CH}=\text{NH}$.

formol titration The titration of an amino acid, peptide, or protein in the presence of formaldehyde. The formaldehyde reacts with, and lowers the pK of, the amino groups so that the region in the titration curve in which the amino groups are being titrated can be identified.

formose reaction An autocatalytic reaction in which formaldehyde, in the presence of alkaline catalysts, gives rise to various carbohydrates. The reaction has been considered as a model for prebiotic synthesis of carbohydrates.

formula weight The sum of the atomic weights, expressed in grams, in the formula of a compound; identical to the molecular weight for those substances that exist as true molecules.

formycin One of a group of pyrimidine anti-

biotics, produced by *Nocardia interforma*.

formylation The introduction of a formyl group into an organic compound.

formyl group The grouping $-\text{CH}=\text{O}$ that is derived from formic acid.

N-formylkynurenine See tryptophan dioxygenase.

N-formylmethionine A formylated form of methionine that, when bound to a specific transfer RNA molecule, serves as the initiating aminoacyl-tRNA in the translation of bacterial systems. See also *N*-acetylserine.

N-formylmethionyl-tRNA The initiating aminoacyl-tRNA molecule in the translation of bacterial systems. *Abbr* fMet-tRNA.

N⁵-formyltetrahydrofolic acid FOLINIC ACID.

Forssman antigen A heterogenetic antigen located in the red blood cells and in the tissue cells of various organisms.

Forssman hapten The nonprotein portion of the Forssman antigen; a glycosphingolipid (penta-hexosyl ceramide; a ceramide pentasaccharide) that contains 2 mol *N*-acetyl galactosamine (GalNac), 2 mol galactose (Gal), and 1 mol glucose (Glc) per mole of hapten. The hapten has the structure GalNac-GalNac-Gal-Gal-Glc-sphinganine.

fortified food Food to which nutrients have been added over and above those occurring naturally; may refer either to the increase in concentration of a naturally occurring nutrient, or to the addition of a different nutrient.

FORTTRAN Acronym for *formula translation*; a high-level computer language used primarily for mathematical computations.

forward mutation A mutation that changes a normal (wild-type) allele into an abnormal (mutant) allele; a mutation that leads to an altered phenotype which differs from the wild type.

forward scattering The scattering of radiation in the direction of the beam of radiation and away from the source of the radiation.

fossil Any remains of a living organism from a past geological period; frequently restricted to remains that have been petrified (converted to stone).

fossil fuel Fuel derived from fossilized organic material; coal, oil, and natural gas are examples.

Fouchet's test A test for bilirubin in urine that is based on the production of a green color by treatment of urine with ferric chloride and trichloroacetic acid.

Fould's rules A set of six general principles that describe the progression of tumors in animals: (1) Different tumors in the same animal progress independently. (2) Progression

occurs independently in different characters of the same tumor. (3) Progression occurs in latent tumor cells and in tumor cells in which growth is arrested. (4) Progression is continuous or discontinuous and proceeds gradually or by abrupt changes. (5) Progression follows one of alternate paths of development. (6) Progression does not always reach an endpoint within the lifetime of the host. See also tumor progression.

founder cells One or more ancestral cells that have become specialized for development into a given type of differentiated tissue. Thus, there are founder cells for bone cells, liver cells, cartilage cells, and so on.

founder effect The principle that when a small group establishes itself as a separate and isolated entity, it carries only a fraction of the genetic variability of the parent population.

four-carbon plants See C_4 plants.

Fourier analysis The theory of representing functions of a variable as the sum of a series of sine and cosine terms of the type $a_j \sin(2\pi j/\lambda_j)$ and $a_j \cos(2\pi j/\lambda_j)$ where $j = 0, 1, \dots$

Fourier synthesis The process of computing the form of a function from the values of its coefficients in a Fourier series (an infinite series of sine and cosine terms); used in deriving the electron density distribution of a molecule from x-ray diffraction data.

Fourier transform infrared spectroscopy A powerful spectroscopic technique for collection of infrared absorption data that has three major advantages over ordinary infrared spectroscopy: (a) it permits the simultaneous passage of all infrared frequencies through a sample so that spectral data are obtained very rapidly; (b) it does not require slits or filters, resulting in greater intensities of radiation and hence greater sensitivity for the analysis of mixtures; and (c) it permits collection of more accurate and precise data since the instrument is continually calibrated by an internal laser. *Abbr* FTIR.

Fourier transform nuclear magnetic resonance A nuclear magnetic resonance technique in which all resonances are excited simultaneously by a short radio frequency pulse that encompasses all proton frequencies in the sample. The resulting time domain signal, containing the mixed frequencies of sample resonances, is Fourier transformed in a computer to reveal each resonance in the normal frequency domain. Advantages of the method include increased sensitivity, shortened resolution time, and double resonance capability. *Abbr* FTNMR.

FP Flavoprotein.

F-1-p Fructose-1-phosphate.

F-6-p Fructose-6-phosphate.

F-pilus (*pl* F-pili). A hollow tube that is formed by a male bacterium and that serves for the transfer of its DNA to a female bacterium during conjugation. *Aka* sex pilus.

F plasmid FERTILITY FACTOR.

F' plasmid F' FACTOR.

FPLC Fast protein, peptide, and polynucleotide liquid chromatography.

FPR Fluorescence photobleaching recovery.

fractal dimension A measure of the degree of irregularity (roughness) of the surfaces of protein molecules. The fractal dimension (D) varies from 2 for a completely smooth surface to 3 for a completely space-filling surface, and is defined by $D = 2 - (d \log A_s / d \log R)$, where A_s is the molecular surface area and R is the radius of the probe.

fractile The value of a statistical variable below which the indicated fraction of the measurements of the frequency distribution falls.

fraction 1. A preparation derived from a biological source and composed of one or more components. 2. A discrete portion of material obtained by fractionation.

fractional centrifugation DIFFERENTIAL CENTRIFUGATION.

fractional distillation The slow distillation of a liquid that permits the collection of fractions (portions) which distill at different temperatures.

fractional electrical transport An electrochemical technique for determining whether an "active principle" for which an assay is available, is a strong acid, a strong base, an amphoteric compound, a nonelectrolyte, or a combination of these. The technique is based on subjecting dilute solutions of the "active principle" to electrolysis under high potentials and in cells that can be cut into a number of compartments in which the principle can then be assayed.

fractional precipitation The stepwise separation of substances, particularly macromolecules, from a solution; based on precipitating the substances in the order of their increasing solubilities by changing the ionic strength, the pH, the dielectric constant, etc., of the solution.

fractional saturation The fraction of occupied binding sites; the average number of ligands (ν) bound per molecule of protein divided by the number of binding sites (n) per molecule of protein for the particular ligand; $\bar{Y}_s = \nu/n$, where \bar{Y}_s (or \bar{Y}) is the fractional saturation.

fractional sterilization The sterilization of a material by means of short, intermittent periods of heating that are separated by periods of incubation. Spores are allowed to germinate during the incubation period and

are then killed by the subsequent heating period. The method is used for materials that cannot tolerate the long exposure to the high temperatures that are used in ordinary sterilization procedures.

fractional turnover rate The reciprocal of the turnover time.

fraction-antibody binding Fab FRAGMENT.

fractionated dose A dose of radiation that is administered in the form of a series of short exposures.

fractionation The separation of sample material into discrete portions.

fraction collector An automatic device for the collection of consecutive portions of a liquid, as those obtained from a chromatographic column or from a density gradient. The collection may be based on time, volume, weight, or number of drops.

fraction-crystalline Fc FRAGMENT.

fractogram *See* sedimentation field flow fractionation.

fracture faces The exposed sample surfaces obtained by the freeze fracture method. The face representing the hydrophobic interior of the cytoplasmic half of the bilayer is called the P face; the face representing the hydrophobic interior of the external half of the bilayer is called the E face.

fracture label A modification of freeze fracture electron microscopy in which the cleavage surfaces produced are cytochemically labeled.

fragile site A site at which a chromosome is particularly likely to become broken. Some fragile sites are those at which chromosomal translocations occur frequently.

fragile X syndrome The most common form of inherited mental retardation in humans which occurs in about 1 out of 2000 newborn males; it is associated with a fragile site on the X chromosome.

fragmentation reaction A chemical reaction in which there is a cleavage of one or more carbon-to-carbon bonds, leading to a breakage in the carbon skeleton of the molecule.

fragment ion Any one of the positively charged fragments obtained in mass spectrometry when the original molecule is broken up.

fragment length mapping A technique that aids in determining the base sequence of a nucleic acid molecule that is synthesized *in vitro* by a nuclease-free polymerase. The incubation of the polymerase with substrate for varying lengths of time results in the synthesis of polynucleotide fragments of different size, all of which contain the same 5'-terminal. The fragments are separated according to their size by means of polyacrylamide gel electrophoresis, and a specific oligonucleotide is then located in the nucleic acid by determining the mini-

mum fragment length that is required to ensure the presence of the oligonucleotide.

fragment map RESTRICTION MAP.

fragment reaction An *in vitro* assay of the enzyme peptidyl transferase; involves measuring the ribosome-dependent transfer of the growing polypeptide chain to puromycin as evidenced by the release of peptidyl puromycin.

fragmin A calcium-sensitive protein that binds to monomeric actin (G-actin) and thereby suppresses actin filament (F-actin) formation.

frame of reading See reading frame.

frameshift mutation A mutation that leads to an alteration in the normal relation between nucleotide readout from a nucleic acid and amino acid sequence in the corresponding protein. A point mutation that results in a deletion or an insertion of a nucleotide constitutes a frameshift mutation; in this case, the codons will be unchanged up to the point of the mutation and will specify correct amino acids, but all subsequent codons will be altered and will specify incorrect amino acids.

frameshift suppression The suppression of a frameshift mutation.

framework model A molecular model in which the atoms are represented by their nuclei and by their bonds and in which the bond angles have their actual values.

framework regions Those parts of the variable regions of an immunoglobulin molecule that are not hypervariable regions; the variability of amino acid sequences in framework regions is much less than that in hypervariable regions.

Franck-Condon principle The principle that a change in the electronic configuration of a molecule as a result of the emission or the absorption of a photon requires about one-hundredth the length of time that is required for a vibration of the molecule; consequently, the atomic nuclei do not alter their positions appreciably during the emission or the absorption of a photon.

Frank-Evans iceberg See iceberg.

FRAP Fluorescence recovery after photobleaching.

fraudulent DNA A DNA molecule into which purine and/or pyrimidine analogues have been incorporated that do not occur naturally.

fraudulent nucleotide A nucleotide into which purine and/or pyrimidine analogues have been incorporated that do not occur naturally.

frayed end The terminal region of a double-stranded nucleic acid molecule in which the bases are not perfectly complementary.

free calcium The sum of ionized calcium and calcium complexes in serum. Calcium complexes represent the small amount of calcium

that is bound to bicarbonate, phosphate, citrate, or other anions.

free diffusion The diffusion across a boundary in a solution or that in a gas phase as opposed to the diffusion across a membrane or some other porous medium.

free-draining polymer A polymer in solution that is coiled and flexible in such a fashion that the solvent held within the polymer is free to travel at its own velocity rather than at the velocity of the polymer; consequently, a free-draining polymer is not well approximated by a solid particle in solution. *Aka* free-draining coil.

free electrophoresis MOVING BOUNDARY ELECTROPHORESIS.

free energy That component of the total energy of a system that can do work under conditions of constant temperature and pressure; known as the Gibbs free energy (G) and expressed by the thermodynamic function $G = H - TS$, where H is the enthalpy, T is the absolute temperature, and S is the entropy. See also Helmholtz free energy.

free energy change The difference between the free energy of formation of the products and that of the reactants in a chemical reaction; denoted ΔG . The free energy change for a reaction at pH 7.0 is the biochemical free energy change and is denoted $\Delta G'$. See also standard free energy change.

free fatty acids Nonesterified fatty acids. *Abbr* FFA.

free insulin IMMUNOREACTIVE INSULIN.

freely jointed chain An artificial, mathematical model for a polymer in which a string of vectors of fixed length represents the bonds between atoms. The atoms are not included in the chain and the chain has no volume. The angle between each pair of bond vectors is free to assume all values with equal probability and all rotations about the bonds are equally likely. The direction of each bond vector is completely uncorrelated to every other bond vector so that the polymer is freely jointed. *Aka* random walk chain; random flight chain.

freely rotating chain An artificial, mathematical model for a polymer that is based on the freely jointed chain model but includes the constraint of fixed bond angles; rotations about these skeletal bonds are, however, completely unhindered.

free radical An atom or a group of atoms that has an odd number of electrons; an atom or a group of atoms containing an unpaired electron.

free rotation The sterically unhindered rotation of an atom or a group of atoms about a single bond.

freeze-blowing A modification of the freeze-clamp technique that is used for the preparation of brain specimens; entails the rapid removal and rapid freezing of brain tissue from conscious animals.

freeze-clamp technique A technique for determining the concentration and the compartmentation of metabolites under conditions that closely resemble those of the *in vivo* state; performed by abruptly stopping the metabolic reactions in a tissue specimen by pressing the tissue into a thin, frozen wafer between two aluminum blocks, previously cooled in liquid nitrogen, and then analyzing the tissue for the metabolites.

freeze-cleaving FREEZE-FRACTURING.

freeze-drying LYOPHILIZATION.

freeze-etching A modification of the freeze-fracturing technique in which the specimen is suspended in water prior to freezing, rather than in glycerol or in some other cryoprotective agent. The cleaved surfaces can then be etched by a brief heating of the specimen to -100°C in a vacuum; this removes some of the ice bound to the surfaces in the specimen by sublimation.

freeze-fracturing A technique used to prepare specimens for electron microscopy. The specimen is frozen and then fractured with a knife edge to yield cleavage surfaces; the surfaces are then replicated by metal casting and are examined by conventional transmission electron microscopy after the original cellular material has been digested away. Analysis of the resultant micrographs provides three-dimensional information of ultrastructural details with a resolution of 0.1 to 0.2 nm.

freeze-stop technique FREEZE-CLAMP TECHNIQUE.

freeze-substitution The dehydrating of tissue specimens by freezing them in a cold organic solvent such as propane or isopentane.

freeze-thawing The disruption of cells by repeated freezing and thawing of a cell suspension.

freezing 1. A restriction in the rotation of a molecule that enhances its binding to another molecule, as in the freezing of a substrate that binds to an enzyme, or in the freezing of ribosomes that bind to mRNA. 2. The transition of a liquid to a solid that is produced by a lowering of the temperature.

freezing-point osmometer An osmometer, the operation of which is based on the lowering of the freezing point of a solvent by the addition of a solute.

French press An apparatus used for the disruption of cells and for the preparation of cell-free extracts. The cells, in suspension, are subjected to high pressures by means of a piston and the suspension is then forced

through a small orifice. The sudden decrease in pressure leads to an explosion of the cells. Some cell breakage is also caused by the shearing forces.

Freon Trademark for a group of fluorinated alkanes used in refrigeration and aerosols. There is concern that escape of freon to the stratosphere leads to reactions that deplete the ozone layer which shields the earth from excessive ultraviolet irradiation.

frequency The number of times that an event recurs per unit time, such as the number of vibrations per second. For electromagnetic radiations, the frequency is equal to the speed of light divided by the wavelength of the radiation.

frequency distribution A systematic graphical arrangement of statistical data that shows both the classes into which a variable is divided and the frequencies of these classes.

frequency factor See Arrhenius equation.

frequency of recombination A measure of the distance between loci on a genetic map that is equal to the number of recombinants divided by the total number of progeny.

frequency shift See chemical shift.

Freund's adjuvant An adjuvant that is used as either a complete or an incomplete adjuvant; complete Freund's adjuvant consists of mineral oil, detergent, and dead mycobacteria; incomplete Freund's adjuvant consists of mineral oil and detergent.

FRF Follicle-stimulating hormone releasing factor; See follicle-stimulating hormone releasing hormone.

FRH Follicle-stimulating hormone releasing hormone.

frictional coefficient See rotational frictional coefficient; translational frictional coefficient.

frictional force The force that is exerted on a particle in solution as a result of friction; it is equal to the product of the velocity of the particle and its frictional coefficient.

frictional ratio The ratio of the experimentally determined translational frictional coefficient of a macromolecule to the translational frictional coefficient of a sphere that has the same molecular weight as the macromolecule. The frictional ratio is commonly divided into two factors which measure the contribution of hydration and the contribution of molecular asymmetry. See also Oncley equation.

Friedman test A test, analogous to the Aschheim-Zondek test, except that the voided urine is injected intravenously into rabbits.

Friend leukemia virus A mouse leukemia virus that belongs to the group of leukoviruses.

front See solvent front.

frontal analysis See frontal chromatography.

frontal chromatography A column chromatographic technique in which the sample is passed continuously into the column and only the component that emerges first from the column can be obtained in pure form.

fronting LEADING.

frontside attack The mechanism of a chemical displacement reaction that proceeds with retention of configuration.

frozen accident theory A theory of the evolution of the genetic code according to which the code evolved by chance until the current codon assignments had been developed; once this was achieved, the code was essentially prevented from any further evolution because the code provided the organism with selective advantages and any changes in the code would have been deleterious for the organism. *See also* lethal mutation model; specific interaction theory.

frozen replica method FREEZE-ETCHING.

FRS Ferredoxin-reducing substance.

Fru Fructose.

fructan A homopolysaccharide of fructose that occurs in plants.

fructose A six-carbon ketose that, together with glucose, makes up a molecule of sucrose. *Abbr* Fru.

fructose-1,6-bisphosphate A metabolite that is cleaved in glycolysis to two triose phosphates, glyceraldehyde-3-phosphate and dihydroxyacetone phosphate. *Abbr* FBP. *Aka* fructose-1,6-diphosphate (FDP).

fructose intolerance A genetically inherited metabolic defect in humans that is due to a deficiency of the enzyme fructose-1-phosphate aldolase.

fructose-6-phosphate A metabolite that is phosphorylated in glycolysis to fructose-1,6-bisphosphate.

fructosuria A genetically inherited metabolic defect in humans that is characterized by the presence of excessive amounts of fructose in the urine and that is due to a deficiency of the enzyme fructokinase.

fruit fly A fly of the genus *Drosophila*, an organism widely used for genetic research.

fruit-ripening hormone The gas ethylene that occurs widely in plant tissues and that accelerates the ripening of fruit; it is formed from methionine.

fruit sugar FRUCTOSE.

FSF Fibrin-stabilizing factor.

FSH Follicle-stimulating hormone.

FSHRF Follicle-stimulating hormone releasing factor. *See* follicle-stimulating hormone releasing hormone.

FSHRH Follicle-stimulating hormone releasing hormone.

FST-DNA First-step transfer DNA.

F' strain A bacterial strain in which an augmented fertility factor has become incorporated into the bacterial chromosome. *See also* F' factor.

F test A statistical test for comparing the variances of two sets of results by means of their *F* value (the ratio of the two variances); widely used to test for the identity of the means of two populations.

FTIR Fourier transform infrared spectroscopy.

FTNMR Fourier transform nuclear magnetic resonance.

FU 5-Fluorouracil.

Fuc Fucose.

fucolipid Any fucose-containing glycolipid.

fucose A deoxysugar that occurs in some bacterial cell walls; 6-deoxy-L-galactose. *Abbr* Fuc.

fucosidosis A genetically inherited metabolic defect in humans that is characterized by cerebral degeneration, muscle spasticity, and an accumulation of H-isoantigen; a lipid storage disease that is due to a deficiency of the enzyme alpha fucosidase.

full agonist A ligand that binds to a receptor and causes a maximum biological response. *See also* agonist; partial agonist.

Fuller's earth Any clay that has adequate decolorizing capacity and that contains aluminum magnesium silicate.

fulvic acid The complex mixture of acid-soluble and alkali-soluble substances that are extracted from the organic matter of soil. *See also* humic acid; humin.

fumagillin An antibiotic, produced by *Aspergillus fumigatus*, that has no activity against bacteria or fungi but does act against amoeba. It also inhibits the development of some bacteriophages and has some antiviral activity in tissue culture.

fumarase The enzyme that catalyzes the reversible hydration of fumaric acid to malic acid in the citric acid cycle.

fumarate pathway A catabolic pathway whereby either phenylalanine or tyrosine is converted to fumaric acid, which then feeds into the citric acid cycle.

fumaric acid The unsaturated, dicarboxylic acid that is formed from succinic acid in the citric acid cycle.

functional death The death of an organism that results from the inability of a gene, or a group of genes, to carry out their functions.

functional group A reactive atom or a group of atoms in a molecule that has specific properties; aldehyde, ketone, amino, hydroxyl, carboxyl, and sulfhydryl groups are some examples.

functional group isomer One of two or more isomers that have the same molecular com-

position but differ from each other in the type of functional group that they contain.

function of state See state function.

fungal Of, or pertaining to, fungi.

fungicide An agent that kills fungi.

fungus (*pl* fungi) A plant protist that is non-photosynthetic and that is devoid of chlorophyll; fungi generally contain a mycelium and are frequently coenocytic.

furan A heterocyclic compound, the structure of which resembles the ring structure of the furanoses.

furanose A monosaccharide having a five-membered ring structure.

furanoside A glycoside of a furanose.

fused gene A hybrid gene produced by linking a gene of interest (for example, a mammalian gene) to some other gene (for example, a plasmid gene) using methods of recombinant DNA technology. *Aka* hybrid gene. See also fusion gene.

fused protein A hybrid protein molecule, consisting of two linked and different proteins, and produced from a fused gene. *Aka* hybrid protein.

fused ring A ring that has two or more atoms in common with another ring.

fused rocket immunoelectrophoresis See rocket electrophoresis.

fusel oil A group of compounds formed as side products during alcoholic fermentation; the mixture consists mainly of amyl, isoamyl, isobutyl, and propyl alcohols.

fusidic acid A steroid antibiotic, produced by *Fusidium coccineum*, that inhibits protein

synthesis in both prokaryotes and eukaryotes by interfering with elongation factor G (translocase).

fusiform Spindle-shaped; tapered at each end.

fusion See plasmid fusion; replicon fusion; gene fusion; nuclear fusion.

fusion gene A hybrid gene consisting of parts of two others genes. A fusion gene can be formed by deletion of a chromosomal segment between two genes or by crossing over. See also fused gene.

fusogenic agent An agent, such as polyethylene glycol or Sendai virus, that induces cell fusion.

futile cycle A substrate cycle in which the two opposing reactions occur at comparable rates in the same cell. Such a cycle accomplishes nothing except the waste of the free energy difference between the two reactions or, possibly, the generation of some heat. For example, the reaction $\text{glucose} + \text{ATP} \rightleftharpoons \text{glucose-6-phosphate} + \text{ADP}$ together with the reaction $\text{glucose-6-phosphate} + \text{H}_2\text{O} \rightleftharpoons \text{glucose} + \text{P}_i$ leads only to the net reaction of $\text{ATP} \rightleftharpoons \text{ADP} + \text{P}_i$.

fuzzy coat CELL COAT.

F value 1. A ratio of two variances; See *F* test.
2. The time required, when treating an aqueous suspension at 121°C, to heat inactivative (kill) the entire population of viable bacterial cells or spores.

Fv fragment The N-terminal portion of the Fab fragment of the immunoglobulins; it consists of the variable portions of one heavy and one light chain.

G

- g** 1. Gram. 2. Gravity; used to describe centrifugal forces. *See also* relative centrifugal force. 3. *g* value.
- G** 1. Guanine. 2. Guanosine. 3. Glycine. 4. Gibbs free energy. 5. Glucose. 6. Gauss. 7. *G* value.
- G₀** *See* G protein.
- G₁** *See* cell cycle.
- G₂** *See* cell cycle.
- G 17, G 34** *See* gastrin.
- GA** 1. Glyceric acid. 2. Glutamic acid.
- GABA** γ -Aminobutyric acid; 4-aminobutyric acid.
- GABAergic neuron** *See* inhibitory transmitter.
- GABA shunt** *See* γ -aminobutyrate bypass.
- G-actin** The monomeric, water-soluble, and globular form of actin.
- gal** Gallon.
- Gal** Galactose.
- galactan** One of a group of polymers of galactose that occur in plants, have high molecular weights, and are usually unbranched; agar and carrageenan are two examples.
- galactin** PROLACTIN.
- galactocerebroside** A galactose-containing cerebroside.
- galactolipid** A galactose-containing lipid.
- galactosamine** The amino sugar of galactose that occurs in glycolipids and in chondroitin sulfate.
- galactose** A six-carbon aldose that is widespread in animals and that is a component of cerebroside and gangliosides. *Abbr* Gal.
- galactosemia** A genetically inherited metabolic defect in humans that is characterized by the inability of an infant to metabolize the galactose that is derived from the lactose in milk; due to a deficiency of the enzyme galactose-1-phosphate uridyl transferase. The condition leads to an accumulation of galactose, a loss of inorganic phosphate, liver failure, and mental retardation.
- galactose operon** *See* gal operon.
- galactose tolerance test** A liver function test that measures the ability of the liver to remove galactose from the blood stream and to convert it to glycogen; performed in a similar manner as a glucose tolerance test.
- β -galactosidase** *See* beta galactosidase.
- galactoside permease** LACTOSE PERMEASE.
- galactosphingolipid** GALACTOCEREBROSIDE.
- Galactostat** Trade name for a galactose oxidase reagent.
- galactosuria** The presence of excessive amounts of galactose in the urine; a consequence of galactosemia.
- galactozymase** The enzyme system responsible for the inducible fermentation of galactose in *E. coli*; consists of galactokinase, galactose-1-phosphate uridyl transferase, and UDP-glucose epimerase.
- galaptins** Low molecular weight, β -galactoside-specific, animal lectins believed to function in cell-cell recognition and adhesion by a bridging mechanism.
- GalN** Galactosamine.
- GalNAc** *N*-Acetylgalactosamine.
- gal operon** The operon in *E. coli* that functions in the metabolism of galactose and codes for the enzymes galactokinase, galactose transferase, and galactose epimerase.
- gamblegram** A diagrammatic representation of the composition of body fluids. It consists of two rectangles, placed side by side, one for cations and one for anions. The various ions are indicated within each rectangle by means of blocks, with the height of each block being proportional to the concentration of the ion in the given body fluid.
- gamete** A mature, haploid germ cell.
- genetic number** HAPLOID NUMBER.
- gametocyte** A cell that is destined to develop into a gamete; an oocyte or a spermatocyte.
- gametogenesis** The formation of gametes; oogenesis or spermatogenesis.
- gametophyte** The haploid individual in the life cycle of an organism exhibiting alternation of generations.
- gamma** 1. *n* A microgram. 2. *adj* Denoting the third carbon atom from the carbon atom that carries the principal functional group of the molecule. *Sym* γ .
- gamma aminobutyrate bypass** *See* γ -aminobutyrate bypass.
- gamma aminobutyric acid** *See* γ -aminobutyric acid.
- gamma chain** 1. The heavy chain of the IgG immunoglobulins. 2. One of the two types of polypeptide chains present in fetal hemoglobin.
- gamma globulin** 1. A protein that belongs to a specific fraction of serum proteins. 2. IMMUNOGLOBULIN.
- gamma ray** An electromagnetic radiation of short wavelengths that is frequently emitted by radioactive isotopes and that consists of

photons that originate in the nucleus of an atom.

gamma ray spectrometer An instrument for measuring the distribution of the energies of gamma rays.

gamone A plant sex hormone produced by a gamete; gamones facilitate fertilization and act as chemotactic agents. *See also* pheromone.

ganglion (*pl* ganglia) A mass of nervous tissue consisting principally of numerous nerve cell bodies.

ganglio series glycosphingolipids *See* glycosphingolipids.

ganglioside A ceramide oligosaccharide that contains at least one residue of sialic acid in addition to the other sugars; a glycosphingolipid containing sialic acid; a sialosylglycosyl sphingolipid (sialoglycosphingolipid). Gangliosides are especially abundant in the gray matter of the brain and in the thymus gland.

gangliosidosis *See* generalized gangliosidosis; Tay-Sachs disease.

gap filament A very thin filament seen in electron micrographs in the gap between the A-band and the I-band of striated muscle; believed to be composed of accidental sarcomere constituents that appear as a result of muscle stretching.

gap-filling The extension and linking of Okazaki fragments in DNA replication.

gap junction A communicating junction between two cells such that small molecules can pass directly from the interior of one cell to the interior of the other cell. The interacting plasma membranes are separated by a gap of 2 to 4 nm, hence the term gap junction. A gap junction differs from a chemical synapse in that the communication between the two cells is direct rather than indirect. Gap junctions consist of clusters of transmembrane channels through which the molecules move. Each channel is called a connexon. Each connexon is formed by a hexameric protein spanning the cell membrane. An interconnecting aqueous channel is formed by apposition of the two hexameric structures (connexons) in the two cells. *See also* synapse; cell junction.

GAR Glycinamide ribonucleotide; an intermediate in the biosynthesis of purines.

gargoylism A genetically inherited metabolic defect in humans that is characterized by skeletal deformities and mental deficiency and that is due to a defect in mucopolysaccharide storage, resulting in the presence of excessive amounts of chondroitin sulfate in the urine. *See also* Hunter's syndrome; Hurler's syndrome.

Garrod's disease ALKAPTONURIA.

GAS General adaptation syndrome.

gas amplification 1. The process whereby the ions formed in an ionization chamber produce more ions from the gas molecules in the chamber and thereby increase the electrical current that is measured. The magnitude of the current produced depends on the applied potential; as the potential is increased, the current rises above a saturation current, passes through a proportional region, a limited proportional region, a Geiger-Mueller region, and ultimately reaches a level at which there is a continuous discharge in the chamber. 2. The ratio of the actual charge collected at the electrode of an ionization chamber to the charge produced in the chamber by the initial radiation.

gas chromatogram The tracing of a gas chromatographic separation; a plot of detector response versus either time or volume of carrier gas. Each component, or mixture of components, is represented by a peak in a differential chromatogram and by a step in an integral chromatogram.

gas chromatography 1. Column partition chromatography in which the stationary phase is a solid and the mobile phase is a gas. *Abbr* GSC. 2. Column partition chromatography in which the stationary phase is an inert carrier, coated with an essentially nonvolatile liquid, and the mobile phase is an inert gas which sweeps volatile compounds through the column. *Abbr* GLC.

gas chromatography-mass spectrometry The combination of gas chromatographic and mass spectrometric techniques in which components are separated by a gas chromatography column and are then fed into a mass spectrometer. *See also* mass fragmentography.

gas constant The physical constant that is derived from the ideal gas law, $PV = nRT$, where R is the gas constant [1.987 cal/(deg)(mol)], P is the pressure, V is the volume, T is the absolute temperature, and n is the number of moles.

gaseous exposure method WILZBACH METHOD.

gaseous group A group of compounds that have very low melting points and that are believed to have occurred in the original gas dust of the solar nebula. *See also* earthy group; icy group.

gas flow counter A radiation counter in which the ionization detector must be flushed continually with the counting gas, used for gas amplification, to eliminate air leakage into the detector.

gas holdup HOLDUP VOLUME.

gas ionization The formation of ion pairs from gases that are subjected to an ionizing radiation.

gas liquid chromatography *See* gas chromato-

- graphy (2).
- gasohol** A fuel, chiefly for internal combustion engines, composed of a 9:1 ratio by volume of unleaded gasoline and ethyl alcohol.
- gasometry** The measurement of gas volumes and/or gas pressures.
- gas solid chromatography** See gas chromatography (1).
- gas storage** The storage of fruit at decreased oxygen levels and at increased carbon dioxide levels compared to those in air; used in an attempt to prolong the storage life of the fruit.
- gastric** Of, or pertaining to, the stomach.
- gastric inhibitory peptide** A polypeptide gastrointestinal hormone that is a potent inhibitor of gastric secretion and motility and that also functions in the regulation of insulin release. *Abbr* GIP.
- gastric juice** The digestive juice that consists of the secretion from the stomach and that contains hydrochloric acid and pepsinogen. *Aka* gastric fluid.
- gastricin** A proteolytic enzyme present in gastric juice.
- gastrin** A peptide hormone of 17 amino acids that is produced by the gastric mucosa and that stimulates the secretion of gastric juice. Human gastrin is known as gastrin I, little gastrin, or G 17; a modified form, in which a sulfate group is esterified to tyrosine 12, is known as gastrin II. Human gastrin also occurs in the form of a 34-amino acid peptide, believed to be a precursor of gastrin I; it is known as big gastrin, gastrin II, or G 34. A shortened form of gastrin I, consisting of 13 amino acids is known as minigastrin.
- gastrinoma** A gastrin-producing tumor which may occur in the pancreas, the duodenum, or the stomach.
- gastrointestinal** Of, or pertaining to, the stomach and the intestine.
- gastrone** A glycoprotein in gastric juice that, when injected into animals, inhibits gastric secretion.
- gate** 1. A channel in a biological membrane that can open and close in a transient fashion. 2. A cutoff level for pulses in scintillation counting. See also differential counting; integral counting.
- gated channel** A membrane channel whose permeability is regulated; a mediated transport system. Two major types involve the opening of a channel in response to (a) changes in the membrane potential (voltage-gated channels) or (b) extracellular binding of a ligand to a specific receptor (ligand-gated channels). *Aka* gated pore.
- gating** The opening and closing of a channel in a biological membrane; believed to be brought about by conformational changes of the integral membrane proteins, lining the channel, as a result of the binding of substrates or other ligands.
- gating current** The electric current set up in a gate as a result of the movement of ions through the gate.
- gauche conformation** A stable, staggered conformation at which there is a potential energy minimum and interatomic interactions are minimized.
- Gaucher's disease** A genetically inherited metabolic defect in humans that is characterized by an accumulation of cerebroside in tissues and by an enlargement of the spleen and the liver; due to a deficiency of the enzyme glucocerebrosidase.
- gauss** A unit of magnetic field strength. *Sym* G.
- Gauss error function** NORMAL DISTRIBUTION.
- Gaussian chain** FREELY JOINTED CHAIN.
- Gaussian distribution** NORMAL DISTRIBUTION.
- Gaussian error curve** NORMAL DISTRIBUTION.
- Gay-Lussac equation** The simple equation for alcoholic fermentation, established in 1815 by Gay-Lussac: $C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH$.
- GC** Gas chromatography.
- G + C/A + T ratio** See A + T/G + C ratio.
- GC box** A nucleotide sequence, present upstream from the CAAT box in a few eukaryotic promoters. It has the consensus sequence GGGCGG.
- GC content** The amount of guanine plus cytosine in a nucleic acid, expressed in mole percent. In Watson-Crick-type, double-stranded DNA, the GC content plus the AT content equals 100 mol% and the melting out temperature of the DNA increases with increasing GC content.
- GC-MS** Gas chromatography-mass spectrometry.
- GC pair** A guanine-cytosine base pair.
- GC-rich nucleus** A region in a double-helical nucleic acid structure that is rich in guanine and cytosine; GC-rich nuclei are denatured more slowly than regions that are rich in either adenine and thymine, or adenine and uracil.
- GDH** 1. Glucose dehydrogenase. 2. Glycerophosphate dehydrogenase. 3. Glutamate dehydrogenase.
- GDP** 1. Guanosine diphosphate. 2. Guanosine-5'-diphosphate.
- GDPM** Guanosine diphosphate mannose.
- GEF** Gel electrofocusing.
- gegenion** COUNTERION.
- Geiger-Mueller counter** A radiation counter, of the ionization chamber type, that is designed for operation in the Geiger-Mueller region. *Aka* Geiger counter.
- Geiger-Mueller plateau** The counting plateau

obtained with a Geiger-Mueller counter.

Geiger-Mueller region That portion of the characteristic curve of an ionization chamber in which, during gas amplification, maximum gas amplification is obtained, and the collected charge is independent of the size of the initial charge produced by the radiation.

gel A solid colloidal dispersion consisting of a network of particles and a solvent that is immobilized in this network.

Gelarose Trademark for a group of agarose gels that are used in gel filtration chromatography.

gelatin See parent gelatin.

gelation Gel formation; the transition from a sol to a gel.

gelation protein CROSS-LINKER.

gel blot hybridization See blotting.

gel chromatography GEL FILTRATION CHROMATOGRAPHY.

gel diffusion See single diffusion; double diffusion.

gel electrofocusing Isoelectric focusing in which a gel is used as the supporting medium for the pH gradient; gel electrofocusing is faster and requires smaller amounts of sample and reagents than isoelectric focusing in a density gradient. *Abbr* GEF.

gel electrophoresis Zone electrophoresis in which a gel is used as the supporting medium.

gel exclusion chromatography GEL FILTRATION CHROMATOGRAPHY.

gel filtration chromatography 1. A column chromatographic technique in which the stationary phase consists of gel particles of controlled size and porosity, as those prepared from polymeric carbohydrates. Molecules are fractionated on such a column on the basis of their size and shape and, hence, their rates of diffusion into the gel particles; smaller molecules of a given shape diffuse more rapidly into the gel and move more slowly through the column than larger ones. 2. Molecular sieving in which aqueous systems are used. *Abbr* GFC. *Aka* gel filtration.

gel immunofiltration See immuno-gel filtration.

gellan gum A high molecular weight, water-soluble, heteropolysaccharide, produced by fermentation of some species of *Pseudomonas*, that forms a gel similar to that formed by agar.

gel osmometer An osmometer, the operation of which is based on changes in the dimensions of a gel.

gel permeation chromatography 1. GEL FILTRATION CHROMATOGRAPHY. 2. Molecular sieving in which nonaqueous systems are used. *Abbr* GPC.

gelsolin A protein, isolated from macrophages,

that binds to, and fragments, actin filaments; a capping protein.

gem- Combining form meaning geminal.

geminal Referring to two substituents on the same carbon atom. *Abbr* gem.

gene The unit of heredity that occupies a specific locus on the chromosome. A sequence of bases along a DNA molecule (in certain viruses, an RNA molecule). The gene may be a functional unit (cistron; structural gene), a mutational unit (muton), or a recombinational unit (recon).

gene activation The process of genetic induction in which an individual molecule brings about the transcription of one or more structural genes. See also operon hypothesis.

gene amplification The selective replication of specific genes disproportionately to the extent of their occurrence in the genome. During development, some genes become amplified in specific tissues permitting the synthesis of vast quantities of a specific gene product. As an example, the genes coding for rRNA increase in number about 4000-fold during oogenesis in the toad *Xenopus laevis*.

gene bank GENE LIBRARY.

gene cloning See recombinant DNA technology.

gene cluster MULTIGENE FAMILY.

gene conversion The asymmetrical segregation of genes during replication that leads to an apparent conversion of one gene into another.

gene dosage The number of times that a particular gene occurs in the nucleus of a cell.

gene duplication The process whereby one or more genes from one chromosome are integrated by crossing over into a second chromosome that already carries the same genes. This results in a duplication, or in higher states of multiplication, of the material present in the chromosome. Gene duplication may be partial or virtually complete, and is considered to be responsible for the similarities in amino acid sequences among groups of proteins, such as the immunoglobulins, the hemoglobins, and the haptoglobins.

gene expression 1. The multistep process, and the regulation of this process, by which the product of a gene is synthesized; the flow of genetic information. 2. GENE ACTIVATION.

gene family MULTIGENE FAMILY.

gene frequency A measure of the proportion of an allele in a population; equal to the number of loci at which a particular allele is found divided by the total number of loci at which it could occur.

gene fusion See fused gene; fusion gene.

gene hypothesis The hypothesis that, in the development of life, nucleic acids were formed

first and proteins arose later; based in part on the attributes of life shown by nucleic acids in that they are able to replicate, code for protein, and undergo mutation.

gene insertion Any process for the introduction of a gene or genes from some source into a cell; such processes include recombinant DNA technology, cell fusion, transformation, conjugation, and transduction.

gene library A clone library which contains a large number of representative nucleotide sequences from all sections of the DNA of a given genome; a random collection of DNA fragments from a single organism, linked to vectors, and cloned in a suitable host. The DNA from the organism of interest is fragmented (enzymatically or mechanically), the fragments are linked to suitable vectors (plasmids or viruses), the modified vectors are introduced into host cells, and the latter are cloned. A gene library contains both transcribed DNA fragments (exons) as well as nontranscribed fragments (introns, spacer DNA). Retrieval of specific DNA sequences from a gene library frequently involves screening by means of a probe. *Aka* colony bank; DNA library. *See also* genomic library; probe.

gene linkage *See* linkage.

gene locus *See* locus.

gene machine Any one of a variety of manual, semiautomatic, or automatic instruments used for the synthesis of deoxyoligonucleotides. Recent advances, including solid-phase synthesis on silica-bound supports and stable deoxynucleoside phosphoramidites as synthons, permit the rapid synthesis of segments containing over 100 deoxynucleotides in good yield.

gene mapping 1. The assignment of a specific gene to a specific chromosome. 2. The determination of the sequence of specific genes, and their relative distances from each other, on a given chromosome.

gene pair The identical or nonidentical alleles of a specific gene at a given locus on homologous chromosomes in a diploid cell.

gene pool The sum total of all the genes in a population of sexually reproducing organisms.

gene product 1. The polypeptide chain translated from the mRNA molecule transcribed from the given gene. 2. The nontranslated RNA molecule (for example, rRNA) transcribed from the given gene.

gene 32 protein A phage T4 protein that was the first single strand binding protein to be discovered.

general acid-base catalysis The catalysis in solution in which the catalysts are various aci-

dic and/or basic species that serve as proton donors and/or proton acceptors. *See also* specific acid-base catalysis.

general adaptation syndrome The sequence of reactions that are initiated by an increased secretion from the adrenal cortex in response to a stress and that allows an animal to adapt to the stress. *Aka* GAS.

generalized anaphylaxis A severe, reagent-mediated, systemic reaction to an allergen that is characterized by itching, edema, wheezing respiration, rapid and weak pulse, and falling blood pressure; may result rapidly in shock and death.

generalized gangliosidosis A genetically inherited metabolic defect in humans that is characterized by mental retardation, skeletal deformities, an enlargement of the liver, and an accumulation of gangliosides; a sphingolipidosis that is due to a deficiency of the enzyme beta galactosidase which removes galactosyl groups from both gangliosides and keratin.

generalized transduction Bacterial transduction in which any of the genes of the donor bacterium may become transduced.

generally labeled Designating a compound that is randomly labeled at various positions in the molecule; usually refers to tritiated compounds. *Sym* G.

general recombination Genetic recombination in which the exchange of genetic material takes place between two homologous DNA sequences, most commonly between two copies of the same chromosome. *Aka* homologous recombination; legitimate recombination. *See also* site-specific recombination.

generation cycle CELL CYCLE.

generation time The time required by a cell for the completion of one cycle of growth. *Sym* T_g . *See also* doubling time.

generation-time hypothesis The hypothesis that protein and DNA evolution is faster in species having unusually short generation times (many generations per unit time) than in species with unusually long generation times (few generations per unit time).

gene redundancy GENE REITERATION.

gene reiteration The occurrence of multiple copies of the same gene on a given chromosome.

gene repetition *See* gene redundancy; gene reiteration; dosage repetition; variant repetition.

generic Of, or pertaining to, a genus.

genesis The origin or the coming into existence of anything; the formation or the production of anything.

gene splicing *See* recombinant DNA technology.

gene substitution The replacement of one allele by another allele of the same gene.

gene synthesis *See* gene machine.

gene therapy The introduction of a functional gene or genes from some source into a living cell to correct for a genetic disease. The genetic material may be introduced into the recipient cell by any of the processes of gene insertion.

genetic Of, or pertaining to, genetics.

genetic anticodon A tabular arrangement of tRNA anticodons that resembles that of mRNA codons in outlay. The array indicates that certain amino acid properties can be correlated with certain properties of the anticodons. This has been taken to support the notion that the genetic code evolved as a result of necessary chemical-physical relations between amino acids and nucleotides.

genetic block A metabolic block that results from a mutation.

genetic code The specification of a sequence of amino acids in a protein by a sequence of nucleotides in a nucleic acid; the set of codons that specify the amino acids and carry the information for protein synthesis.

genetic code dictionary The set of 64 codons, 61 of which code for amino acids commonly occurring in proteins, and 3 of which are termination codons.

genetic complementation *See* complementation.

genetic cross 1. The mating of two organisms that results in the formation of genetic recombinants. 2. The production of progeny containing genotype of two or more parents, as in the simultaneous infection of bacteria with several types of phages. 3. The progeny derived from two or more parents by mating or by other means.

genetic disease A hereditary disease that arises from an abnormality in the genetic makeup of an organism, as that caused by the presence of a mutant gene. *See also* inborn error of metabolism; genotrophic disease.

genetic drift The random change of gene frequency due to chance fluctuations, particularly that occurring in small populations.

genetic engineering The experimental or industrial approaches involving modification of the genome of a living cell that do not involve normal sexual or asexual transmission of genetic material; the manipulation of the genetic complement of a cell with the aim of altering the functions or the products of the cell. Thus, a cell may be designed that is capable of new functions or that is capable of synthesizing either new chemicals or more of existing chemicals. The design of microorganisms capable of degrading wastes or toxic substances or the design of microorganisms

capable of synthesizing hormones or new antibiotics, are examples. The term is often used synonymously with recombinant DNA technology. *See also* biotechnology; gene therapy.

genetic equilibrium The condition in which a given gene frequency remains constant throughout successive generations.

genetic expression The phenotypic aspect of a gene; the active function of a gene.

genetic fine structure The location of mutable sites on a chromosome as determined by fine-structure genetic mapping.

genetic induction GENE ACTIVATION.

genetic information The hereditary information contained in a sequence of nucleotides in either chromosomal DNA or chromosomal RNA.

genetic linkage *See* linkage.

genetic locus *See* locus.

genetic map The linear arrangement of mutable sites, or of genes, on a chromosome that is deduced from genetic recombination experiments.

genetic marker A mutable site on a chromosome that, when mutated, leads to gross and visible changes in the organism. *See also* biochemical marker.

genetic material The chromosomal nucleic acid, predominantly DNA but at times RNA, that carries the information for the synthesis of proteins and for the synthesis of other nucleic acids.

genetic recombination *See* recombination.

genetic reversion *See* reversion (1).

genetics The science that deals with heredity.

genetic system The genetic material of a given species; includes the genetic components, their organization, and the methods of transmission of genetic information.

genetotrophic disease A disease in which there are genetic insufficiencies that may be prevented, or at least ameliorated, by an increased supply of one or more nutrients. Some genetic diseases appear to be genetotrophic in origin and supply of the nutrient partially restores the impaired activity of the defective enzyme. Mental retardation is also believed to be, in part, genetotrophic in origin.

genetotrophic principle The principle that the nutritional requirements of an organism are determined by its genetic makeup.

gene transfection *See* transfection.

gene walking CHROMOSOME WALKING.

genic Of, or pertaining to, genes.

genin The aglycone portion of a saponin.

genome 1. A complete single set of the genetic material of a cell or of an organism; the complete set of genes in a gamete. 2. The single

DNA molecule of bacteria, phages, and most animal and plant viruses.

genomic blotting See Southern blotting.

genomic library A clone library, established much as a gene library, but containing varying amounts of the total DNA segments from a given genome. See also gene library.

genopathy GENETIC DISEASE.

genophore The genetic material (nucleic acid) in prokaryotes and viruses that is the equivalent of the chromosome in eukaryotes but lacks associated histones.

genotype 1. The genetic makeup of an organism; the totality of the genes of an organism. 2. A group of organisms that have an identical genetic makeup. See also phenotype.

genotypic Of, or pertaining to, genotype.

genotypic adaptation The preferential growth of a genotypically varied organism.

genotypic variation A rare mutation that involves only a few organisms in a population and that leads to a new genotype.

gentamicin An aminoglycoside antibiotic, produced by *Micromonospora*, that is similar to streptomycin in its mechanism of action. *Var sp* gentamicin.

gentiobiose A disaccharide of D-glucose in which the glucose molecules are linked by means of a $\beta(1 \rightarrow 6)$ glycosidic bond.

genus (*pl* genera) A taxonomic group that includes one or more closely related species.

geobiochemistry BIOGEOCHEMISTRY.

geometrical isomer One of two isomers that differ from each other in the configuration of the groups attached to two carbon atoms that are linked by a double bond; the groups may be on the same side (*cis*; *syn*) with respect to the plane of the double bond, or they may be on opposite sides (*trans*; *anti*).

geometric mean A special kind of "average"; for a set of n positive numbers, the geometric mean is equal to the n th root of their product. Thus, the geometric mean of 4, 6, and 9 is equal to $(4 \times 6 \times 9)^{1/3}$.

geotaxis A taxis in which the stimulus is gravity.

geotropism A tropism in which the stimulus is gravity.

geriatrics The branch of medicine that deals with the diseases, debilities, and problems of old age and aging people. See also gerontology.

GERL Golgi-endoplasmic reticulum lysosomes; a hydrolase-rich region of the endoplasmic reticulum, associated with the Golgi apparatus. Originally considered to be a region from which lysosomes arise; now believed to be the last Golgi compartment in which the sorting of all proteins into separate pathways (membrane proteins, secretory pro-

teins, lysosomal enzymes) takes place. *Aka* trans-Golgi network (TGN); trans-tubular network.

germ cell A reproductive cell; a cell that can be fertilized when it is mature and that can reproduce the organism; an ovum or a spermatozoon, or any of their antecedents. See also somatic cell.

germ-free animal An animal reared in a bacteria-free environment.

germicide GERMICIDAL AGENT.

germinal cell A cell that develops into a gamete upon meiosis; an oocyte or a spermatocyte.

germinal mutation A mutation in a germinal cell.

germination 1. The overall process, consisting of activation, initiation, and out-growth, whereby a spore is converted to a vegetative cell. 2. The second stage in the conversion of a spore to a vegetative cell that is characterized by the rehydration of the spore and by the loss of dipicolinic acid and glycopeptides. *Aka* initiation. 3. The beginning of growth of a seed or of a reproductive body after a period of dormancy.

germ layer See ectoderm, endoderm, mesoderm.

germ line The gametes and their antecedents.

germ-line theory A theory of the origin of the genes that code for the variable regions of antibody molecules and that allow for the great diversity of antibodies. According to this theory all cells, including lymphocytes, have the same set of genes as those in the germ cells from which the individual arose. All the genes for all the antibodies that an individual can make are, therefore, already present in the fertilized egg and are transmitted through the germ line.

germ plasm The genetic material in the germ cells; the sum total of the genes transmitted to the offspring through the germ cells.

gerontology The science that deals with the physical processes and phenomena of old age and aging people. See also geriatrics.

gerovital A buffered solution of procaine hydrochloride, better known as Novocain, a painkiller used by dentists. As the name indicates, the compound is being promoted as one that alleviates symptoms of aging and it has been designated by some as vitamin H₃ or vitamin GH₃. These claims have not been supported and gerovital is not recognized as a vitamin by United States and Canadian drug authorities.

gestagen PROGESTIN.

gestation Pregnancy.

gestin PROGESTIN.

GeV Giga (10^9) electron volts.

g factor See g value.

G factor 1. GUANOSINE TRIPHOSPHATASE. 2. TRANSLOCASE.

GFC Gel filtration chromatography.

GFR Glomerular filtration rate.

GGE Gradient gel electrophoresis.

GH Growth hormone.

GHIF See growth hormone regulatory hormone.

GHIH See growth hormone regulatory hormone.

ghost 1. An erythrocyte that has lost some or all of its cytoplasmic content; prepared by allowing the erythrocyte to swell in distilled water so that its permeability is increased and the cytoplasmic material leaks out. 2. A T-even phage that has lost some or all of its DNA; prepared by subjecting the phage to an osmotic shock and digesting the DNA of the ruptured phage with deoxyribonuclease. 3. A spheroplast that has lost essentially all of its intracellular material; prepared by growing gram-negative bacteria in the presence of penicillin or by digesting the cell wall of gram-negative bacteria with lysozyme.

ghost peak An unexpected peak that is present in a gas chromatogram and that is usually due to a contaminant.

GHRF See growth hormone regulatory hormone.

GHRH See growth hormone regulatory hormone.

GHRIF See growth hormone regulatory hormone.

GHIH See growth hormone regulatory hormone.

G_i See G protein.

giant chromosome POLYTENE CHROMOSOME.

giant messenger-like RNA HETEROGENEOUS NUCLEAR RNA.

giant RNA HETEROGENEOUS NUCLEAR RNA.

gibberellic acid The parent compound of the gibberellins.

gibberellin One of a group of widely occurring plant hormones that stimulate the growth of leaves and shoots; chemically, they are diterpenoid acids, derived from a tetracyclic skeleton.

gibberellin antagonist Any compound that functions by counteracting the effect of gibberellin; this includes competitive inhibitors (antigibberellins), growth retardants (such as chlorocholine chloride), and other plant hormones (such as abscisic acid).

Gibbs-Donnan equilibrium The unequal distribution of diffusible ions that is established at equilibrium on the two sides of a membrane if one side contains a nondiffusible ion.

The unequal distribution of the diffusible ions becomes more pronounced with an increase in the concentration and/or the charge of the nondiffusible ion; it becomes less pronounced with increasing concentrations of the diffusible ions added initially to that side of the membrane that does not contain the nondiffusible ion. *Aka* Gibbs-Donnan effect; Gibbs-Donnan membrane equilibrium.

Gibbs-Duhem equation An equation that relates the chemical potential of different components in a system. At constant temperature and pressure the equation can be written as $dG = \sum \mu_i dn_i + \sum n_i d\mu_i$, where G is the free energy, and μ_i and n_i are the chemical potential and the number of moles of component i . Since $dG = \sum \mu_i dn_i$, the equation simplifies to $\sum n_i d\mu_i = 0$.

Gibbs free energy See free energy.

Gibbs-Helmholtz equation An equation that describes the variation in free energy changes as a function of temperature at constant pressure (P). It can be formulated as $(\partial G/\partial T)_P = -\Delta S$ or as $[\partial(\Delta G/T)/\partial T]_P = -\Delta H/T^2$ where ΔG is the change in free energy, T is the absolute temperature, ΔH is the enthalpy change, and ΔS is the entropy change.

Gibbs phase rule PHASE RULE.

GIF See growth hormone regulatory hormone.

giga- Combining form meaning one billion (10^9) and used with metric units of measurement. *Sym* G.

gigantism ACROMEGALY.

GIH See growth hormone regulatory hormone.

Gilbert-Maxam method See Maxam-Gilbert method.

Gilbert's disease CRIGLER-NAJJAR SYNDROME.

GIP Gastric inhibitory peptide.

Girard's reagent One of a group of reagents used to extract ketosteroids from urine; reagent T is trimethylammonium acetyl hydrazide chloride, and reagent P is pyridinium acetyl hydrazide chloride.

G_k See G protein.

GK Glycerokinase.

gland A cell or an organ that produces specific substances that are secreted outside the cell or the organ, either directly or through ducts, and that are used in other parts of the body or are eliminated from the body.

glandular Of, or pertaining to, glands.

glass electrode An electrode that has a thin glass membrane incorporated into its design and that is sensitive to the hydrogen ion concentration of solutions; it is used for the measurement of pH.

Glc Glucose.

GLC Gas liquid chromatography.

GlcA Gluconic acid.

GlcN Glucosamine.

GlcNAc *N*-Acetylglucosamine.

GlcUA Glucuronic acid.

GLDH Glutamate dehydrogenase.

GLI Glucagon-like immunoreactivity.

gliadin A seed protein of wheat.

glial cell A cell of neural tissue that plays an important role in controlling the chemical environment of neurons.

Gln 1. Glutamine. 2. Glutaminyl.

globin The polypeptide chain that is associated with an iron-porphyrin group in both hemoglobin and myoglobin.

globinometer An instrument for measuring the amount of oxyhemoglobin in blood.

globin zinc insulin The zinc salt of a mixture of globin and insulin that is less soluble than insulin alone. *See also* NPH insulin.

globoid leukodystrophy KRABBE'S DISEASE.

globoprotein One of a group of cell surface glycoproteins that react with antibodies to globosides.

globo-series glycosphingolipids *See* glycosphingolipids.

globoside A ceramide oligoglycoside that contains two or more simple sugars, amino sugars, and *N*-acetyl amino sugars.

globular Spherical.

globular actin G-ACTIN.

globular protein A protein in which the polypeptide chain (or chains) is coiled in three dimensions to form a more or less globular molecule. The polypeptide chain is held together through intrachain bonds such as hydrogen bonds, hydrophobic bonds, electrostatic bonds, and disulfide bonds, and varying lengths of the polypeptide chain may be in helical configuration. Globular proteins have diverse functions and occur in the form of enzymes, storage proteins, transport proteins, and so on. *See also* fibrous protein.

globulin A globular and simple protein that is either insoluble or sparingly soluble in water, is soluble in dilute salt solutions, and is precipitated by ammonium sulfate at 50% saturation.

glomerular filtrate The filtrate, free of cells and colloidal particles, that is produced from blood by the glomeruli of the kidney.

glomerular filtration rate The rate at which the glomerular filtrate is produced; a measure of the efficiency of the kidney that is generally expressed in terms of the clearance of a substance, such as inulin, which is metabolically inert, freely filterable, and neither absorbed nor secreted by the kidney. *Abbr* GFR.

glomerulus (*pl* glomeruli). *See* nephron.

glove box A sealed box of glass or plastic that has two or more gloves fitted into its sides; allows for the safe manipulation of the contents of the box without breaking the atmos-

pheric seal. *Aka* glove bag.

Glu 1. Glutamic acid. 2. Glutamyl.

GluA Glucuronic acid.

glucagon A polypeptide hormone that antagonizes the action of insulin and leads to an increase in the level of blood sugar by stimulating glycogenolysis; it is secreted by the islets of Langerhans in the pancreas.

glucagon-like immunoreactivity ENTEROGLUCAGON.

glucalogue A monosaccharide analogue of glucose, such as deoxyglucose, methylglucose, or galactose.

glucan A homopolysaccharide composed of glucose units.

glucocerebroside A glucose-containing cerebroside.

glucocorticoid A 21-carbon steroid hormone that is secreted by the adrenal cortex and that acts primarily on carbohydrate, lipid, and protein metabolism. Glucocorticoids include corticosterone, cortisone, and cortisol, and lead to protein catabolism, gluconeogenesis from the amino acids thus formed, lipid mobilization, and an increase in ketone bodies. In addition, glucocorticoids also have antiallergic and anti-inflammatory effects.

glucocorticoid receptors A group of cytosolic receptors that mediate the action of glucocorticoids.

glucocorticosteroid GLUCOCORTICOID.

glucogenesis The synthesis of glucose from precursors other than glycogen.

glucogenic Of, or pertaining to, glucogenesis.

glucokinase An enzyme that catalyzes the phosphorylation of glucose to glucose-6-phosphate. It has different molecular and kinetic properties than hexokinase and is found almost exclusively in the liver. *See also* hexokinase.

glucolipid A glucose-containing lipid.

glucomannan A heteropolysaccharide composed of glucose and mannose residues.

glucone The glucose moiety of a glucoside.

gluconeogenesis The synthesis of glucose from noncarbohydrate precursors such as amino acids, intermediates of glycolysis, or intermediates of the citric acid cycle.

gluconeogenic Of, or pertaining to, gluconeogenesis.

glucoplastic amino acid An amino acid whose degradation products can contribute to gluconeogenesis.

glucopyranose Glucose that has a six-membered ring structure resembling that of the compound pyran.

glucosamine An amino sugar of glucose that is a component of chitin and occurs in vertebrate tissues. *Abbr* GlcN.

glucosaminoglycan *See* proteoglycan.

glucose The six-carbon aldose that is the major sugar in the blood and a key intermediate in metabolism. *Abbr* Glc; G.

glucose-alanine cycle A cyclic set of reactions whereby glucose is converted to alanine in muscle and alanine is reconverted to glucose in the liver. The reactions are connected via the blood which transports alanine from muscle to liver and glucose from liver to muscle. The cycle serves two functions: (a) transport of amino groups from amino acids in muscle to the liver where they can be converted to urea; (b) supply of muscle with glucose derived from amino acids catabolized in the liver.

glucose effect CATABOLITE REPRESSION.

glucose electrode One of a number of membrane probes that permit the determination of glucose by means of enzymes incorporated into the electrode.

glucose-6-phosphatase The enzyme that catalyzes the hydrolysis of glucose-6-phosphate to glucose and inorganic phosphate and that is responsible for maintaining the glucose level in the blood. The enzyme is found only in the liver, the kidneys, and the intestine, and acts as a member of a multienzyme system which includes glucose-6-phosphotranslocase (T_1), an inorganic phosphate translocase (T_2), and a glucose translocase (T_3).

glucose-6-phosphate dehydrogenase The pyridine-linked dehydrogenase that catalyzes the first reaction of the hexose monophosphate shunt whereby glucose-6-phosphate is oxidized to 6-phosphogluconate- δ -lactone. *Abbr* G6PDH; G6PD.

glucose-6-phosphate dehydrogenase deficiency A genetically inherited metabolic defect in humans that is due to a deficiency of the enzyme glucose-6-phosphate dehydrogenase. Afflicted individuals show primaquine sensitivity, develop Favism upon eating broad beans, and appear to be protected from malaria transmitted by *Plasmodium falciparum*.

glucose-regulated protein One of a number of proteins in animal cells whose synthesis is regulated by the glucose concentration in the culture medium. *Abbr* GRP.

glucose repression CATABOLITE REPRESSION.

glucose tolerance factor A low molecular weight (500 daltons), water soluble, organic complex of chromium that is required by humans and animals for normal glucose tolerance. *Abbr* GTF.

glucose tolerance test A measure of the rate at which glucose is metabolized; used as a screening test for diabetes. A dose of glucose is administered to a fasting individual and the

blood glucose concentration is then determined as a function of time. In normal individuals, the glucose concentration rises to a maximum within about 30 min and drops back to the initial level within about 2 h. In diabetic individuals, the glucose concentration rises to a higher value and does not drop back as rapidly as is the case for normal individuals.

β -glucosidase See amygdalin.

glucoside A glycoside of glucose.

glucosphingolipid GLUCOCEREBROSIDE.

Glucostat Trade name for a glucose oxidase reagent.

glucosuria The presence of excessive amounts of glucose in the urine.

glucosylation The introduction of a glucose residue into an organic compound.

glucosylceramide lipidosis GAUCHER'S DISEASE.

glucosyl group A glucose residue that is linked to another group or molecule by means of a glycosidic bond.

glucuronate pathway A metabolic pathway for the conversion of glucose to xylulose-5-phosphate that is operative in higher plants, mammals, crustaceans, and yeast; it is apparently not a major pathway for the oxidation of glucose. The pathway serves to provide vitamin C in plants and in those animals capable of synthesizing this vitamin and ties in with the pentose phosphate pathway. A specific block in the glucuronate pathways leads to the human disease idiopathic pentosuria. *Aka* glucuronic acid oxidation pathway; glucuronate-gulonate pathway; glucuronate-xylulose cycle.

glucuronic acid A sugar acid of glucose. *Abbr* GluA; GicUA.

glucuronic acid oxidation pathway GLUCURONATE PATHWAY.

β -glucuronidase See laetrile.

glucuronide A compound formed by linking glucuronic acid to another compound by means of a glycosidic bond; many toxic compounds are detoxified by being converted to a glucuronide and are then excreted in this form.

glumitocin A peptide hormone, secreted by the posterior lobe of the pituitary gland, that is related in structure and function to oxytocin and occurs in some fish.

GluNH₂ 1. Glutamine. 2. Glutamyl.

Glusulase Trademark for an enzyme preparation, obtained from the intestinal juice of snails (*Helix pomatia*), that contains a mixture of β -glucuronidase and sulfatase.

glutamate dehydrogenase An enzyme that catalyzes the addition of NH₃ to α -ketoglutarate to form glutamate in ammonia fixation and catalyzes the removal of NH₃

from glutamate to form α -ketoglutarate in amino acid deamination. *Abbr* GDH.

glutamic acid An aliphatic, acidic, and polar alpha amino acid. *Abbr* Glu; E; GA.

glutamic semialdehyde A derivative of glutamic acid in which only one of the two carboxyl groups has been converted to an aldehyde group.

glutamine An aliphatic, polar alpha amino acid; the amide of glutamic acid. *Abbr* Gln; GluNH₂; Q.

glutamine antagonists Analogues of glutamine that serve as competitive inhibitors in enzyme reactions involving glutamine.

γ -glutamyl cycle A cyclic set of reactions, present in some tissues, that serves to transport amino acids across the cell membrane; uses reactions of glutathione metabolism and a membrane-localized enzyme, γ -glutamyl transpeptidase (γ -glutamyl transferase). *Aka* Meister cycle.

glutaredoxin A heat-stable protein that acts in conjunction with glutathione in the formation of deoxyribonucleotides from ribonucleotides.

glutaric acid A five-carbon dicarboxylic acid that is structurally similar to succinic acid and that is a competitive inhibitor of succinate dehydrogenase; it is an intermediate in lysine metabolism.

glutaric aciduria One of two genetically inherited metabolic defects in humans that are characterized by a large excretion of glutaric acid. Type I involves progressive neurological degeneration and is due to a deficiency of the enzyme glutaryl-CoA dehydrogenase. Type II involves hypoglycemia and fatal neonatal acidosis; its enzyme deficiency is not known.

glutarimide antibiotics A group of antibiotics that includes cycloheximide, streptimidone, and streptovitacin.

glutathione A widely distributed tripeptide, γ -glutamyl-cysteinyl-glycine, that serves as a coenzyme for some enzymes and is also thought to function as an antioxidant in protecting the sulfhydryl groups of enzymes and other proteins. Reduced glutathione is synonymous with glutathione and is abbreviated GSH; oxidized glutathione is a dimer of two glutathione molecules, linked by means of a disulfide bond, and is abbreviated GSSG.

glutathione-S-transferase *See* mercapturic acids.

glutelin A simple, globular protein of plant origin that is insoluble in water, alcohol, or salt solutions, but is soluble in dilute solutions of acids or bases.

gluten The principal protein of wheat; the properties of gluten permit the formation of leavened bread.

Glx The sum of glutamic acid and glutamine

when the amide content is either unknown or unspecified.

Gly 1. Glycine. 2. Glycyl.

glycan POLYSACCHARIDE.

glycaric acid An acid formed by the oxidation of both the terminal —CHO group and the terminal —CH₂OH group of an aldose to —COOH groups.

glycation The nonenzymatic glycosylation of proteins; the reaction of glucose with the alpha and epsilon amino groups of proteins.

glycemia The presence of glucose in the blood.

glyceraldehyde A three-carbon aldose, a phosphorylated derivative of which is an intermediate in glycolysis; serves as a reference compound for the assignment of D and L configurations to amino acids, carbohydrates, and related compounds.

glycerate pathway An anaplerotic reaction sequence whereby glyoxylate is converted to 3-phosphoglyceric acid.

glyceride ACYLGLYCEROL.

glycerin GLYCEROL.

glycerol A three-carbon trihydroxy alcohol that occurs in many lipids; phosphorylated derivatives of glycerol are intermediates in glycolysis.

glycerol fermentation The formation of small amounts of glycerol during alcoholic fermentation.

glycerolipid A lipid derived from glycerol.

glycerol phosphate shuttle A shuttle involving glycerol-3-phosphate, dihydroxyacetone phosphate, and glycerol phosphate dehydrogenase. The shuttle achieves the oxidation of cytoplasmic NADH to NAD⁺ at the expense of the reduction of mitochondrial FAD to FADH₂. As a result, for every NADH formed in the cytoplasm, and then oxidized, 2 ATPs are formed inside the mitochondria as FADH₂ feeds into the electron transport system.

glycerol phosphatide PHOSPHOGLYCERIDE.

glycerone The ketone derived from glycerol; dihydroxyacetone.

glycerophospholipid Any derivative of glycerophosphoric acid that contains at least one *O*-acyl, *O*-alkyl, or *O*-alkenyl group attached to the glycerol residue. The common glycerophospholipids are named as derivatives of phosphatidic acid (phosphatidyl choline, phosphatidyl serine, and phosphatidyl ethanolamine). *Aka* phosphatidate.

glycerophosphoric acid PHOSPHOGLYCERIC ACID.

glycine The simplest alpha amino acid (NH₂CH₂COOH); it can be classified as an aliphatic and polar amino acid. *Abbr* Gly; G. *Aka* aminoacetic acid; glycolli.

glycine-allantoin cycle A cyclic set of reactions that leads to the synthesis of urea and that

occurs in the lung fish and in some urea-accumulating plants; involves glycine for purine biosynthesis, formation of allantoin from purine degradation, and conversion of allantoin to glycine.

glycine cleavage enzyme A multienzyme system that catalyzes the conversion of glycine and tetrahydrofolic acid to N^5,N^{10} -methylene tetrahydrofolic acid and CO_2 . A deficiency of this enzyme system leads to nonketotic hyperglycinemia.

glycine-succinate cycle SHEMIN CYCLE.

glycinin The major protein component of soybeans.

glycitol ALDITOL.

glyco- Combining form meaning carbohydrate.

glycoaldehyde group GLYCOLALDEHYDE GROUP.

glycoalkaloids See saponin; steroid alkaloids.

glycoalyx CELL COAT.

glycocholic acid The compound formed by the conjugation of cholic acid and glycine; one of the bile salts.

glycocoll GLYCINE.

glycoconjugates Collective term for glycolipids and glycoproteins; refers to these lipids and proteins together with their oligosaccharide components.

glycocyanine GUANIDINOACETIC ACID.

glycogen A highly branched homopolysaccharide of D-glucose units that is the major form of storage carbohydrate in animals; the glucose units are linked by means of $\alpha(1 \rightarrow 4)$ and $\alpha(1 \rightarrow 6)$ glycosidic bonds.

glycogenesis The synthesis of glycogen; the anabolism of glycogen.

glycogen granule A cytoplasmic storage particle of glycogen that also contains proteins and enzymes that function in the synthesis and breakdown of glycogen.

glycogenic Of, or pertaining to, glycogenesis.

glycogenic amino acid An amino acid that can serve as a precursor of pyruvic acid, glucose, and glycogen in metabolism.

glycogenolysis The breakdown of glycogen; the catabolism of glycogen.

glycogenosis (*pl* glycogenoses) GLYCOGEN STORAGE DISEASE.

glycogen phosphorylase The enzyme that catalyzes the successive hydrolytic removal of glucose residues, in the form of glucose-1-phosphate, from the nonreducing end of glycogen; this reaction is the first step for the utilization of glycogen in glycolysis. See also phosphorylase.

glycogen storage disease One of a group of genetically inherited metabolic defects in humans that are characterized by an abnormal accumulation of liver and tissue glycogen and that are due to deficiencies of enzymes which

function in glycogen metabolism. The enzymatic deficiencies and the synonymous names of the eight known types of glycogen storage diseases are as follows: type I, glucose-6-phosphatase, von Gierke's disease; type II, α -1,4-glucosidase, Pompe's disease; type III, amylo-1,6-glucosidase, Cori's disease, limit dextrinosis; type IV, amylo (1,4 \rightarrow 1,6) transglucosylase, Andersen's disease, amylopectinosis; type V, muscle glycogen phosphorylase, McArdle's disease; type VI, liver glycogen phosphorylase, Hers' disease; type VII, muscle phosphofructokinase; type VIII, liver phosphorylase kinase.

glycogen synthase The enzyme that catalyzes the synthesis of the straight chains of glycogen from UDP-glucose. Two forms of glycogen synthase exist, a dependent form, denoted D, and an independent form, denoted I. See also dependent form; independent form.

glycoglycerolipid A glycolipid containing one or more glycerol residues.

glycol A 1,2-diol such as ethylene glycol, $\text{HOCH}_2\text{—CH}_2\text{OH}$.

glycolaldehyde group The grouping $\text{CH}_2\text{OH—CO—}$.

glycolic acid cycle A cyclic set of reactions whereby glyoxylate (CHO—COO^-) is converted to glycolate ($\text{CH}_2\text{OH—COO}^-$) which is then reoxidized to glyoxylate.

glycolipid Any compound containing one or more monosaccharide residues linked via a glycosidic bond to a lipid component such as an acylglycerol, a sphingoid, or a ceramide.

glycoloyl group GLYCOLALDEHYDE GROUP.

glycolyl group GLYCOLALDEHYDE GROUP.

glycolysis 1. The anaerobic degradation of carbohydrates whereby a molecule of glucose is converted by a series of steps to two molecules of lactic acid. The overall reaction sequence yields a limited amount of ATP and is commonly divided into two stages. Stage I refers to the ATP-requiring reactions whereby glucose is converted to glyceraldehyde-3-phosphate; stage II refers to the ATP-yielding reactions whereby glyceraldehyde-3-phosphate is converted to lactic acid. *Aka* anaerobic glycolysis. 2. The sequence of reactions from glucose to pyruvic acid that is common to carbohydrate catabolism under both aerobic and anaerobic conditions. *Aka* aerobic glycolysis.

glycolytic Of, or pertaining to, glycolysis.

glycolytic flux The rate of glycolysis particularly in reference to the energy requirements of the cell or the organism. Thus, if an organism requires energy and can obtain it only from glucose, the resultant glycolytic flux would be high.

glycolytic pathway GLYCOLYSIS.

glycone The carbohydrate portion of a glycoside.

glyconeogenesis The synthesis of glycogen from noncarbohydrate precursors, such as fat or protein.

glyconic acid An acid formed by the oxidation of the terminal —CHO group of an aldose to a —COOH group.

glycopeptide A peptide that is linked covalently to a carbohydrate, as that which is polymerized to form the peptidoglycan of bacterial cell walls.

glycophorin A major sialoglycoprotein in the red blood cell membrane; it contains sialic acid, carbohydrate (60%), and protein (40%). Glycophorin is an integral membrane protein that spans the entire width of the membrane. The probable structure of glycophorin is that of a single polypeptide chain to which are attached short carbohydrate chains. The latter represent a large proportion of the total mass of the molecule and protrude on the extracellular side of the membrane. *Aka* PAS-1.

glycophosphoglyceride A compound composed of phosphatidic acid, the phosphate group of which is linked to a sugar.

glycophosphosphingolipid A phosphosphingolipid that is a derivative of a ceramide and that contains both sugars and phosphate esters.

glycoprotein A conjugated protein in which the nonprotein portion is a carbohydrate that is linked covalently to the protein. The attached carbohydrate is either a monosaccharide or a relatively short oligosaccharide. Frequently, the amount of carbohydrate per molecule is small (about 4%). Some glycoproteins contain only one or a few carbohydrate groups; others have numerous oligosaccharide side chains which may be linear or branched. Glycoproteins are generally either secreted into body fluids or are membrane proteins; that is, they have an extracellular location and function. Glycoproteins include enzymes, hormones, carriers, lectins, membrane proteins, antibodies, and so on. *See also* proteoglycan.

glycosaminoglycan The carbohydrate moiety of proteoglycans; consists of repeating disaccharide units in which either D-glucosamine or D-galactosamine is always present. Glycosaminoglycans generally contain uronic acid and sulfate groups, linked via ester or amide bonds. Six distinct classes are recognized: hyaluronic acid, chondroitin sulfate, dermatan sulfate, keratan sulfate, heparin, and heparan sulfate.

glycosidase CARBOHYDRASE.

glycoside A mixed acetal (or ketal) derived from the cyclic hemiacetal (or hemiketal)

form of an aldose (or a ketose); a compound formed by replacing the hydrogen of the hydroxyl group of the anomeric carbon of the carbohydrate with an alkyl or an aryl radical.

glycosidic bond The bond between the anomeric carbon of a carbohydrate and some other group or molecule; the C—O bond in disaccharides and the C—N bond in nucleosides are two examples. *Aka* glycosidic link.

glycosome A proposed compartment that contains the enzymes of glycolysis; such an organelle, containing all of the glycolytic enzymes, has been observed in trypanosomes.

glycosphingolipid Any compound containing a sphingoid and one or more monosaccharide units; glycosylsphingoids and glycosylceramides are examples. Most polyglycosyl ceramides have one of the following core structures: (a) ganglio series, ceramide-glucose-galactose-N-acetylglucosamine-galactose; (b) globo series, ceramide-glucose-galactose-galactose-N-acetylglucosamine; (c) lacto series, ceramide-glucose-galactose-N-acetylglucosamine-galactose. *See also* glycosyl ceramide.

glycosuria The presence of excessive amounts of glucose and/or other reducing sugars in the urine. When the particular carbohydrate has been identified, more specific terms (glucosuria, fructosuria, etc.) are used to describe the condition.

glycosylase *See* DNA glycosylase.

glycosylation The covalent attachment of carbohydrates to a molecule. Used particularly for the attachment of carbohydrates to secretory proteins (forming glycoproteins) which occurs in the lumen of the rough endoplasmic reticulum and which is believed to play a role in guiding secretory proteins to their particular cellular destinations. Glycosylated proteins are of two types. Some contain N-linked oligosaccharides (oligosaccharides linked to the amide group of asparagine); others contain O-linked oligosaccharides (oligosaccharides linked to the hydroxyl group of serine, threonine, or hydroxylysine). The oligosaccharide is transferred to the protein via a carrier, dolichol phosphate. *See also* undecaprenol; signal hypothesis.

glycosyl ceramide A carbohydrate-containing derivative of a ceramide. Monoglycosyl ceramides contain one carbohydrate group per molecule and include cerebrosides and sulfatides; oligoglycosyl ceramides contain 2 to 10 carbohydrate groups per molecule and include cytosides, globosides, and gangliosides; polyglycosyl ceramides contain more than 10 carbohydrate groups per molecule. Mono-, oligo-,

and polyglycosyl ceramides are also known either as ceramide mono-, ceramide oligo-, and ceramide polyglycosides, or as ceramide mono-, ceramide oligo-, and ceramide poly-saccharides. *See also* glycosphingolipid.

glycosyl glyceride A glycerolipid that is a glycoside of a diacylglycerol.

glycosyl group A sugar residue that is linked to another group or molecule by means of a glycosidic bond.

glycosyllipid GLYCOLIPID.

glycosyltransferase One of a group of enzymes that catalyze the transfer of a glycosyl group (a mono- or oligosaccharide) from a glycosyl-nucleotide to some acceptor (a carbohydrate, peptide, or lipid) having a suitable OH group. *See also* one enzyme-one linkage hypothesis.

glucuronic acid An acid formed by the oxidation of the terminal $-\text{CH}_2\text{OH}$ group of an aldose to a $-\text{COOH}$ group.

glycyrrhizic acid A sweet compound in licorice roots that has mineralocorticoid activity. Its aglycone is a pentacyclic triterpene called glycyrrhetic acid (glycyrrhetin). *Aka* glycyrrhizic acid.

glyoxalase The enzyme that catalyzes the conversion of methyl glyoxal to lactic acid.

glyoxalate The ionized form of glyoxal (glyoxalic acid; glyoxylic acid); the compound $\text{O}=\text{CH}-\text{COO}^-$. *Var sp* glyoxylate.

glyoxisome PEROXISOME.

glyoxylate Variant spelling of glyoxalate.

glyoxylate bypass A set of two enzymatic reactions whereby isocitric acid is converted to malic acid; the operation of these reactions results in a modified citric acid cycle, known as the glyoxylate cycle.

glyoxylate cycle A modified citric acid cycle in which the reaction sequence between isocitric acid and malic acid is altered and acetate is used both as a source of energy and as a source of intermediates. The cycle occurs in some plants and in some microorganisms, and requires the input of two molecules of acetyl coenzyme A; it leads to the synthesis of a molecule of succinic acid which is used for the synthesis of carbohydrates and other cell components. *Aka* glyoxylate shunt; dicarboxylic acid cycle.

glyoxylic acid reaction HOPKINS-COLE REACTION.

glyoxysome A cytoplasmic organelle of plants that contains the enzymes of the glyoxylate cycle.

gm Gram; the preferred abbreviation is g.

G-M counter Geiger-Mueller counter.

Gm group A group of allotypic antigenic sites on the gamma chain of human IgG immunoglobulins.

GMP 1. Guanosine monophosphate (guanylic acid). 2. Guanosine-5'-monophosphate (5'-

guanylic acid).

G myeloma protein An abnormal IgG immunoglobulin that is produced by individuals suffering from multiple myeloma.

gnotobiosis The rearing of gnotobiotic animals.

gnotobiota The known microfauna and microflora of a gnotobiotic animal.

gnotobiotic animal 1. GERM-FREE ANIMAL. 2. A germ-free animal that has purposely been infected with one or more known bacterial species.

GnRF Gonadotropin releasing factor; *See* luteinizing hormone releasing hormone.

goiter An abnormal enlargement of the thyroid gland.

goitrogen A goitrogenic compound; an anti-thyroid compound; a compound that inhibits the formation of thyroxine and triiodothyronine.

goitrogenic Causing goiter.

goitrogenic glycoside A plant toxin that is a glycoside and that causes hyperthyroidism.

Goldberg-Hogness box TATA BOX.

Goldman equation An equation for calculating the potential of a membrane that is permeable to several ionic species; based on the ionic concentrations on both sides of the membrane and on the permeability coefficients of the ions.

Golgi apparatus A cytoplasmic organelle, composed of cisternae and vesicles, that functions in the collection and in the subsequent secretion of substances synthesized by the cell; an example of such substances are the proteins that are synthesized by the ribosomes attached to the endoplasmic reticulum. *Aka* Golgi body; Golgi complex; Golgi material.

Golgi-endoplasmic reticulum lysosomes *See* GERL.

Golgi stack A set of flattened, disk-shaped cisternae of the Golgi apparatus that form a structure resembling a stack of plates. *Aka* dictyosome.

gonad A sex gland; an ovary or a testis.

gonadal hormones SEX HORMONES.

gonadoliberin GONADOTROPIN RELEASING HORMONE.

gonadotrophic hormone Variant spelling of gonadotropic hormone.

gonadotropic hormone GONADOTROPIN.

gonadotropin A hormone that stimulates the gonads; gonadotropins are secreted by the anterior lobe of the pituitary gland, the placenta, and the endometrium. Gonadotropins include follicle-stimulating hormone (FSH), luteinizing hormone (LH), human menopausal gonadotropin (HMG), prolactin (PRL), and human chorionic gonadotropin (HCG). *Var sp* gonadotrophin.

gonadotropin releasing hormone LUTEINIZING

HORMONE RELEASING HORMONE.

gonane The parent hydrocarbon skeleton of the steroids; the tetracyclic ring system without the angular methyl groups and the aliphatic side chain.

gonosome A motile germ cell of animal origin; a spermatozoon.

goodness of fit The agreement between an observed set of values and a second set, derived wholly or partly on the basis of theoretical or hypothetical considerations.

Good's buffers A group of buffers, proposed by N. E. Good, that are especially suited for research involving biochemical systems in the physiological pH range. *See also* biological buffers.

gossypol An aromatic triterpene found in cotton seed (*Gossypium hirsutum*).

GOT Glutamate-oxaloacetate transaminase. *Aka* aspartate transaminase.

gougerotin A pyrimidine antibiotic, produced by *Streptomyces gougeroti*, that inhibits protein synthesis in both prokaryotic and eukaryotic systems.

gout A metabolic disease that is characterized by an increase in the concentration of uric acid in the serum and by its precipitation as sodium urate in various tissues of the body; a form of acute arthritis. One type of gout is a genetically inherited metabolic defect due to a deficiency of the enzyme hypoxanthine-guanine phosphoribosyl transferase.

Gouy interferometer An interferometer in which constructive and destructive interference of light that has passed through a horizontal slit results in a series of horizontal light and dark fringes that are progressively compressed in one direction.

GP Glycerophosphate. *Aka* glycerol-1-phosphate; α -glycerophosphate.

G-1-P Glucose-1-phosphate.

G-3-P Glyceraldehyde-3-phosphate.

G-6-P Glucose-6-phosphate.

GPC Gel permeation chromatography.

G6PD Glucose-6-phosphate dehydrogenase.

GPDH Glyceraldehyde phosphate dehydrogenase.

G6PDH Glucose-6-phosphate dehydrogenase.

G protein One of a number of guanosine triphosphate (GTP)-binding, regulatory proteins that serve as membrane bound transducers of chemically and physically coded information; they are intermediaries in transmembrane signaling pathways that consist of three proteins: receptor, G protein, and effector. The G protein becomes activated upon binding GTP. The latter is subsequently slowly hydrolyzed to GDP. When the hydrolysis is complete, the regulatory effect of the G protein is terminated and it is then available for

reactivation by binding GTP. A G protein has been isolated from human red blood cells (designated G_k); it functions in the activation of K^+ channels in heart cells. Another G protein (called transducin) is a peripheral membrane protein, occurring in retinal rods, and plays a part in the biochemistry of vision. Other G proteins include G_s and G_i , which regulate adenyl cyclase, and G_0 , a G protein of unknown function. *See also* amplifier enzyme.

GPT Glutamate-pyruvate transaminase.

gradient The change in the value of a property per unit distance in a specified direction.

gradient-coupled active transport SECONDARY ACTIVE TRANSPORT.

gradient curve The plot of refractive index gradient, which is proportional to the concentration gradient, versus distance; obtained with the schlieren optical system.

gradient elution A column chromatographic technique in which the composition of the eluent is changed continuously, usually with respect to ionic strength and/or pH.

gradient-flow method A method for studying the kinetics of enzymatic reactions by means of a flow system and a gradient, such as a linear substrate gradient.

gradient gel electrophoresis An electrophoretic technique in which the particles move across a concentration gradient by passing through a gel of progressively decreasing pore size. *Abbr* GGE.

gradient layer A layer, the composition of which forms a gradient; used in thin-layer chromatography and thin-layer electrophoresis.

gradient mixer A device for preparing density gradients.

gradient plate technique A technique for isolating antibiotic resistant mutants by plating the culture on a petri dish containing a solid medium with a gradient of antibiotic concentration. The petri dish is prepared by first pouring agar into it, with one edge of the plate being elevated. After hardening, the dish is leveled and a second quantity of agar, containing the antibiotic, is poured into it.

gradient sievortive chromatography Any sievortive chromatographic technique in which there is a gradient of small molecules across the chromatographic support.

graduated Divided into equal units by means of lines, such as the scale of a thermometer.

Graff leukemia virus A mouse leukemia virus that belongs to the group of leukoviruses.

graft TRANSPLANT.

graft copolymer A synthetically produced copolymer in which homopolymer branches of one monomer unit (for example, vinyl polym-

greenhouse effect The environmental phenomenon in which an increase in the concentration of atmospheric gases (such as CO₂ and methane) could lead to a decrease of radiative heat loss and to a rise in the earth's temperature resulting, possibly, in the melting of the polar ice caps.

Greenstein hypothesis A hypothesis of cancer according to which tumors are characterized by a general convergence of enzyme patterns which leads to a biochemical uniformity of tumor tissues.

GRF 1. Growth hormone releasing factor. *See* growth hormone regulatory hormone. 2. Growth factor for guinea pigs.

GRH *See* growth hormone regulatory hormone.

grid 1. A two-dimensional network of uniformly spaced horizontal and vertical lines. 2. A screen for mounting specimens in electron microscopy.

GRIF *See* growth hormone regulatory hormone.

GRIH *See* growth hormone regulatory hormone.

grisein An iron-containing antibiotic, produced by *Streptomyces griseus*; a cyclic polypeptide that contains cytosine and that is active against gram-negative bacteria.

griseofulvin A polyketide antibiotic, produced by a number of *Penicillium* species, that is used as a fungicide.

groove *See* major groove; minor groove.

Gross leukemia virus A mouse leukemia virus that belongs to the group of leukoviruses.

Grotthus-Draper law FIRST LAW OF PHOTOCHEMISTRY.

ground state The normal, unexcited, lowest-energy level of a nucleus, an atom, or a molecule.

ground substance The gel-like and mucopolysaccharide-containing matrix of connective tissue.

group activation The transfer of a high-energy group (such as a pyrophosphate moiety) from one compound to another.

group frequency band An infrared absorption band that is characteristic of a particular chemical group in a molecule, such as the C=O, C=C, C—H, or C=N group. *See also* skeletal band.

group specificity The selectivity of an enzyme that allows it to catalyze a reaction with a group of related substrates.

group transfer agent COENZYME.

group transfer potential The free energy change for the hydrolysis reaction in which a given group of atoms is removed from a compound.

group transfer reaction A reaction, other than

an oxidation-reduction reaction, in which a functional group is transferred from one molecule to another.

group translocation The active transport of a solute across a membrane that is coupled to a chemical modification of the solute. The transport of monosaccharides by the bacterial phosphotransferase system is an example; here the monosaccharides are phosphorylated and transported as such.

growing point REPLICATING FORK.

growth curve A plot of either the number of cells or the cell mass of a growing culture as a function of time.

growth factor 1. Any factor, such as a mineral, a vitamin, or a hormone, that promotes the growth of an organism. 2. A specific substance that must be present in a growth medium to permit cell multiplication. 3. A substance that has hormone-like properties and acts as a mitogen, stimulating cell division and multiplication. Some growth factors act on a variety of cells, others act on a single cell type only. *See also* specific compounds.

growth hormone The protein hormone that is secreted by the anterior lobe of the pituitary gland, stimulates body growth, and affects many aspects of metabolism. *Abbr* GH.

growth hormone regulatory hormone One of two hypothalamic hormones (or factors) that, respectively, stimulate or inhibit the release of growth hormone from the pituitary gland. The growth hormone releasing hormone (or factor) is abbreviated variously as GRH (GRF), GHRH (GHRF), or SRH, SHRH (SRF) where S stands for somatotropin. The growth hormone release-inhibiting hormone (or factor) is abbreviated variously as GIH (GIF), GHIH (GHIF), GRIH (GRIF), GHRIH (GHRIF), SIH (SIF), or SRIH, SHRIH (SRIF).

growth hormone release-inhibiting hormone *See* growth hormone regulatory hormone.

growth hormone releasing hormone *See* growth hormone regulatory hormone.

growth medium *See* medium.

growth rate constant The relative increase in either the number of cells or the cell mass per unit time; specifically, $dN/dt = \alpha N$, where α is the growth rate constant, and dN is the increase in the number of cells or the cell mass in the time dt .

growth retardant A synthetic compound that inhibits the growth of plants.

growth substance AUXIN.

growth vitamin VITAMIN A.

GRP Glucose-regulated protein.

G₂ *See* G protein.

GSC Gas-solid chromatography.

GSH Glutathione.

GSSG Oxidized glutathione; *see* glutathione.

GTF Glucose tolerance factor.

GTP 1. Guanosine triphosphate. 2. Guanosine-5'-triphosphate.

GTPase Guanosine triphosphatase.

GTP-binding protein G PROTEIN.

Gua Guanine.

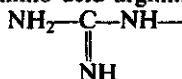
GU-AG rule The observation that the base sequence of an intron begins with GU and ends with AG; GU represents the 5'-end of the donor junction and AG represents the 3'-end of the acceptor junction.

guanidinium group GUANIDO GROUP.

guanidino acetic acid An intermediate in the biosynthesis of creatine that is formed by transfer of the guanido group from arginine to glycine.

guanidino group GUANIDO GROUP.

guanido group The basic grouping that is present in the amino acid arginine:



guanine The purine, 2-amino-6-oxypurine, that occurs in both RNA and DNA. *Abbr* G; Gua.

guanine-nucleotide-binding protein G PROTEIN.

guanosine The ribonucleoside of guanine. Guanosine mono-, di-, and triphosphate are abbreviated, respectively, as GMP, GDP, and GTP. The abbreviations refer to the 5'-nucleoside phosphates unless otherwise indicated. *Abbr* Guo; G.

guanosine-3', 5'-cyclic monophosphate A cyclic nucleotide, commonly called cyclic GMP, that is formed from GTP in a reaction catalyzed by the enzyme guanylate cyclase. Cyclic GMP is present intracellularly at very low concentrations and is believed to function as an antagonist of cyclic AMP in systems composed of opposing reactions that are controlled in both directions, such as muscle contraction-muscle relaxation, and glycogen synthesis-glycogen breakdown. *Abbr* cGMP, *Aka* cyclic guanylic acid.

guanosine polyphosphates MAGIC SPOTS.

guanosine triphosphatase The enzyme that catalyzes the hydrolysis of GTP, as in the process of peptide bond formation during protein synthesis. *Abbr* GTPase.

guanosine-5'-triphosphate A high-energy compound that is required for peptide bond formation in protein synthesis. *Abbr* GTP.

guanylate cyclase The enzyme that catalyzes the formation of guanosine-3',5'-cyclic monophosphate from guanosine-5'-triphosphate.

guanylic acid The ribonucleotide of guanine.

guest *See* host-guest system.

gum An excretion of certain plants that usually contains polysaccharides composed of glucuronic acid, galactose, arabinose, and, at times, other sugars.

gum arabic The gum produced by trees of the genus *Acacia*

Guo Guanosine.

gutta A rubber-like polyterpene containing about 100 isoprene units; produced from the latex of *Palaquium gutta*. A mixture of gutta and resins is called gutta-percha. A mixture of gutta and triterpene alcohols is called chicle and is used in the preparation of chewing gum.

g value A factor used in electron paramagnetic resonance to relate the frequency of the absorbed radiation to the strength of the applied magnetic field. The magnitude of this factor is a measure of the extent to which an electron interacts with other electrons or nuclei.

G value A measure of the sensitivity of a compound to undergo a reaction subsequent to and as a result of exposure to an ionizing radiation; equal to the number of molecules sensitized by the radiation per 100 eV absorbed.

gyrase *See* DNA gyrase.

gyratory shaker A shaker that provides a rotational motion.

gyromagnetic coefficient The ratio of the magnetic moment of a nucleus to its angular momentum spin; used in nuclear magnetic resonance.

gyromagnetic ratio A constant that is characteristic of an individual atomic nucleus and that is related to the energy that must be absorbed by this nucleus before it can undergo a transition. *See also* nuclear magnetic resonance.

H

h 1. Hour. 2. Planck's constant. 3. Hecto.

H 1. Hydrogen. 2. Enthalpy. 3. Histidine. 4. Henry. 5. Magnetic field strength.

H1, H2A, H2B, H3, H4 See histones; nucleosome.

³H Tritium; the radioactive isotope of hydrogen that has a half-life of 12.3 years and is a weak beta emitter.

HA Hydroxyapatite.

HAA Hepatitis-associated antigen; the Australia antigen.

habituation The phenomenon that an organism frequently shows a decreased response to repeated stimuli, such as a decreased transmission of nerve impulses through a synapse upon repeated electrical stimulations; may be related to the nature of memory.

hadron See elementary particles.

haem British spelling of heme.

haemoglobin British spelling of hemoglobin.

Hageman factor The plasma zymogen that is activated by surface contact or by the kallikrein system at the start of the intrinsic pathway of blood clotting.

HAI Hemagglutination inhibition.

hairpin bend BETA BEND.

hairpin DNA See foldback DNA.

hairpin loop The looped structure of hairpin DNA.

Hakamori methylation A method for the exhaustive methylation of carbohydrates, glycolipids, and glycoproteins by means of methylsulfinyl carbanions.

Haldane coefficient The change in the concentration of hemoglobin-bound hydrogen ions with changing concentration of hemoglobin-bound oxygen at a constant pH; the number of protons taken up per O₂ released.

Haldane effect The release of protons that accompanies the oxygenation of hemoglobin.

Haldane-Oparin hypothesis The hypothesis that the origin of life on earth was preceded by a very long period of abiogenic evolution. During this period simple organic compounds were formed first, primarily from gases in the atmosphere, and more complex compounds were then formed from them by a variety of reactions, occurring primarily in the seas. These reactions and compounds then gave rise to macromolecules which ultimately assembled to form structures that were the forerunners of living cells.

Haldane relation An expression that relates the

equilibrium constants of an enzymatic reaction to the kinetic constants of the forward and the reverse reactions. For a simple, one-substrate enzymatic reaction the Haldane relation is $K_{eq} = V_f K_{mr} / V_r K_{mf}$, where K_{eq} is the equilibrium constant, V is the maximum velocity, and K_m is the Michaelis constant; the subscripts f and r refer to the forward and the reverse reaction, respectively. *Aka* Haldane equation.

half-band width The width of an absorption band at the point at which the absorption equals one-half of the maximum absorption.

half-cell HALF-REACTION.

half-life 1. The time required for one-half of either the mass or the number of atoms of a radioactive substance to undergo radioactive decay. *Aka* radioactive half-life. 2. The time required for one-half of the mass of a substance to be either metabolized or excreted by an organism. *Aka* biological half-life. 3. The time required for one-half of the mass of a reactant to undergo chemical reaction. For a first-order reaction, $t_{1/2} = 0.693/k$, where $t_{1/2}$ is the half-life and k is the rate constant.

half-mustard A monofunctional sulfur or nitrogen mustard.

half-of-the-sites reactivity The phenomenon, observed with a number of regulatory enzymes, in which the reaction at one site of the enzyme prevents the reaction at a second site so that, at any given time, only one-half of the potential sites of the enzyme participate in the reaction. *Aka* half-of-the-sites phenomenon; flip-flop.

half-period HALF-TIME.

half-reaction A reaction in which there is either a gain or a loss of electrons; a half-reaction in which there is a gain of electrons can take place only in the presence of a second half-reaction in which there is a corresponding loss of electrons, and vice versa.

half-reaction time See cot value.

half-site editing A procedure for in vitro mutagenesis that is designed to make precise plasmid constructions; based on hybridization of a mutagenic oligonucleotide primer to a single-stranded template DNA, followed by polymerization with DNA polymerase I (Klenow fragment).

half-thickness HALF-VALUE LAYER.

half-time The time required to achieve one-half of the maximum of a reaction.

half-time of exchange The time required for

one-half of the exchangeable atoms to be exchanged in a reaction that involves the exchange of atoms.

half-value dose The dose of radiation or toxic compound that produces deaths in 50% of the cells, or loss of infectivity in 50% of the virus particles, in a test group within a specified time; analogous to the median lethal dose for animals.

half-value layer The thickness of an absorbing material that reduces the intensity of a beam of incident radiation to one-half of its original intensity. *Abbr* HVL.

half-wave potential The polarographic potential at which one-half of the maximum current is obtained.

halide A binary compound formed from a halogen and either a metal or an organic radical; a fluoride, a chloride, a bromide, or an iodide.

hallucinogenic drug A substance that, if taken in appropriate doses, produces distortion of perception, vivid images, or hallucinations. *Aka* hallucinogen. *See also* narcotic drug.

halobacteria A family of aerobic, extreme halophiles which grow only in media containing at least 15–20% sodium chloride.

halogen An element of group VIIA in the periodic table that consists of the elements fluorine F, chlorine Cl, bromine Br, iodine I, and astatine At.

halogenation The introduction of a halogen into an organic compound.

halogen quenching The quenching of an ionization detector that occurs when a halogen gas is added to the mixture used for gas amplification. *See also* internal quenching.

halophile An organism that grows only in solutions of either moderate or high salt concentration. Extreme halophiles constitute one group of archaeobacteria. They are found in salty habitats such as the Great Salt Lake and the Dead Sea. *See also* archaeobacteria.

Hamilton syringe A finely tooled syringe for the delivery of volumes in the microliter range.

Hammett equation One of two equations that describe the effect of meta and para substituents of an aromatic compound on either the rate or the equilibrium constant of a reaction. Specifically, $\log k^0 - \log k = \rho\sigma$, where k and k^0 are either the rate constants or the equilibrium constants for the substituted and unsubstituted compound, respectively, and $\log k$ and $\log k^0$ are the corresponding negative logarithms of these constants; ρ is a constant that characterizes the reaction with respect to its sensitivity to electron supply at the reaction site and that is independent of the substituent; and σ is a constant that characterizes a substituent with respect to its electron-withdrawing

power and that is independent of the nature of the reaction. It is called the substituent constant.

Hammond postulate An attempt to link reaction rate and product stability by considering the energy level and structure of the transition state of the reaction. The structure and energy of the transition state are taken to be close to those of the nearest stable species. It is postulated, therefore, that for an endergonic reaction, the transition state resembles a product while, for an exergonic reaction, the transition state resembles a reactant.

handedness The property of a helix of being either right-handed or left-handed; chirality.

handle method An early method for sequencing nucleic acids in which the polynucleotide strand was labeled at each end and then cleaved to yield fragments of varying sizes. *Aka* double-label method.

hands-on experience Experience gained by the actual manipulation and use of instruments and other items of equipment.

Hanes plot A graphical treatment of enzyme kinetics data in which $[S]/v$ is plotted as a function of $[S]$, where $[S]$ is the substrate concentration, and v is the velocity of the reaction; a single reciprocal plot of the Michaelis-Menten equation. *Aka* Hanes-Wilkinson plot; Hanes-Woolf plot.

Hanes report Acronym for Health And Nutritional Examination Survey; an extensive dietary survey involving 24-hour recalls from 28,000 Americans, aged 1 to 74, from 1971 to 1974. The survey indicated that many Americans may be consuming suboptimal amounts of iron, calcium, vitamin A, and vitamin C.

hanging drop technique A technique for the microscopic examination of live microorganisms that avoids possible distortion of the organisms which may be caused by drying or fixing; performed by suspending the microorganisms in a drop of fluid on a concave microscope slide.

hanging mercury drop electrode An electrode used for fast-sweep polarography.

hanging strip electrophoresis An electrophoretic technique in which paper strips are used that are suspended from a central support in the form of an inverted V, with each end of the paper dipping into a buffer compartment.

H antigen 1. A protein antigen of bacterial flagella. 2. A precursor of the A and B antigens of the human ABO blood group system. 3. HISTOCOMPATIBILITY ANTIGEN.

H-2 antigens *See* major histocompatibility complex.

Hanus iodine number An iodine number determined by the use of a solution of iodine in glacial acetic acid, with iodine bromide serving as an accelerator of the reaction.

haploid number The fundamental number of chromosomes that comprise a single set; the number of chromosomes in a genome; the gametic chromosome number. *Syn* N.

haploid state The chromosome state in which each type of chromosome is represented only once; the state of a cell or an organism having only one set of chromosomes. *Aka* haploidy.

haptén A substance that can react selectively with antibodies of the appropriate specificity but that stimulates the production of these antibodies in an animal only when it is coupled to a carrier.

hapténic antigen HAPTÉN.

hapténic group The haptén plus the amino acid through which it is covalently linked to a protein carrier; the hapténic group may constitute either all, or part of, an antigenic determinant.

haptén inhibition test A test that measures the extent to which a haptén inhibits an antigen-antibody reaction; performed by allowing the haptén to bind to and block the antigen binding sites of the appropriate antibody, and then adding antigen that is directed against the same antibody.

haptén protection The shielding of the antigen binding sites of an antibody by allowing a haptén to bind to them. The reaction may be used to specifically label the antibody by reacting the antibody-haptén complex first with an unlabeled reagent, and, after removal of the haptén, with the same, but labeled, reagent.

haptoglobin One of several plasma glycoproteins that bind hemoglobin and aid in its transport and conservation.

hard center An electrophilic center in a molecule which, when attacked by a nucleophile, leads to a transition state that involves the formation of a normal bond. *See also* soft center.

hard clot The final, insoluble blood clot that is formed by the cross-linking of fibrin molecules in the presence of calcium ions and the enzyme fibrin stabilizing factor.

hardening The hydrogenation of oils; the conversion of triacylglycerols (triglycerides), rich in unsaturated fatty acids, to those rich in saturated fatty acids.

Harden-Young ester FRUCTOSE-1,6-BISPHOSPHATE.

hard ligand A small atom, or a group of atoms, of low polarizability; oxygen and nitrogen atoms are examples. *See also* soft ligand.

hard soap A sodium salt of a long-chain fatty acid; hard soaps are less water soluble than soft soaps.

hardware The physical equipment used with computers; the electronic, magnetic, and

mechanical items such as cabinets, tubes, transistors, and wires.

hard water Water that contains appreciable concentrations of calcium, magnesium, and iron ions; these ions form insoluble soaps that are ineffective as surface-active agents.

hard x rays High-frequency x rays that have short wavelengths and great penetrating power.

Harris-Ray test A test for vitamin C that is based on the titrimetric reduction of the dye 2,6-dichlorophenol indophenol.

Hartnup's disease A genetically inherited metabolic defect in humans that is associated with mental retardation and that is due to a deficiency of the enzyme tryptophan pyrrolase.

harvest The collection of bacterial cells at a particular stage of growth.

hashish 1. The dried resin from the glandular hairs of the female hemp plant (*Cannabis*); contains Δ^1 -tetrahydrocannabinol (THC), which is psychoactive; a common narcotic. 2. MARIJUANA.

Hatch-Slack-Kortschak pathway An alternative pathway to the Calvin cycle of photosynthesis in which phosphoenolpyruvate is carboxylated to yield oxaloacetate as the first product; the cycle is operative in C_4 plants. *Abbr* HSK pathway; C_4 pathway.

HAT medium A growth medium for animal cells in tissue culture; contains hypoxanthine, aminopterin, and thymidine and is useful for the selection of hybrid cells.

H^+ -ATPase One of a group of adenosine triphosphatases that do not require other cations for activation and that occur in both prokaryotic and eukaryotic organisms. One class of H^+ -ATPases is designated as F_0F_1 -ATPases (ATP synthases). This class includes the mitochondrial enzyme which functions in the reverse direction (synthesis of ATP) and is driven by the proton gradient resulting from electron transport. *See also* F_0F_1 -ATPase.

hawkinsin *See* tyrosinosis.

Haworth projection A representation of carbohydrates in which the ring structures are drawn as regular hexagons or pentagons, in a plane that is perpendicular to the plane of the paper; the attached atoms or groups of atoms are indicated as being either above or below the plane of the ring. *Aka* Haworth formula.

Hayflick limit The number of times that animal cells appear to be capable of dividing in tissue culture before they reach the crisis stage; this amounts to 30-50 divisions for mouse and human cells. *See also* crisis (2).

hazard The likelihood of toxic injury to a living system by a harmful chemical under the circumstances of its intended use.

Hb Hemoglobin; also abbreviated as HHb.

Related compounds are abbreviated as follows: HbA, adult hemoglobin; HbCO, carbon monoxide hemoglobin; HbF, fetal hemoglobin; HbO₂, HHbO₂, oxyhemoglobin; HbS, sickle cell hemoglobin; HbC, hemoglobin in which lysine has replaced glutamic acid at position 6 in the beta chain; HbH, hemoglobin that is a tetramer of four identical beta chains; HbM, hemoglobin in which at least two of the heme groups have been oxidized to hemin groups (Fe³⁺).

HB-Ag Hepatitis B-antigen.

H band H ZONE.

HB_s-Ag Hepatitis B surface antigen.

HBV Hepatitis B virus; *See* hepatitis.

HCG Human chorionic gonadotropin.

H chain 1. One of the two types of polypeptide chains of lactate dehydrogenase isozymes; denoted H, since the tetramer of H chains is found predominantly in heart tissue. 2. HEAVY CHAIN.

HCI Heme-controlled inhibitor.

H-2 complex The major histocompatibility complex of mouse. *See* major histocompatibility complex.

HCR 1. Hemin-controlled repressor. 2. Host-cell reactivation.

HCS Human chorionic somatomammotropin.

Hcy Homocysteine.

HD₅₀ Median hemolytic dose.

HDL High-density lipoprotein.

H-DNA An unusual form of DNA that consists of a mixture of single-stranded and triple-stranded sequences.

HDP 1. Hexose diphosphate. 2. Helix-stabilizing protein; *See* single-strand binding protein.

head 1. The hexagonal, DNA-containing structure of a T-even phage. 2. The activated portion of a condensing unit. 3. The globular portion of the myosin molecule. 4. The 5'-phosphate end of an oligo- or a polynucleotide strand. 5. ROTOR. 6. A structural domain of prokaryotic 30S ribosomal subunits. 7. The polar, ionic, portion of a fatty acid or a phospholipid molecule. 8. The region of a sperm that contains a condensed haploid nucleus.

headful mechanism A mechanism of packaging DNA in a phage head that involves cutting the DNA from long concatemers. The cuts are not made at specific points, determined by particular base sequences, but rather at points, determined by the amount of DNA that can fit into a head. The mechanism can account for the circular permutation of phage DNA.

head growth *See* headward growth.

headpiece *See* supermolecule.

head space analysis A gas chromatographic

technique for substances that are sufficiently volatile so that a determination of their concentration in the vapor phase can be used as a measure of their concentration in the liquid phase; involves an analysis of the vapor in equilibrium with the liquid phase (called the head space).

head-to-head condensation The condensation of two molecules by way of their activated ends, as in the condensation of two molecules of acetaldehyde to form acetoin.

head-to-tail condensation The condensation of two molecules by way of the active end of one molecule and the passive end of the other molecule. The condensation of isoprene units in the biosynthesis of cholesterol, and the polymerization of amino acids in the formation of peptides and proteins are two examples.

headward growth The polymerization mechanism in which the passive tail of a monomer adds to the activated head of a chain, thereby making its own head the receptor for the next addition of monomer. *Aka* head polymerization. *See also* head-to-tail condensation.

heat capacity The quantity of heat required to raise the temperature of a given amount of substance by 1°C.

heat content ENTHALPY.

heat labile Descriptive of a molecule that loses its activity upon heating to moderate temperatures of about 50°C.

heat labile citrovorum factor 10-Formyltetrahydrofolic acid. *Abbr* HLCF.

heat-sensitive enzyme An enzyme that loses its stability and activity as the temperature is raised; due to progressive denaturation of the polypeptide chain as the temperature is increased.

heat shock proteins Proteins that are synthesized by an organism following a heat shock (a shift-up in growth temperature). This includes proteins not synthesized at all at the lower temperature and proteins synthesized at increased rates at the higher temperature. Heat shock proteins protect the organism against thermal damage in some unknown way; their synthesis is under control of the HTP-regulon. *Abbr* hsp, HSP, HTP.

heat shock puffs A set of chromosome puffs induced in *Drosophila* upon exposure to elevated temperatures.

heat shock response The transcriptional and translational activity of an organism induced by a heat shock (a shift-up in the growth temperature). The response includes complete repression of the synthesis of some proteins, synthesis of some proteins not made at the lower temperature at all, and increased rates of synthesis of other proteins. The heat shock

response is widespread among both prokaryotes and eukaryotes. *See also* HTP regulon.

heat stable Descriptive of a molecule that retains its activity upon heating to moderate temperatures of about 50°C.

heavy Labeled with a heavy isotope.

heavy atom method ISOMORPHOUS REPLACEMENT.

heavy chain One of two polypeptide chains that are linked to two light chains to form the immunoglobulin molecule. The molecular weight of a light chain is about 25,000 and that of a heavy chain is about 50,000. The heavy chains of the IgA, IgD, IgE, IgG, and IgM immunoglobulins are denoted, respectively, as α , δ , ϵ , γ , and μ chains.

heavy-chain class switching *See* class switching.

heavy-chain disease A disorder in which free Fc fragments of immunoglobulin heavy chains are present in the serum.

heavy hydrogen DEUTERIUM.

heavy isotope An isotope that contains a larger number of neutrons in the nucleus than the more frequently occurring common isotope of that element.

heavy label A heavy isotope that is generally introduced into a molecule to facilitate its separation from identical molecules containing the more frequently occurring isotope.

heavy meromyosin The fragment of the myosin molecule that consists of the globular head and a portion of the tail of the molecule. *Abbr* H-meromyosin; HMM. *Aka* ($F_1 + F_2$) fragment.

heavy metal contamination The presence of trace amounts of heavy metals, such as lead and zinc, in the water and/or in the chemicals that are used in the preparation of media and other solutions.

heavy ribosome 1. A ribosome labeled with a heavy isotope. 2. POLYSOME.

heavy strand 1. A polynucleotide chain labeled with a heavy isotope. 2. The naturally occurring polynucleotide chain of a duplex that has a greater density than the complementary chain.

heavy water Deuterium oxide; D_2O .

hecto- Combining form meaning one hundred and used with metric units of measurement. *Sym* h.

Hegner number The percentage of nonvolatile, water-insoluble fatty acids in a fat. *Aka* Hegner value.

Heidelberg curve PRECIPITIN CURVE.

height equivalent to a theoretical plate The length of a gas chromatographic column, some other chromatographic column, or a distillation column divided by its efficiency in terms of theoretical plates; the length of a column over which the separation effected is

equivalent to that of one theoretical plate. *Abbr* HETP; EHTP. *See also* theoretical plate.

Heinz body INCLUSION BODY (2).

Heisenberg uncertainty principle *See* uncertainty principle.

Heitler-London theory VALENCE BOND THEORY.

HeLa cells Cells that have been derived from a human carcinoma of the cervix from a patient named Henrietta Lack; the cells have been maintained in tissue culture since 1953.

helical Of, or pertaining to, a helix.

helical content The proportion of hydrogen-bonded base pairs in a nucleic acid, or the proportion of hydrogen-bonded amino acid residues in a protein.

helical cross The cross-like x-ray diffraction pattern that is obtained with fibrous helical material such as DNA.

helical virion A virus, such as tobacco mosaic virus, in which the capsid is a helix that forms a hollow cylinder.

helicase An enzyme that binds ahead of the replicating fork in the discontinuous replication of DNA and that catalyzes the energy-dependent unwinding of the duplex. The enzyme has ATPase activity and hydrolyzes 2 molecules of ATP per DNA base pair broken. The helicase activity in *E. coli* is called the Rep protein.

helicene A chiral polyaromatic hydrocarbon that has a helical shape.

helicity Helical structure.

heliotropism PHOTOTROPISM.

helix A coiled structure, or spiral, that is described by the thread of a bolt or the turns of a tubular spring; the curve that is traced on the surface of a cylinder by the rotation of a point that cuts the elements of the cylinder at a constant oblique angle. A helix is said to be left-handed or right-handed depending on whether it corresponds to the thread of a left-handed or a right-handed bolt. *See also* alpha helix; collagen helix; Watson-Crick model.

3_{10} helix A variant of the alpha-helix structure of proteins that is occasionally seen in short stretches of the polypeptide chain. In this structure, the separation between successive hydrogen bonds is shortened by one amino acid residue, and there are only three amino acid residues per turn of the helix.

helix-breaking amino acid An amino acid that, wherever it occurs in the polypeptide chain, interrupts the alpha-helical structure and creates a bend in the chain. This is always the case for proline and hydroxyproline since the imino group, after being tied up in a peptide bond, no longer carries a hydrogen atom and hence cannot serve as a hydrogen bond donor. Breaks in the helix can also be pro-

duced by amino acids with bulky side chains and by electrostatic repulsion of charged functional groups of the amino acids.

helix-coil transition The transition of a polymer from a helical configuration to that of a random coil, as in the denaturation of helical proteins and double-stranded DNA.

helix-destabilizing protein SINGLE-STRAND BINDING PROTEIN.

helix nucleation The slow step, involving formation of a short stretch of double helix, in the renaturation of double-stranded DNA or RNA from the single strands. This step is followed by rapid zippering as the double helix grows to maximize base-pairing interactions. *See also* nucleation.

helix winding number LINKING NUMBER.

Heller's test A qualitative test for protein that is based on the formation of a white precipitate at the interface between concentrated nitric acid and a test solution which is layered over it.

Helmholtz double layer IONIC DOUBLE LAYER.

Helmholtz free energy That component of the total energy of a system that can do work under conditions of constant temperature and volume; expressed by the thermodynamic function $A = E - TS$, where A is the Helmholtz free energy, E is the internal energy, T is the absolute temperature, and S is the entropy.

helper factors Protein regulatory factors isolated from helper T cells.

helper phage *See* helper virus.

helper T cells A group of T cells that help specific T or B lymphocytes respond to an antigen and that can activate some nonlymphocyte cells, such as macrophages. *Aka* helper T lymphocytes.

helper virus A virus that, by infecting a cell and supplying a missing product, allows the simultaneous infection of that cell by a defective virus.

hemadsorption The adsorption of a substance to red blood cells.

hemagglutination The agglutination of red blood cells.

hemagglutination inhibition The inhibition of hemagglutination; used for assaying hemagglutinating viruses by adding antiviral antibodies to a mixture of virus particles and red blood cells. *Abbr* HI.

hemagglutinin An agglutinin of red blood cells.

hematin FERRIHEME.

hematometer HEMOGLOBINOMETER.

hematocrit 1. The relative volume of blood occupied by the erythrocytes and expressed in cubic centimeters per 100 cc of blood. 2. An apparatus for measuring the relative volume

of cells and plasma in blood, usually by means of centrifugation.

hematology The science that deals with blood and blood-forming organs.

hematolysis HEMOLYSIS.

hematopoiesis HEMOPOIESIS.

hematopoietic HEMOPOIETIC.

hematoside One of a class of monosialogangliosides; a compound having the structure: ceramide-glucose-galactose-*N*-acetylneuraminic acid.

hematuria The presence of either blood or red blood cells in the urine.

heme 1. Any tetrapyrrolic chelate of iron, generally an iron porphyrin complex, in which four coordination positions of iron are occupied. 2. A protoheme; an iron-porphyrin complex that has a protoporphyrin nucleus, specifically one containing protoporphyrin IX, which is the oxygen-binding portion of the hemoglobin molecule. Heme A (protoheme A) is the prosthetic group of cytochrome *a*; heme C (protoheme C) is the prosthetic group of cytochrome *c*.

heme-controlled inhibitor HEMIN-CONTROLLED REPRESSOR.

heme-heme interactions The cooperative interactions between the hemes of the subunits of hemoglobin with respect to the binding of oxygen.

heme iron An iron atom that is coordinately bound in a porphyrin.

hemel An aziridine mutagen.

heme pocket The hydrophobic crevice in a hemoglobin subunit in which the heme is located.

heme protein *See* hemoprotein.

hemerythrin A nonheme, iron-containing, respiratory pigment of sipunculid worms and other marine invertebrates.

heme synthetase FERROCHELATASE.

hemiacetal A compound formed by either an inter- or an intramolecular reaction between an aldehyde group and an alcohol group.

hemicellulose A heterogeneous group of branched polysaccharides that serve to cement plant fibers together. Each polysaccharide has a long linear backbone of sugar units of one type, linked β (1 \rightarrow 4), and short side chains, composed of other sugars, that protrude from the backbone.

hemichrome FERRIHEMOCHROME.

hemichromogen FERRIHEMOCHROME.

hemidesmosome A cell junction that resembles spot desmosomes but, instead of joining adjacent epithelial cell membranes, serves to join the basal surface of epithelial cells to the underlying basal lamina. *See also* cell junction.

hemoglobin METHEMOGLOBIN.

hemiketal A compound formed by either an inter- or an intramolecular reaction between a ketone group and an alcohol group.

hemin FERRIHEME.

hemin-controlled repressor A protein kinase that functions in the translational control of globin synthesis in reticulocytes. The enzyme catalyzes the phosphorylation of initiation factor 2 (eIF-2) and thereby prevents eIF-2 from complexing with another protein (called eIF-2 stimulating protein or ESP). This prevents the initiation of translation since the latter requires formation of a ternary complex between the initiator-tRNA, eIF-2, and ESP. The hemin-controlled repressor is activated by a cAMP-dependent protein kinase which is activated by hemin. Thus, if there is excess hemin present, the hemin-controlled repressor is not activated, and globin synthesis can begin. *Abbr* HCR. *Aka* heme-controlled inhibitor.

hemizygous gene A gene that is present only once among the chromosomes of a cell, such as a sex-linked gene.

hemochromatosis A disease that is caused by excessive iron absorption from the intestine and by excessive iron deposition in various organs. The organs thus affected show pathological damage and the disease is frequently associated with glucosuria. *See also* bronzed diabetes.

hemochrome A low-spin compound of heme in which the fifth and sixth coordination positions of the iron are occupied by strong-field ligands.

hemochromogen FERROHEMOCHROME.

hemococentration An increase in the concentration of red blood cells in the blood; a decrease in the concentration of plasma.

hemocyanin A copper-containing respiratory pigment of mollusks and crustaceans.

hemocyte 1. A blood cell. 2. An ameboid blood cell of insects.

hemodialysis The dialysis of blood by means of a semipermeable membrane.

hemodialyzer An artificial kidney; an apparatus that circulates blood from and back into the body by passing it through a series of semipermeable membranes which remove waste products in a manner analogous to the operation of the kidney.

hemodilution A decrease in the concentration of red blood cells in the blood; an increase in the concentration of plasma.

hemoflavoprotein A heme-containing flavoprotein.

hemoglobin The oxygen-transporting protein of the blood that consists of four polypeptide

chains, two alpha and two beta chains, each one surrounding a heme group. Hemoglobin occurs in several normal forms such as adult and fetal hemoglobin, and in various abnormal forms, such as sickle cell hemoglobin and hemoglobin C. *Abbr* Hb; HHb. *See also* Hb.

hemoglobinemia The presence of free hemoglobin in blood plasma.

hemoglobinometer An instrument for the visual or the photoelectric measurement of the hemoglobin content of blood.

hemoglobinopathy A genetically inherited metabolic defect in humans that is characterized by the presence of a structurally altered hemoglobin.

hemoglobin switching The changeover, during the development of an organism, from the synthesis of one type of hemoglobin to the synthesis of a different type.

hemoglobinuria The presence of either free hemoglobin or closely related pigments in the urine.

hemoglobin variant *See* variant (1).

hemolymph The circulatory fluid of various invertebrates that is functionally comparable to the blood and lymph of vertebrates.

hemolysate The suspension of lysed cells obtained upon hemolysis.

hemolysin 1. An antibody that, in the presence of complement, causes hemolysis. 2. A substance, such as the bacterial toxin streptolysin, that causes hemolysis.

hemolysis The lysis of red blood cells.

hemolytic Of, or pertaining to, hemolysis.

hemolytic anemia An anemia that is characterized by an excessive destruction of red blood cells; several hemolytic anemias are genetically inherited metabolic defects due to a deficiency of a glycolytic enzyme.

hemolytic antibody HEMOLYSIN (1).

hemolytic immune body An antibody to a surface antigen of erythrocytes; an amboceptor. *Abbr* HIB.

hemolytic plaque assay *See* plaque technique.

hemolytic system The mixture of red blood cells and antibodies against them that is used in the complement fixation test.

hemolyze To lyse red blood cells.

hemopexin A plasma glycoprotein that binds heme and aids in its disposal.

hemophilia A genetically inherited, sex-linked metabolic defect in humans that is characterized by prolonged clotting times of blood and that is caused by a deficiency of the anti-hemophilic factor. Hemophilia A is caused by a deficiency of antihemophilic factor A, and hemophilia B is caused by a deficiency of anti-hemophilic factor B.

hemopoiesis The formation of red blood cells.

hemopoietic Of, or pertaining to, hemopoiesis.

hemopoietine ERYTHROPOIETIN.

hemoprotein A conjugated protein that contains a heme as a prosthetic group.

hemorrhagic disease The pathological condition that is characterized by bleeding and by long clotting times, and that is caused by a deficiency of vitamin K.

hemorrhagic disease of the newborn A temporary hemorrhagic disease, characterized by vitamin K deficiency, that occurs in an infant and that persists only until a bacterial flora is established in the infant's intestine.

hemosiderin A water-insoluble protein that serves to store iron in the form of ferric hydroxide in the liver, the spleen, and the bone marrow.

hemosiderosis An increase in the storage forms of iron, such as hemosiderin; the condition may be relative or absolute. Relative hemosiderosis represents a redistribution of the body's iron with less in the red cell mass and more in the iron stores; absolute hemosiderosis (or iron overload) represents an increase in the total iron content of the body with the extra iron being laid down in storage compounds.

hempa An aziridine mutagen.

Henderson-Hasselbalch equation An equation that relates the pH of a solution to the dissociation constant of a weak acid, and to the concentrations of the proton donor form HA and the conjugated proton acceptor form A^- of the acid. Specifically, $pH = pK_a + \log ([A^-]/[HA])$, where pK_a is the negative logarithm of the dissociation constant and brackets indicate molar concentrations.

Henle's loop See nephron.

Henri equation An equation, analogous to that obtained by integration of the Michaelis-Menten equation, that is applicable to an enzymatic reaction if the decrease in reaction rate as a function of time is due solely to the decrease in enzyme saturation as the concentration of the substrate decreases. The equation was reported by Victor Henri in 1902, prior to the derivation of the Michaelis-Menten equation.

Henri-Michaelis-Menten equation MICHAELIS-MENTEN EQUATION.

henry A unit of inductance, equal to the inductance in which an induced electromotive force of 1 V is produced when the inducing current is changed at the rate of 1 A/s. *Sym* H.

Henry's function The product of the radius of a macromolecule and its reciprocal ion-atmosphere radius.

Henry's law The law that the solubility of a gas in a liquid, at constant temperature, is proportional to the partial pressure of the gas.

hepadnavirus A virus belonging to a family that includes the hepatitis B virus and similar viruses; contains circular DNA which is only partially duplex. The name is derived from hepatotropic DNA virus.

heparan sulfate A glycosaminoglycan closely related to heparin and containing the same disaccharide repeating units; it differs from heparin in being smaller and less sulfated. Heparan sulfate is extracellularly distributed and is found in the lungs, arterial walls, and many cell surfaces.

heparin A glycosaminoglycan that contains two types of disaccharide repeating units; one consists of D-glucosamine and D-glucuronic acid, the other consists of D-glucosamine and L-iduronic acid. Heparin is highly sulfated and has anticoagulant activity; it combines with and activates antithrombin III which can then bind to and inhibit many clotting factors. Heparin occurs in the lungs, the liver, the skin, and the intestinal mucosa.

hepatectomy The surgical removal of the liver.

hepatic Of, or pertaining to, the liver.

hepatic porphyria A porphyria that is characterized by the formation of excessive amounts of heme precursors in the liver.

hepatitis An inflammation of the liver, usually caused by a viral infection but sometimes caused by a toxic compound. Two forms of viral hepatitis have been recognized. Type A (infectious or epidemic hepatitis) is transmitted through the mouth and the intestine and has an incubation period of 2-6 weeks. Type B (serum hepatitis or homologous serum jaundice) is transmitted via blood transfusions and has an incubation period of 2-6 months; it is characterized by the presence of Australia antigen in the serum. The hepatitis B virus (HBV) is now considered to be a member of the family of hepadnaviruses.

hepatitis-associated antigen AUSTRALIA ANTIGEN.

hepatitis B antigen AUSTRALIA ANTIGEN.

hepatitis B surface antigen AUSTRALIA ANTIGEN.

hepatocyte A liver cell.

hepatoflavin An impure preparation of riboflavin from liver.

hepatolenticular degeneration Wilson's disease.

hepatoma A carcinoma of liver cells.

HEPES N-2-Hydroxyethylpiperazine-N'-2-ethanesulfonic acid; used for the preparation of biological buffers in the pH range of 6.8 to 8.2. *See also* biological buffers.

HEPPS A biological buffer, also designated as EPPS. *See* EPPS.

HEP strain A high egg passage strain; a viral strain that has been passed repeatedly from one chick embryo to another (serial passage).

hepta- Combining form meaning seven.

- heptamer** An oligomer that consists of seven monomers.
- heptose** A monosaccharide that has seven carbon atoms.
- herbicide** A chemical that kills herbs, especially weeds.
- hereditary code** See genetic code.
- hereditary disease** See genetic disease.
- hereditary material** See genetic material.
- heroin** A semisynthetic narcotic drug, made by converting morphine to diacetylmorphine; a highly addictive narcotic.
- herpesvirus** An enveloped, icosahedral virus that contains double-stranded DNA and that infects humans and lower animals. Type I herpes simplex causes cold sores; type II herpes simplex is associated with genital lesions and is sexually transmitted.
- herpes zoster** The recurrent form of the disease that is produced by varicella virus in a host that was previously infected by the virus.
- herring bodies** Neurosecretory granules that contain neurohypophyseal hormones and neurophysins and that are located within axonal dilations in the posterior lobe of the pituitary gland.
- Hers' disease** GLYCOGEN STORAGE DISEASE TYPE VI.
- Hershey-Chase experiment** An experiment that demonstrates that, during phage infection, the phage DNA is injected into, and the phage protein coat remains outside of, the bacterial cell. The experiment is performed by infecting *E. coli* cells with ³²P- or ³⁵S-labeled T-even phages, followed by removal of the empty phage heads and the phage tails by shearing in a blender.
- Hershey circle** A double-stranded, circular DNA molecule formed by hydrogen bonding between cohesive ends.
- hertz** A unit of frequency; one cycle per second. *Sym* Hz.
- Hess's law** See thermochemistry.
- het** A partially heterozygous phage.
- hetaeron** See zwitterion-pair chromatography.
- HETE** Hydroxyeicosatetraenoic acid; a compound obtained by reduction of HPETE (hydroperoxyeicosatetraenoic acid), which is derived from arachidonic acid.
- hetero-** Combining form meaning different or other.
- heteroallelic** Pertaining to alleles of a gene that have mutations at different sites.
- heteroantibody** An antibody to a heteroantigen.
- heteroantigen** An antigen that is immunogenic in a given animal species and that is either produced by synthetic reactions or is derived from plants, microorganisms, or other animal species.
- heteroatom** An atom in a ring structure that is not a carbon atom.
- heteroauxesis** ALLOMETRY.
- heterocapsidic virus** See segmented genome.
- heterocatalytic** Pertaining to the catalysis of the reaction of one substance by another, different substance, as distinct from autocatalytic.
- heterochiral** Descriptive of the relation between isometric chiral molecules that are only improperly congruent. See also homochiral.
- heterochromatin** The condensed chromatin that is not very active in RNA synthesis and that stains strongly during interphase.
- heterochromosome** A chromosome that consists primarily of heterochromatin.
- heterocyclic** Of, or pertaining to, an organic compound that has a ring structure which consists of carbon atoms and one or more noncarbon atoms.
- heterocyclic atom** HETEROATOM.
- heterocysts** Cells that occur in some blue-green algae and that appear to have a specialized function of fixing molecular nitrogen.
- heterocytotropic antibody** A cytotoxic antibody that binds to and sensitizes target cells of a species that differs from the one in which the antibody was produced.
- heterodimer** A protein composed of two nonidentical polypeptide chains.
- heterodisperse** Consisting of macromolecules that differ greatly in their size.
- heteroduplex** 1. A double-stranded DNA in which the two strands have different hereditary origins; produced during genetic recombination by base pairing between single strands from different parental duplexes. 2. A double-stranded nucleic acid molecule formed *in vitro* by annealing two single strands of different origins that have some, but not complete, complementary base sequences. A double-stranded phage DNA molecule, formed by hybridizing one strand from a wild-type phage with one strand from a mutant of this phage, is an example. A hybrid, formed by annealing eukaryotic mRNA with corresponding single-stranded DNA is another example. See also homoduplex.
- heteroenzyme** One of two or more isodynamic enzymes derived from different sources, such as alcohol dehydrogenase from yeast and alcohol dehydrogenase from liver. See also isodynamic enzyme; isozyme.
- heterofermentation** 1. Fermentation in which more than one product is formed. 2. HETERO-LACTIC FERMENTATION.
- heterofermentative lactic acid bacteria** Lactic acid bacteria that produce in fermentation less than 1.8 mol of lactic acid per mole of glucose; in addition to lactic acid, these

organisms produce ethanol, acetate, glycerol, mannitol, and carbon dioxide. *See also* homofermentative lactic acid bacteria.

heterogeneous XENOGENEIC.

heterogeneity 1. The state of a preparation of macromolecules in which the macromolecules differ with respect to size, charge, structure, or other properties. 2. The state of a system in which there are two or more phases.

heterogeneity index A measure of antibody heterogeneity that is based on the assumption of an essentially random distribution of the binding affinity of antigen binding sites and hapten molecules. It can be expressed as $r/n = (K_0c)^a/[1 + (K_0c)^a]$, where a is the heterogeneity index, n is the antibody valence, r is the average number of hapten molecules bound per molecule of antibody, c is the concentration of free hapten molecules, and K_0 is the average intrinsic association constant (the association constant for that concentration of hapten at which half of the antibody sites are occupied by hapten molecules). The equation can be rewritten as $\log[r/(n - r)] = a \log c + a \log K_0$, and a can be determined from a plot of $\log[r/(n - r)]$ versus $\log c$. The heterogeneity index varies from 0 to 1; a value of 1 indicates homogeneous antibody. *See also* Hill equation; Hill plot.

heterogeneous Of, or pertaining to, heterogeneity.

heterogeneous catalysis Catalysis in a system that consists of two or more phases.

heterogeneous nuclear RNA 1. The total pool of extrachromosomal RNA fragments in the nucleus of a eukaryotic cell; consists of molecules of widely varying sizes and includes primary transcripts, partly processed transcripts, discarded intron RNA, ubiquitous RNA, and small nuclear RNA. 2. The pool of primary RNA transcripts and partly processed transcripts in the nucleus of a eukaryotic cell. *Abbr* hnRNA.

heterogenic Widely distributed in many species.

heterogenic antigen An antigen that is produced by several, phylogenetically unrelated species.

heterogenic process An unsymmetrical formation of a covalent bond in which both of the electrons of the bond are contributed by one of the bonding atoms.

heterogenote A merozygote in which corresponding alleles on its endogenote and exogenote are different.

heteroglycan HETEROPOLYSACCHARIDE.

heterograft A transplant from one individual to another individual of a different species.

heteroimmune phage One of two phages that

are sensitive to different immunity substances.

heteroimmune superinfection The superinfection of a bacterium with a heteroimmune phage, as in the infection of a lysogenic bacterium with a phage that is insensitive to the immunity substance of the prophage.

heteroimmunity 1. The immune reactions in which the antigens and the antibodies are derived from different animal species. 2. The immune reactions in which the antigens are derived from plants, microorganisms, or synthetic reactions.

heterokaryon A cell that contains two or more nuclei, derived from genetically different sources, as a result of cell fusion that is not accompanied by fusion of the nuclei; commonly occurs in fungi.

heterolactic fermentation *See* heterofermentative lactic acid bacteria.

heterologous 1. Pertaining to subcellular fractions, such as transfer RNA, ribosomes, and enzymes, that have been isolated from different species. 2. Pertaining to an antigen and an antibody (or an antiserum) when the antibody has been produced in response to the administration of a different antigen. 3. Pertaining to an antigen, an antibody, or an antiserum when the antigens and antibodies are derived from different species. 4. Pertaining to genetically dissimilar individuals of the same species; xenogenic.

heterologous association An association of identical protein subunits in which the interacting surfaces of the subunits are not identical.

heterologous bonds The nonidentical interactions between subunits linked via heterologous associations.

heterologous desensitization The decreased sensitivity of cells to stimulation that is brought about by a variety of ligands and not just the one to which the cells had been previously exposed. *See also* desensitization (3).

heterologous graft HETEROGRAFT.

heterologous interference The viral interference induced by either an active or a suitably inactivated virus against a virus of a different taxonomic group.

heterologous mischarging The reaction whereby an aminoacyl-tRNA synthetase from one source (for example, yeast) aminoacylates the "wrong" tRNA from another source (for example, *E. coli*).

heterolysis The cleavage of a chemical bond between two atoms in which both of the two electrons constituting the bond move to one of the atoms; a reaction of the type $R:X \rightleftharpoons R^{\cdot} + X^{\cdot}$

heterolysosome An organelle produced by the

fusion of a lysosome, originating from the Golgi apparatus, with other vesicles or cytoplasmic bodies.

heterolytic process An unsymmetrical covalent bond breakage in which one of the two bonded atoms leaves with both of the electrons that constitute the bond.

heteromultimer HETEROPOLYMER.

heterophagic Other-digesting, as in the digestion by lysosomes of exogenous material taken up by the cell.

heterophagosome An endocytotic vacuole that has fused with other cellular vesicles, or with cytoplasmic bodies containing particulate matter, but that has not fused with a lysosome to form a digestive vacuole.

heterophile antibody An antibody that reacts with antigens of more than one species.

heterophile antigen HETEROGENETIC ANTIGEN.

heteroploid state The chromosome state in which the number of chromosomes differs from that of the characteristic diploid (or haploid) state. *Aka* heteroploidy.

heteropolar AMPHIPATHIC.

heteropolar bond POLAR BOND.

heteropolymer A polymer composed of two or more types of monomers.

heteropolysaccharide A polysaccharide composed of two or more types of monosaccharides.

heteropynosis The variation in the degree of condensation of either different chromosomes or of parts of the same chromosome; used as the basis for classifying chromatin into euchromatin and heterochromatin.

heteroreactivation The reactivation of a poxvirus by another poxvirus of a different immunological subgroup. *See also* reactivation (2).

heteroside A glycoside, the "aglycone" portion of which is not a carbohydrate. *See also* holo-side.

heterosomal aberration An interchromosomal aberration. *See also* chromosomal aberration.

heterospecific antibody An artificially produced antibody that has one antigen binding site that is specific for one antigen and a second antigen binding site that is specific for a different antigen.

heterothallic Descriptive of organisms, such as certain fungi and algae, that exist in the form of two mating types so that only gametes from strains of opposite mating type can fuse to form zygotes.

heterotherm POIKILOTHERM.

heterotopic transplant A transplant from one site to another on the same organism.

heterotroph A cell or an organism that requires a variety of carbon-containing compounds from animals and plants as its source

of carbon, and that synthesizes all of its carbon-containing biomolecules from these compounds and from small inorganic molecules.

heterotropic interactions Cooperative interactions between binding sites involving ligands of different kinds. The interactions associated with the binding of substrate molecules, activators, and inhibitors to an allosteric enzyme are an example.

heterovalent resonance Resonance in which the various resonance structures do not have the same number of chemical bonds.

heterozygosity The state of having different alleles at one or more loci in the homologous chromosomes.

heterozygote A zygote that carries different alleles at one or more loci in the homologous chromosomes and that does not breed true; a cell or an organism that carries two different alleles of the same gene.

heterozygous Of, or pertaining to, a heterozygote.

HETP Height equivalent to a theoretical plate.

heuristic process A problem-solving process in which solutions are discovered by evaluating the progress made toward the final solution as by means of a controlled trial and error method, exploratory methods, the sequencing of investigations, etc. The process is valuable for stimulating further research, calculations, and the like, even though individual steps may remain unproven or be incapable of proof. *See also* algorithm; stochastic process.

hexa- Combining form meaning six.

hexagonal capsomer *See* capsomer.

hexamer 1. An oligomer that consists of six monomers. 2. HEXAGONAL CAPSOMER.

hexokinase The enzyme that catalyzes the conversion of glucose to glucose-6-phosphate in the first step of glycolysis; it is found in all tissues and exists in three isoenzyme forms (types I, II, and III). *See also* glucokinase.

hexon A capsomer composed of 6 protomers; a morphological subunit of some viruses.

hexon antigen An antigen of the hexon capsomer of adenoviruses.

hexosamine An amino sugar of a six-carbon monosaccharide.

hexosaminidase An enzyme, composed of two subunits, that functions in the metabolism of gangliosides. A deficiency of this enzyme leads to Tay-Sachs and Sandhoff diseases.

hexosan A polysaccharide of hexoses.

hexose A monosaccharide that has six carbon atoms.

hexose diphosphate pathway GLYCOLYSIS.

hexose monophosphate oxidative pathway The formation of ribose-5-phosphate from glucose-

6-phosphate in the initial reactions of the hexose monophosphate shunt.

hexose monophosphate pathway HEXOSE MONOPHOSPHATE SHUNT.

hexose monophosphate shunt The metabolic pathway that requires the input of six molecules of glucose-6-phosphate and leads to the complete oxidation of one molecule of glucose-6-phosphate to carbon dioxide, water, and phosphate. The pathway functions to generate reducing power in the form of NADPH, allows for the interconversion of monosaccharides, and is linked to the fixation of carbon dioxide in photosynthesis. *Abbr* HMS; HMP shunt.

hexose phosphoketolase pathway A catabolic pathway of glucose that is related to the hexose monophosphate shunt and that occurs in some bacteria.

hexuronic acid A sugar acid, formed by oxidation of the C-6 group of a hexose to a carboxyl group.

Hfr strain HIGH-FREQUENCY OF RECOMBINATION STRAIN.

HFT HIGH-FREQUENCY TRANSDUCTION.

HFT lysate High-frequency transduction lysate; a lysate prepared by induction of a prophage that possesses an unusually high transducing power.

Hg Mercury.

HGF Hyperglycemic-glycogenolytic factor.

HGG Human gamma globulin.

HGH Human growth hormone.

HGPRT Hypoxanthine-guanine phosphoribosyl transferase; *See* Lesch-Nyhan syndrome.

HHbO₂ OXYHEMOGLOBIN.

HI Hemagglutination inhibition.

5-HIAA 5-Hydroxyindoleacetic acid.

HIB Hemolytic immune body.

high-angle x-ray diffraction LARGE-ANGLE X-RAY DIFFRACTION.

high-copy number *See* copy number.

high-density lipoprotein A plasma lipoprotein that has a density of 1.063–1.210 g/mL and that is designated as HDL. An increase in the concentration of HDL is believed to be linked to a decrease in the incidence of atherosclerosis. HDL contain about 33% protein, 29% phospholipid, 30% cholesterol and cholesterol esters, and 8% triglycerides; they have molecular weights of about 2 to 4×10^5 and are classified as the α -fraction on the basis of electrophoresis. *See also* lipoprotein.

high-efficiency liquid chromatography HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY.

high egg passage strain *See* HEP strain.

high-energy bond A covalent bond, the hydrolysis of which under standard conditions yields a large amount of free energy. The term refers to the large negative free energy

change associated with the hydrolysis reaction, and not to the bond energy. High-energy bonds are commonly denoted by a squiggle (~).

high-energy compound A compound that, upon hydrolysis under standard conditions, yields a large amount of free energy. High-energy compounds are frequently those in which a phosphate group is removed by hydrolysis and the free energy change of this reaction is of the order of 7 kcal/mol or more. *See also* high-energy bond.

high-energy ion scattering RUTHERFORD BACK-SCATTERING.

high-energy phosphate donor A high-energy compound that can function as a phosphoryl group donor to a low-energy phosphate acceptor by way of the ADP-ATP phosphoryl group carrier system. *Aka* high-energy phosphate compound.

high-frequency of recombination strain A bacterial strain that has a high frequency of recombination due to the fact that the episomal fertility factor has become incorporated into the bacterial chromosome. *Abbr* Hfr strain.

high-frequency transduction Transduction in which the phages that are capable of transducing constitute a high proportion of the total phage population. *Abbr* HFT.

high-level language A programming language that allows a person to give instructions to a computer in an English-like text rather than by means of a numerical (binary) code of ones and zeros.

high-level promoter A promoter that can undergo a promoter-up mutation.

high-lipid lipoprotein LOW-DENSITY LIPOPROTEIN.

highly repetitive DNA *See* repetitive DNA.

high-mannose glycoproteins *See* glycosylation.

high-mannose oligosaccharides A group of N-linked oligosaccharides that contain up to 6 mannose residues, in addition to those in the core region. These oligosaccharides occur in ovalbumin, thyroglobulin, and in some cell-surface glycoproteins. They may have 2, 3, or 4 branches and are then designated as bi-, tri-, or tetraantennary.

high-mobility group A group of abundant, nonhistone chromosomal proteins; so called, because they are relatively small and highly charged and, therefore, move rapidly in electrophoresis. *Abbr* HMG.

high molecular weight kininogen A plasma glycoprotein of high molecular weight (150,000 daltons) that functions in the initiation of the intrinsic pathway of blood coagulation. *Abbr* HM_wK.

high-mutability gene MUTATOR GENE.

high-performance liquid chromatography A column chromatographic technique that is rapid and provides high resolution; it can be used with the various modes of liquid chromatography such as gel filtration, adsorption, partition, and ion exchange. The apparatus consists of a column, a hydraulic system, a detector, and a recorder. The liquid is forced in series and under pressure through a column that is maintained at a constant temperature, through a detector, and then into a fraction collector. *Abbr* HPLC.

high polymer A polymer of very high molecular weight, such as a polymer occurring in plastics, rubber, fibers, or human tissues.

high-potential iron protein An iron-sulfur protein that has a high standard reduction potential (E'_0) which may be of the order of +0.4 V as opposed to one of the order of -0.4 V for a low-potential iron protein. High-potential iron proteins contain ($\text{Fe}_3^{3+} - \text{Fe}_2^{2+}$) in their iron clusters as opposed to the ($\text{Fe}_2^{3+} - \text{Fe}_2^{2+}$) which occurs in the low-potential iron proteins. *Abbr* HiPiP. *Aka* high-potential iron-sulfur protein.

high-pressure liquid chromatography HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY.

high-quality proteins Proteins from animal sources (eggs, milk, meat, and fish) that supply adequate amounts of all of the essential amino acids.

high-resistance-leak method A method for amplifying the ion current produced in an ionization chamber.

high-sensitivity liquid chromatography HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY.

high-speed liquid chromatography HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY.

high-speed sedimentation equilibrium MENISCUS DEPLETION SEDIMENTATION EQUILIBRIUM.

high spin The state of a complex in which there is a maximum of unpaired electrons; referred to as a state of essentially ionic bonding and ascribed to certain hemoproteins.

high-temperature protection regulon *See* HTP regulon.

high-temperature-short-time method The pasteurization of material by heating it at 71.7°C for 15 s. *Abbr* HTST method.

high-voltage electrophoresis An electrophoretic technique in which the applied electric field is greater than 20 V/cm and in which separations are achieved in short times; useful for the separation of low molecular weight compounds such as amino acids, peptides, and nucleotides.

high-yielding strain PRODUCTION STRAIN.

Hill-Bendall scheme Z SCHEME.

Hill coefficient The coefficient n_H in the Hill equation; it is also the slope in a Hill plot. *See*

also Hill equation; Hill plot.

Hill equation An equation that describes the binding of ligands to a protein; common forms of the equation are (i) $r/n = K'[S]^{n_H}/(1 + K'[S]^{n_H})$; (ii) $r/(n - r) = K'[S]^{n_H}$; (iii) $\log [r/(n - r)] = n_H \log [S] + \log K'$; (iv) $Y_s = [S]^{n_H}/(K + [S]^{n_H})$; (v) $\log [Y_s/(1 - Y_s)] = n_H \log [S] - \log K$, where r is the number of moles of ligand S bound per mole of total protein, n is the number of binding sites of a given type per molecule of protein, K' is the intrinsic association constant for this type of site, Y_s is the fraction of total binding sites occupied by ligand S ($Y_s = r/n$), K is the intrinsic dissociation constant ($K = 1/K'$), and n_H is the interaction factor for the sites which varies from 1, for noninteracting sites, to n , for highly cooperative binding.

Hill plot A graphical representation of binding data based on the Hill equation that is used for determining intrinsic association constants and for determining the number of binding sites of a given type per molecule of protein; consists of a plot of $\log[r/(n - r)]$ as a function of $\log[S]$ or a plot of $\log[Y_s/(1 - Y_s)]$ as a function of $\log[S]$. *See also* Hill equation.

Hill reaction The light reaction in photosynthesis that is carried out in the presence of an artificial electron acceptor; the reaction: $2\text{H}_2\text{O} + \text{A} = 2\text{AH}_2 + \text{O}_2$, where A is the electron acceptor.

Hill reagent The artificial electron acceptor in the Hill reaction.

hinge point The position in an analytical ultracentrifuge cell at which the concentration, during sedimentation equilibrium, is equal to the initial concentration of the solution.

hinge region 1. That portion of the IgG immunoglobulin molecule that is adjacent to the two disulfide bonds that link the two heavy chains together; the hinge region is near the sites of action of papain and pepsin and is believed to be a flexible region that permits the molecule to open up in the form of a Y. 2. One of two regions in the predominantly helical rod section of the myosin molecule that is less stable than the rest of the molecule, and that is more susceptible to proteolytic attack; a trypsin-sensitive region of myosin.

HiPiP High-potential iron protein.

hippuric acid *N*-Benzoylglycine; the form in which benzoic acid is detoxified and excreted in the urine.

Hirano bodies Paracrystalline inclusions found in the brains of humans exhibiting senile dementia and other neurodegenerative diseases; thought to be stacked sheets of membrane-bound ribosomes, derived from partially de-

graded rough endoplasmic reticulum of neurons (Nissl substance).

His 1. Histidine. 2. Histidyl.

H isoantigen A pentahexosyl ceramide that accumulates in individuals suffering from fucosidosis.

His operon The operon in *Salmonella typhimurium* that consists of the genes that code for the 10 enzymes involved in the biosynthesis of histidine.

histamine A pharmacologically active mediator of the allergic response that causes vasodilation, increased capillary permeability, and contraction of smooth muscle. Histamine is formed by decarboxylation of histidine and is widely distributed in mammalian tissues, particularly in mast cells from which it is released during the allergic response. *See also* H₁ receptors; H₂ receptors.

histidine A heterocyclic, basic, and polar alpha amino acid that contains the imidazole ring system. *Abbr* His; H.

histidinemia A genetically inherited metabolic defect in humans that is characterized by elevated blood and urine levels of histidine, and that is due to a deficiency of the enzyme histidase that functions in histidine catabolism.

histochemistry The science that deals with the chemical constitution and the chemical changes of tissues and cells by combining the techniques of biochemistry and histology.

histocompatibility Immunological tolerance to transplanted tissue. *See also* major histocompatibility complex.

histocompatibility antigen A tissue antigen of the donor of an allograft that induces transplantation immunity in the recipient of the transplant; one of a group of cell-surface glycoprotein antigens that are involved in the rejection of transplanted tissues between two genetically dissimilar individuals of the same species.

histocompatibility gene A gene responsible for the production of a histocompatibility antigen.

histogram A graphical representation of a frequency distribution by means of rectangles, the widths of which represent the class interval and the heights of which represent the frequencies of the different classes.

histohematin CYTOCHROME.

histoincompatibility Immunological intolerance to transplanted tissue that results from antigenic differences between the donor and the recipient of a transplant.

histological chemistry *See* histochemistry.

histology The branch of anatomy that deals with the structure and the properties of tissues, as examined by staining and microscopy.

histolysis The destruction of tissues.

histone A basic, globular, and simple protein

that is characterized by its high content of arginine and lysine. Histones are found in association with nucleic acids in the nuclei of eukaryotic cells; they are classified into five major groups, on the basis of their arginine and lysine content: H1 (28% lys, 2% arg), H2A (11% lys, 9% arg), H2B (16% lys, 6% arg), H3 (10% lys, 13% arg), H4 (10% lys, 14% arg).

histoplasmin A crude and sterile filtrate, derived from mycelia of the fungus *Histoplasma capsulatum*, that is used for intradermal injections as a test for delayed-type skin hypersensitivity.

hit theory *See* target theory.

HIV *See* AIDS virus.

hive The inflammation of human skin produced during cutaneous anaphylaxis.

HL One of four chloroform-soluble fractions from liver (HL-1 through HL-4) that contain growth factors for *Lactobacillus helveticus* and *Lactobacillus lactis* and that may be related to folic acid and lipoic acid.

HLA antigens *See* major histocompatibility complex.

HLA complex Human-leukocyte associated complex; the major histocompatibility complex in humans.

HLB Hydrophilic-lipophilic balance.

HLCF Heat-labile citrovorum factor.

H locus A chromosomal site in humans that is responsible for synthesis of an enzyme, fucosyl transferase, that functions in the biosynthesis of ABO blood group antigens.

HMC 5-Hydroxymethylcytosine; a minor base.

H-meromyosin Heavy meromyosin.

HMG 1. β -Hydroxyl- β -methyl glutarate. 2. Human menopausal gonadotropin. 3. High-mobility group.

HMM Heavy meromyosin.

HMP 1. Hexose monophosphate pathway. 2. Hexose monophosphate.

HMP shunt Hexose monophosphate shunt.

HMS Hexose monophosphate shunt.

H mutant HOST-RANGE MUTANT.

HM_wK High molecular weight kininogen.

HMW-MAP High molecular weight microtubule-associated protein. A family of high molecular weight proteins (about 300,000 daltons) that appear to function in the assembly of microtubules.

HnRNA Heterogeneous nuclear RNA.

Hodge scheme A schematic summary of various enzymatic and nonenzymatic mechanisms of the browning reactions.

Hodgkin's disease A malignant disorder characterized by painless, progressive enlargement of lymphoid tissue.

Hofmeister series LYOTROPIC SERIES.

Hogness box TATA BOX.

holandric Designating a trait that appears only in males.

holandric gene A gene that is located only on the Y chromosome and that appears only in males.

holdback carrier A nonradioactive compound that is added to a sample to prevent either the coprecipitation or the adsorption of a soluble radioactive compound. *Aka* holdback agent.

holdup volume The gas chromatographic retention volume of a nonadsorbed component; the volume of mobile phase that must be eluted before a component, which is not retarded by the stationary phase, can be eluted.

hole 1. An energy level that is not occupied by a particle even though adjacent energy levels are filled. 2. An unoccupied position in a crystal, a metal, or a liquid where there should normally be either an electron or an atom.

hole zones Thin regions in collagen fibers, resulting from the presence of gaps between staggered collagen fibrils.

holism The doctrine that higher levels of organization cannot be understood or predicted from a knowledge of lower levels; the entirety is greater than the sum of the parts. *See also* reductionism.

Holliday model A model, proposed by R. Holliday, that accounts for crossing over between homologous chromosomes in terms of a series of breakage and reunion events, involving X-shaped (χ) structures. The crossed strand regions are called Holliday junctions and the χ structures are called Holliday intermediates.

hollow fiber technique A technique for dialyzing, desalting, concentrating, and fractionating solutions of macromolecules; entails the use of bundles of semipermeable, hollow-bore fibers that function as molecular sieves and that have pores of controlled dimensions.

holo- Combining form meaning whole or entire.

holocrine gland A gland that produces a secretion that consists of altered secretory cells of the gland itself.

holoenzyme 1. An entire conjugated enzyme that consists of a protein component, or apoenzyme, and of a nonprotein component, or cofactor, which may be either a coenzyme or an activator. 2. An entire oligomeric enzyme that consists of two or more subunits and that retains some activity even when one (or several) of the subunits is missing; DNA-dependent RNA polymerase and DNA-dependent DNA polymerase III are two examples.

hologynic Designating a trait that appears only in females.

holophytic nutrition A mode of nutrition, as

that of green plants, that requires only inorganic compounds for growth and maintenance of the organism.

holoside A glycoside whose "aglycone" portion is another carbohydrate; an oligosaccharide. *See also* heteroside.

holothurin ANIMAL SAPONIN.

holozoic nutrition A mode of nutrition, as that of animals, that requires organic compounds for growth and maintenance of the organism.

homeomorph One of a group of possible and reasonable reaction mechanisms that obey the same rate equation.

homeoplastic graft HOMOGRAFT.

homeostasis 1. The constancy of the internal environment of an organism; the steady state with respect to functions, tissues, and fluids of the organism. 2. The processes involved in the regulation and maintenance of the internal environment of an organism.

homeostatic Of, or pertaining to, homeostasis.

homeothermic Variant spelling of homiothermic.

homeotic genes Genes that establish the diverse pathways by which an embryonic segment develops a distinct adult phenotype. Mutations of homeotic genes result in the replacement of one development pattern by a different, but homologous one. *Var sp* homeoctic genes.

homeotic mutation A mutation that results in transformation of parts of an organism into structures that are appropriate for other positions; the sprouting of a wing from the head of a fruitfly is an example. *Var sp* homeoctic mutation.

homo- 1. Combining form meaning the same or alike. 2. Prefix meaning one additional $-\text{CH}_2-$ group; the next higher homologue of the compound indicated.

homoallelic Pertaining to alleles of a gene that have mutations at identical sites.

homoamino acid An amino acid that has an additional $-\text{CH}_2-$ group compared to another amino acid; an amino acid homologue.

homocellular transport The transport across the cell membrane that moves material into or out of the cell. *See also* intracellular transport; transcellular transport.

homochiral Descriptive of the relation between isometric chiral molecules that are properly congruent. The molecules in an enantiomerically pure material are homochirally related.

homochromatography A chromatographic technique in which a group of compounds are separated by development with a solvent that contains either the same or related compounds; applied, for example, to the paper chromatographic separation of a mixture of

labeled nucleotides from a hydrolysate of *E. coli* 5S RNA by development with a solvent containing a mixture of unlabeled nucleotides from a hydrolysate of yeast RNA.

homocodonic amino acid One of four amino acids that have codons in which all three bases are identical: glycine (GGG), proline (CCC), lysine (AAA), and phenylalanine (UUU).

homocopolymer A copolymer in which individual chains are composed entirely of one type of monomer, as in poly dA:dT.

homocysteine A homologue of cysteine that contains one $-CH_2-$ group more than cysteine. *Abbr* Hcy.

homocystinuria A genetically inherited metabolic defect in humans that is associated with mental retardation and that is characterized by the presence of excessive amounts of homocystine in the urine; due to a deficiency of the enzyme cystathionine synthase which functions in the metabolism of cysteine.

homocytotropic antibody A cytotoxic antibody that binds to and sensitizes target cells in the same species in which it was produced. *See also* reagin.

homodimer A protein that is composed of two identical polypeptide chains.

homoduplex DNA A double-stranded DNA molecule, formed by complementary base pairing of single strands from the same DNA sample. The DNA formed by annealing ordinary *E. coli* DNA or that formed by annealing ^{15}N -labeled *E. coli* DNA are two examples. *See also* heteroduplex.

homologous chromosomes Chromosomes that are only partially homologous.

homeotic genes HOMEOTIC GENES.

homeotic mutation HOMEOTIC MUTATION.

homofermentation 1. Fermentation in which only one major product is formed. 2. HOMOLACTIC FERMENTATION.

homofermentative lactic acid bacteria Lactic acid bacteria that produce in fermentation 1.8 to 2.0 mol of lactic acid per mole of glucose. *See also* heterofermentative lactic acid bacteria.

homogenate The suspension prepared by homogenization of tissues, cells, or cellular components.

homogeneity 1. The state of a preparation of macromolecules of a single type (e.g., of one enzyme) in which the macromolecules are identical with respect to size, charge, structure, and all other properties. 2. The state of a system in which there is only one phase.

homogeneous Of, or pertaining to, homogeneity.

homogeneous catalysis Catalysis in a system that consists of one phase.

homogenic process A symmetrical formation of a covalent bond in which each of the two bonding atoms contributes one electron to the shared pair of electrons that constitutes the bond.

homogenization The disruption of tissues, cells, or cellular components and their reduction to particles of small size so that a relatively uniform suspension is obtained.

homogenizer A device, frequently a tube with a finely tooled pestle, that is used for homogenization.

homogote A merozygote in which corresponding alleles on its endogote and exogote are identical.

homogentisic acid 2,5-Dihydroxyphenylacetic acid; an intermediate in the catabolism of phenylalanine and tyrosine.

homoglycan HOMOPOLYSACCHARIDE.

homograft ALLOGRAFT.

homoimmune phage One of two phages that are sensitive to the same immunity substance.

homolimmunity The resistance of a bacterium carrying a prophage (a lysogenic bacterium) to infection by a phage that is of the same kind as the prophage.

homoiothermic Descriptive of an organism that has a nearly constant body temperature irrespective of the temperature of its environment; it can regulate its body temperature by means of its metabolism. *Aka* warm-blooded.

homokaryon A fungus cell that contains two or more nuclei of only one genotype. *Var sp* homocaryon.

homolactic fermentation *See* homofermentative lactic acid bacteria.

homologous 1. Pertaining to subcellular fractions such as tRNA, ribosomes, and enzymes that have been isolated from the same species; isologous. 2. Pertaining to genetically dissimilar individuals of the same species; allogenic. 3. Pertaining to proteins or nucleic acids from different species that have identical or similar functions, such as the hemoglobins of various vertebrate species. 4. Pertaining to two proteins that show sequence homology. 5. Pertaining to an antigen and an antibody (or an antiserum) when the antibody has been produced in response to the administration of that antigen. 6. Pertaining to an antigen and an antibody (or an antiserum) when the antigens and the antibodies are derived from the same species; isologous. 7. Pertaining to chemical compounds that are members of a homologous series. 8. Pertaining to DNA molecules that have identical or nearly identical base sequences.

homologous chromosomes Chromosomes that occur in pairs, with one each derived from the

- male and female parent, and that contain the same linear gene sequences so that each gene is present in duplicate.
- homologous desensitization** The decreased sensitivity of cells to stimulation that is brought about only by that ligand to which the cells had been previously exposed. *See also* desensitization (3).
- homologous disease** GRAFT-VERSUS-HOST REACTION.
- homologous enzyme variants** Enzyme variants that have similar molecular structures and catalytic properties. *See also* homologous (3).
- homologous hapten** A hapten that closely resembles the haptenic group of the immunogen.
- homologous interference** The inhibition of the multiplication of one virus by an active or a suitably inactivated different virus which belongs to the same taxonomic group.
- homologous recombination** Genetic exchange between DNA molecules that have identical or nearly identical base sequences. *Aka* general recombination.
- homologous series** A series of organic compounds in which each member differs from the preceding one by having one additional $-CH_2-$ group.
- homologous serum jaundice** *See* hepatitis.
- homologue** 1. A member of a homologous series. 2. One of a pair of homologous chromosomes. *Var sp* homolog.
- homolysis** The cleavage of a chemical bond between two atoms in which one of the two electrons constituting the bond moves to one atom and the second electron moves to the other atom; a reaction of the type $R:X = R + X \cdot$.
- homolytic process** A symmetrical covalent bond breakage in which each of the two bonded atoms leaves with one of the electrons of the pair that constitutes the bond.
- homomultimer** HOMOPOLYMER.
- homophilic bonding** The attraction of like groups for each other, as that of nonpolar groups in a hydrophobic bond or that of polar groups in an electrostatic bond.
- homopolar bond** NONPOLAR BOND (1).
- homopolymer** A polymer composed of only one type of monomer.
- homopolymer tail joining** A method for joining two double-stranded DNA molecules by means of homopolymer sequences that are attached through the action of the enzyme terminal nucleotidyl transferase. Poly(dA) tails are put on one DNA molecule and poly(dT) tails are put on the other. The two types of tails are then allowed to anneal and DNA ligase is used to complete the linking of the two DNA molecules.
- homopolynucleotide** A polynucleotide composed of only one type of nucleotide.
- homopolyptide** A polypeptide composed of only one type of amino acid.
- homopolysaccharide** A polysaccharide composed of only one type of monosaccharide.
- homoreactant antibody** An autoantibody, occurring in rabbits, that appears to be directed against antigenic determinants of the autologous IgG immunoglobulin that are hidden in the intact IgG molecule but are exposed when it is digested with the enzyme papain.
- homoreactivation** The reactivation of a poxvirus by another poxvirus of the same immunological subgroup. *See also* reactivation (2).
- homoserine** The homologue of serine that contains one $-CH_2-$ group more than serine.
- homosomal aberration** An intrachromosomal aberration. *See also* chromosomal aberration.
- homospecific antibody** An antibody in which both of the antigen binding sites are specific for the same antigen. *See also* heterospecific antibody.
- homosteroid** A steroid-like molecule; a modified steroid in which a ring has been expanded by the introduction of one or more $-CH_2-$ groups; a homologous steroid.
- homothallic** Descriptive of organisms, such as certain fungi and algae, that exist in the form of one mating type so that gametes from a single strain can fuse to form zygotes.
- homotope** A monomer that can take the place of another monomer in a definable segment of a polymer; thus serine and glycine which occupy position 9 of the A chain of ox and sheep insulin, respectively, are said to be homotopes.
- homotropic interactions** Cooperative interactions between binding sites involving ligands of one kind. The interactions associated with the binding of 4 oxygen molecules by a molecule of hemoglobin and those associated with the binding of several substrate molecules by an allosteric enzyme are two examples. In the latter case, the substrate functions both as a substrate and as an effector.
- homozygosity** The state of having identical alleles at one or more loci in the homologous chromosomes.
- homozygote** A zygote that carries identical alleles at one or more loci in the homologous chromosomes and that breeds true; a cell or an organism that carries two identical alleles of the same gene.
- homozygous** Of, or pertaining to, a homozygote.
- Hoogsten base pairs** A proposed set of base pairs in which the hydrogen bonds involve

purine atom N₇ rather than N₁ as in Watson-Crick base pairs. Specifically, the proposed hydrogen bonds are as follows: AT: N₆ (adenine) - O₄ (thymine); N₇ (adenine) - N₃ (thymine); GC: O₆ (guanine) - N₄ (cytosine); N₇ (guanine) - N₃ (cytosine).

hook model A model for the attachment of the prophage to the bacterial DNA. According to this model, the prophage is joined through a point to the uninterrupted bacterial DNA, somewhat in the manner of a hook. *See also* insertion model.

hopanoids A group of pentacyclic, sterol-like molecules found in many bacteria and some plants. Like the sterols, they are synthesized from mevalonic acid, which is converted to squalene; the latter is then cyclized to yield the hopane nucleus. Bacterial hopanoids appear to play a role in maintaining the stability of membranes.

Hopkins-Cole reaction A colorimetric reaction for tryptophan and other compounds containing the indole ring; based on the formation of a violet color upon treatment of the sample with glyoxylic acid and sulfuric acid.

Horecker cycle HEXOSE MONOPHOSPHATE SHUNT.

horizontal evolution The simultaneous, parallel evolution of many sequences in the gene complement of a single species. The process whereby a population splits into two or more subgroups which then evolve into separate and distinct species. This contrasts with the more common evolution of a single gene in two or more diverging species.

horizontal strip electrophoresis An electrophoretic technique in which paper strips are used that are supported in a horizontal frame, with each end of the paper dipping into a buffer compartment.

horizontal transmission The transmission of viruses between individual hosts of the same generation. *Aka* horizontal infection.

hormonad One of a group of proposed multienzyme complexes that function in the biosynthesis of steroids such as estradiol, cortisol, and aldosterone.

hormone A regulatory substance that is synthesized by specialized cells of an organism, that is active at low concentrations, and that exerts its effect either on all of the cells of the organism or only on certain cells in specific organs. Hormones act by binding to macromolecular receptors that are located either on the cell membrane or inside responsive cells. Hormones have three major functions: (a) an integrative function that deals with the interrelations between different hormones and with the interrelations between hormones and the nervous system, the blood flow, the blood pressure, and other factors; (b) a mor-

phogenetic function that deals with the control of the type and rate of growth of various tissues; and (c) a regulatory function that deals with the maintenance of a constant internal environment with respect to the intra- and extracellular fluids. An animal hormone is a substance such as a polypeptide, a protein, or a steroid, that is secreted principally by an endocrine gland and that is transported by way of the circulation to target organs or target tissues; there the hormone exerts its effect either directly or indirectly and helps to regulate such overall physiological processes as metabolism, growth, and reproduction. A plant hormone is an organic compound that controls growth or some other function at a site removed from its place of production in the plant. Five major types of plant hormones have been identified: auxin, cytokinin, gibberellin, abscisic acid, and ethylene. All of the plant hormones are pleiotropic; that is, they have multiple effects. *See also* acceptor (1).

hormonogen PROHORMONE.

horror autotoxicus An early synonym for autoimmunity, so named because it was originally believed to be nonexistent; it is now known to be widespread.

host 1. An organism upon or in which a parasite lives. 2. The recipient of a transplant. 3. The cell used to propagate a vector and its insert.

host-cell reactivation The restoration of the activity of an ultraviolet-irradiated DNA phage by means of the excision-repair mechanism of the host, subsequent to the infection of the host cells by the phage. *Abbr* HCR.

host-controlled modification HOST-INDUCED MODIFICATION.

host-controlled restriction A host-induced modification that results in the formation of a restricted virus.

host-guest system A system in which a molecule having a well-defined and relatively rigid cavity (the host) binds ions or small molecules (the guest) to sites within this cavity. Examples of naturally occurring hosts are the cyclodextrins and examples of synthetic ones are the crown ethers. Host-guest systems have been used to study membrane aspects and to determine the helix-forming tendencies of amino acids.

host-induced modification A change in the properties of a virus that is brought about by the propagation of the virus in the host cells. In phages, the change amounts to a chemical alteration such as that produced by glucosylation or methylation of the phage DNA; in animal viruses, the change amounts to an incorporation of host cell membrane compon-

ents into the viral envelope.

host range The spectrum of hosts that can be infected by a specific virus.

host-range mutant A mutant virus that can adsorb to, and infect, cells that are resistant to the wild-type virus.

hot Containing one or more radioactive isotopes.

hot spot A site on the DNA molecule at which mutational changes or recombinational events occur at a much higher frequency than is the case for the average site. The term is used particularly for sites in the rII region of T4 phage DNA.

housekeeping genes Genes that provide for general cell function and that are theoretically expressed in all cells and are continuously transcribed; the genes coding for the enzymes of glycolysis and the citric acid cycle are examples. *See also* luxury genes.

Houssay animal A hypophysectomized and depancreatized animal that is used in endocrinological studies.

HPETE Hydroperoxyeicosatetraenoic acid; a compound derived from arachidonic acid by oxidation with lipoxygenase.

HPG Human pituitary gonadotropin.

HPIC High-performance ion-exchange chromatography. *See* high-performance liquid chromatography.

HPL Human placental lactogen.

HPLC High-performance liquid chromatography; also used as an abbreviation for high-pressure liquid chromatography.

HPr A cytoplasmic, heat-stable protein that functions in the transfer of glucose across a bacterial membrane. *See also* enzyme I; enzyme II.

hr Hour.

H1 receptors Receptors, present in some smooth muscles, that are affected by histamine and that cause dilation of arterioles and constriction of venules and bronchioles.

H2 receptors Receptors, present in the gastric mucosa, that are affected by histamine and that cause an increase in the secretion of gastric HCl.

HSA Human serum albumin.

HSK-pathway Hatch-Slack-Kortschak pathway.

HSLC High-speed liquid chromatography.

HSP Heat shock proteins.

H substance A polysaccharide precursor in the biosynthesis of the ABO blood group antigens.

5-HT 5-Hydroxytryptamine.

HTLV-III *See* AIDS virus.

HTP High-temperature protection; also used as an abbreviation for heat shock proteins.

5-HTP 5-Hydroxytryptophan.

HTP regulon High-temperature protection regulon; the regulon responsible for production of heat shock proteins.

HTST method High-temperature-short-time method.

hu Dihydrouridine.

Hudson's rule An empirical rule for assigning anomeric configurations to carbohydrates. The rule states that the α -anomer of a given carbohydrate is that anomer which has a more positive specific rotation in the D-series and a more negative specific rotation in the L-series of the carbohydrates than the other anomer of the same carbohydrate.

Huebl number IODINE NUMBER.

Huebl's iodine solution A solution of iodine and mercuric chloride that is used in the determination of iodine numbers.

Huefner's quotient The ratio of the absorbance at one wavelength to that at another wavelength for a solution containing two hemoglobin derivatives (such as oxyhemoglobin and deoxyhemoglobin, or oxyhemoglobin and carbon monoxide hemoglobin). Such absorbance ratios can be used to determine the relative proportions of the two hemoglobin derivatives.

human chorionic gonadotropin A gonadotropic hormone, produced by the placenta, that has similar biological effects to luteinizing hormone. *Var sp* human chorionic gonadotrophin. *Abbr* HCG.

human lactogen PLACENTAL LACTOGEN.

human menopausal gonadotropin A glycoprotein of the anterior lobe of the pituitary gland that is formed in increasing amounts during menopause and that has follicle-stimulating hormone activity. *Var sp* human menopausal gonadotrophin. *Abbr* HMG.

humectant A hygroscopic substance that is added to other materials, such as food, to ensure a desired level of moisture content.

humic acid A complex mixture of acid-insoluble and alkali-soluble substances that are extracted from the organic matter of soil. *See also* fulvic acid; humin.

humin The heterogeneous fraction of soil organic matter that cannot be extracted with base. *See also* humic acid; fulvic acid.

humor 1. A chemical substance, such as acetylcholine, that is formed in the body and that acts locally. 2. A fluid or a semifluid substance of an animal or a plant, such as the vitreous humor of the eye.

humoral 1. Of, or pertaining to, a humor. 2. Involving only soluble factors as distinct from being cell-mediated.

humoral immunity Immunity that is due to circulating antibodies in the blood and antibodies secreted onto mucous surfaces in contrast to

cellular immunity; it involves extracellular phases of infection and is associated with B lymphocytes. *Aka* humoral immune response; humoral antibody response.

humus The major insoluble portion of the organic substances in soil that is produced by the decomposition of animal and vegetable matter.

Hund's rule The principle that when two or more empty atomic orbitals of equal energy are available, one electron will enter each orbital until all of the orbitals are half-filled (that is, contain one electron). Only after that has occurred are the second electrons added to the orbitals.

Hunter's syndrome A mucopolysaccharidosis due to a deficiency of the enzyme iduronate sulfatase that is involved in the catabolism of dermatan sulfate and heparan sulfate.

H₂Urd Dihydrouridine.

Hurier's syndrome An autosomally linked form of gargoylism; a mucopolysaccharidosis due to a deficiency of the enzyme α -L-iduronidase and characterized by an accumulation of dermatan and heparan sulfates. It appears in infancy and involves steady mental and physical deterioration.

Huxley-Hanson model SLIDING FILAMENT MODEL.

Huxley-Simmons model ROWBOAT MODEL.

HVL Half-value layer.

hv region Hypervariable region.

hyaline VITREOUS.

hyaloplasm CYTOSOL.

hyaluronic acid A glycosaminoglycan of connective tissue that is composed of D-glucuronic acid and N-acetyl-D-glucosamine; it aids in blocking the spread of invading microorganisms and toxic substances and serves as a lubricant and shock absorbant. It occurs in connective tissue, synovial fluid, vitreous humor, and cartilage.

hyaluronidase The enzyme, present in snake venom and in bacteria, that catalyzes the hydrolysis of hyaluronic acid and thereby decreases the effectiveness of hyaluronic acid for blocking the spread of invading microorganisms and toxic substances in the tissues.

hybrid antibody An artificially produced antibody molecule that is composed of fragments, such as intact light and heavy chains, which are derived from two purified and different antibodies.

hybrid-arrested translation A screening procedure that is similar to that of hybrid-selected translation; it is based on the ability of the DNA to hybridize with, and remove, a translatable mRNA, thereby leading to the disappearance of the corresponding protein from the in vitro translation products.

hybridase RIBONUCLEASE H.

hybrid cell HYBRIDOMA.

hybrid duplex A double-stranded nucleic acid molecule that is produced by hybridization.

hybrid gene FUSED GENE.

hybrid hemoglobin An artificially produced hemoglobin molecule that contains either globin chains or subunits which are derived from different sources.

hybridization 1. A technique for assessing the extent of sequence homology between single strands of nucleic acids. The technique is based on allowing the polynucleotide strands to form double-helical segments through hydrogen bonding between complementary base pairs. The greater the extent of complementarity between the strands, the greater is the extent of formation of double-helical segments. The polynucleotide strands may be those of single-stranded nucleic acids or they may be derived from denatured double-stranded nucleic acids. The hybrids formed can be of the DNA/DNA, RNA/RNA, or DNA/RNA type. *See also* Southern blotting; northern blotting. 2. The reconstitution of an oligomeric protein, such as hemoglobin, or of a molecular aggregate, such as a ribosome, from separate and different monomers and/or component parts. The monomers and/or the component parts may be either chemically or mutationally altered ones, or they may be derived from different sources. 3. The fusion of two cells in tissue culture to form a hybrid cell, as in the production of a hybridoma. The hybrid cell contains nuclei and cytoplasm from the two different cells. Cell fusion is promoted by the adsorption of certain viruses (such as Sendai virus), by chemicals (such as polyethylene glycol), or by other means (such as electrofusion). 4. The rearrangement and combination of atomic orbitals in a compound that is due to the effects of either neighboring or bonded atoms.

hybridoma A hybrid cell, produced by the fusion of two cells, and useful for the production of monoclonal antibodies. Antibody-producing lymphocytes of limited life span in cell culture are fused with tumor lymphocytes that are "immortal" in cell culture. From the resulting heterogeneous mixture of hybrid cells, those hybrids are selected that have both the ability to produce a specific antibody, and the ability to multiply indefinitely in tissue culture. These hybridomas are then propagated and provide a permanent and stable source of a single monoclonal antibody. *See also* hybridization (3).

hybrid protein FUSED PROTEIN.

hybrid-selected translation A screening procedure for clones from a cDNA library that can

be used if the mRNA, corresponding to a desired gene sequence, can be translated *in vitro* to produce an identifiable protein product. The method involves hybridization of mRNA and DNA under R-looping conditions, separation of the hybrids formed, and translation of the hybrids *in vitro*.

hydratase An enzyme that catalyzes the reversible hydration of a double bond.

hydrate A compound that contains one or more molecules of water in loose combination.

hydrated electron See solvated electron.

hydration 1. The process whereby water molecules surround, and bind to, solute ions and solute molecules in solution. 2. The formation of a hydrate.

hydration factor See Oncley equation.

hydration shell The layer of water molecules that are bound to an ion or a molecule in solution. *Aka* hydration sphere.

hydrazinolysis The cleavage of a polypeptide or a protein by treatment with hydrazine. The C-terminal amino acid is released as the free amino acid and can be identified; all the other amino acid residues are converted to acyl hydrazine derivatives.

hydr-, hydro- Proposed prefixes for the mixture of hydrogen isotopes that occurs in nature. See also *proti-, proto-*.

hydride ion The anion H^- ; a proton with an associated pair of electrons.

hydrion A hydrogen ion; a proton.

hydrocarbon An organic compound consisting only of carbon and hydrogen.

hydrocortisone CORTISOL.

hydrodynamic Of, or pertaining to, the motion of fluids and the force on, as well as the motion of, particles that are immersed in these fluids.

hydrodynamic method A physical method for studying molecules, particularly macromolecules, on the basis of their movement in solution; includes such methods as sedimentation, diffusion, electrophoresis, and viscosity.

hydrodynamic unit The unit that moves in solution and that consists of the solute particle together with the solvent that is bound tightly to it.

Hydrogenomas See Knallgas reaction.

hydrogen An element that is essential to all plants and animals. Symbol, H; atomic number, 1; atomic weight, 1.00797; oxidation states, -1, +1; most abundant isotope, 1H ; the stable isotope, 2H ; the radioactive isotope, 3H , half-life, 12.26 years, radiation emitted, beta particles.

hydrogenase An enzyme that catalyzes the reduction of a substrate by molecular hydrogen.

hydrogenation The introduction of hydrogen

into an organic compound.

hydrogen bond The attractive interaction that occurs between a covalently linked hydrogen atom and a neighboring atom or group of atoms. The hydrogen atom is linked covalently to an electronegative atom referred to as the donor, and is attracted to an electronegative atom or group of atoms referred to as the acceptor; the acceptor is frequently an oxygen or a nitrogen atom. The hydrogen bond is weaker and has a smaller bond energy than a covalent bond; it has a major electrostatic component and a minor covalent component. The hydrogen bond occurs both intra- and intermolecularly and it is known as a bifurcated bond if the hydrogen atom is attracted simultaneously to two acceptor atoms.

hydrogen carrier An electron carrier that undergoes oxidation-reduction reactions by either the loss or the gain of hydrogen atoms.

hydrogen electrode An electrode at which hydrogen gas is in equilibrium with hydrogen ions in solution. The hydrogen electrode serves as the primary standard for determinations of pH and electrode potentials.

hydrogen exchange See deuterium exchange.

hydrogen ion concentration See pH.

hydrogen ion equilibrium The dissociation and association reactions of hydrogen ions, particularly those pertaining to the functional groups in a protein.

hydrogen ion titration curve A titration curve, particularly that of a protein, in which the number of hydrogen ions that are either bound or dissociated per molecule is plotted as a function of pH.

hydrogen isotope exchange DEUTERIUM EXCHANGE.

hydrogenosome A subcellular organelle of some anaerobic parasitic protozoans that contains pyruvate synthase and hydrogenase and that produces molecular hydrogen by using protons as terminal electron acceptors.

hydrogen peroxide A toxic compound (H_2O_2) that is the substrate of the enzyme catalase.

hydrogen transport system ELECTRON TRANSPORT SYSTEM.

hydrolase An enzyme that catalyzes a hydrolysis reaction. See also enzyme classification.

hydrolysate The solution that contains the mixture of compounds obtained by hydrolysis. *Var sp* hydrolyzate.

hydrolysis (*pl* hydrolyses) The reaction of a substance with water in which the elements of water (H, OH) are separated: (a) the breakage of a molecule into two or more smaller fragments by the cleavage of one or more covalent bonds of acid derivatives; the elements of water are incorporated at each cleavage point such that one of the products com-

binates with the hydrogen of the water while the other product combines with the hydroxyl group of the water; (b) the formation of the undissociated form of a weak electrolyte through the reaction of the ion of that electrolyte with either protons or hydroxyl ions.

hydrolysis constant The equilibrium constant for a hydrolysis reaction.

hydrolytic Of, or pertaining to, hydrolysis.

hydrolytic deamination Nonoxidative deamination.

hydrolytic enzyme HYDROLASE.

hydrolyze To carry out a hydrolysis reaction.

hydrometer An instrument for measuring the specific gravity of liquids.

hydron See proti-, proto-.

hydration See proti-, proto-.

hydronium ion The hydrated proton H_3O^+ .

hydroperoxide A compound that contains the grouping $-OOH$.

hydroperoxyl radical The free radical $HO_2\cdot$; an oxidizing agent that is readily reduced to hydrogen peroxide (H_2O_2).

hydrophilic 1. POLAR. 2. Descriptive of the tendency of a group of atoms or of a surface to become either wetted or solvated by water. See also lyophilic.

hydrophilic-lipophilic balance A characteristic parameter of a detergent, defined as the ratio of the mass (in atomic mass units) of the hydrophilic portion of the molecule to that of the hydrophobic portion. *Abbr* HLB.

hydrophobic 1. NONPOLAR. 2. Descriptive of the tendency of a group of atoms or of a surface to resist becoming either wetted or solvated by water. See also lyophobic.

hydrophobic bond HYDROPHOBIC INTERACTION.

hydrophobic chromatography A column chromatographic technique for the separation of proteins in which the chromatographic support consists of a nonpolar material, such as a hydrocarbon-coated agarose. Fractionation is achieved primarily on the basis of the interactions that take place between accessible hydrophobic pockets or regions on the proteins and the hydrocarbon chains of the support.

hydrophobic effect The phenomenological aspects of hydrophobic interactions, that is, the attraction of nonpolar molecules or nonpolar groups for each other. The basis for these interactions is due, largely, to the gain in entropy experienced by the surrounding water molecules as the interacting molecules or groups aggregate together.

hydrophobic interaction The attractive force between nonpolar molecules or nonpolar groups of molecules which leads to the association of these molecules or groups in an aqueous environment. Hydrophobic interactions occur due to the gain in entropy of the

water which results when nonpolar groups associate and liberate the water molecules that were previously organized around the nonpolar groups. Hydrophobic interactions are unique in that their strength increases as the temperature is raised in the range of 0 to 60°C.

hydrophobic interaction chromatography HYDROPHOBIC CHROMATOGRAPHY.

hydrophobicity constant A measure of the hydrophobic contribution of a substituent to a parent compound (S); defined as follows: $\pi = \log(P/P_0)$, where π is the hydrophobicity constant for substituent R; P_0 is the ratio of the solubility of the parent compound (H-S) in *n*-octanol to that in water; and P is the ratio of the solubility of the substituted compound (R-S) in *n*-octanol to that in water.

hydroponics The growth of plants in aqueous solutions that contain chemical nutrients.

hydrops fetalis See Thalassaemia.

hydrosol A sol in which the dispersion medium is water.

hydrosphere The aqueous envelope of the earth; includes oceans, lakes, streams, underground water, and water vapor in the atmosphere.

hydroxide ion The anion OH^- . *Aka* hydroxyl ion.

hydroxy acid A carboxylic acid in which one or more hydrogen atoms of the alkyl group has been replaced by a hydroxyl group; lactic acid is an example.

hydroxyallysine A derivative of hydroxylysine in which the epsilon amino group has been converted to an aldehyde group; hydroxyallysine undergoes an aldol condensation with allysine during the crosslinking of collagen chains.

hydroxyapatite A calcium phosphate-calcium hydroxide complex, $Ca_{10}(PO_4)_6(OH)_2$, that is useful as an adsorbent for the purification of proteins and that also binds double-stranded DNA. The mineral of bone has an approximate composition corresponding to hydroxyapatite. *Abbr* HA.

β -hydroxybutyric acid A compound that can be formed from acetyl coenzyme A and that is one of the ketone bodies.

5-hydroxyindoleacetic acid A catabolite of serotonin. *Abbr* 5-HIAA.

β -hydroxyisovaleric aciduria A genetically inherited metabolic defect in humans that is due to a deficiency of the enzyme β -methylcrotonyl CoA carboxylase.

hydroxylamine A chemical mutagen that leads to the deamination of cytosine, which then forms a base pair with adenine.

hydroxylase MONOOXYGENASE.

hydroxylation The introduction of a hydroxyl

group into an organic compound.

hydroxyl group The radical —OH. *See also* alcoholic hydroxyl group; phenolic hydroxyl group.

hydroxyl value The number of milligrams of potassium hydroxide that are chemically equivalent to the hydroxyl content of 1g of fat.

hydroxyllysine An alpha amino acid that is derived from lysine and occurs in collagen and gelatin. *Abbr.* Hyl; Hyls.

5-hydroxymethylcytosine A pyrimidine that is found in the DNA of T-even phages where it takes the place of cytosine and is hydrogen-bonded to guanine.

β -hydroxy- β -methylglutarate A compound that, in the form of β -hydroxy- β -methylglutaryl CoA (HMG-CoA), is an important intermediate in the biosynthesis of cholesterol and ketone bodies. *Abbr.* HMG.

hydroxymethyl group The one-carbon fragment —CH₂OH.

hydroxyproline An alpha imino acid that is derived from proline and occurs in collagen and gelatin. *Abbr.* Hyp; Hypo.

hydroxyprolinemia A genetically inherited metabolic defect in humans that is characterized by high plasma and urine concentrations of hydroxyproline and that is due to a deficiency of the enzyme hydroxyproline oxidase.

5-hydroxytryptamine SEROTONIN.

5-hydroxytryptophan An intermediate in the biosynthesis of serotonin. *Abbr.* 5-HTP.

hydroxyurea A derivative of urea that inhibits ribonucleotide reductase and DNA replication; it does not inhibit DNA repair.

Hyflow supercel Trademark for a preparation of diatomaceous earth.

hygrometer An instrument for measuring the moisture content of a gas, particularly that of the atmosphere.

hygroscopic Descriptive of a substance that readily absorbs moisture from the atmosphere.

Hyl 1. Hydroxyllysine; also abbreviated Hyls.
2. Hydroxylsyl.

Hyp 1. Hydroxyproline; also abbreviated Hypo. 2. Hydroxyprolyl. 3. Hypoxanthine.

hyper- Prefix meaning excessive.

hyperacidity Excessive acidity, particularly that due to increased concentrations of gastric hydrochloric acid which is associated with "heartburn," "indigestion," and peptic ulcers.

hyperalaninemia One of a number of genetically inherited metabolic defects in humans that are due to blocks in the metabolism of pyruvate, such as those resulting from a deficiency of pyruvate carboxylase and pyruvate dehydrogenase.

hyperammonemia A genetically inherited

metabolic defect in humans that is due to a deficiency of the enzyme ornithine carbamoyl transferase, in the case of hyperammonemia I, and due to a deficiency of the enzyme carbamoyl phosphate synthase, in the case of hyperammonemia II.

hyperargininemia A genetically inherited metabolic defect in humans that is characterized by elevated levels of arginine in the blood and in the urine, and that is due to a deficiency of the urea cycle enzyme arginase. *Aka* argininemia.

hyperbilirubinemia CRIGLER-NAJJAR SYNDROME.

hyperbolic inhibition Inhibition that yields a curve that is convex upward when either slopes or intercepts from a primary plot are plotted as a function of inhibitor concentration.

hyperbolic kinetics *See* Michaelis-Menten kinetics.

hypercalcemia The presence of excessive amounts of calcium in the blood.

hypercalcemic factor PARATHORMONE.

hypercapnia The presence of excessive amounts of carbon dioxide in the blood.

hyperchloremia The presence of excessive amounts of chloride in the blood.

hyperchloremic metabolic acidosis Metabolic acidosis in which there is an increase in the concentrations of both protons and chloride ions.

hyperchlorhydria The presence of excessive amounts of hydrochloric acid in the gastric juice.

hypercholesterolemia *See* familial hypercholesterolemia; cholesterolemia.

hyperchromic effect The increase in the ultraviolet absorbance of a solution containing either DNA or RNA that occurs upon either the denaturation or the degradation of the nucleic acid. The effect is due to changes in the electronic interactions between the bases and is generally measured at 260 nm.

hyperchromicity The increase in absorbance that is due to the hyperchromic effect and that is measured at a specified wavelength.

hyperchromism 1. The increase in absorbance that is due to the hyperchromic effect and that is measured between two wavelengths, or between two forms, or between two states, of the absorbing substance. 2. HYPERCHROMICITY.

hyperfine splitting The breakup of a spectral peak into a series of peaks. In electron paramagnetic resonance this is due to the interaction of electrons with other electrons or nuclei; in nuclear magnetic resonance this is due to spin-spin coupling.

hyperglycemia The presence of excessive amounts of glucose in the blood.

hyperglycemic factor GLUCAGON.

hyperglycemic-glycogenolytic factor GLUCAGON.

hyperglycinemia A genetically inherited metabolic defect in humans that is associated with mental retardation and that is due to a deficiency of the enzyme propionate carboxylase. *See also* ketotic hyperglycinemia; non-ketotic hyperglycinemia.

hyperimmunity Immunity that is characterized by the presence of large amounts of antibodies in the blood, and that may be produced by repeated injections of antigens into an animal organism.

hyperinsulinism The presence of excessive amounts of insulin in the body, resulting in hypoglycemia.

hyperkalemia HYPERPOTASSEMIA.

hyperlipemia LIPEMIA.

hyperlipoproteinemia The presence of excessive amounts of lipoproteins in the blood.

hyperlysinemia A genetically inherited metabolic defect in humans that is associated with mental retardation and that is due to a deficiency of the enzyme lysine-ketoglutarate reductase.

hypermagnesemia The presence of excessive amounts of magnesium in the blood.

hypermethioninemia A genetically inherited metabolic defect in humans that is due to a deficiency of the enzyme methionine adenosyl transferase which catalyzes the conversion of methionine to S-adenosyl methionine.

hypermodified nucleosides A group of more than 20 complex nucleosides that occur in transfer RNA. These nucleosides are more complex than simple methylated derivatives of the common nucleosides and do not include compounds such as dihydrouridine, pseudouridine, and ribothymidine but include compounds such as queuosine and wyosine.

hypermorph A mutant gene that has a similar, but stronger, effect than its wild-type gene.

hypernatremia The presence of excessive amounts of sodium in the blood.

hyperon A nuclear particle that has a mass greater than that of a nucleon.

hyperoxaluria A genetically inherited metabolic defect in humans that is characterized by a high urinary excretion of oxalate and deposition in the tissues of insoluble calcium oxalate. Two types are known, one due to a deficiency of α -ketoglutarate-glyoxylate carboxylase and one due to a deficiency of D-glycerate dehydrogenase.

hyperphenylalaninemia PHENYLKETONURIA.

hyperphosphatemia The presence of excessive amounts of phosphate in the blood.

hyperplasia The increase in the size of a tissue or an organ, excluding tumor formation, that results from an increase in the number of the

component cells.

hyperploid state The aneuploid state in which the chromosome number is greater than that of the characteristic euploid number. *Aka* hyperploidy.

hyperpolarization A change in membrane potential that is the opposite of depolarization. An increase in membrane potential; the membrane potential becomes more negative than it is in the normal resting state.

hyperpotassemia The presence of excessive amounts of potassium in the blood.

hyperprolinemia A genetically inherited metabolic defect in humans that is due to a deficiency of the enzyme proline oxidase, in the case of hyperprolinemia I, and due to a deficiency of the enzyme pyrroline-5-carboxylate reductase, in the case of hyperprolinemia II.

hypersensitive response ALLERGIC RESPONSE.

hypersensitive sites Specific regions in eukaryotic DNA that are cleaved by deoxyribonuclease at higher rates than the bulk regions of the DNA; these sites frequently correlate with transcriptional activity of particular genes and may constitute regulatory regions in the DNA.

hypersensitivity 1. The altered immunological state that is produced in humans and animals by their previous exposure to an antigen and that is characterized by the occurrence of different and pathological reactions upon their subsequent exposure to either the same antigen or a structurally related substance. *Aka* allergy. 2. The above average response of a human or an animal to a drug.

hypertensin ANGIOTENSIN.

hypertensinogen ANGIOTENSINOGEN.

hypertension High blood pressure.

hypertensive agent An agent that brings about an increase in blood pressure.

hyperthermia A higher than normal temperature.

hyperthyroidism Excessive activity of the thyroid gland that leads to an increase in oxygen consumption and to an increase in the overall metabolic rate.

hypertonic contraction An alteration in the water and electrolyte balance in the body in which there is a decrease in the volume of the extracellular fluid but no equivalent loss of electrolytes, so that the osmotic pressure of the extracellular fluid increases.

hypertonic expansion An alteration in the water and electrolyte balance in the body in which there is an increase in the electrolyte concentration and a less than equivalent increase in the volume of the extracellular fluid, so that the osmotic pressure of the extracellular fluid increases.

hypertonic solution A solution that has a high-

er osmotic pressure than another solution.

hypertrophy The increase in the size of a tissue or an organ, excluding tumor formation, that is due to either an increase in the volume of the component cells, or an increase in the functional activity of the tissue or the organ.

hyperuricemia The presence of excessive amounts of uric acid in the blood.

hypervalinemia A genetically inherited metabolic defect in humans that is due to a deficiency of the enzyme valine transaminase.

hypervariable codon A codon that has undergone an excessive number of mutations when it is considered in the context of the biochemical evolution of proteins.

hypervariable regions A number of small regions, present in the variable regions of both the light and the heavy immunoglobulin chains, in which the bulk of the variability of amino acid sequences is found. The remainder of the variable regions are relatively constant in amino acid sequence and are called framework regions.

hyperventilation Excessive aeration of the blood in the lungs.

hypervitaminosis A pathological condition resulting from an overdose of a vitamin, such as that produced by an overdose of either vitamin A or vitamin D.

hypha (*pl* hyphae) One of a number of filamentous and branched tubes of a fungus that contain cytoplasm and that form a network known as mycelium.

hypo- Prefix meaning less than.

hypo Sodium thiosulfate, a commonly used photographic fixer; a reagent for the removal of unexposed and unreduced silver halide grains from a photographic film.

hypobaria A lower than normal atmospheric pressure.

hypobetalipoproteinemia A genetically inherited metabolic defect in humans that is characterized by low concentrations of plasma low-density lipoproteins (LDL).

hypocalcemia A deficiency of calcium in the blood.

hypocalcemic factor CALCITONIN.

hypocapnia A deficiency of carbon dioxide in the blood.

hypochloremia A deficiency of chloride in the blood.

hypochlorhydria A deficiency of hydrochloric acid in the gastric juice.

hypcholesterolemia A deficiency of cholesterol in the blood.

hypochromic anemia An anemia that is characterized by a decrease in the hemoglobin concentration of the red blood cells.

hypochromic effect The decrease in the ultraviolet absorbance of a solution containing

either DNA or RNA compared to the absorbance of the same solution but containing either the denatured or the degraded nucleic acid. The effect is due to changes in the electronic interactions between the bases and is generally measured at 260 nm.

hypochromicity The decrease in absorbance that is due to the hypochromic effect and that is measured at a specified wavelength.

hypochromism 1. The decrease in absorbance that is due to the hypochromic effect and that is measured between two wavelengths, between two forms, or between two states, of the absorbing substance. 2. HYPOCHROMICITY.

hypofibrinogenemia A pathological condition characterized by low levels of fibrinogen in the blood.

hypogammaglobulinemia A genetically inherited metabolic defect in humans that is characterized by an almost complete absence of specific immunoglobulins. *See also* agammaglobulinemia.

hypoglycemia A deficiency of glucose in the blood.

hypoglycemic factor INSULIN.

hypoglycin A derivative of propionic acid that is the toxic principle of the ackee fruit; it inhibits the enzyme isovaleryl CoA dehydrogenase and hence gives rise to the same symptoms present in the genetic disease isovaleric acidemia.

hypohaptoglobinemia A genetically inherited metabolic defect in humans that is characterized by decreased levels of haptoglobins in the blood.

hypokalemia HYPOKALASSEMIA.

hypomagnesemia A genetically inherited metabolic defect in humans that is characterized by a deficiency of magnesium in the blood and that is due to a failure of intestinal absorption of magnesium ions.

hypomorph A mutant gene that has a similar, but weaker, effect than its wild-type gene.

hyponatremia A deficiency of sodium in the blood.

hypophase technique KLEINSCHMIDT TECHNIQUE.

hypophosphatasia A genetically inherited metabolic defect in humans that is characterized by deficient bone formation and that is due to a deficiency of the enzyme alkaline phosphatase.

hypophosphatemia A deficiency of phosphate in the blood.

hypophyseal Of, or pertaining to, the pituitary gland.

hypophysectomy The surgical removal of the pituitary gland.

hypophysin An extract made of the posterior lobe of the pituitary gland.

hypophysis PITUITARY GLAND.

hypoplasia 1. The arrested development of a tissue or an organ. 2. The decrease in the size of a tissue or an organ that results from a decrease in the number of the component cells.

hypoploid state The aneuploid state in which the chromosome number is less than that of the characteristic euploid number. *Aka* hypoploidy.

hypopotassemia A deficiency of potassium in the blood.

hyposensitivity The below average response of a human or an animal to a drug.

hypostatic gene A gene, the expression of which is suppressed by another gene in epistasis.

hypotension Low blood pressure.

hypotensive agent An agent that brings about a lowering of the blood pressure.

hypothalamic hormone A hormone that is produced by the hypothalamus and that either stimulates or inhibits the release of another hormone. Hypothalamic stimulatory hormones stimulate the release of corticotropic hormone, luteinizing hormone, follicle-stimulating hormone, thyrotropic hormone, and growth hormone; hypothalamic inhibitory hormones inhibit the release of prolactin and melanocyte-stimulating hormone. *Aka* hypothalamic factor; hypothalamic regulatory hormone. *See also* chalone.

hypothalamus A basal part of the brain.

hypothermia A lower than normal temperature.

hypothesis (*pl* hypotheses) A statement describing a relation that may be either true or untrue; the statement appears to be confirmed by experimental facts but is not as certain as a theory. A hypothesis is a tentative explanation or description of observed phenomena that remains to be critically tested by further experiments.

hypothyroidism Deficient activity of the thyroid gland that leads to a decrease in the oxygen consumption and to a decrease in the overall metabolic rate. *Aka* myxedema.

hypotonic contraction An alteration in the water and electrolyte balance in the body in which there is a decrease in the volume of the extracellular fluid and a more than equivalent decrease of electrolytes, so that the osmotic pressure of the extracellular fluid decreases.

hypotonic expansion An alteration in the water

and electrolyte balance in the body in which there is an increase in the volume of the extracellular fluid but no equivalent increase in electrolytes, so that the osmotic pressure of the extracellular fluid decreases.

hypotonic solution A solution that has a lower osmotic pressure than another solution.

hypotrophy 1. Subnormal growth. 2. The degeneration and loss of function of a tissue or an organ.

hypoveentilation Deficient aeration of the blood in the lungs.

hypovitaminosis The deficiency disease that results from the inadequate dietary intake of one or more vitamins.

hypoxanthine The purine 6-hydroxypurine that occurs in transfer RNA and that is formed in catabolism by the deamination of adenine. *Sym* I.

hypoxia A condition in which the oxygen concentration of the blood and the tissues is below normal either as a result of environmental deficiency or as a result of impaired respiration and circulation.

hypro Hydroxyproline.

hypro-protein Hydroxyproline in its protein form as distinct from free hydroxyproline.

hypsochromic group A group of atoms that, when attached to a compound, shifts the absorption of light by the compound to shorter wavelengths.

hypsochromic shift A shift in the absorption spectrum of a compound toward shorter wavelengths.

hysteresis The phenomenon in which changes of a property in one direction can be reversed back to the initial value of the property, but in so doing take on intermediate values that differ from those taken on in the forward direction. A plot of such a system results in two curves, coming together at both ends and forming a hysteresis loop in between.

hysteretic Of, or pertaining to, hysteresis.

hysteretic enzyme An enzyme that appears to undergo very slow changes in either kinetic or molecular properties after the addition or the removal of a ligand; believed to be due to conformational changes of the enzyme as a result of the change in ligand concentration.

Hz Hertz.

H zone The central, less dense portion of the A band of the myofibrils of striated muscle. *Aka* H band.