

Over the last two decades Biotechnology has evolved as an important scientific discipline with intimate overlapping interactions with several other disciplines of Biology. In order to have clarity of understanding in this field, at least optimal knowledge in different related/ allied areas of biology is essential. Often it is being felt that a B Sc. Biotechnology student while pursuing his/her masters in Biotechnology often stumbles at several terms and terminology from pure Botany/ Zoology/ Microbiology. Considering this aspect, as many as possible, have been incorporated in this glossary, from these areas for their ready reference. Hence, we the authors engaged in teaching Biotechnology and research in different fields within the broad domain of biology have made an attempt for the first time, to carefully and comprehensively compile a glossary referring a broad spectrum of sources of texts, journals and websites. This glossary, which at the outset will definitely be helpful to the students of Biotechnology at the UG, PG, M. Phil. and the researchers pursuing Ph. D course work as well as catering to certain needs of the NET and GATE aspirants, and also be useful to the teachers

Glossary of Biotechnology



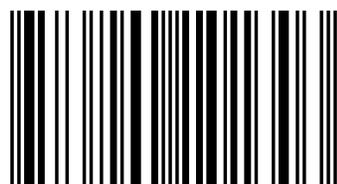
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A Glossary of Biotechnology & Allied Sciences

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5-Azacytidine An antitumor antimetabolite that is incorporated into RNA. Its exact mechanism of action is not known.

A form A duplex DNA structure with right-handed twisting in which the planes of the base pairs are tilted about 70° with respect to the helix axis.

A site (aminoacyl site) Site on a ribosome occupied by an incoming tRNA with its linked amino acid.

Abdomen Abdomen in mammals is the portion of the body which is located below the rib cage, and in arthropods below the thorax. It is the cavity that contains stomach, intestines, etc.

Abiotic factors The non-biological environmental influences that affect growth and development of organisms; for example, temperature, rainfall, light intensity, humidity and chemicals.

Abiotic stress The stress caused to plants due to abiotic factors like herbicides, water deficiency, ozone, intense light etc.

ABO blood group System Classification of red blood cells based on the presence or absence of A and B carbohydrate antigens.

Abscess A localized accumulation of pus.

Abscissic acid (ABA) A growth inhibiting hormone enabling perennial plants to tolerate stressful conditions by promoting dormancy, stomatal closure and inhibiting growth.

Abscission zone The zone at the base of the flower (pedicel), fruit (peduncle) or leaf (petioles), at which plant cells fray off, thereby facilitating the easy fall of these plant parts.

Abscission Abscission is a process of shedding or separating part of an organism from the rest of it. Common examples are that of, plant parts like leaves, fruits, flowers and bark being separated from the plant.

Absolute configuration The spatial arrangement of chemical groups around a chiral center.

Absorbance (A_λ) A function of the amount of light transmitted through a solution (I) relative to the incident light (I_0) at a given wavelength. $A = \log_{10} I_0/I$. It is also called optical density.

Absorption field A system of properly sized and constructed narrow trenches partially filled with a bed of washed gravel or crushed stone into which perforated or open joint pipe is placed. The discharge from the septic tank is distributed through these pipes into trenches and surrounding soil. While seepage pits normally require less land area to install, they should be used only where absorption fields are not suitable and well-water supplies are not endangered.

Absorption Movement of ions and water into an organism as a result of metabolic processes, frequently against an electrochemical potential gradient (active) or as a result of diffusion along an activity gradient (passive).

Absorption spectrum Graph indicating the relative abilities of pigments to absorb various wavelengths of light.

Abzymes The catalytic antibodies or antibody enzymes.

Acceptor In a hydrogen bond, the atom (oxygen, nitrogen, or sulfur) that is not covalently bonded to the hydrogen but nevertheless it accepts a small share of the electrons.

Acceptor arm Part of the structure of a tRNA molecule.

Acceptor domain The base-paired region of a tRNA molecule that contains the 5' end and the 3' end to which an amino acid is attached.

Acceptor site The splice site at the 3' end of an intron.

Accession number (GenBank) The accession number is the unique identifier assigned to the entire sequence record when the record is submitted to GenBank. The GenBank accession number is a combination of letters and numbers that are usually in the format of one letter followed by five digits (e.g., M12345) or two letters followed by six digits (e.g., AC123456). The accession number for a particular record will not change even if the author submits a request to change some of the information in the record. An accession number is a unique identifier for a complete sequence record, while a sequence identifier, such as a Version, GI, or ProteinID, is an identification number assigned just to the sequence data. The NCBI Entrez System is searchable by accession number using the Accession [ACCN] search field.

Accession number (RefSeq) This accession number is the unique identification number for a complete RefSeq sequence record. RefSeq accession numbers are written in the following format: two letters followed by an underscore and six digits (e.g., NT_123456). The first two letters of the RefSeq accession number indicate the type of sequence included in the record as described below: NT_123456 constructed genomic contigs, NM_123456 mRNAs (actually the cDNA sequences constructed from mRNA), NP_123456 proteins, and NC_123456 chromosomes.

Accessory pigment A molecule in the photosynthetic system that absorbs light at wavelength other than those absorbed by chlorophyll e.g. Phycocyanin.

Accidental Accidental refers to the occurrences or existence of all those species that would not be found in a particular region under normal circumstances.

Acclimation Acclimation refers to the morphological and/or physiological changes experienced by various organisms to adapt or accustom themselves to a new climate or environment.

Accumulator species Plants that take up large amounts of heavy metal ions from the soil without injury.

Acellular vaccine Vaccine consisting of antigenic parts of cells.

Acetal The product formed by the successive condensation of two alcohols with a single aldehyde. It contains two ether-linked oxygens attached to a central carbon atom.

Acetogenic bacterium Prokaryotic organism that uses carbonate as a terminal electron acceptor and produces acetic acid as a waste product.

Acetone (CH₃—CO—CH₃) A chemical with a fruity smell produced from acetoacetate during the ketosis that can occur in diabetes.

Acetyl coenzyme A (acetyl CoA) It is a high-energy ester of acetic acid that is important both in the tricarboxylic acid cycle and in fatty acid biosynthesis. It is developed as an intermediate of

carbohydrate/ fat/ protein oxidation in the citric acid cycle, the acetylated form of coenzyme A. It provides the means for pyruvic acid to enter the Krebs cycle.

Acetylcholine A transmitter released by various nerve cells including motoneurons and autonomic vasodilator neurons.

Acetylcholine receptor Integral membrane protein that binds acetylcholine. There are two types: the nicotinic acetylcholine receptor is ionotropic while the muscarinic acetylcholine receptor is metabotropic, linked via Gq to phospholipase C β .

Acetylcholinesterase Enzyme that hydrolyzes acetylcholine, terminating its action at synapses.

Acetylene-block assay Estimates denitrification by determining release of nitrous oxide (N₂O) from acetylene-treated soil.

Acetylene-reduction assay Estimates nitrogenase activity by measuring the rate of acetylene reduced to ethylene.

Achene A simple, single-seeded, dry, indehiscent fruit comprising one seed attached to only the base of the pericarp.

Acid A molecule that readily gives H⁺ and one or more negative ions to water. Most organic acids are compounds containing the group —COOH, although —SH is also weakly acidic.

Acid soil Soil with a pH value < 6.6.

Acid-base catalysis A catalytic mechanism in which partial proton transfer from an acid or partial proton abstraction by a base lowers the free energy of a reaction's transition state.

Acid-fast stain A differential stain used to identify bacteria that are not decolorized by acid-alcohol.

Acidic dye A salt in which the color is in the negative ion; used for negative staining e.g. anthraquinone, congo red, azobenzene.

Acidophile Organism that grows best under acid conditions (down to a pH of 1).

Acquired immune deficiency The inability of an individual to produce specific antibodies or T cells due to drugs or disease.

Acquired immunity The ability of an individual to produce specific antibodies.

Acridine dye A chemical compound that causes a frameshift mutation by intercalating between adjacent base pairs of the double helix.

Acrosome Actin-rich structure that helps the sperm to penetrate the egg at fertilization.

ActA The protein on the surface of the bacterium *Listeria* from which actin filaments polymerize.

Actin A protein found in combination with myosin in muscle and also found as filaments constituting an important part of the cytoskeleton in many eukaryotic cells.

Actin Force-generating cytoplasmic and muscle protein, present in both globular (G-actin) and fibrous form (F-actin).

Actin-binding proteins Proteins that have the ability to bind actin monomers, or polymers, or both.

Actinomycete Nontaxonomic term applied to a group of high G + C base composition, Gram-positive bacteria that have a superficial resemblance to fungi. Includes many but not all organisms belonging to the order Actinomycetales.

Actinomycetes Gram-positive bacteria that tend to form branching filaments; may form true mycelia; may produce conidiospores.

Actinomycin D An antibiotic that binds to DNA and inhibits RNA chain elongation.

Actinorhizae Associations between actinomycetes and plant roots.

Actin-related protein (Arp) An actin nucleation protein. New actin filaments can grow out from an Arp base.

Actin-severing protein One of a group of enzymes that cuts actin microfilaments. Gelsolin is an example.

Actinomycin D Also known as dactinomycin. An antitumor antibiotic originally isolated from *Streptomyces parvulus*. It binds tightly to cellular DNA to inhibit the synthesis of RNA.

Action potential The wave of transient depolarization and repolarization that constitutes the electrical signal generated by a nerve cell.

Activated complex The highest free energy state of a complex in going from reactants to products.

Activated sludge Sludge particles produced in raw or settled wastewater (primary effluent) by the growth of organisms (including zoogeal bacteria) in aeration tanks in the presence of dissolved oxygen. The term "activated" comes from the fact that the particles are teeming with fungi, bacteria, and protozoa. Activated sludge is different from primary sludge in that the sludge particles contain many living organisms which can feed on the incoming wastewater.

Activation domain The part of an activator that makes contact with the initiation complex of transcription.

Activation energy Amount of energy required to bring all molecules in one mole of a substance to their reactive state at a given temperature. It is the height of the energy barrier between the reactants and the products of a chemical reaction. It can also be defined as the minimum collision energy required for a chemical reaction to occur.

Activator A DNA-binding protein that stabilizes construction of the RNA polymerase II transcription initiation complex.

Active carrier An individual who has an evident clinical case of a disease and who can transmit the infection to others.

Active site The region of an enzyme molecule that contains the substrate binding site and the catalytic site for converting the substrate(s) into product(s).

Active transport The transport of solute molecules across a membrane against an electrochemical gradient; it requires a carrier protein and the input of energy.

Actively acquired immunity Production of antibodies or specialized lymphocytes by an individual in response to an antigen.

Activity space The entire range of climatic and environmental conditions suitable to normal functions, process and activities of a living organism.

Acute disease A disease in which symptoms develop rapidly but last for only a short time.

Acyl-carrier protein A phosphopantetheine containing protein that binds the intermediates of fatty acid synthesis as thioesters.

Acyl group A portion of a molecule with the formula $-\text{COR}$, where R is an alkyl group. Acyl groups are formed when fatty acids are attached to other compounds by ester bonds.

Acylation The attachment of a lipid side chain to a polypeptide.

Acyl-enzyme intermediate An intermediate of peptide bond hydrolysis in which the carbonyl carbon of the scissile bond is covalently bound to the enzyme nucleophile that attacked it.

Ada enzyme An *Escherichia coli* enzyme that is involved in the direct repair alkylation mutations.

Adaptation Adaptation refers to the genetic mechanism of an organism to survive, thrive and reproduce by constantly enhancing itself, by altering its structure or function, in order to become better suited to the changing environment.

Adaptive radiation The evolutionary diversification from an ancestral group of organisms, into a number of new more specialized forms, each suited to live in new habitats.

Adaptor A synthetic, double-stranded oligonucleotide used to attach sticky ends to a blunt-ended molecule.

Addition line An addition line has one pair of chromosomes from another variety or species in addition to the normal somatic chromosome complement ($2n$) of the species.

Adenine A purine nucleic acid found in DNA and RNA base that pairs with thymine in DNA and uracil in RNA.

Adenocarcinoma A malignant tumor of epithelial cells in which the cells are arranged in the form of a gland.

Adenoma A benign tumor of epithelial cells in which the cells are arranged in the form of a gland.

Adenosine Adenine base linked to the sugar ribose. Adenosine is a nucleoside. It is a purine nucleoside found in DNA, RNA, and many cofactors.

Adenosine deaminase acting on RNA (ADAR) An enzyme that edits various eukaryotic mRNAs by deaminating adenosine to inosine.

Adenosine diphosphate (ADP) A nucleotide comprising adenine, two phosphate units and ribose, it is a cofactor contributing either phosphate group or energy or both to a reaction. It is formed when ATP is split and energy is released. The nucleotide formed by adding a pyrophosphate group to the 5'-OH group of adenosine.

Adenosine diphosphoglucose (ADPG) Glucose activated by ATP which acts as a precursor for glycogen synthesis.

Adenosine monophosphate (AMP) Adenosine with one phosphate attached to the 5' carbon of ribose.

Adenosine triphosphate (ATP) A nucleotide comprising adenine, ribose and three phosphate units; is the major energy currency of the cell. It is a cofactor contributing phosphate group, energy or both to the reaction. The nucleotide formed by adding yet another phosphate group to the pyrophosphate group on ADP.

Adenosine triphosphatase The enzyme that catalyzes the reaction $ATP \rightarrow ADP + P$.

Adenoviruses They are medium-sized (90–100 nm), nonenveloped (without an outer lipid bilayer) viruses with an icosahedral nucleocapsid containing a double stranded DNA genome. Their name derives from their initial isolation from human adenoids in 1953. They have linear double-stranded (ds) DNA molecules that are typically 26-46 Kbp long, containing 23-46 protein-coding genes. They are present in a latent form in many healthy individuals. Some 28 different types of adenoviruses have been identified and several of them have been shown to cause diseases of the upper respiratory tract.

Adenyl cyclase A membrane-bound enzyme that converts ATP to the intracellular messenger cyclic AMP (cAMP). It is also called adenylate cyclase.

Adenylate cyclase system A signal transduction pathway in which hormone binding to a cell-surface receptor activates a G protein which in turn stimulates adenylate cyclase to synthesize the second messenger cyclic 3',5' adenosine monophosphate (cAMP) from ATP.

Adenylation Addition of an adenylyl (AMP) group.

Adherence Attachment of a microbe or phagocyte to another's plasma membrane or other surface.

Adherens junctions Type of anchoring junction in which the cell adhesion molecules are linked to actin microfilaments.

Adhesive force It is the force of attraction between dissimilar molecules due to which they stay together. For e.g. water droplets on a leaf.

Adipocyte A fat cell, which is specialized for the synthesis and storage of triacylglycerols from free fatty acids.

Adipose tissue A type of fatty connective tissue.

Adjuvant A material added to an antigen to increase its immunogenicity. Common examples are alum, killed *Bordetella pertussis*, and an oil emulsion of the antigen, either alone (Freund's incomplete adjuvant) or with killed mycobacteria (Freund's complete adjuvant).

Adjuvant chemotherapy The use of chemotherapy in a latent form in conjunction with surgery, radiotherapy or both to try ensure that all tumor cells are killed at the time of treatment. This approach is based on the principles (1) that chemotherapy is most effective when there are only a small number of malignant cells to be dealt with and (2) that surgery and radiotherapy often leave a small number of undiscerned malignant cells.

A-DNA A structural configuration of the double helix, present but not common in cellular DNA.

ADP/ATP exchanger A carrier in the inner mitochondrial membrane. ADP is moved in one direction and ATP in the other.

Adrenal glands Two small organs, located next to the kidneys that are responsible for the synthesis and release of several hormones, primarily catecholamines and steroids.

Adrenaline Hormone released into the blood when an individual is under stress. Adrenaline acts at β -adrenergic receptor to activate Gs and hence adenylate cyclase.

Adrenergic receptor G protein-coupled receptors that are targets for adrenaline and noradrenaline.

Adriamycin An antitumor antibiotic isolated from a mutant strain of *Streptomyces peucetius*. It is believed to act by binding with cellular DNA to block the production of RNA. Adriamycin is an analog of daunorubicin.

Adsorption Process by which atoms, molecules, or ions are taken up and retained on the surfaces of solids by chemical or physical binding.

Adventitious roots The roots that do not originate from primary roots are called adventitious. They generally arise from stems or leaves.

Adventitious shoot (root) A shoot (or root) that arises where it is not normally expected, such as at the base of stem cuttings or from a clump of callus tissue in in vitro culture.

Aerated lagoon (aerated ponds) Facultative stabilization ponds with surface aerators to overcome bad odours (due to overload of organic materials).

Aerial behavior Aerial behavior is a type of behavior that deals with communicative or playful behavior. It is most seen in whales and dolphins when they surface above water to either jump, leap, or just flit across.

Aerial mycelium A mycelium composed of fungal hyphae that project above the surface of the growth medium and produce asexual spores.

Aerobic (i) Having molecular oxygen as a part of the environment. (ii) Growing only in the presence of molecular oxygen, as in aerobic organisms. (iii) Occurring only in the presence of molecular oxygen, as in certain chemical or biochemical processes such as aerobic respiration.

Aerobic anoxygenic photosynthesis Photosynthetic process in which electron donors such as organic matter or sulfide, which do not result in oxygen evolution, are used under aerobic conditions.

Aerobic cellular respiration Part of cellular respiration, and plays a significant role in producing energy required to carry out different functions of the organism. It requires oxygen for the process.

Aerobic respiration Respiration in which the final electron acceptor in the electron transport chain is oxygen (O_2).

Aerotolerant anaerobes Microbes that grow under both aerobic and anaerobic conditions, but do not shift from one mode of metabolism to another as conditions change. They obtain energy exclusively by fermentation. Thus it is an organism that does not use oxygen (O_2) but is not affected by its presence.

Affinity chromatography A procedure in which a molecule is separated from a mixture of other molecules by its ability to bind specifically to an immobilized ligand.

Affinity labeling A technique in which a labeled substrate analog reacts irreversibly with and can thereby be used to identify a group in an enzyme active site.

Affinity tag The tagged amino acid sequence which forms a part of the recombinant protein and acts as an identification tag.

Aflatoxin (C₁₇H₁₀O₆) A very powerful, naturally occurring carcinogen produced by some strains of a mold, *Aspergillus flavus*, that grows on damp peanuts and other crops.

After-shaft A small supplementary feather, growing from the underside of the base of the shafts of a body feather. It is found in many birds and essential to keep them warm.

Agamospermy Asexual reproduction method involving cells of only the ovule to yield seeds and fruit.

Agar Complex polysaccharide derived from certain marine algae that is a gelling agent for solid or semisolid microbiological media. Agar consists of about 70% agarose and 30% agaropectin. Agar can be melted at temperature above 100°C; gelling temperature is 40-50°C.

Agarose Nonsulfated linear polymer consisting of alternating residues of D-galactose and 3,6-anhydro-L-galactose. Agarose is extracted from seaweed, and agarose gels are often used as the resolving medium in electrophoresis.

Agarose gel electrophoresis Electrophoresis carried out in an agarose gel and used to separate DNA molecules between 100 bp and 50 kb in length.

Agglutinates The visible aggregates or clumps formed by an agglutination reaction.

Agglutination reaction The formation of an insoluble immune complex by the cross-linking of cells or particles.

Agglutination The clumping together of cells suspended in a fluid in response to the binding of an external agent to appropriate receptors on the cell surface. Malignant cells in culture, for example, agglutinate in the presence of lectins.

Aggregate fruit The conjunction of several small, individual fruits, formed by different ovaries, located within the same flower to form a single fruit like that of raspberry.

Agronomic trials Evaluation of new strains for release as a variety; an entry showing superior performance in the first year of URT is included in trials designed to determine the optimum date of sowing and irrigation level; under the respective All India Coordinated Crop Improvement Projects.

Alditol A sugar produced by reduction of an aldose or ketose to a polyhydroxy alcohol. Or in other words compounds that are produced by reducing the carbonyl group on a monosaccharide (that is reducing R-CH=O to R-CH₂-OH).

Aldonic acid A sugar produced by oxidation of an aldose aldehyde group to carboxylic acid group.

AIDS (acquired immune deficiency syndrome) A disease caused by prolonged infection with human immunodeficiency virus (HIV) and characterized by crippling of the immune system. Victims die of infections or cancers, that their immune system cannot control.

Air sac A thin walled air filled structure which is a part of the respiratory system of birds. The air passing through the air sac aids in their breathing and temperature regulation.

Airborne transmission The type of infectious organism transmission in which the pathogen is truly suspended in the air and travels over a meter or more from the source to the host.

Airfoil A structure designed to lift and control the airflow by making use of different levels of air waves. A bird in flight uses the concept of airfoil to control its speed.

Akinetes Specialized, nonmotile, dormant, thick-walled resting cells formed by some cyanobacteria.

Akt Earlier name for protein kinase B, a protein kinase that is activated when it is itself phosphorylated; this in turn only occurs when Akt is recruited to the plasma membrane by phosphatidylinositol trisphosphate (PIP3). Akt phosphorylates proteins on serine and threonine residues (e.g., the bcl-2 family protein BAD).

Alarmone One of the stringent response activators, ppGppp and pppGpp.

Albuminous seed Seed containing large amounts of endosperm.

Alcohol A molecule with a hydroxyl group attached to a carbon atom.

Alcoholic fermentation A metabolic pathway that synthesizes ethanol from pyruvate through decarboxylation and reduction.

Aldehyde A molecule containing a double bonded oxygen and a hydrogen attached to the same carbon atom. An organic molecule with the functional -CHO group.

Aldol cleavage A carbon-carbon cleavage reaction of an aldol (an aldehyde or ketone with β hydroxyl group) that yields small carbonyl compounds.

Aldose A sugar whose carbonyl group is an aldehyde.

Aleurone The outermost layer of the endosperm in a seed.

Alga (plural, algae) Phototrophic eukaryotic microorganism. Algae could be unicellular or multicellular. Blue-green algae are not true algae; they belong to a group of bacteria called cyanobacteria.

Algalization The process of cultivation of blue green algae.

Algin Sodium salt of mannuronic acid ($\text{C}_6\text{H}_8\text{O}_6$); found in brown algae.

Algorithm A fixed procedure embodied in a computer program. The **Basic Local Alignment Search Tool** or BLAST is a sequence comparison algorithm that NCBI uses to search sequence databases for optimal local alignments with a query sequence. FASTA is another type of algorithm used for database similarity searching.

Alien-addition line It has one pair of chromosome from a related wild species in addition to the normal somatic chromosome complement ($2n$) of the species.

Allosteric effector A small molecule whose binding to a protein affects the function of another site on the protein.

Allosteric interaction The binding of ligand at one site in a macromolecule that affects the binding of other ligands at other sites in the molecule.

Aliphatic Organic compound in which the main carbon structure is a straight chain.

Alkali Strong base (that will take H^+ from water) such as sodium hydroxide or potassium hydroxide.

Alkaline Having more hydroxide ions (OH^-) than hydrogen ions (H^+); pH is greater than 7.

Alkaline phosphatase An enzyme that removes phosphate groups from the 5' ends of DNA molecules.

Alkaline soil Soil having a pH value greater than 7.3.

Alkaloids A large group of nitrogenous basic substances found in plants. Most of them taste bitter, and many are pharmacologically active. The term can also be used for synthetic compounds of the same type. Morphine, caffeine and nicotine are familiar alkaloids.

Alkalophile Organism that grows best under alkaline conditions (up to a pH of 10.5).

Alkalosis A pathological condition in which the pH of the blood rises above its normal value of 7.4.

Alkane Straight chain or branched organic structure that lacks double bonds.

Alkene Straight chain or branched organic structure that contains at least one double bond.

Alkylating agent A mutagen that acts by adding alkyl groups to nucleotide bases. Alkylating agents act as antitumor agents that can donate an alkyl group to another molecule. The antitumor alkylating agents are usually, but not always, polyfunctional. One way in which they are thought to act is by cross-linking cellular DNA, thereby interfering with its ability to be replicated and to serve as a template for the synthesis of RNA. Some alkylating agents are carcinogenic.

Allele frequency The frequency of an allele in a population.

Allele mining A research directed to the identification of useful alleles within genetic resources collections.

Allele One of two genes for a given trait that occurs in a specific position on each homologous chromosome. It can also be defined as a specific version of a gene that occupies a particular location in the genome. It is distinguished from other alleles of the same gene by differences in nucleotide sequence.

Allele-specific oligonucleotide (ASO) hybridization The use of an oligonucleotide.

Allergen An antigen that evokes a hypersensitivity response.

Allergy A pathological reactivity to antigens, manifested by excessive sneezing, difficult breathing, itching or skin rashes.

Alligator A broad snouted crocodylians of the genus Alligator found in subtropical regions. This reptile is known for its sharp teeth and powerful jaws.

Allochthonous flora Organisms that are not indigenous to the soil but that enter soil by precipitation, diseased tissues, manure, and sewage. They may persist for some time but do not contribute in a significant way to ecologically significant transformations or interactions.

Allotamy In allotamy, pollen grains from flowers of one plant pollinate the flowers of other plants.

Allograft A graft between persons who aren't identical twins.

Allolactose A disaccharide sugar. Lactose is converted to allolactose by the enzyme β -galactosidase. Allolactose is an inducer of *lac* operon transcription.

Allopatric Organisms that occur in, originate or occupy separate geographical areas.

Allopatric speciation Speciation emerging as the result of physical separation of two or more populations of one species, such that interbreeding is not possible.

Allopolyploid A polyploid nucleus derived from fusion between gametes from different species.

Allosteric effector A small molecule whose binding to a protein affects the function of another site on the protein.

Allosteric enzyme An enzyme whose active site can be altered by the binding of a small molecule at a nonoverlapping site.

Allosteric inhibition The process in which an enzyme's activity is changed because of binding on the allosteric site.

Allosteric site A site on the enzyme other than the active site to which a nonsubstrate compound binds. This may result in a conformational change at the active site so that the normal substrate cannot bind to it.

Allosteric With respect to enzymes, an effect on the function of one part of an enzyme (such as an active site) by the binding of an effector molecule to a different part of the enzyme.

Allotype Allelic variants of antigenic determinant(s) found on antibody chains of some, but not all, members of a species, which are inherited as simple Mendelian traits.

Allozymes Allelic forms of an enzyme that can be distinguished by gel electrophoresis (see isozyme).

Alpha diversity A measurement of species richness in a natural unit (specified area) consisting of all plants, animals and micro-organisms in a habitat functioning together.

Alpha helix One of two types of protein secondary structure. An alpha helix is a tight helix that results from the hydrogen bonding of the carboxyl (CO) group of one amino acid to the amino (NH) group of another amino acid. According to this secondary structure the polypeptide chain is coiled, each turn of the helix taking 3.6 amino acid residues. The nitrogen atom in each peptide bond forms a hydrogen bond with the oxygen four residues ahead of it in the polypeptide chain.

Alpha hemolysis A greenish zone of partial clearing around a bacterial colony growing on blood agar.

Alpha particle The nucleus of a helium atom; that is, a particle containing two protons and two neutrons. There is evidence to suggest that alpha particles may be useful in the radiotherapy of tumors.

Alpha-amino acid An amino acid with -COOH and -NH₂ attached to the same carbon atom.

Alpha-feto protein (AFP) A protein that occurs in the blood of normal embryos, infants and of adults with liver tumors. Its presence in adults was originally thought to be specific for the presence of a liver tumor, but it has subsequently been observed in individuals with a few other types of tumors or with liver diseases such as hepatitis. It has been found in higher than normal concentrations in pregnant women who subsequently bore children with certain types of congenital abnormalities.

Alpha-proteobacteria One of the five subgroups of proteobacteria, each with distinctive 16S rRNA sequences. This group contains most of the oligotrophic proteobacteria; some have unusual metabolic modes such as methylophily, chemolithotrophy, and nitrogen fixing ability. Many have distinctive morphological features.

Alphoid DNA The tandemly repeated nucleotide sequences located in the centromeric regions of human chromosome.

Alternation of generations Life cycle in sexually reproducing organisms like plants involving alternation of diploid sporophyte phase and haploid gametophyte phase.

Alternative complement pathway An antibody-independent pathway of complement activation that includes the C3-C9 components of the classical pathway and several other serum protein factors (e.g., factor B and properdin).

Alternative hypothesis Any hypothesis, which is complementary to null hypothesis is called alternative hypothesis.

Alternative polyadenylation The two or more different sites for polyadenylation of all mRNA.

Alternative promoter One of two or more different promoters acting on the same gene.

Alternative splicing Phenomenon in which a single eukaryotic primary mRNA transcript can be processed to yield a number of different processed mRNAs and can therefore generate a number of different proteins i.e. the production of two or more mRNAs from a single pre-mRNA by joining together different combinations of exons.

Altruism Instinctive behavior performed towards the welfare of others, sometimes at personal cost.

Alu A type of SINE found in the genomes of humans and related mammals. These elements are DNA sequences of about 300 base pairs long that occur in many copies scattered throughout the genome of mammals; the human genome has hundreds of thousands of them. They may serve an unknown function or they may be purely "parasitic"; spreading as mobile elements through the genome.

Alula A set of quill-like feathers located close to the base of the primary feathers that play a part in increasing or decreasing the bird's lift by affecting the airflow of the wings.

Alum Aluminum sulfate $[Al_2(SO_4)_3]$.

Alu-PCR A clone fingerprinting technique that uses PCR to detect the relative positions of Alu sequences in cloned DNA fragments.

Alveolar macrophage A vigorously phagocytic macrophage located on the epithelial surface of the lung alveoli where it ingests inhaled particulate matter and microorganisms.

Alveolus A small angular cavity, sac or pit in the body.

Amanitin Polypeptide mushroom toxin that causes liver and nerve damage.

Ambulacra This term refers to echinoderm's five part radial areas (undersurfaced side) from where the tube feet protrude as well as withdraw.

Ameboid motion Type of locomotion in which the cell changes shape actively, sending cytoplasmic pseudopodia in the direction of movement.

Amensalism (antagonism) Production of a substance by one organism that is inhibitory to one or more other organisms. The terms antibiosis and allelopathy also describe cases of chemical inhibition.

Ames test A test for the mutagenicity of a substance by using bacteria to identify potential carcinogens. A strain of the bacterium *Salmonella typhimurium* having a mutation that disables an enzyme necessary for histidine utilization is exposed to the substance in question and plated on a medium lacking histidine. A reversion mutation that activates the mutant enzyme causes the cells to grow on this medium.

Amination The addition of an amino group.

Amino acid activating enzyme Enzyme that attaches an amino acid to RNA.

Amino acid activation The initial stage of protein synthesis in which amino acids are attached to transfer RNA molecules.

Amino acid Amino terminus The end of a polypeptide that has a free amino group.

Amino acid An organic acid containing amino group and a carboxyl group. It is one of the monomeric units of a protein molecule and is one of about 20 nitrogen-containing organic acids used by the cell for polypeptide formation.

Amino group An $-NH_2$ group attached to a carbon skeleton as in the amines and amino acids.

Amino terminal End of a peptide or polypeptide that has a free α -amino group.

Aminoacyl or acceptor site (A site) The site on the ribosome that contains an aminoacyl-tRNA at the beginning of the elongation cycle during protein synthesis; the growing peptide chain is transferred to the aminoacyl-tRNA and lengthens by an amino acid.

Aminoacyl tRNA synthases Family of enzymes, each of which attaches an amino acid to the appropriate tRNA.

Aminoacyl tRNA tRNA attached to an amino acid via an ester bond.

Aminoacylation Attachment of an amino acid to the acceptor arm of a tRNA.

Aminoglycoside An antibiotic consisting of amino sugars and an aminocyclitol ring; for example, streptomycin.

Aminoglycoside antibiotics A group of antibiotics synthesized by *Streptomyces* and *Micromonospora*, which contain a cyclohexane ring and amino sugars; all aminoglycoside antibiotics bind to the small ribosomal subunit and inhibit protein synthesis.

Aminoglycosides Oligosaccharide antibiotics.

Ammonia oxidation Test drawn during manufacturing process to evaluate the ammonia oxidation rate for the nitrifiers.

Ammonification Liberation of ammonium (ammonia) from organic nitrogenous compounds by the action of microorganisms.

Amniocentesis Puncture of the uterine wall with a needle for the purpose of obtaining amniotic fluid, which can be analyzed to determine sex of the fetus and whether the fetus has a genetic abnormality.

Amnion The innermost delicate embryonic or fetal membranes of higher vertebrates like mammals, birds and reptiles.

Amniotic egg Eggs found in a water impermeable amniotic membrane, filled with fluid in the amniotic cavity, that can develop on land without dehydrating themselves.

Amoeba (plural, amoebae) Protozoa that can alter their cell shape, usually by the extrusion of one or more pseudopodia.

Amoeboid movement Moving by means of cytoplasmic flow and the formation of pseudopodia (temporary cytoplasmic protrusions of the cytoplasm).

Amorphous Without form. Not a specifically scientific word.

AMP Adenosine monophosphate; adenosine with one phosphate attached to the 5' carbon.

Amphibians Animals that can survive and live on land as well as in water. Amphibians are vertebrates and cold-blooded e.g. frog.

Amphibolic pathways Metabolic pathways that function both catabolically and anabolically.

Amphipathic For a molecule, the property of having both hydrophobic and hydrophilic portions. Usually one end or side of the molecule is hydrophilic and the other end or side is hydrophobic, e.g. phospholipids.

Amphisbaenian A long reptile (worm-like) with a short tail and ring shaped scales that have well adapted it to burrowing.

Amphitrichous Having tufts of flagella at both ends of a cell.

Ampholyte A substance whose molecules have both acidic and basic groups, e.g. amino acids.

Amphotericin B An antibiotic from a strain of *Streptomyces nodosus* that is used to treat systemic fungal infections; it also is used topically to treat candidiasis.

Amplexus Mating position of the frogs and toads, in which the female sheds the eggs into the water and the male fertilizes it. Fertilization takes place outside the female's body.

Amplicons DNA fragments amplified by PCR.

Amplification refraction mutation system (ARMS test) A technique for SNP typing in which PCR is directed by a pair of primers, one covering the position of the SNP.

Amplified Fragment Length Polymorphism (AFLP) A molecular marker technique that targets variation in DNA restriction sites and in DNA restriction fragments.

Anabolism Process of metabolism by which various small molecules are combined to form large ones.

Anabolism The sum of all the metabolic processes by which complex biomolecule are built up from simpler ones i.e all synthesis reactions in a living organism. In general these processes consume rather than produce cellular energy.

Anaerobic sludge digester Anaerobic digestion used in secondary sewage treatment.

Anaerobe An organism that does not require oxygen (O₂) for growth.

Anaerobic (i) Absence of molecular oxygen. (ii) Growing in the absence of molecular oxygen, such as anaerobic bacteria. (iii) Occurring in the absence of molecular oxygen, as a biochemical process.

Anaerobic glycolysis Degradation of glucose into lactic acid in the absence of oxygen.

Anaerobic respiration Metabolic process whereby electrons are transferred from an organic, or in some cases, inorganic compounds to an inorganic acceptor molecule other than oxygen. The most common acceptors are nitrate, sulfate, and carbonate. It can be accomplished in the absence of oxygen.

Anal pore A site in certain protozoa for elimination of waste.

Analytical epidemiology Comparison of a diseased group and a healthy group to determine the cause of the disease.

Anamorph Asexual stage of fungal reproduction in which cells are formed by the process of mitosis.

Anaphase Period of mitosis or meiosis during which sister chromatids or homologous chromosome pairs separate and begin moving toward opposite poles of the cell; consists of anaphase A and anaphase B. **Anaphase A** is a part of anaphase in which the chromosomes move to the spindle poles. **Anaphase B** is a part of anaphase in which the spindle poles are separated. **Anaphase I** Anaphase of the first meiotic division (meiosis I). **Anaphase II** Anaphase of the second meiotic division (meiosis II).

Anaphylaxis A hypersensitivity reaction involving IgE antibodies, mast cells, and basophils.

Anaplasia A structural abnormality, characteristic of tumor cells in which cells resemble more primitive or embryonic cells and in which adult cell functions are absent or diminished.

Anaplerotic reactions Reactions that replenish depleted tricarboxylic acid cycle intermediates.

Anapsid An extinct subclass of reptiles except for the turtles, that have no opening in the temporal region of the skull.

Anastomosis A network of intersecting or connecting blood vessels, nerves, or leaf veins that form a plexus.

Ancestral character state A character state possessed by a remote common ancestor of a group of organisms.

Anchoring junction Class of cell junction that attaches the cytoskeleton of one cell to the cytoskeleton of its neighbor, forming a physically strong connection. There are two types: desmosomes, which connect to intermediate filaments, and adherens junctions, which connect to actin microfilaments.

Ancient DNA DNA preserved in ancient biological material.

Androgens The male sex hormones; specifically, the steroid hormones testosterone, dihydrotestosterone, and androstenedione, which act mainly to promote male sexual development and maintain male sex characteristics.

Energy A state of unresponsiveness to antigens. Absence of the ability to generate a sensitivity reaction to substances that are expected to be antigenic.

Aneuploid Anomaly in the usual chromosome number, wherein one or more chromosomes are missing or present as extras.

Aneuploidy Karyotypic abnormality in which a specific chromosome(s) is present in too many or too few copies.

Angioma A benign tumor arising in cells from blood vessels, (hemangioma) or from lymph vessels (lymphangioma).

Angiosarcoma A sarcoma that contains very many small blood vessels.

Angiosperm Plants with seeds enclosed in ovaries that mature into a fruit.

Angstrom (Å) A unit of length equal to 10^{-10} m.

Animalia A kingdom composed of multicellular eukaryotes lacking cell walls.

Anion An ion with a negative charge. e.g., chloride, Cl^- , or phosphate, HPO_4^{2-} .

Anion exchange capacity Sum total of exchangeable anions that a soil can adsorb. Expressed as centimoles of negative charge per kilogram of soil.

Annealing Attachment of an oligonucleotide primer to a DNA or RNA template.

Annelida The taxonomic group of animals that includes coelomate, and elongated and segmented invertebrates such as leeches, earthworms, marine worms, etc.

Annotation The process of determining the location of specific genes in a genome map after it has been produced by nucleic acid sequencing.

Annual ring The formation of wood in plants on an annual basis comprises two concentric layers of wood: springwood and summerwood.

Annulus Ring-shaped structure enclosing the nuclear pore, consisting of eight surrounding granules and a proteinaceous material in the pore opening.

Anode Positively charged electrode, e.g., in a gel electrophoresis apparatus used for SDS-PAGE.

Anomers The sugar isomers that differ in configuration about the carbonyl carbon atom. This carbon atom is called the anomeric carbon atom of the sugar. (This carbon is a centre of chirality in the cyclized but not in the open-chain form of the molecule).

ANOVA table While doing the variance ratio test for comparison of several means, it is customary to summarize calculations for sums of squares, together with their numbers of degrees of freedom and mean squares in a tabular form called the analysis of variance table or ANOVA.

Anoxic Literally "without oxygen." An adjective describing a microbial habitat devoid of oxygen.

Anoxygenic Not producing molecular oxygen; typical of cyclic photophosphorylation.

Anoxygenic photosynthesis Type of photosynthesis in green and purple bacteria in which oxygen is not produced.

Antiseptic A chemical for disinfection of the skin, mucus membrane, or other living tissues.

Antagonism Active opposition; for example, between two drugs or two microbes.

Antagonist Biological agent that reduces the number or disease-producing activities of a pathogen. In biochemistry, a substance that counteracts the cellular effects of a natural compound (such as a hormone or neurotransmitter) by binding to the cellular receptor for the compound and blocking its action.

Antenna A sensory apparatus found on the heads of insects and most arthropods. It is usually in pairs.

Antenna chlorophyll Chlorophyll molecules that capture light and pass the energy to reaction center chlorophylls.

Anterograde Forward movement; when applied to axonal transport it means away from the cell body.

Anther culture Culture of anthers on a suitable medium for the production of callus and/or haploid plants.

Anther Part of the stamen containing sporogenous tissue which produces pollen.

Antheridium A male gamete-producing organ, which may be unicellular or multicellular, found in the phylum Oomycota (Kingdom Stramenopila) and phylum Ascomycota (Kingdom Fungi).

Anthesis The first opening of a flower.

Anthocyanin Water soluble pigment located in the cell sap, which varies from red to blue in color. Found in flowers of most plants.

Anthrax Lethal bacterial disease. When food supplies are exhausted, anthrax bacteria produce spores that can survive for long periods in the soil or in (illegal) stocks of biological weapons. Can also occur in humans and is sometimes called woolsorter's disease.

Antibiosis Inhibition or lysis of an organism mediated by metabolic products of the antagonist; these products include lytic agents, enzymes, volatile compounds, and other toxic substances.

Antibiotic Chemical that is produced by one type of organism and kills others—often by inhibiting protein synthesis. The most useful antibiotics to humans are those that are selective for prokaryotes. Some possess antitumor properties. Some of these, such as Actinomycin D and Adriamycin bind to cellular DNA, thereby preventing its transcription. The mechanism of action of some others is unknown.

Antibody A complex protein (immunoglobulin) synthesized by certain types of lymphocytes in response to an antigen. Antibodies have two or more specific sites complementary in structure to groupings on the antigen so that they can combine with it. If the antigen is part of a cell, attachment of the antibody to the antigen in the presence of appropriate accessory factors, such as complement may lead to eventual destruction of the cell. Some types are released into body fluids and mediate humoral immunity; other types are retained on the surface of the H cell or are taken up and displayed by some other cell types. Antibodies can be extremely selective for their ligand and are useful in many aspects of cell biology such as immunofluorescence microscopy and western blotting.

Antibody titer The amount of antibody in serum.

Antibody-dependent cell-mediated cytotoxicity (ADCC) The killing of antibody-coated target cells by cells with Fc receptors that recognize the Fc region of the bound antibody. Most ADCC is mediated by NK cells that have the Fc receptor or CD16 on their surface.

Anticodon A sequence of three bases at positions 34-36 in a tRNA molecule by which a tRNA recognizes an RNA codon and pair with the bases in the corresponding codon on the messenger RNA during protein synthesis. It thus mediates the translation of the codon into a specific amino acid.

Antigen A substance that elicits an immune response. Also called an immunogen because it induces the immune response. A high molecular weight substance, usually a protein or a complex of protein and polysaccharide that stimulates the formation of specific antibodies or specific lymphocytes in an animal to which it is foreign.

Antigen modulation The process whereby tumor cells shed their specific antigens, thus avoiding the host's immune response.

Antigen receptors Antibodylike molecules on Band T cells that allow them to recognize and bind to their specific antigens.

Antigen-binding fragment (Fab, Fragment antigen binding) A monovalent antigen-binding fragment of an immunoglobulin molecule that consists of one light chain and part of one heavy chain, linked by interchain disulfide bonds.

Antigen-binding sites Sites on an antibody that bind to antigenic determinants.

Antigenic determinant A specific region on the surface of an antigen against which antibodies are formed.

Antigenic drift A small change in the antigenic character of an organism that allows it to avoid attack by the immune system.

Antigenic shift A major change in the antigenic character of an organism that alters it to an antigenic strain unrecognized by host immune mechanisms.

Antigen-presenting cells Antigen-presenting cells (APCs) are cells that take in protein antigens, process them, and present antigen fragments to B cells and T cells in conjunction with class II MHC molecules so that the cells are activated. Macrophages, B cells, dendritic cells, and Langerhans cells may act as APCs.

Antihuman immune serum globulin Antibodies that react specifically with human antibodies.

Antimetabolites Chemicals that have a close structural resemblance to normal metabolites. Antimetabolites either substitute for a normal metabolite to block crucial enzymes or otherwise interfere with the metabolism of cells. Thus antimetabolites interfere with metabolism by competitive inhibition of an enzyme. In some cases, antimetabolites are preferentially toxic to tumor cells and can be used as antitumor agents. Among the best known antimetabolites active against tumors are methotrexate and 5-fluorouracil.

Antimicrobial agent An agent that kills microorganisms or inhibits their growth.

Antimicrobial drug A chemical that destroys pathogens without damaging body tissues.

Antioxidant A strongly reducing compound such as ascorbic acid, which counteracts the tendency of a metabolite to undergo oxidation to a potentially toxic or harmful species.

Antiparallel DNA The condition in double-stranded DNA in which the two strands with polarity run in opposite directions. In DNA molecule one strand is 5' → 3' and the complement is 3' → 5'.

Antiparallel β sheet A hydrogen bonded secondary structure formed between two or more extended polypeptide chains, in which alternate parallel polypeptide chains run in opposite directions.

Antiport A membrane transport process that couples the transport of a substance in one direction across a membrane to the transport of a different substance in the other direction.

Antisense RNA An RNA molecule that is, complementary to an mRNA; it can block translation of the mRNA by forming a duplex with it. Gene expression can be regulated by the production of antisense mRNAs.

Antisense therapy The in vivo treatment of a genetic disease by blocking translation with a DNA or RNA sequence that is complementary to specific mRNA.

Antiseptic Agent that kills or inhibits microbial growth but is not harmful to human tissue.

Antiserum Serum that contains high concentration of antibodies against a particular antigen.

Antitermination A bacterial mechanism for regulating the termination of transcription.

Antiterminator protein A protein that attaches to bacterial DNA and mediates antitermination.

Antitoxin A specific antibody produced by the body in response to a bacterial exotoxin or its toxoid.

Antiviral protein Protein made in response to interferon that blocks viral multiplication.

Antler One pair of bony, deciduous and branched hornlike structure found on the head of a deer, moose, elk, etc.

Anus An opening at the lower end of the digestive tract through which all solid waste is eliminated from the body.

AP (apurinic/apyrimidinic) site A position in a DNA molecule where the base component of the nucleotide is missing.

AP endonuclease DNA repair enzyme that cleaves the phosphodiester links on either side of a depurinated or depyrimidinated sugar residue. AP stands for apurinic/apyrimidinic.

Apical meristem Meristem located at the tip of the root, shoot or other organs of the plant; the growing point at the tip of a shoot or root

Apical dominance The phenomena in which hormones produced at the tip of the shoot cause suppression of lateral bud development in growing plant shoots and thus cause growth of the shoot tip.

Apoactivator A regulatory protein that stimulates transcription from one or more genes in the presence of a coactivator molecule.

Apoenzyme The protein portion of an enzyme, which requires activation by a coenzyme.

Apogamy Development of embryo from synergids or antipodal cells without fertilization; a form of apomixis.

Apolipoproteins The specific proteins that constitutes the protein fraction of lipoprotein; they mediate the interactions of lipoproteins with tissues.

Apomorph A new specialized trait in an evolving organism which is completely different from its ancestral line.

Apomorphic character state Character state that evolved in a recent ancestor of a subset of organism in a group being studied.

Apoptosis inhibitor protein Proteins that block the action of caspases and hence help prevent apoptosis.

Apoptosis Programmed cell death. The fragmentation of a cell into membrane-bound particles that are eliminated by phagocytosis. Apoptosis is a physiological suicide mechanism that preserves homeostasis and occurs during normal tissue turnover. It is responsible for cell death in pathological circumstances, such as exposure to low concentrations of xenobiotics and infections by HIV and various other viruses. Thus it is a process in which a cell actively promotes its own destruction, as distinct from necrosis.

Aporepressor An inactive form of the repressor protein, which becomes the active repressor when the corepressor binds to it. On activation it binds to an operator region and represses transcription.

Aposematic Color construct characteristics in animals (changing color), either as a warning to other animals or as a self defense mechanism.

Apospecies A species concept based on cladistics that does not insist on monophyly. It recognizes species pairs, one a monophyletic daughter species (apospecies) and the other a paraphyletic progenitor species (plesiospecies).

Apospory A form of apomixes in which the embryo sac develops from a vegetative cell of the ovule.

Apothecium Open ascoma of fungi in the phylum Ascomycota.

Aptamers A special type of oligonucleotides that can specifically bind to target proteins and not to nucleic acids.

Arabinocyl cytosine Also known as cytosine arabinoside, cytarabine or Ara-C. An antimetabolite of cytidylic acid in which the sugar arabinose is substituted for the sugar ribose, the normal sugar in RNA. It substitutes for cytidylic acid to inhibit the enzyme that converts cytidylic acid to deoxycytidylic acid and also inhibits DNA polymerase; in both cases, it inhibits the biosynthesis of DNA. It is especially useful for treatment of acute leukemias.

Arbitrarily Primed Polymerase Chain Reaction (AP-PCR) A variant of the RAPD technique that uses longer arbitrary primers than RAPDs.

Arboreal Arboreal refers to animals that have adapted themselves to live and move in the trees.

Arbuscular mycorrhiza (AM) Mycorrhizal type that forms highly branched arbuscules within root cortical cells.

Arbuscule Special "tree-shaped" structure formed within root cortical cells by arbuscular mycorrhizal fungi.

Archaea Evolutionarily distinct group (domain) of prokaryotes mostly found in extreme environments. It consist of the methanogens, most extreme halophiles and hyperthermophiles, and *Thermoplasma*.

Aarchaeobacteria Older term for the Archaea. These prokaryotic organisms lack peptidoglycan.

Archegonium Female reproductive organ in non-vascular plants like ferns and mosses.

Arf GAP proteins The ADP-ribosylation factor (Arf) Arf GTPase-activating proteins (GAPs) are a family of proteins that induce hydrolysis of GTP bound to Arf. A conserved domain containing a zinc finger motif mediates catalysis. The substrate, Arf.GTP, affects membrane trafficking and actin remodelling.

Aromatic Organic compounds which contain a benzene ring, or a ring with similar chemical characteristics.

Arthroconidium A thallic conidium released by the fragmentation or lysis of hypha. It is not notably larger than the parental hypha, and separation occurs at a septum.

Arthropod An animal phylum characterized by an exoskeleton and a segmented body with jointed appendages; includes (includes insects, arachnids, and crustaceans).

Arthrospore An asexual fungal spore formed by fragmentation of a septate hypha.

Arthus reaction Inflammation and necrosis at the site of injection of foreign serum, due to immune complex formation.

Artificial gene synthesis Construction of an artificial gene from a series of overlapping oligonucleotides.

Artificial selection A selection process where the breeder chooses the plants or animals for mating and producing offspring of desired inheritable qualities.

Artificially acquired active immunity The type of immunity that results from immunizing an animal with a vaccine. The immunized animal now produces its own antibodies and activated lymphocytes.

Aryl-hydrocarbon hydroxylases (AHH's) A family of enzymes, found in microsomes, that can add a hydroxyl group-possibly through an intermediary epoxide to polycyclic aromatic hydrocarbons such as benzo[a]pyrene.

Ascocarp A multicellular structure in ascomycetes lined with specialized cells called asci in which nuclear fusion and meiosis produce ascospores. An ascocarp can be open or closed and may be referred to as a fruiting body.

Ascogenous hypha A specialized hypha that gives rise to one or more asci.

Ascoma (plural, ascomata) Fungal fruiting body that contains ascospores; also termed an ascocarp.

Ascospore A sexual fungal spore produced in an ascus, formed by the Ascomycetes class of fungi. It is the haploid products of meiosis in an ascomycete, such as the yeast *Saccharomyces cerevisiae*.

Ascus The saclike structure which contains the four ascospores produced by a single meiosis in the yeast *Saccharomyces cerevisiae*.

Asepsis The absence/ free of contamination by unwanted organisms. Also called Aseptic.

Aseptic packaging Commercial food preservation by filling sterile containers with sterile food.

Aseptic technique Technique of maintaining sterile instruments or culture media free from contamination by unwanted organisms.

Asexual reproduction Growth and cell duplication that does not involve the union of nuclei from cells of opposite mating types.

Asexual spores Reproductive cells produced by mitosis and cell division (eukaryotes) or binary fission (actinomycetes).

Asidosis A pathological condition in which the pH of the blood drops below its normal value of 7.4.

Asparaginase An enzyme that hydrolyzes the amino acid asparagine into aspartic acid and ammonia. Certain types of tumor cells especially in leukemias, require an external source of asparagine. Bacterial or animal L-asparaginase administered intravenously thus acts as an antitumor agent by reducing the asparagine content of body fluids.

Aspartame A low calorie artificial sweetener used in soft drink industry, chemically it is aspartylphenylalanine methyl ester.

Aspect diversity It is the measure of the different physical appearances that are found in a group of species living in a common habitat and are hunted by other animals that use visual hunting skill to identify and kill their prey.

Assay Term for a chemical measurement, e.g., one in which the activity of an enzyme reaction is measured.

Assimilatory nitrate reduction Conversion of nitrate to reduced forms of nitrogen, generally ammonium, for the synthesis of amino acids and proteins.

Association constant (K) An equilibrium constant that indicates the tendency of two chemical species to associate with each other; it is equal to the concentration of the associated form divided by the product of the concentrations of the free species at equilibrium. Also called as affinity constant.

Association genetics A research field directed to the identification of correlations between phenotypic traits and genetic markers with the aim to identify and locate the underlying genes in the genome.

Associative dinitrogen fixation Close interaction between a free-living diazotrophic organism and a higher plant that results in an enhanced rate of dinitrogen fixation.

Associative recognition T-cell response to a foreign antigen and MHC protein.

Associative symbiosis Close but relatively casual interaction between two dissimilar organisms or biological systems. The association may be mutually beneficial but is not required for accomplishment of a particular function.

Aster Microtubule fibers radiating from each cell pole metaphase stage of mitosis.

Asymmetric carbon A carbon molecule that carries four different group/ substituent and therefore acts as a center of chirality, meaning that the substance can occur in two different enantiomers (stereoisomers that are nonsuperimposable mirror images of each other).

Asymmetric hybrids Cells/plants produced through somatic hybridization and containing the full somatic complement of one fusion partner but only a part of the somatic complement of the other.

Atherosclerotic plaques The protruding masses that form on the inner walls of arteries in atherosclerotic disease. A mature plaque consists partly of lipid, mainly cholesterol esters, which may be free or contained in lipid-engorged macrophages called foam cells, and partly of an abnormal proliferation of smooth-muscle and connective-tissue cells.

Atom The smallest unit of matter that can enter into chemical reaction.

Atomic number The number of protons in the nucleus of an atom.

Atomic weight The total number of protons and neutrons in the nucleus of an atom.

ATP synthetase Another name for ATP synthase; a carrier of the inner mitochondrial membrane that is built around a rotary motor. Ten H⁺ enter the mitochondrial matrix for every three ATP made.

ATP/ADP exchanger Carrier in the inner mitochondrial membrane. ADP is moved in one direction and ATP in the other.

Attenuation A process used by some bacteria to regulate expression of an amino acid biosynthetic operon in accordance with the amino acid in the cell. It lessens the virulence of a microorganism.

Attenuator A provisional transcription stop signal.

AU-AC intron A type of intron found in eukaryotic nuclear genes: the first two nucleotides in the intron are 5'-AU-3' and the last two are 5'-AC-3'.

Auriculars Auriculars is a set of feathers that are found near a bird's ear openings.

Autocatalytic Refers to a reaction that an enzyme catalyzes on part of its own structure, such as a cleavage performed by a protease on its own polypeptide precursor.

Autoclave Equipment for sterilization by steam under pressure usually operated at 15 psi and 121°C.

Autogenous hypothesis Model for evolution of eukaryotes proposing that organelles arose from internal membranes in prokaryotes.

Autogenous infection An infection that results from a patient's own microbiota, regardless of whether the infecting organism became part of the patient's microbiota subsequent to admission to a clinical care facility.

Autograft A Tissue graft from one's self.

Autoimmune disease A disease produced by the immune system attacking self-antigens of healthy tissues. Autoimmune disease results from the activation of self-reactive T and B cells that damage tissues after stimulation by genetic or environmental triggers. Arthritis, for example is believed to be an autoimmune disease.

Autoimmunity Autoimmunity is a condition characterized by the presence of serum autoantibodies and self-reactive lymphocytes. It may be benign or pathogenic. Autoimmunity is a normal consequence of aging; is readily inducible by infectious agents, organisms, or drugs; and is potentially reversible in that it disappears when the offending "agent" is removed or eradicated.

Autoinduction Process of self-induction that occurs when a product of a reaction stimulates the production of more of itself. An example is the activation of the *lux* operon by the small molecule *N*-acyl-HSL; transcription of the *lux* operon then causes the production of more *N*-acyl-HSL.

Autologous cells Cells taken from an individual, cultured/stored and sometimes genetically manipulated and infused back into the original donor.

Autolysins Enzymes that partially digest peptidoglycan in growing bacteria so that the peptidoglycan can be enlarged.

Autolysis Programmed cell death; the orderly self-destruction of a cell in a multicellular organism. It is the process by which unwanted cells are eliminated in the body. Also called apoptosis.

Autonomic nerves Nerves that control processes of which we are usually not consciously aware, such as blood vessel size.

Autonomic nervous system The part of the vertebrate nervous system that regulates involuntary action of an animal's internal organs like the intestines, heart and glands.

Autonomously replicating sequences (ARSs) Sequences in yeast chromosomes that, when incorporated into an artificial plasmid, enable the plasmid to replicate efficiently in yeast cells.

Autophagy Digestion of cellular material by the cell's own enzymes; part of the normal.

Autopoiesis refers to a system capable of reproducing and maintaining itself. The term was introduced in 1972 by Chilean biologists Humberto Maturana and Francisco Varela to define the self-maintaining chemistry of living cells.

Autopolyploid A polyploid nucleus derived from fusion of two gametes from the same species, neither of which is haploid.

Autoradiography Process that detects a radioactive molecule. For example, in a Southern blot experiment, the membrane that has been hybridized to a radioactive gene probe is placed in direct contact with a sheet of X-ray film. Radioactive decay activates the silver grains on the emulsion of the X-ray film. When the film is developed, areas that have been in contact with radioactivity will show as black areas.

Autoregulation The process in which a gene regulates its own expression.

Autosome A chromosome that is not sex chromosome.

Autotrophic nitrification Oxidation of ammonium to nitrate through the combined action of two chemoautotrophic organisms, one forming nitrite from ammonium and the other oxidizing nitrite to nitrate.

Autotrophs Organisms that can synthesize their organic compounds entirely from inorganic precursors, in particular needing only CO₂ as a carbon source. These are the mutant microorganism that can grow only when supplied with a nutrient that is not needed by the wild type. Usually the requirement

results from a mutation that disables an enzyme necessary for the endogenous synthesis of the substance.

Auxin Growth regulating substance involved in apical dominance, cell elongation, rooting, etc.

Auxotrophs Microorganism strains that require a particular substance as a nutrient. Usually the requirement results from a mutation that disables an enzyme necessary for the endogenous synthesis of that substance.

Aves A class of vertebrates comprising the entire bird family.

Avian leukosis-sarcoma viruses A family of type C RNA viruses that cause malignant diseases in fowl, especially chickens. The Rous sarcoma virus is an example.

Avogadro's number The number of molecules in a gram molecular weight of any compound (6.023×10^{23}).

Avoidance Escaping of a susceptible host plant from damage due to an insect pest, usually, as a result of the developmental stage of host plants being less susceptible when the pest population is at its peak.

Axenic Literally "without strangers." A system in which all biological populations are defined, such as a pure culture.

Axial filament The organ of motility in spirochetes. It is made of axial fibrils or periplasmic flagella that extend from each end of the protoplasmic cylinder and overlap in the middle of the cell. The outer sheath lies outside the axial filament.

Axil Angle formed at the point of attachment between the petiole of a leaf and the upper part of the plant.

Axillary bud Bud situated just above the point of attachment of the leaf, i.e. leaf axil. It can be a floral bud or leaf bud.

Axis of symmetry An imaginary axis through a structure, such that rotating the structure around the axis through an appropriate angle leaves the appearance of the structure unchanged.

Axon A threadlike process extending from a nerve cell by which impulses are transmitted to other nerve cells or to effector cells such as muscle or gland cells. Most nerve cells have one axon; shorter processes that function in receiving impulses from other neurons are called dendrites.

Axonal transport Movement of material along microtubules within a nerve cell process; can be outward (anterograde) or inward (retrograde).

Axoneme Axial microtubular component of cilia and flagella that is their essential motile.

Azathioprine Also known as Immuran. A derivative of the antimetabolite 6-mercaptopurine that is thought to act as an antitumor agent by releasing 6-mercaptopurine inside tumor cells, probably through a reaction with sulfhydryl compound.

N-Acetylglucosamine and **N-Acetylmuramic acid** Sugar derivatives in the peptidoglycan layer of bacterial cell walls.

α adrenergic receptor A receptor for the related chemicals adrenaline and noradrenaline. The α adrenergic receptor activates Gq and therefore generates a calcium signal. To a first approximation, α receptors respond to noradrenaline, while adrenaline acts mainly on β adrenergic receptors.

α -amanitin Toxin that inhibits the eukaryotic RNA polymerases to different extents.

α -amino acid Amino acid in which the carboxyl and amino groups are attached to the same carbon.

$\alpha\alpha$ motif A protein motif consisting of two α helices packed against each other with their axis inclined.

γ -amino butyric acid A γ -amino acid that acts to open chloride channels in the plasma membrane of sensitive nerve cells. Usually called γ -amino butyric acid rather than γ -amino butyrate, even though the latter ($-\text{OOC}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{NH}_3^+$) is the form in which it is found at neutral pH.

B cell A type of lymphocyte derived from bone marrow stem cells that matures into an immunologically competent cell. Following interaction with antigen, it becomes a plasma cell, which synthesizes and secretes antibody molecules involved in humoral immunity, synthesis of antibodies, and immediate hypersensitivity reactions. B cells can differentiate to form memory cells or antibody-forming cells. Also known as a B lymphocyte, thymus-independent lymphocyte or e bursa-equivalent lymphocyte.

B form The most common form of duplex DNA, containing a right-handed helix and 10.5 base pairs per turn of the helix axis.

BAC (bacterial artificial chromosome) A high capacity cloning vector based on the F plasmid of *Escherichia coli*.

Bacillus Any rod-shaped bacterium; when written as a genus, it refers to rod-shaped, endospore-forming, facultative anaerobic, gram-positive bacteria.

Bacillus Calmette-Guerin (BCG) An attenuated strain of the bacterium, *Mycobacterium bovis*, that causes bovine tuberculosis. It is frequently used as a vaccine against human tuberculosis (especially in Europe) and is generally thought to be a potent nonspecific stimulator of the immune system. It is thus sometimes used on an experimental basis for the treatment of tumors.

Bacillus thuringiensis A rod shaped bacterium whose toxic crystals act as an insecticide against certain species of arthropods.

Backcross A cross between a hybrid and one of its parents (or a genetically equivalent organism).

Backcross breeding A breeding method based on repeated backcrossing of the F1 and the subsequent generations to the recurrent parent.

Backtracking The reversal of a RNA polymerase a short distance along its DNA template strand.

Bacteremia A condition in which there are bacteria in the blood.

Bacteria All prokaryotes that are not members of the domain Archaea. The domain that contains prokaryotic cells with primarily diacyl glycerol diesters in their membranes and with bacterial rRNA. Bacteria also is a general term for organisms that are composed of prokaryotic cells and are not multicellular

Bacterial growth curve A graph indicating the growth of a bacterial population over time.

Bacterial photosynthesis A light-dependent, anaerobic mode of metabolism. Carbon dioxide is reduced to glucose, which is used for both biosynthesis and energy production. Depending on the hydrogen source used to reduce CO₂, both photolithotrophic and photoorganotrophic reactions exist in bacteria.

Bactericidal Capable of killing bacteria.

Bacteriochlorophyll The light-absorbing pigment found in green sulphur and purple bacteria.

Bacteriocin Toxic protein produced by bacteria that inhibits or kills closely related isolates and species.

Bacteriophage A virus that infects a bacterium; also called "a phage".

Bacteriophage PI vector A high-capacity cloning vector based on bacteriophage PI.

Bacteriorhodopsin The light-absorbing purple pigment in the *Halobacterium* cell membrane and which is involved in light-mediated ATP synthesis.

Bacteriostatic Capable of inhibiting bacterial growth and reproduction.

Bacteroid Altered form of cells of certain bacteria. Refers particularly to the swollen, irregular vacuolated cells of rhizobia in nodules of legumes. A modified, often pleomorphic, bacterial cell within the root nodule cells of legumes; after transformation into a symbiosome it carries out nitrogen fixation.

BAD A bcl-2 family protein that causes the release of cytochrome c from mitochondria.

Baeocytes Small, spherical, reproductive cells produced by pleurocapsalean cyanobacteria through multiple fission.

Baker's yeast The living cells of aerobically grown yeast, *Sacchromyces cerevisiae*, used in bread making.

Balanced growth Microbial growth in which all cellular constituents are synthesized at constant rates relative to each other

Balanced polymorphism A situation where more than one allele is maintained in a population, which is the outcome of the heterozygote being superior to both homozygotes.

Baleen Baleen whales are those whales that filter plankton for ingestion, out of large quantities of water. Baleen is the fibrous structure in their mouths, usually referred to as baleen plates that enable them to feed in this way. They do not have teeth.

Banding The manner in which a metal or plastic band is attached to the legs of birds and other animals. This is done with the purpose of identifying the individual/creature at the time of recapture.

Bar diagram A graphical representation of the frequency distribution of a discrete variable. Straight line segments (bars), proportional to the frequencies of the values of a variable are drawn perpendicular to an axis on which these are represented.

Barbel Often found on fish, a barbel is a slim, whisker-like tactile organ located near the mouth. In some fish, they contain the taste buds, and assist the fish to locate food in murky water.

Barbicels Barbicels are tiny curved structures on barbules, that connect contiguous barbules to form the firm, mesh like structure of the feather vane.

Barbs The barbs are attached to the main shaft of a feather, and make up its vanes.

Barbules Barbules are tiny structures that emerge from the barbs of a bird's feather. They interlock, overlap and knit together, making the feather solid and stiff.

Barcode deletion strategy A method that has been developed for the large-scale screening of deletion mutations in *Saccharomyces cerevisiae*.

Bark Tissues of the vascular cambium forming tough layer on the outer region of the woody stems and roots.

Barophile An organism able to live optimally at high hydrostatic pressure.

Barotolerant An organism able to tolerate high hydrostatic pressure, although growing better at normal pressures.

Barr body The highly condensed chromatin structure taken up by an inactivated X chromosome.

Basal body A structure that anchors flagella to the cell wall and plasma membrane. Structurally identical to the centriole but serving as a cilium or flagellum attachment site; also called a kinetosome.

Basal cell carcinoma A skin tumor that in many respects appears to be intermediate between a benign and a malignant tumor. Basal cell carcinomas invade, compress, and destroy surrounding tissues and erode through bone and cartilage, but almost never metastasize.

Basal medium A medium which allows the growth of many types of microorganisms without any requirement for any special nutrient supplements, e.g. nutrient broth.

Basal promoter element Sequence motifs that are present in many eukaryotic promoters and set the basal level of transcription.

Basal promoter The position within the eukaryotic promoters where the initial complex is assembled.

Basal rate of transcription The number of productive initiations of transcription occurring per unit at a particular promoter.

Base A substance that dissociates into one or more hydroxide ions (OH⁻) and one or more positive ions.

Base analog A chemical that is structurally similar to the normal nitrogenous bases in nucleic acids but with altered base pairing properties which enables it to act as a mutagen.

Base composition Proportion of the total bases consisting of guanine plus cytosine or thymine plus adenine base pairs. It is usually expressed as a guanine + cytosine (G + C) value, e.g. 60% G+C.

Base excision repair A DNA repair process that involves excision and replacement of an abnormal base.

Base pair The hydrogen bonded structure formed by two complementary nucleotides. When abbreviated to "bp", the shortest unit of length for a double-stranded DNA molecule. In DNA, base pairs are A-T and G-C; in RNA, base pairs are A-U and G-C.

Base pairing The attachment of base of one polynucleotide to base of another polynucleotide.

Base ratio The ratio of A to T or G to C in a double stranded DNA molecule. Chargaff showed that the base ratio is always close to 1.0.

Base stacking The close packing of the planes of base pairs, commonly found in DNA and RNA structures.

Base substitution The replacement of a single base in DNA by another base, causing a mutation.

Base (1) The adenine, guanine, cytosine or thymine group attached to a nucleotide or nucleoside. Also may be used to refer to a nucleic acid unit within a polynucleotide chain, as when a gene is said to be 2000 bases long. (2) Substances that reduce the concentration of hydrogen ions.

Baseless site A position in DNA molecule where the base component of the nucleotide is missing.

Basement membrane Thin layer of extracellular fibers that supports epithelial cells.

Basic domain A type of DNA binding domain.

Basic dye A salt in which the color is in the positive ion; used for bacterial stains.

Basic Local Alignment Search Tool (BLAST) A bioinformatics tool to find matches between a DNA sequence and known sequences stored in databases.

Basic number The haploid chromosome number of the ancestral diploid species of a polyploidy. Represented by "x". It constitutes a genome.

Basic plumage Among the bird species that molt only once a year, the basic plumage are those feathers they have on them throughout the year. Whereas, among species that molt twice annually, the basic plumage (in most cases) are the feathers that grow after the first complete molt, and is present at the time of the bird's non-breeding season.

Basic seed Seed produced through mass selection (with progeny test) in a pureline variety or clone; source of breeder seed.

Basidiocarp Fruiting body in basidiomycete fungi, such as puffball or mushroom.

Basidioma (plural, basidiomata) Fruiting body that produces basidia; also termed a basidiocarp.

Basidiospore Spore resulting from karyogamy and meiosis that are formed on a basidium. Sexual spore of the Basidiomycota.

Basidium The cells in basidiomycete fungi in which fusion of nuclei and meiosis occur to produce basidiospores.

Basophil A type of granulocyte that accounts for about 0.5% percent of leukocytes in the blood. It readily takes up basic dye. Basophils are chemically, structurally, and functionally similar to the mast cells found in connective tissues. They contain large amounts of heparin and vasoamines (histamine, serotonin, dopamine). Abnormal release of these amines contributes to the inflammation observed in hypersensitivity and in some nonimmunological disorders.

Batch culture A bioreactor that is emptied and set up again each time the reaction has run to completion.

Batch process A treatment process in which a tank or reactor is filled, the wastewater (or solution) is treated or a chemical solution is prepared and the tank is emptied. The tank may then be refilled and the process repeated. Batch processes are also used to cleanse, stabilize or condition chemical solutions for use in industrial manufacturing and treatment processes.

Batesian mimicry In a situation where a harmless species has evolved to replicate the warning signal given by a harmful species (directed at a common predator), Batesian mimicry occurs.

BAX bcl-2 family protein that causes the release of cytochrome *c* from mitochondria,

Bayes' theorem Bayesian approach addresses to the question of determining the probability of some event A, given that another event B, has already (or will be) occurred.

Bayesian analysis A statistical approach for constructing phylogenetic tree and a model of evolution.

B-cell antigen receptor (BCR) A transmembrane immunoglobulin complex on the surface of a B cell that binds an antigen and stimulates the B cell. It is composed of a membrane-bound immunoglobulin, usually IgD or a modified IgM, complexed with another membrane protein (the Ig- α /Ig- β heterodimer).

Bcl-2 Antiapoptotic protein. By binding to BAD and BAX, it prevents them causing release of cytochrome *c* from mitochondria.

BCNU A nitrosourea used as an alkylating agent in the treatment of tumors.

B-DNA A DNA duplex with a specific right-hand helix structure. It is the usual form of DNA duplexes in vivo.

Beads-on-a-string An unpacked form of chromatin consisting of nucleosome beads on a string of DNA.

Beak The protruding part of the mouth of several groups of vertebrates, including some cetaceans. Birds use them not only to eat, but also to groom, kill prey, manipulate objects, in courtship and to feed the young.

Beer's law The equation that relates the absorbance of a solution sample at a given wavelength to the length of the light path, the concentration of the dissolved substance, and the extinction coefficient of the substance at that wavelength.

Benthic A Benthic zone is the ecological region that encompasses the bottom most level of any body of water, be it a river, lake or ocean. When used in conjunction with a living organism, it refers to bottom-dwelling.

Bergmann's plating technique The most widely used method for culture of isolated single plant cells.

Beta diversity A term of measurement that gauges the variety of organisms in a region. It is impacted by the turnover of species among habitats.

Beta hemolysis A zone of complete clearing around a bacterial colony growing on blood agar. The zone does not change significantly in color.

Beta oxidation The removal of two carbon units from a fatty acid to form acetyl CoA.

Beta-bend (β -bend) or turn. A characteristic way of turning an extended polypeptide chain in a different direction, involving the minimum number of residues, and held together by hydrogen bonding.

Beta-oxidation (β -oxidation) Oxidative degradation of fatty acids in the mitochondria that generates acetyl-coA, which enters the citric acid cycle, and NADH and FADH₂, which are used by the electron transport chain.

Beta-proteobacteria One of the five subgroups of proteobacteria, each with distinctive 16S rRNA sequences. Members of this subgroup are similar to the alpha-proteobacteria metabolically, but tend to use substances that diffuse from organic matter decomposition in anaerobic zones.

Beta-sheet (β -sheet) A sheetlike structure formed by the interaction between two or more extended polypeptide chains.

Bidirectional replication Replication in both directions away from the origin, as opposed to replication in one direction only.

Biennial Plants requiring two seasons to complete their life cycle. The first season growth is purely vegetative and the second one bears fruit.

Bilateral symmetry This type of symmetry is exhibited by most animals, and just means that if a line were drawn down the middle of the body, both sides would be equal and symmetrical.

Bilayer A double layer of lipid molecules with the hydrophilic ends oriented outward, in contact with water, and the hydrophobic parts oriented inward.

Bile acids A family of amphipathic cholesterol derivatives that are produced in the liver and excreted in the bile; salts of the bile acids emulsify fat in the intestine.

Bile salts Derivatives of cholesterol with detergent properties that aid in the solubilization of lipid molecules in the digestive tract.

Bin run seed Seed saved from a farmer's current crop to be used to plant next season crop.

Binal symmetry The symmetry of some virus capsids (e.g., those of complex phages) that is a combination of icosahedral and helical symmetry.

Binary fission Process of cell division in prokaryotes, and yeasts where the cell divides into two daughter cells.

Binary vector system A two plasmid vector system for transferring T-DNA into plant cells. The virulence genes are on one plasmid while the engineered T-DNA region is on the other plasmid.

Binding site Region of a protein that specifically binds a ligand.

Binocular vision An animal with this kind of vision has eyes that are projected forward, due to which the field of view overlap, enabling the creature to judge depth.

Binomial classification System of classification that provides scientific names to organisms. Each name consists of a genus name and a species name, for each organism.

Bioaccumulation Intracellular accumulation of environmental pollutants such as organic materials by living organisms. Accumulation of a chemical substance in living tissue.

Bioaugmentation The addition to the environment of microorganisms that can metabolize and grow on specific organic compounds.

Bioavailability The availability of chemicals to potentially biodegradative microorganisms.

Biochemical oxygen demand (BOD) Amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter. In particular the requirement for molecular oxygen by

microbes during oxidation of biological substances in sewage. The BOD test measures the oxygen consumed (in mg/L) over 5 days at 20°C.

Biochemical pathway A series of enzyme-catalyzed reactions that results in the conversion of a precursor molecule into a product molecule.

Biochemical profiling The study of metabolites.

Biochemistry The science of chemical processes in living organisms.

Bioconversion Changes in organic matter brought about by the growth of microorganisms.

Biodegradable Substance capable of being decomposed by biological processes.

Biodegradation The breakdown of organic substances by microorganisms

Biodiversity A term of measurement, that gauges the diversity of organisms in a habitat or ecosystem. This measurement can be made based on the number of species or genetic variation that exist within an ecosystem or region.

Bioengineering The application of engineering techniques to biological processes, such as large-scale cultures of fungi to produce drugs.

Biofertilizer The nutrient inputs of biological origin that support plant growth.

Biofilm Microbial cells encased in an adhesive, usually a polysaccharide material, and attached to a surface. Organized microbial systems consisting of layers of microbial cells associated with surfaces, often with complex structural and functional characteristics. Biofilms have physical/chemical gradients that influence microbial metabolic processes. They can form on inanimate devices (catheters, medical prosthetic devices) and also cause fouling (e.g., of ships' hulls, water pipes, cooling towers).

Biogas Methane gas that is generated by the microbial decomposition of organic matter in the absence of oxygen.

Biogenesis The concept that living cells can arise only from preexisting cells.

Biogenic amines A set of low-molecular-weight amino acid derivatives that contain a basic amino group and function in the body as intercellular mediators. Examples are serotonin, histamine and epinephrine.

Biogeochemical cycling The oxidation and reduction of substances carried out by living organisms and/or abiotic processes that results in the cycling of elements within and between different parts of the ecosystem (the soil, aquatic environment, and atmosphere).

Biogeochemistry Study of effect of biota on global chemistry, and the cycles of matter and energy that transport the Earth's chemical components in time and space.

Biogeography The study of the distribution of organisms and species, past and present, and of diverse processes that underlie their distribution patterns. The patterns of species distribution at this level can usually be explained through a combination of historical factors such as speciation, extinction, continental drift, glaciation (and associated variations in sea level, river routes, and so on), and river

capture, in combination with the area and isolation of landmasses (geographic constraints) and available energy supplies.

Biohazards The accidents or risks associated with biological materials.

Bioinformatics The use of computer methods in studies of genomes.

Bioinsecticide A pathogen that is used to kill or disable unwanted insect pests. Bacteria, fungi, or viruses are used, either directly or after manipulation, to control insect populations.

Bioleaching The use of bacteria to recover valuable metals from ores.

Biolistics A means of introducing DNA into cells that involves bombardment with high-velocity microprojectiles coated with DNA.

Biologic transmission A type of vector-borne transmission in which a pathogen goes through some morphological or physiological change within the vector.

Biological control or biocontrol The control of the numbers of one organism as a result of natural predation by another or others. Specifically, the human use of natural predators for the control of pests or weeds. Also applied to the introduction of large numbers of sterilized males of the pest species, whose matings result in the laying of infertile eggs (2) Control method involving a biological control agent that is a natural enemy of a target pest.

Biological databases The collection of biological data on a computer in different arrangements and subsets.

Biological diversity or biodiversity Used to describe species richness, ecosystem complexity, and genetic variation (Allaby 1998).

Biological information The informations contained in the genome of organisms and which directs the development and maintenance of that organism.

Biological transmission Transmission of a pathogen from one host to another when the pathogen reproduces in the vector.

Bioluminescence The emission of light from the electron transport chain of certain living organisms.

Biomagnification Increase in the concentration of a chemical substance as it progresses to higher trophic levels of a food chain.

Biomass Total mass of living matter present in a given habitat, expressed as volume of organisms per unit of habitat's volume or weight per unit area.

Biome A region that is defined based on its climate and geography, which has ecologically similar communities of plants, animals, and soil organisms. The similarity is based on plant structures (such as trees, grasses and shrubs), plant spacing (forest, savanna, woodland), leaf types (such as needle-leaf and broad-leaf), and climate; i.e. major terrestrial assemblages.

Biometry Application of statistical methods to study biological problems.

Biopesticides The toxic compound produced by living organisms that can specifically kill a particular pest species.

Bioplastics The biodegradable plastics, chemically composed of polyhydroxy alkanooates (PHAs).

Biopol A biodegradable plastics composed of polyhydroxybutyric acid and valeric acid.

Bioprocess technology A more recent usage to replace fermentation technology that involves large scale cultivation of microbes for industrial purpose.

Biopsy The surgical removal of a small piece of tissue for laboratory examination by a pathologist to determine if it is malignant.

Bioreactor Any system that uses living organisms or enzymes to effect chemical changes, such as decomposition, decontamination, or production of chemical products. These are fermentation vessel with controls for environmental conditions, e.g., temperature and pH.

Bioregion A biological subdivision of the earth's surface delineated by the flora and fauna of the region (Allaby 1998).

Bioremediation The process by which living organisms act to degrade, detoxify or transform hazardous organic contaminants from an environment.

Biosensor An analytic device containing an immobilized biological material which reacts with an analyte to produce signals that can be measured.

Biosolid The residues of wastewater treatment. Formerly called sewage sludge.

Biosorption The process of microbial cell surface adsorption of metals.

Biosphere Zone incorporating all forms of life on earth. The biosphere extends from deep in sediment below the ocean to several thousand meters elevation in high mountains.

Biostimulation A process that increases the activity of microorganisms involved in biodegrading contaminants by addition of nutrients, oxygen, or other electron donors and acceptors.

Biosynthesis Production of needed cellular constituents from other, usually simpler, molecules.

Biota The plants and animals of a specific region or period, or the total aggregation of organisms in the biosphere (Allaby 1998); the total collection of organisms of a geographic region or a time period.

Biotechnology Use of living organisms to carry out defined physiochemical processes having industrial or other practical application.

Biotic factors The living environmental influences that affect organisms, such as predators, competitors, prey.

Biotinylation Attachment of a biotin label to a DNA or RNA molecules.

Bio-Tower An attached culture system. A tower filled with a media similar to ratchet or plastic rings in which air and water are forced up a counterflow movement in the tower.

Biotransformation Alteration of the structure of a compound by a living organism or enzyme.

Biotrophic Nutritional relationship between two organisms in which one or both must associate with the other to obtain nutrients and grow.

Biotype Strains of a species of pathogen, particularly, an insect pest, differing in their ability to attack different varieties of the same host species.

Biovar A subgroup of a *Salmonella serovar* based on biochemical testing.

Bioventing The process of supplying oxygen in situ to oxygen deprived soil microbes by forcing air through unsaturated contaminated soil at low flow rates. This stimulates biodegradation and minimizes stripping volatiles into the atmosphere. Frequently used to remediate soil under structures since it is relatively non-invasive.

Biparental cross analysis A design for genetic analysis based on progenies derived from the mating involving a random sample of F2 generation or plants from a cross between two pure lines; the four designs based on such progenies are NCDI, NCDII, NCDIII, and TTC.

Bipedal Bipedalism is a manner of moving on land, where the organism progresses using only its two rear limbs, or legs.

Birefringence Property of some substances that affect the polarization of transmitted light in such a way that these substances appear prominent under a polarization microscope.

Birth Rate The term is the average number of young produced within a specific period of time. It is calculated per individual, and is usually communicated as a function of age.

Bisphosphate A compound, bearing two independent phosphate groups (as opposed to a diphosphate, which bears a chain of two phosphates in a line). Fructose-1,6-bisphosphate is an example.

Bittner virus Mouse mammary tumor virus.

Bivalent The structure formed when a pair of homologous chromosomes lines up during meiosis.

Black smoker Thermal vent emitting very hot (270-380 °C) water and minerals

Blade The broad, flattened, conspicuous part of the leaf called lamina that is distinguished from the petiole or stalk.

Blastocyst Early embryo.

Blastoderm The stage in embryogenesis when a unicellular layer at the surface surrounds the yolk mass.

Blastomycosis An acute or chronic mycosis which usually affects man and animals (e.g. dogs). Blastomycosis is caused by a fungus called *Blastomyces dermatitidis* and occurs in North America, Africa and Israel. Infection apparently occurs by inhalation of spores from the fungus although *B. dermatitidis* has proved difficult to isolate from environmental habitats.

Blastospore An asexual fungal spore produced by budding from the parent cell.

Blastula Early embryonic form consisting of a hollow sphere of cells.

Bleomycin A mixture of antitumor antibiotics isolated from *Streptomyces verticillus*. Present data suggest that the primary action of the bleomycin is the scission of DNA strands or the inhibition of a DNA ligase (repair enzyme) with results in inhibition of cell division and production of fatally damaged daughter cells. Bleomycins are among the few antitumor agents that do not depress synthesis of lymphocytes in bone marrow.

Blocking antibody An IgG antibody that reacts with an allergen to prevent a hypersensitivity reaction.

Blocking factor An unidentified substance, found in the blood serum of animals with growing tumors, that will block the action of immune lymphocytes previously sensitized to that tumor. The activity of blocking factor has been demonstrated primarily with cultured tumor cells. Many investigators think blocking factor is a complex of tumor antigen and host antibody.

Blood group antigens A group of oligosaccharides that are carried in the form of glycoproteins and phospholipids on the surface of cells, including blood cells; they are encoded by a large number of polymorphic gene loci and can provoke an immune response in an individual with different blood group antigens.

Blood-brain barrier A selective permeability barrier that is found in the walls of blood vessels in the brain and that prevents most large or polar molecules from readily entering brain tissue. Physically the barrier consists of tight junctions between endothelial cells; these cells have transporters for polar substances such as glucose that need to enter the brain.

Bloom (algal) Abundant growth of microscopic algae, producing visible colonies in nature.

Bloom's syndrome Disease resulting from a deficiency in helicase. Affected individuals cannot repair their DNA and are susceptible to developing skin cancer and other cancers.

Blotting The transfer of macromolecules by capillary action from a gel to a membrane.

Blowhole A blowhole is an opening on the top of a cetacean's head, from which air is inhaled and exhaled.

Blue-green algae Old name for the photosynthetic prokaryotes now known as cyanobacteria.

Blunt end An end of a double stranded DNA molecule where both strands terminate at the same nucleotide position with no single-stranded extension.

Bohr effect The effect of pH on oxygen binding by hemoglobin, by which a decrease in pH causes a decrease in oxygen affinity. The effect promotes both the release of oxygen from hemoglobin in the tissues and the release of CO₂ from the blood to the air in the lungs.

Bond energy The energy required to break a bond.

Bone marrow grafts A technique sometime used in the treatment of myelocytic leukemias. To ensure that all leukemia cells are destroyed, all the patient's bone marrow cells are killed by drugs or radiation.

Bone marrow Soft tissues in the medullary canal of long bones and in the interstices of cancellous (spongy) bones. Bone marrow is the primary site for production of leukocytes and is thus an important constituent of the body's immune system.

Book lung It is an organ used for respiration, and is part of the body system of arachnids, such as spiders and scorpions. The book lung is located inside the ventral abdominal cavity.

Bootstrap analysis A method for inferring the degree of confidence that can be assigned to a branch point in a phylogenetic tree. It is a method in cladistic analysis to infer the "strength" or "confidence" of a branch on a phylogenetic tree, obtained by generating trees many times from a sample distribution of characters. Bootstrap values theoretically can vary from 0% (poor support) to 100%.

- Bottleneck** A temporary reduction in the size of a population.
- Bow Riding** It is an activity carried out by cetaceans (most commonly dolphins), in which they swim or drift along the crests of waves in the ocean.
- Bract** Leaf like structure situated at the base of the flower or inflorescence.
- Bragg peak** A sharp increase in the radiation energy transferred to a tissue by a charged particle as the particle comes to a halt. If the initial energy of such a particle is adjusted properly the particle will come to rest in an internal tumor and most of the radiation will be released to the tumor.
- Branch migration** A step in the Holliday model for homologous recombination, involving exchange of polynucleotides between a pair of recombining double-stranded DNA molecule by simultaneous unwinding and rewinding in both duplexes.
- Branchpoint** An intermediate in a biochemical pathway that can follow more than one route in following steps.
- Breeder seed** Seed produced by the breeder or the institute, which developed the variety. It is a source of foundation seed.
- Breeding system** A breeding system includes all the different breeding behavior (polygyny, outcrossing, or selective mating) of a population, and the methods in which the members of the population adapt to them.
- Bridging species** A species used in gene transfer from one species to another sexually incompatible species; bridging species is compatible with both donor and the recipient species; it may be a natural or synthetic species.
- Bright-field microscopy** Most basic form of light microscopy. The specimen appears against a bright background and appears darker than the background because of the light it has absorbed or scattered.
- Brilles** The German word for 'glasses', it is a transparent, immovable layer of scale/skin that covers the eyes of some creatures, such as snakes and lizards, and provides protection.
- Bristles** Bristles are long, stiff strands of hair or feathers. In birds, they are situated near the mouth or eyes. Their function may be to assist the bird in eating and give protection to the eyes.
- Broad-spectrum drug** A chemical that has antimicrobial activity against many infectious microorganisms.
- Bromodeoxyuridine (BUDR)** A nucleoside analog that can function as an antimetabolite by substituting for thymidine in DNA synthesis. Its common effect is interference with the differentiation of cells. It is frequently used for the induction of latent viruses in cultured cells. It is also a mutagen.
- Bronchogenic carcinoma** A malignant tumor of the lung.
- Brood parasitism** The method adopted by one organism to make another individual of the same or different species to raise its offspring. In birds, this is done by laying ones eggs in other birds nest. The organism who exhibit such character is a brood parasite.

Brood patch Located on the lower abdomen of birds, it develops by the shedding of feathers in this area, and the consequent thickening of the skin, after which it becomes densely populated with blood vessels. The brood patch is used to incubate the eggs and keep the young warm.

Brood reduction When a clutch of eggs hatch sequentially, if there is inadequate food, brood reduction takes place. This happens when the weakest chick or chicks, being deprived of food either fail to survive out of starvation, or are devoured by their stronger siblings.

Brooding The practice of birds, where the parent birds continue to provide warmth to their young, during the time when they are unable to maintain their own body temperatures.

Broth Any fluid medium supporting the growth of microbes.

Broth dilution tests A method of determining the MIC by using serial dilutions of an antimicrobial drug.

Brown fat Tissue specialized for generating heat specially in newborns. Thermogenin, an uncoupling protein, present in the inner mitochondrial membrane of the brown fat tissues, generates heat.

Brown rot fungus Fungus that attacks cellulose and hemicellulose in wood, leaving dark-colored lignin and phenolic materials behind.

Brownfield An abandoned, idled, or under-used industrial or commercial facility where expansion or redevelopment is complicated by a real or perceived environmental contamination.

Brownian movement The movement of particles, including microorganisms, in a suspension owing to bombardment by the moving molecules in the suspension.

Bryophyte Phylum comprising non-vascular plants: lacking xylem and phloem. Mosses, liverworts, etc are bryophytes.

Bt plants The plant carrying the toxin producing gene from *Bacillus thuringiensis*, and capable of protecting themselves from insect attack.

BTEX Benzene, toluene, ethylbenzene, and xylenes.

Bubo An enlarged lymph node caused by inflammation.

Bud mutation Mutation in somatic tissue; usually in the axillary bud.

Bud selection A form of clonal selection in which mutant buds are selected.

Budding (1) Asexual reproduction beginning as a protuberance from the parent cell that grows to become a daughter cell. (2) Release of an enveloped virus through the plasma membrane of an animal cell.

Buffer A conjugate acid-base pair that is capable of resisting changes in pH when acid or base is added to the system. This tendency will be maximal when the conjugate forms are present in equal amounts and buffering the ability of a mixture of an acid and its conjugate base at a pH near their pK_a to minimize pH changes caused by an influx of acid or base.

Bulk density of soil Mass of dry soil per unit bulk volume (combined volume of soil solids and pore space).

Bulking Condition arising when sludge floats rather than settles in secondary sewage treatment.

Bulky lesion Distortion of the DNA helix caused by a thymine dimer.

Bundle sheath Layer of parenchyma or sclerenchyma cells encircling the vascular bundle in plant leaves and stems.

Buoyant density The density possessed by a molecule or particle when suspended in an aqueous salt or sugar solution.

Burkitt's lymphoma A tumor of the lymphoid system, especially B lymphocytes, that arises in facial bones, ovaries and abdominal lymph nodes.

Burst size The number of newly synthesized bacteriophage particles released from a single cell.

Butanediol fermentation A type of anaerobic fermentation of glucose most often found in the family Enterobacteriaceae in which 2,3-butanediol is a major product; detected by the Voges-Proskauer test.

Butanol A type of alcohol consisting of four carbon atoms per molecule.

β adrenergic receptor A receptor for the related chemicals adrenaline and noradrenalin.

β oxidation pathway The major pathway of fatty acid oxidation to produce NADH, FADH₂, and acetyl coenzyme A.

β oxidation Process by which fatty acids are broken down into individual two-carbon units coupled to CoA to form acetyl-CoA. The process, which takes place in the mitochondrial matrix, generates both NADH and FADH₂.

β sheet Common secondary structure in proteins in which lengths of fully extended polypeptide run alongside each other, hydrogen bonds forming between the peptide bonds of the adjoining strands.

β galactosidase Enzyme that cleaves the disaccharide lactose to produce glucose and galactose.

Biosafety Biosafety is the prevention of large-scale loss of biological integrity, focusing both on ecology and human health.

Biosafety level It is the level of the biocontainment precautions required to isolate dangerous biological agents in an enclosed facility. The levels of containment range from the lowest biosafety level 1 (BSL-1) to the highest at level 4 (BSL-4).

5'Cap 7-methyl-guanosine structure added to beginning of eukaryotic mRNA.

Cytosine (C) One of the pyrimidine bases present in DNA and RNA

C value Characteristic DNA content of the cells of a given species.

C₄ cycle A cycle in some plants that minimizes the wasteful effects of photorespiration by using an enzyme other than rubisco to perform the initial oxidation of CO₂. This enzyme is found in mesophyll cells, where it fixes CO₂ into a four-carbon compound (hence C₄). This fixed carbon is shuttled into sheltered bundle sheath cells, where it is released as CO₂ and enters the Calvin cycle.

Ca²⁺ ATPase A Carrier that uses the energy released by ATP hydrolysis to move calcium ions up their concentration gradient out of the cytosol. Different isoforms of calcium ATPase are located at the plasma membrane and in the membrane of the endoplasmic reticulum.

CAAT box A basal promoter element. It is the promoter sequence of DNA for eukaryotic transcription units.

Cadherin A class of type-1 transmembrane protein, that play important role in cell adhesion, forming adherens junctions to bind cells within tissues together. They are dependent on calcium (Ca^{2+}) ions to function, hence their name.

Calamus It is the hollow base of a feather shaft, which attaches the feather to the skin.

Calcereous Calcium containing parts of a body such as shells, bones and exoskeletons, which give physical support and protection to an animal.

Calcineurin Calcium-calmodulin-activated phosphatase, that is, an enzyme that removes phosphate groups from proteins, opposing the effects of kinases. Calcineurin is inhibited by the immunosuppressant drug cyclosporin.

Calcium action potential Action potential driven by the opening of voltage-gated calcium channels and the resulting calcium influx (as in smooth muscles of gastrointestinal tract).

Calcium ATPase A carrier that uses the energy released by ATP hydrolysis to move calcium ions up their concentration gradient out of the cytosol. Different isoforms of calcium ATPase are located at the plasma membrane and in the membrane of the endoplasmic reticulum.

Calcium pump A Carrier that moves calcium ions up their electrochemical gradient out of the cytosol into the extracellular medium or into the endoplasmic reticulum. There are two important calcium pumps: the sodium/calcium exchanger is found on the plasma membrane, while different isoforms of the calcium ATPase are found on the plasma membrane and on the membrane of the endoplasmic reticulum.

Calcium-binding protein Any protein that binds calcium. Calmodulin, troponin and calreticulin are examples found in the cytosol, attached to actin filaments in striated muscle, and in the endoplasmic reticulum respectively.

Calcium-calmodulin-activated protein kinase Important regulatory enzyme, activated when calcium-loaded calmodulin binds, which phosphorylates target proteins on serine and threonine residues.

Calcium-induced calcium release Process in which a rise of calcium concentration in the cytoplasm triggers the release of more calcium from the endoplasmic reticulum.

Call matching This refers to the male and female of a pair duplicating each others flight call, vocally. This is a behavioral trait, often displayed by members of the finch family.

Callose A plant polysaccharide composed of glucose residues linked together through β -1, 3-linkages secreted by an enzyme complex (callose synthase), resulting in the hardening or thickening of plant cell walls.

Callus Tissue formed over damaged areas of the plant in the form of a seal, thereby protecting it from further deterioration, and allowing the wound to heal. It is the undifferentiated mass of cells.

Calmodulin Calcium-binding protein found in many cells. When calmodulin binds calcium, it can then activate other proteins such as the enzymes calcineurin and glycogen phosphorylase kinase.

- Calorie** A unit of energy defined as that amount of heat energy that will raise the temperature of 1 gram of water by 1°C. 1 calorie = 4.182 joules.
- Calvin-Benson cycle** A pathway for conversion of CO₂ into reduced organic compounds; used by autotrophs.
- Calyptra** Small sheath of cells found in non-vascular plants, derived from the archegonium to cover the tip of the capsule partially or completely.
- Calyx** Collective terminology for the sepals of a flower.
- Cambium** Layer of meristematic tissue (also known as lateral meristems), responsible for secondary growth in plants.
- Capillary water** Water held in the tiny pores between soil particles by the adhesive force of surface tension.
- Capsule** Dry, dehiscent fruit consisting of two or more carpels that splits in several ways at maturity to release seeds.
- Carpel** Single member of a compound pistil or single pistil unit, bearing the ovule in angiosperms.
- CaM-kinase** Another name for calcium-calmodulin-activated protein kinase; an important regulatory enzyme, activated when calcium-loaded calmodulin binds, that phosphorylates target proteins on serine and threonine residues.
- Camouflage** A feature common to invertebrates, which helps them blend with their surroundings using its skin color or pattern. It is a survival strategy that resulted during evolution.
- Cyclic adenosine monophosphate (cAMP)** Nucleotide produced from ATP by the action of the enzyme adenylate cyclase. cAMP is an intracellular messenger in many cells. This cyclic nucleotide has a regulatory function in many metabolic processes. It is also referred to as second messenger in protein hormone action.
- cAMP-dependent protein kinase (protein kinase A; PKA)** Protein kinase that is activated by the intracellular messenger cyclic-AMP. PKA phosphorylates proteins (e.g., glycogen phosphorylase kinase) on serine and threonine residues.
- cAMP-gated channel** Channel found in the plasma membrane of scent-sensitive olfactory receptor neurons. The channel opens when cAMP binds to its cytoplasmic face and allows sodium and potassium ions to pass.
- cAMP phosphodiesterase** Enzyme that hydrolyzes cyclic AMP, producing AMP and hence turning off signaling through the cAMP system.
- Cancer** A malignant, invasive cellular tumor that has the capability of spreading throughout the body or body parts.
- Canine tooth** A single point tooth that is shaped and used for piercing and holding on to food. It is located near the front of the jaw, and is prominently seen in carnivores.

Catabolite activator protein (CAP) The catabolite gene activator protein found in prokaryotes that binds to cAMP. The CAP–cAMP complex then binds within the promoter region of some bacterial operons and helps RNA polymerase to bind to the promoter.

Cap binding complex The complex that makes the initial attachment to the cap structure at the scanning phase of eukaryotic translation.

CAP site A DNA-binding site for the catabolic activator protein.

Cap It is the chemical modification at the 5' end of most eukaryotic mRNA molecules by which addition of methylated guanine to 5' end of a eukaryotic mRNA is facilitated.

Capillary electrophoresis Polyacrylamide gel electrophoresis carried out in a thin capillary tube providing high resolution.

Capsases A group of protease enzymes that are associated with apoptosis.

Capsid The protein coat that surrounds the DNA or RNA genome of a virus. Capsomere is the protein subunit of a capsid.

Capsule An outer, viscous covering on some bacteria composed of a polysaccharide or polypeptide.

Carapace A hard shell which shields the dorsal side of an animal's body. It is used more specifically to refer to the upper side of a tortoise or turtle's shell.

Carbohydrate Any chemical compound which consists of only carbon (C), oxygen (O), and hydrogen (H) elements, for examples, sugars, starches, and cellulose. The ratio of hydrogen to oxygen atoms in carbohydrates is usually 2:1. In general, substances that have the stoichiometric formula $(CH_2O)_n$, where $n \geq 3$, or that are derived from such a substance by the addition of functional groups.

Carbon cycle Sequence where carbon dioxide is converted to organic forms by photosynthesis or chemosynthesis, recycled through the biosphere, with partial incorporation into sediments, and ultimately returned to its original state through respiration or combustion.

Carbon fixation It is the reduction of inorganic carbon (carbon dioxide) to organic compounds by living organisms. The most prominent example is photosynthesis.

Carbon skeleton The basic chain or ring of carbon in a molecule.

Carbon-nitrogen (C/N) ratio The C/N ratio (C:N) or carbon-to-nitrogen ratio is a ratio of the mass of carbon to the mass of nitrogen in a substance. Carbon-to-nitrogen ratios are an indicator for nitrogen limitation of plants and other organisms. When composting, microbial activity utilizes a C/N ratio of 30-35:1 and a higher ratio will result in slower composting rates. Thus, for practical agricultural purposes, a compost should have a initial C/N ratio of 20-30:1.

Carboxyl group (—COOH) Carboxyl groups give up hydrogen ions to form the deprotonated group—COO⁻, so molecules that bear carboxyl groups are usually acids.

Carboxyl terminus The end of a polypeptide that has a free carboxyl group.

Carboxylation Introduction of a carboxyl group (—COOH).

Carboxylic acid. A molecule containing a carbon atom attached to a hydroxyl group and to an oxygen atom by a double bond.

Carboxysomes Polyhedral cellular inclusions of crystalline ribulose biphosphate carboxylase (RuBisCO), the key enzyme of the Calvin cycle.

Carcinoembryonic antigen (CEA) A glycoprotein originally isolated from colon tumors and subsequently found in fetal tissues. Its function is not yet known, CEA was at first thought to be a unique marker for colon tumors in adults, but more recent studies have shown that it is present in small quantities in normal blood and is present in increased amounts in the blood of smokers, of individuals with emphysema or cirrhosis of the liver and of individuals with certain other types of tumors.

Carcinogen Any agent that initiates the formation of a tumor.

Carcinoma A malignant tumor arising in epithelial tissues. These include skin, glands, nerves, breasts, and the linings of the respiratory, gastrointestinal, urinary, and genital systems. Carcinomas account for about 85 percent of human malignancies.

Carcinoma-in-situ Also known as preinvasive carcinoma. A type of tumor in which the abnormal cells still lie within the epithelial origin, without invasion of the basement membrane. The term is often applied to such tumors in the uterine cervix because the tumor is localized, the survival rate after its removal is very high.

Carcinoycin An antitumor antibiotic that is thought to act by binding to DNA to block the production of RNA. It is a synthetically prepared analog of daunorubicin.

Cardiac muscle Muscle that is found in the heart. It shows some structural features of skeletal and some features of smooth muscles. They are spontaneous and autogenic in nature.

Cardiolipin A beef heart extract used in the venereal disease research laboratory (VDRL) slide test to detect antibodies against syphilis.

Carnassial tooth A tooth that has resulted by fusion of last premolar and first molar, and is used to efficiently tear and slice meat of prey. This tooth is seen only in the carnivores.

Carnitine A low-molecular-weight lysine derivative that shuttles fatty acids through the inner mitochondrial membrane to the matrix. The fatty acyl moiety is transferred from CoA to carnitine for transit through the membrane and is then transferred back to CoA; the carnitine released on the matrix side of the membrane is shuttled back for reuse.

Carnivore A mammal belonging to the order Carnivora, that sustains by eating the flesh of other animals.

Carotenoids Lipid-soluble pigments that are made from isoprene units.

Carrageenan A galactose polymer in the cell walls of red algae.

Carrier (1) An integral membrane protein that forms a tube through the membrane that is never open all the way through. Solutes can move into the tube through the open end. When the channel changes shape, so that the end that was closed is open, the solute can leave on the other side of the membrane. (2) A person who has one nonfunctional or mutant copy of a gene, but who shows no effects because the other copy produces sufficient functional protein.

Carrier proteins Plasma membrane proteins that transport substances across the membrane.

Caruncle A fleshy outgrowth, without feathers, seen on the neck and face of a bird. It is also referred to as fowl's comb and usually seen in the turkey family.

Caryopsis Small, dry, single seeded fruits which do not split at maturity. The pericarp cleaves to the seed coat; typically seen in grains.

Casette mutagenesis Also called site-specific mutagenesis or oligonucleotide-directed mutagenesis, is a molecular biology technique in which a mutation is created at a defined site in a DNA molecule. In general, this form of mutagenesis requires that the wild type gene sequence be known. It is commonly used in protein engineering.

Casparian strip The Casparian strip is a band of cell wall material deposited on the radial and transverse walls of the endodermis, which is chemically different from the rest of the cell wall. It is used to block the passive flow of materials, such as water and solutes into the stele of a plant.

Caspase Cysteine-containing protease that cleaves at aspartate residues. Caspases are responsible for the degradative processes that occur during apoptosis.

CASPs (CTD-associated SR-like proteins) Carboxy terminal domain-associated splicing-recognition-like protein; any protein that contains a motif for sequence-specific RNA-binding and a domain for binding to the C-terminal domain of RNA polymerase II.

Casque A formation on the head resembling a helmet, that is located on the head of a lizard.

Caste A group of species, which share similar features, form or behavior and belong to the same social group.

Casein Milk protein.

Catabolic repression Carbon catabolite repression, or simply catabolite repression, allows bacteria to adapt quickly to a preferred (rapidly metabolisable) carbon and energy source first. This is usually achieved through inhibition of synthesis of enzymes involved in catabolism of carbon sources other than the preferred one. The catabolite repression was first shown to be initiated by glucose and therefore sometimes referred to as the glucose effect. However, the term "glucose effect" is actually a misnomer since other carbon sources are known to induce catabolite repression.

Catabolism Biochemical processes involved in the breakdown of organic compounds, usually leading to the production of energy. The sum of all the metabolic processes by which complex molecules are broken down to simpler ones, including the processes by which molecules are broken down to yield cellular energy.

Catabolite activation In bacteria, a transcriptional control system that induces the synthesis of enzymes for the catabolism of energy substrates other than glucose when glucose levels are low. It involves an activator protein, CRP, that binds cyclic AMP under conditions of low glucose; this complex then binds to DNA sites and promotes transcription of the appropriate genes.

Catabolite repression The process by which extracellular glucose levels dictate whether genes for sugar utilization are switched on or off in bacteria. Transcription-level inhibition of a variety of inducible enzymes by glucose or other readily used carbon source.

Catalase An enzyme that catalyzes the breakdown of hydrogen peroxide to water and oxygen.

- Catalyst** Chemical or substance that reduces the activation energy of a reaction, allowing it to proceed more quickly. Many biological reactions would proceed at a slow rate without the aid of enzymes, which are biocatalysts. Enzymes are mostly proteins.
- Catalytic rate constant (k_{cat})** Proportionality constant that relates the maximal initial velocity (V_m) of an enzyme-catalyzed reaction to the enzyme concentration. $k_{cat} = V_m / [E]$.
- Catalytic site** The site of an enzyme involved in the catalytic process.
- Catenane** An interlocked pair of circular structures, such as covalently closed DNA molecules.
- Catenation** The linking of molecules without any direct covalent bonding between them, as when two circular DNA molecules interlock like the links in a chain.
- Cathepsins** Lysosomal proteases that function in degrading proteins in lysosomes and are also released into the cell at large during cell autolysis (programmed cell death).
- Cation exchange** Replacement of an essential cation released from a soil particle by a proton.
- Cation exchange capacity (CEC)** Sum of exchangeable cations that a soil can adsorb at a specific pH. Expressed as centimoles of positive charge per kilogram of soil (cmolc kg⁻¹).
- Cavitation** The rupture of the water column in the xylem, when tension surmounts the cohesive nature of water.
- CCNU** Also known as Lomustine. A nitrosourea used as an alkylating agent in the treatment of tumors.
- CD** Cluster of differentiation. A cell surface receptor used to differentiate lymphocytes. CD4 usually refers to helper T cells; CD8 includes cytotoxic and suppressor T cells.
- CD95 pathway** The CD95 receptor is found on many nucleated eucaryotic cells. When the receptor is bound to a specific ligand (CD95L), the CD95-CD95L complex activates several cytoplasmic proteins that initiate a cellular suicide cascade leading to apoptosis.
- Cdc** Cell division cycle. The acronym is usually used to denote genes, especially of the yeasts *Saccharomyces cerevisiae* and *Schizosaccharomyces pombe*, which, when mutated, cause the cell division cycle to be abnormal.
- Cdc25** Protein phosphatase involved in the regulation of CDK1.
- Cdk1 (cyclin-dependent kinase 1)** Protein kinase involved in the regulation of the G₂/M transition of the cell cycle. Associates with cyclin B to form MPF (Maturation-promoting factor abbreviated MPF, also called mitosis-promoting factor or M-Phase-promoting factor is a heterodimeric protein composed of cyclin B and cyclin-dependent kinase (CDK1, also known as Cdc2 or p34 kinase) that stimulates the mitotic and meiotic cell cycles.
- Cdk2 (cyclin-dependent kinase 2)** Protein kinase involved in the regulation of the G₁ phase of the cell cycle. Associates with cyclin E.
- Cdk4 (cyclin-dependent kinase 2)** Protein kinase involved in the regulation of the G₁ phase of the cell cycle. Associates with cyclin D.

Cdk6 (cyclin-dependent kinase 2) Protein kinase involved in the regulation of the G1 phase of the cell cycle. Associates with cyclin D.

cDNA capture (cDNA selection) Repeated hybridization probing of a pool of cDNA with the objective of obtaining a sub pool enriched in certain sequences.

cDNA Complementary DNA, made in vitro from the mRNA by the enzyme reverse transcriptase using deoxyribonucleotide triphosphates. Unlike mRNA, cDNA can be easily propagated and sequenced.

cDNA-AFLP A molecular marker technique performing AFLP analysis on cDNA.

cDNA library Collection of bacterial cells each of which contains a different foreign cDNA molecule.

CDS The coding sequence or the portion of a nucleotide sequence that makes up the triplet codons that actually code for amino acids.

Cell The basic microscopic unit of structure and function of all living organisms. A membrane-bound collection of protein, nucleic acid, and other components that is capable of self-replication using simpler building blocks. It encompasses nuclear and cytoplasmic material.

Cell adhesion molecule Integral membrane protein responsible for sticking cells together. The extracellular domain binds a cell adhesion molecule on another cell while the intracellular domain binds to the cytoskeleton, either directly or via a linker protein.

Cell biology Branch of biology involving the study of cells, their structure, formation, components and functions.

Cell center Point immediately adjacent to the nucleus of eukaryotes where the centrosome and Golgi apparatus are located.

Cell cloning The production of a population of cells derived from a single cell.

Cell coat Continually renewed outermost layer of an animal cell in direct contact with the plasma membrane; also called glycocalyx.

Cell commitment That stage in a cell's life when it becomes committed to a certain line of development.

Cell culture Animal or plant cells grown in vitro.

Cell cycle checkpoint A period before entry into S or M phase of the cell cycle, a key point at which regulation is exerted.

Cell cycle A series of events that take place in a cell leading to its division and duplication (replication) that produces two daughter cells. In eukaryotic cells, it is composed of the G1 period, the S period in which DNA and histones are synthesized, the G2 period, and the M period (mitosis).

Cell division cycle (CDC) mutants Mutants, especially of the yeasts *Saccharomyces cerevisiae* and *Schizosaccharomyces pombe*, that is temperature-sensitive for cell division.

Cell fractionation Technique by which subcellular components are separated and purified on the basis of their physical properties.

Cell junctions Points of cell-cell interaction in tissues; includes tight junctions; anchoring junctions and gap junctions.

- Cell line** An established clone originally derived from a whole organism through a long process of in vitro culture.
- Cell lineage** The pedigree of cells resulting from binary fission.
- Cell mediated immunity** An immune response that involves T cells binding to antigens presented on infected cells; T cells then differentiate into several types of effector T cells, including helper and cytotoxic.
- Cell membrane** A biological membrane that separates the interior of all cells from the outside environment. It is selectively permeable to ions and organic molecules and controls the movement of substances in and out of cells. The basic function of the cell membrane is to protect the cell from its surroundings, also known as the plasmalemma or plasma membrane.
- Cell plate** During cell division, the plate formed at the midpoint between two sets of chromosomes, which is involved in the wall formation between two daughter cells.
- Cell sap** Fluid present in the central vacuole of plant cell.
- Cell senescence** The period in a cell lineage when the cells are alive but no longer able to divide and gradually decline in their functional efficiency.
- Cell synchronization** Manipulation of cells at different stages of cell cycle in a culture so that the cells will be at the same phase of cell cycle.
- Cell theory** A principle that all living things are composed of cell proposed by M.J. Schleiden and T.Schwann (1838). The cell theory states that (i) All life forms are made from one or more cells. (ii) Cells only arise from pre-existing cells. (iii) The cell is the smallest form of life. The modern version of the Cell Theory includes the ideas that (i) Energy flow occurs within cells. (ii) Heredity information (DNA) is passed on from cell to cell. (iii) All cells have the same basic chemical composition.
- Cell transformation** The alteration in morphological and biochemical properties in an animal cell that occurs when it is infected by an oncogenic virus.
- Cell viability** The capability of cellular existence, survival and development.
- Cell wall** A tough outer coating found in many plant, fungal, and bacterial cells that accounts for their ability to withstand mechanical stress or abrupt changes in osmotic pressure. Cell walls always contain a carbohydrate component and frequently also a peptide and a lipid component.
- Cell-free protein synthesizing system** A cell extract containing all the components needed for protein synthesis and able to translate added mRNA molecules.
- Cell-mediated immunity** The type of immunity that results from T cells coming into close contact with foreign cells or infected cells to destroy them; it can be transferred to a non immune individual by the transfer of cells. The system that is responsible for primary rejection of transplants, delayed hypersensitivity, surveillance against tumors and protection against viruses and bacteria.
- Cell-specific module** Sequence motifs present in the promoters of eukaryotic genes that are expressed in just one type of tissue.

Cellular respiration A sequence of metabolic reactions that converts sugars and other substrates to carbon dioxide and water in the presence of oxygen. The principal energy-generating metabolism in a cell.

Cellular slime molds Slime molds with a vegetative phase consisting of amoeboid cells that aggregate to form a multicellular pseudoplasmodium; they belong to the division Acrasiomycota.

Cellulitis A diffusely spreading infection of subcutaneous skin tissue caused by streptococci, staphylococci, or other organisms. The tissue is inflamed with edema, redness, pain, and interference with function.

Cellulose Glucose polysaccharide (with β -1, 4-linkage) that is the main component of plant cell walls. Most abundant polysaccharide on earth.

Cellulose synthase Multiprotein complex of the plant plasma membrane that makes cellulose

Center of chirality With respect to organic compounds, a carbon atom that has four different substituent attached to it; such a can occur in two enantiomers.

Centers of diversity Areas where cultivated plant species and/or their wild relatives show much greater variation than anywhere else in the world.

Centers of origin Areas where cultivated plant species are supposed to have originated.

Central Cell Nuclei Mostly two in number nuclei uniting with sperm to form primary endosperm nucleus in embryo sac. It is a membrane enclosed organelle of eukaryotic cells that contains its genetic material in the form of chromosomes.

Central dogma (of molecular biology) “DNA makes RNA makes protein”—the concept that the sequence of bases on DNA defines the sequence of bases on RNA, and the sequence of bases on RNA then defines the sequence of amino acids on protein.

Central Nervous System A part of the nervous system, made up of inter-neurons, which exercises control over the nervous system.

Central tendency A measure of central tendency is a typical value around which other figures congregate.

Centrifugal Tail Molt The process of shedding and replacing of feathers of a birds tail, that starts with the replacing of the innermost pair of feathers first and then moves from the center outward.

Centrioles Small, cylindrical cell organelles found in animals and some algae and fungi. Located near the nucleus in the cytoplasm of most eukaryotic cells each centriole is usually composed of nine triplets of microtubules. Centrioles are involved in the organization of the mitotic spindle and in the completion of cytokinesis.

Centromere Portion of the chromosome holding the two chromatids together before anaphase stage of mitosis or anaphase II stage of meiosis. The spindle fibers are attached to this region and move the chromosomes during cell division.

Centrosome (microtubule organizing center) structure from which cytoplasmic microtubules arise.

- Cephalization** It is a tendency within animals, with localization of neural control and sensory organs located at an end of the body, usually near the head i.e. formation of anterior most region of the body.
- Cephalosporin** An antibiotic produced by the fungus *Cephalosporium* that inhibits the synthesis of gram-positive bacterial cell walls.
- Cercaria** A free-swimming larva of nematodes.
- Cere** A raised and membranous covering, that is located at the base of the upper mandible in a bird.
- Cetaceans** Mainly marine mammals belonging to the Cetacea species. Toothed whales and toothless filter feeding whales are among those that belong to this category.
- CF (cystic fibrosis)** Inherited disease characterized by failure of the pancreas and by thick sticky mucus in the lungs leading to fatal lung infection unless treated. Cystic fibrosis is caused by failure to make, or properly target, plasma membrane chloride channels.
- CFU** Colony forming units. Viable micro-organisms (bacteria, yeasts & mould) capable of growth under the prescribed conditions (medium, atmosphere, time and temperature) develop into visible colonies (colony forming units) which are counted. The term colony forming unit (CFU) is used because a colony may result from a single micro-organism or from a clump / cluster of micro-organisms.
- cGMP-dependent protein kinase (PKG; protein kinase G)** Protein kinase that is activated by the intracellular messenger cyclic GMP. PKG phosphorylates proteins (e.g., the calcium ATPase) on serine and threonine residues.
- Chain release factors** Proteins that occupy the A site in the ribosome when a stop codon is encountered and that act to trigger termination of polypeptide synthesis.
- Chain termination method** ADNA sequencing method that involves enzymatic synthesis of polynucleotide chains that terminate at specific nucleotide positions.
- Chancre** A chancre is a painless ulceration (sore) formed during the primary stage of syphilis. This infectious lesion forms approximately 21 days after the initial exposure to *Treponema pallidum*, the gram-negative spirochaete bacterium yielding syphilis. A hard spore, the center of which ulcerates.
- Channel** Integral membrane protein that forms a continuous water-filled hole through the membrane.
- Chaotropic reagents** Reagents such as urea, which cause proteins to lose all their higher levels of structure and adopt random, changing conformations.
- Chaotropic** The property of being able to disrupt the hydrogen bonding structure of water. Substances that are good hydrogen bonders, such as urea or guanidine hydrochloride, are chaotropic. Concentrated solutions of these substances tend to denature proteins because they reduce the hydrophobic effect.
- Chaperone** Protein that helps other proteins to remain unfolded for correct protein targeting, or to fold into their correct three-dimensional structure.

Chaperonins Proteins that are involved in managing the folding of other proteins. Some of them help proteins to fold correctly; some prevent premature folding; and some prevent polypeptides from associating with other polypeptides until they have folded properly.

Character A morphological, anatomical or physiological feature of an organism; usually a product of the actions of both genotype and environment. Characters are the fundamental units used to formalize hypotheses of homology for all phylogenetic analyses

Character Displacement Adaptations of different sets of characteristics in two similar species, brought about by overlapping territories, resulting in competition.

Character state One of at least two alternative forms of a character used in phylogenetic analysis.

Charge (1) excess or deficit of electrons giving a negative or positive charge, respectively; (2) transfer RNA is said to be charged when it has an amino acid attached.

Charged tRNA tRNA attached to an amino acid.

Chase Washing and incubation of a pulsed tissue sample in medium containing excess unlabeled precursor.

Chelat A molecule that contains more than one binding site and frequently binds to another molecule through more than one binding site at the same time.

Chelate (chelator) Organic chemical that forms ring compound in which a metal is held between two or more atoms strongly enough to diminish the rate at which it becomes fixed by soil, thereby making it more available for plant and microbial uptake.

Chemical bond Attractive force between atoms forming a molecule.

Chemical cross-linking A technique for investigating the mutual arrangement of components in a complex. The complex is exposed to a reagent that can form chemical cross-links between adjacent components and is then disaggregated and analyzed. Components that are linked together can be assumed to be neighbors in the complex. The interactions or mere proximity of proteins can be studied by the clever use of crosslinking agents. For example, protein A and protein B may be very close to each other in a cell, and a chemical crosslinker^[3] could be used to probe the protein-protein interaction between these two proteins by linking them together, disrupting the cell, and looking for the crosslinked proteins. Examples of some common crosslinkers are the imidoester crosslinker dimethyl suberimidate, the N-Hydroxysuccinimide-ester crosslinker BS3 and formaldehyde. Each of these crosslinkers induces nucleophilic attack of the amino group of lysine and subsequent covalent bonding via the crosslinker.

Chemical degradation sequencing A DNA sequencing method that involves the use of chemicals that cut DNA molecules at specific nucleotide positions.

Chemical element A fundamental substance composed of atoms that have the same atomic number and behave the same way chemically.

Chemical energy The energy of a chemical reaction.

Chemical mutagen A substance that induces mutations, or genetic changes, in the DNA of a living organism, e.g. nitrous acid, polycyclic aromatic hydrocarbon (PAH), mustard gas, vinyl chloride.

Chemical potential (ΔG) (also called partial molar free energy) In a system, the free energy that resides in a chemical component per mole of the component present. For example, in a system consisting of a moles of component A and b moles of component B, the total free energy G would be the sum of the free energy in the two components: $G = a\Delta G_A + b\Delta G_B$.

Chemical reaction The process of making or breaking bonds between atoms. It can be spontaneous or with addition of energy.

Chemical shift The change in the rotation of a chemical nucleus, used as the basis of NMR.

Chemically defined medium A culture medium in which the exact chemical composition is known.

Chemiluminescence The phenomenon of emission of light from a chemical reaction.

Chemiosmosis A mechanism that uses a proton gradient across a cytoplasmic membrane to generate ATP.

Chemiosmotic coupling The coupling of an enzyme-catalyzed chemical reaction to the transport of a substance across a membrane either with or against its concentration gradient. The outstanding example is the coupling of ATP synthesis to the movement of protons across the membrane in response to a proton gradient as in mitochondria.

Chemiosmotic Phosphorylation Occurring in mitochondria and chloroplasts, this process involves the synthesis of ATP from ADP and phosphate unit.

Chemoautotroph Organism that obtains energy from the oxidation of chemical, generally inorganic, compounds and carbon from carbon dioxide.

Chemoheterotroph An organism that uses organic molecules as a source of carbon and energy.

Chemolithotroph- Organism that obtains energy from the oxidation of inorganic compounds and uses inorganic compounds as electron donors.

Chemoorganotroph- Organism that obtains energy and electrons (reducing power) from the oxidation of organic compounds.

Chemostat An apparatus to keep a culture in log phase indefinitely usually controlled by the concentration of limiting nutrient and dilution rate.

Chemosynthetic Origin of Life Theory according to which life began via a series of chemical reactions on primitive Earth.

Chemotaxis Oriented movement of a motile organism with reference to a chemical agent. May be positive (toward) or negative (away) with respect to the chemical gradient.

Chemotherapy Treatment of a disease with chemical substances.

Chemotroph An organism that uses oxidation-reduction reactions as its primary energy source.

Chi form An intermediate structure seen during recombination between DNA molecules.

Chi site A repeated nucleotide sequence in the *Escherichia coli* genome that is involved in the initiation of homologous recombination.

Chiasmata (singular chiasma) X-shaped structure formed by the attachment of two chromatids of homologous chromosomes to each other during crossing over between the chromatids of homologous chromosomes during meiosis; the physical manifestation of genetic recombination. It is the point of chromosomal interchange that becomes visible when the homologues begin to separate at diplotema.

Chimera An organism composed of two or more genetically different cell types. Structure formed from two different parts. Chimeric proteins are generated by joining together all or part of the protein coding sections of two distinct genes. Chimeric organisms are formed by mixing two or more distinct clones of cells.

Chimeric DNA. Recombinant DNA whose components originate from two or more different sources.

Chimeric monoclonal antibodies Genetically engineered antibodies, e.g. a mouse/human chimeric monoclonal antibody (mAb) composed of the variable regions of murine 17-1A mAb and the constant regions of human IgG-1K immunoglobulin made of human constant regions and mouse variable regions.

Chimeric protein Proteins generated by joining together all or part of the protein coding sections of two distinct genes, for example, GFP and a protein of interest.

Chiral With respect to a molecule or other object, the property of being nonsuperimposable on its mirror image. An atom that makes a molecule chiral such as a carbon with four different substituents, is called a chiral atom or center of chirality.

Chiral compound. A compound that can exist in two forms that are non-superimposable images of one another.

Chi-square(χ^2) distribution The square of standard normal variate in a chi square variate with one degree of freedom. The sum of the squares of independent standard normal variate follows a Chi-square distribution.

Chi-square(χ^2) test A statistical test in which the statistics used has a χ^2 distribution. For e.g. (i) Test of goodness of fit (ii) Test of independence.

Chitin A tough, resistant, nitrogen-containing polysaccharide forming the walls of certain fungi, the exoskeleton of arthropods, and the epidermal cuticle of other surface structures of certain protists and animals.

Chlamydiae Members of the genus Chlamydia: gram-negative, coccoid cells that reproduce only within the cytoplasmic vesicles of host cells using a life cycle that alternates between elementary bodies and reticulate bodies.

Chlamydospore Thick-walled resting structure that forms from the cell wall of a fungal hypha; usually formed under conditions where the hypha is no longer able to function optimally.

Chlorambucil Also known as Leucaran. An alkylating agent used in the treatment of tumors.

Chloramines Compounds formed by the reaction of hypochlorous acid (or aqueous chlorine) with ammonia. Chloramines are disinfectants used to treat drinking water.

Chloramphenicol A broad-spectrum antibiotic that is produced by *Streptomyces venezuelae* or synthetically; it binds to the large ribosomal subunit and inhibits the peptidyl transferase reaction. Thus it blocks the progression of the growing peptide.

Chlorenchyma Parenchyma tissues with chlorophyll content.

Chlorophyll Green pigment found in plants, cyanobacteria and algae, which is involved in capturing light energy required for photosynthesis. It is structurally similar to and produced through the same metabolic pathway as other porphyrin pigments such as heme. At the center of the chlorin ring is a magnesium ion.

Chlorophyll a The light-absorbing pigment in cyanobacteria, algae, and plants.

Chloroplast genome The genome present in the chloroplasts of a photosynthetic eukaryotic cell.

Chloroplast. A chlorophyll-containing photosynthetic organelle, found in eukaryotic cells, that can harness light energy.

Chlorosis Process of yellowing of leaves, occurring due to lack of chlorophyll.

Chlorosome (Chlorobium vesicle) Plasma membrane folds in green sulfur bacteria containing bacteriochlorophylls.

Chondroma A benign tumor arising in cartilage (a tissue that lines joints and is present at the growing end of bones).

Chondrosarcoma A malignant tumor arising in cartilage (a tissue that lines joints and is present at the growing end of bones).

Choriocarcinoma A malignant tumor arising in the epithelium of the placenta.

Chromatid Complete DNA double helix plus accessory proteins subsequent to DNA replication in eukaryotes. At mitosis, the chromosome is seen to be composed of two chromatids; these then separate to form the chromosomes of the two progeny cells.

Chromatin The filamentous material of eukaryotic chromosomes, consisting of DNA with associated histones and other proteins. During interphase it is dispersed and fills most of the nucleus; during nuclear division it condenses into compact chromosomes..

Chromatography A technique used to separate different species of molecules (or ions) by subjecting them to two different carrier phases: mobile and stationary phases. Segregation is usually carried out on paper or in glass or metal columns with the help of different solvents. The paper or glass columns contain porous solids with functional groups that have limited affinities for the molecules being separated.

Chromatophore (1) An infolding in the plasma membrane where bacteriochlorophyll is located in photoautotrophic bacteria. (2) It is pigment cell in the skin of fish and amphibian.

Chromatosome A subcomponent of chromatin made up of a nucleosome core octamer with associated DNA and a linker histone.

Chromogen A colorless substrate that is acted on by an enzyme to produce a colored end product.

Chromogenic Producing color; a chromogenic colony is a pigmented colony.

Chromomere Granule found along the axis of a decondensed chromosome, in which the DNA is tightly folded.

Chromophore A chemical group that absorbs light at characteristic wavelengths.

Chromophore group A chemical group with double bonds that absorbs visible light and gives a dye its color.

Chromoplast Plastids containing pigments other than chlorophyll, usually imparting red or yellow color.

Chromosome banding Cytogenetics employs several techniques to visualize different aspects of chromosomes: G-banding is obtained with Giemsa stain following digestion of chromosomes with trypsin. It yields a series of lightly and darkly stained bands - the dark regions tend to be heterochromatic, late-replicating and AT rich. The light regions tend to be euchromatic, early-replicating and GC rich. This method will normally produce 300-400 bands in a normal, human genome. R-banding is the reverse of G-banding (the R stands for "reverse"). The dark regions are euchromatic (guanine-cytosine rich regions) and the bright regions are heterochromatic (thymine-adenine rich regions). C-banding: Giemsa binds to constitutive heterochromatin, so it stains centromeres. Q-banding is a fluorescent pattern obtained using quinacrine for staining. The pattern of bands is very similar to that seen in G-banding. T-banding: visualize telomeres. Silver staining: Silver nitrate stains the nucleolar organization region-associated protein. This yields a dark region where the silver is deposited, denoting the activity of rRNA genes within the NOR.

Chromosome Condensation Also called pachytene, this process is a part of prophase I, wherein the chromosomes become shorter and thicker

Chromosome Genetic element carrying information essential to cellular metabolism. Prokaryotes have a single chromosome, consisting of a circular DNA molecule. Eukaryotes contain more than one chromosome, each containing a linear DNA molecule complexed with specific proteins. It is thread like bodies made up of DNA coiled tightly several times around proteins called histones. Its structure consists of chromatids joined together at the centromere. All human chromosomes have 2 arms -- a short arm and a long arm -- that are separated from each other only by the centromere, the point at which the chromosome is attached to the spindle during cell division. By international convention, the short arm is termed the "p arm" while the long arm of the chromosome is termed the "q arm."

Chromosome manipulation techniques Techniques used for promoting gene transfers from chromosomes of a related species into those of a cultivated species.

Chromosome number Diploid number of a eukaryote.

Chromosome painting A version of fluorescent *in situ* hybridization in which the hybridization probe is a mixture of DNA molecules, each specific for different regions of a single chromosome.

Chromosome puff. A swollen region of a giant chromosome; the swelling reflects a high degree of transcription activity.

Chromosome scaffold A component of the nuclear matrix which changes its structure during cell division, resulting in condensation of the chromosomes into their metaphase forms.

Chromosome stain

Chromosome territory The region of a nucleus occupied by a single chromosome.

Chromosome theory The theory, first propounded by Sutton in 1903, that genes lie on chromosomes.

Chromosome walking A technique with which an unknown region of a chromosome can be explored. It is generally used to isolate a locus of interest for which no probe is available but that is known to be linked to a gene which has been identified and cloned. A fragment containing a known gene is selected and used as a probe to identify other overlapping fragments which contain the same gene. The nucleotide sequences of these fragments can then be characterized. This process continues for the length of the chromosome.

Chronic carrier An individual who harbors a pathogen for a long time.

Chronic disease An illness that develops slowly and is likely to persist or recur for long periods.

Chrysolaminarin Chrysolaminarin is a storage polysaccharide typically found in photosynthetic heterokonts. It is used as a carbohydrate food reserve by phytoplankton such as Bacillariophyta.

Chylomicron A type of lipoprotein that is produced in the intestinal villi and serves to transport dietary lipids in the circulation.

Chytrid Fungal organism in the phylum Chytridiomycota that consists of a spherical cell from which short thin filamentous branches (rhizoids) grow that resemble fine roots.

Cilia Threadlike appendages extending from the surface of some protozoa that beat rhythmically to propel them; cilia are membrane-bound cylinders with a complex internal array of microtubules, usually in a 9 × 2 pattern.

Ciliate A member of the protozoan phylum Ciliata that uses cilia for locomotion like paramecium.

CIP1 Gene encoding a cyclin-dependent kinase inhibitor protein that prevents cells entering the S phase of the cell cycle. p21CIP1 is upregulated by cell–cell contact.

Circadian Rhythm A rhythmic daily activity cycle exhibited by many organisms in an intervals of 24 hours. It is a kind of biological clock.

Circular dichroism spectrum (CD spectrum) An absorption spectrum obtained using circularly polarized light; it gives the circular dichroism of the substance over a range of wavelengths.

Circular dichroism The property of absorbing right circularly polarized light and left circularly polarized light to different extents. Stereoisomers exhibit circular dichroism. Also, some types of secondary structure, such as α helices and β sheets in proteins, exhibit a predictable circular dichroism at specific wavelengths.

Cis Side to which material is added. Of the Golgi complex, the surface that receives vesicles from the endoplasmic reticulum.

Cis dominance. Property of a sequence or a gene that exerts a dominant effect on a gene to which it is linked.

Cis or forming face That side of the Golgi(dictyosomes)closes to the nuclear envelope and ER.

Cis-displacement Movement of a nucleosome to a new position on a DNA molecule.

Cis-dominant Refers to a mutation in a genetic regulatory element that affects the expression of appropriate genes only on the same chromosome, not on another homologous chromosome present in the same cell. Cis-dominance demonstrates that a regulatory element does not code for a diffusible factor.

Cisterna One of the flattened, membrane-enclosed sacs found in parallel stacks in, for example, the nuclear envelope, the ER and the Golgi complex.

Cistron The smallest unit of DNA that must be intact to code for the amino acid sequence of a polypeptide; thus, the coding part of a gene, minus 5' and 3' untranslated sequences and regulatory elements.

Citric acid cycle (also called tricarboxylic acid cycle and Krebs cycle) A cycle of reactions that takes place in the mitochondrial matrix and results in the oxidation of acetyl units to CO₂ with the production of reducing equivalents and ATP. It is a central pathway in oxidative respiration. Other substrates besides acetyl-CoA can enter the cycle at intermediate points.

Citrovorum factor A folic acid derivative that is identical to or substitutes for the product of the enzyme folic acid reductase, if that enzyme has been inhibited by an antimetabolite such as methotrexate, administration of citrovorum factor enables the cell to bypass the inhibited enzyme. For some reason, citrovorum factor works more effectively in healthy cells than in malignant ones, so its use means that higher doses of methotrexate can be administered to treat tumors.

CKI (cyclin-dependent kinase inhibitor) Type of cell cycle regulatory protein. Binds to and inactivates CDKs.

Clade A group of monophyletic organisms or DNA sequences that include all of those in the analysis that are descended from a particular common ancestor.

Cladistic Species Concept A philosophy and set of methods that use cladistic criteria to determine the limits of species

Cladistics A branch of biology that determines evolutionary branching orders or trees of descent based on derived similarities. Or in other words it is the study of evolutionary history of a group of organisms, especially as shown in a family tree.

Cladogram A branching phylogenetic tree of individuals or taxa, rooted on an outgroup(s) produced by a method that minimizes evolutionary changes (by parsimony, maximum likelihood, or other methods) of characters believed to be homologous among a group of organisms.

Cladophyll Also called phylloclade, this is a flattened stem that looks like a leaf as in the asparagus. Also called *cladode*.

Clamp connection Small branch of a fungal hypha that connects two compartments separated by a septum and helps to maintain a dikaryon in each hyphal compartment; characteristic of fungi in the phylum Basidiomycota.

Clapping Slapping of the upper and lower parts of bills together, as a non vocal form of communication, seen especially in birds like storks.

Clarification - A process in which suspended material is removed from a wastewater. This may be accomplished by sedimentation, with or without chemicals, or filtration.

Class A taxonomic ranking between phylum and order.

Class switching A process that results in a complete change in the type of immunoglobulin synthesized by B lymphocyte.

Classification (i) Arrangement of organisms into groups based on mutual similarity or evolutionary relatedness. (ii) Systematic arrangement of soils into groups or categories on the basis of their characteristics.

Clathrate structure The cage like structure of organized water molecules that forms around a hydrophobic molecule in solution. The structure has lower entropy than liquid water, which helps explain why hydrophobic substances dissolve poorly in water.

Clathrin Protein that functions to cause vesicle budding in response to binding of specific ligand.

Clathrin adaptor protein Protein that binds to specific transmembrane receptors and which in turn recruits clathrin to form a coated vesicle. The vesicle therefore contains the molecule for which the receptor is specific.

Clay Soil particle < 0.002 mm in diameter.

Clean gene technology The process of developing transgenic plants without the presence of selectable marker genes or by use of more acceptable genes.

Cleavage Rapid cycles of DNA synthesis followed by cell division in which the cytoplasm is partitioned without growth, occurring very early in embryonic development leads to next stage.

Cleavage and polyadenylation specificity factor (CPSF) A protein that plays an ancillary role during polyadenylation of eukaryotic mRNAs.

Cleavage furrow In animal cells, the structure that constricts the middle of the cell during cytokinesis.

Cleavage stimulation factor (Cst F) A protein that play an ancillary role during polyadenylation of eukaryotic mRNAs.

Cleaved Amplified Polymorphic Sequence (CAPS) A molecular marker technique that is based on the amplification of DNA fragments by PCR followed by DNA restriction of the fragments.

Cleistogamy Flowers do not open at all, i.e., there is no anthesis especially in peanuts, peas, and beans, this behaviour is most widespread in the grass family, though the largest genus of cleistogamous plants is actually *Viola*.

Cleistothecium A cleistothecium is a globose, completely closed fruit body with no special opening to the outside of fungi in the phylum Ascomycota.. The fruit wall which is called peridium may simply consist of loosely interwoven hyphae or pseudoparenchyma. It may be covered with hyphal outgrowth called appendages. The asci inside the ascocarps are found usually scattered i.e. as in *Eurotium* or arising in tufts from the basal region of ascocarps as in *Erysiphe*. The asci are globose, pear shaped and released by irregular disintegration of the wall of cleistothecium. Example – *Gymnoascus Eurotium*.

Climax Most advanced successional community of plants capable of development under, and in dynamic equilibrium with, the prevailing environment.

Climograph Annual cycle of temperature and rainfall for a particular geographical area depicted in a graphical format.

Clinical trial The systematic investigation of materials or methods, according to a formal study plan, as a means of determining effect or relative effectiveness in a human population with a particular disease or class of diseases. In clinical trials of therapeutic methods, the choice of therapeutic protocol is typically random so that neither the patient nor the clinician knows if the patient is receiving the protocol to be tested, an accepted protocol that serves as a control or a placebo protocol that is, in effect, no treatment at all.

Cloacal Spur A claw in boas and pythons, which is an extremity of the pelvic girdle. It is used by the male snake, while courting.

Clonal deletion Elimination of Band T cells that react with self.

Clonal propagation In vitro propagation of plants that are considered to be genetically uniform and originated from a single individual or explant.

Clonal selection theory A model (proved correct) describing how the body is able to produce specific immune responses against a vast array of antigens. The B and T cells produced by the body have randomly generated antigen specificities. When a particular antigen enters the body, it induces proliferation only m B and T cells that happen to be specific for It. Thus, the antigen selects the cells that will mount an immune response against it and stimulates them to undergo clonal proliferation.

Clone (i) Population of cells all descended from a single cell. (ii) Number of copies of a DNA fragment to be replicated by a phage or plasmid.

Clone contig A collection of clones whose DNA fragments overlap.

Clone contig approach A genome sequencing strategy in which the molecules to be sequenced are broken into manageable segments, each a few hundred kb or few Mb in length, which are Sequenced individually.

Clone fingerprinting Any one the several techniques that compare cloned DNA fragments in order to identify the overlapping ones.

Clone library A collection of clones, possibly representing an entire genome, from which individual clones of interest are obtained.

Cloning Strictly, the creation of a number of genetically identical organisms. In molecular genetics, the term is used to mean the multiplication of particular sequences of DNA by an asexual process such as bacterial cell division.

Cloning vector DNA molecule that carries genes of interest, can be inserted into cells, and which will then be replicated inside the cells. Cloning vectors range in size from plasmids to entire artificial chromosomes.

Cloning Vector Molecule of DNA that replicates and transfers DNA from one cell to another.

Cloning, DNA or genes Propagation of recombinant DNA in a suitable host to obtain multiple copies or the protein encoded by the cloned DNA segment.

Closed Carpel Is another phrase used for Angiosperms that are plants with seeds inside the ovary.

Closed promoter complex The structure formed during the initial step in assembly of the transcription initiation complex. The closed promoter complex consists of the RNA polymerase and/or accessory proteins attached to the promoter, before the DNA has been opened up by breakage of base pairs.

Cloverleaf A two-dimensional representation of the structure of a tRNA molecule.

Clue cells Sloughed-off vaginal cells covered with *Gardnerella vaginalis*.

Cluster sampling A method of sampling in which the population consists of items bound together in a certain manner. A sample of these clusters taken at random is called cluster sampling.

Clutch Eggs or young of a species produced in single breeding attempt by a female.

Cnidaria A name given to the invertebrate phylum Coelenterata, the emphasis is given to the stinging characteristic of the phylum, which makes up its basic structure comprising nettles, which are generally toxic in nature as in jelly fish.

Coactivator A molecule that functions together with a protein apoactivator. For example, cAMP is a coactivator of the CAP protein.

Coagulants Chemicals which cause very fine particles to clump (floc) together into larger particles. This makes it easier to separate the solids from the water by settling, skimming, draining, or filtering.

Coagulase An enzyme that induces blood clotting; it is characteristically produced by pathogenic staphylococci.

Coatamer Protein complex that encapsulates one class of coated vesicle. Formation of the coatamer coat on a previously flat membrane forces the membrane into a curved shape and therefore drives vesicle formation.

Coated pit A cell membrane pit that is lined on its cytosolic side by a meshwork of the protein clathrin. Coated pits participate in the mechanism of receptor-mediated endocytosis, in which surface receptors that have bound specific extracellular substances are gathered into coated pits, which pinch off to become cytoplasmic vesicle.

Coated vesicle cytoplasmic vesicle encapsulated by a protein coat. There are two types of coated vesicles, coated by coatamer and clathrin, respectively.

Cobalt-60 A radioactive isotope of the element cobalt that is used as a source of gamma rays in the radiotherapy of tumors.

Coccobacillus A bacterium that is an oval rod.

Coccus A spherical or ovoid bacterium.

COD (Chemical oxygen demand) The amount of oxygen in mg/l required to oxidize both organic and oxidizable inorganic compounds.

Coding RNA A RNA molecule that codes for a protein. i.e. a mRNA.

Codominance That relationship between a pair of alleles which both contribute to the phenotype of a heterozygote.

Codominant marker A genetic marker for which all alleles are expressed when co-occurring in an individual.

Codon A sequence of three nucleotides in mRNA that directs the incorporation of an amino acid during protein synthesis or signals the start or stop of translation.

Codon bias It refers to the fact that not all codons are used equally frequently in the genes of particular organism.

Codon-anticodon recognition The interaction between a codon on an mRNA molecule and the corresponding anticodon on a tRNA.

Coefficient of correlation The coefficient of correlation is a measure of correlation, which exists between two sets of variables. It is a numerical measure and is expressed in numerical figure.

Coefficient of variation The ratio of standard deviation to the absolute value of the arithmetic mean. The ratio may be expressed as percentage.

Coelenterates An invertebrate belonging to Coelenterata phylum characterized by a single internal cavity used for digestion, excretion and for other survival activities and which has tentacles on the oral end. Hydras, jellyfish, corals and sea anemones belong to this group.

Coenocytic Large cells containing myriad nuclei. It is formed when the cell nucleus divides multiple times without the actual division of the cell as in slime molds and certain fungi and algae.

Coenocytic hyphae Fungal filaments that are not divided into uninucleate cell like units because they lack septa as in slime molds and certain fungi and algae.

Coenzyme A (CoA) A coenzyme that functions in decarboxylation.

Coenzyme An organic small molecule that binds to an enzyme and is essential for its activity but is not permanently altered by the reaction. Most coenzymes are derived metabolically from vitamins. Well-known coenzymes include the pyridine nucleotides, nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP); thiamine pyrophosphate (TPP); flavin mononucleotide (FMN) and flavinadenine dinucleotide (FAD); iron protoporphyrin (hemin); uridine diphosphate (UDP) and UDP-glucose; and adenosine triphosphate (ATP), adenosine diphosphate (ADP), and adenosine monophosphate (AMP).

Cofactor A small molecule required for enzyme activity. It could be organic in nature, like a coenzyme, or inorganic in nature, like a metallic cation. Cofactors are associated tightly with the protein but can be removed. Examples are pyridoxal phosphate in aminotransferases and zinc in zinc finger proteins.

Cofermentation Fermentation carried out by simultaneously growing two microorganisms in a bioreactor.

Cohesin The protein that holds sister chromatids together during the period between genome replication and nuclear division.

Cohesion- Force holding a solid or liquid together, owing to attraction between like molecules.

Cohesion-Tension Theory This theory explains that the upward pull of water takes place by the combination of water molecules cohesion in the vessels and tracheids and tension on the water column caused by transpiration.

Cohesive end An end of a double-stranded DNA molecule where there is a single-stranded extension.

Cohort method Comparison of two populations: control and experimental.

Coimmunoprecipitation Immunoprecipitation of intact protein complexes (i.e. antigen along with any proteins or ligands that are bound to it) is known as co-immunoprecipitation (Co-IP). Co-IP works by selecting an antibody that targets a known protein that is believed to be a member of a larger complex of proteins. By targeting this *known* member with an antibody it may become possible to pull the entire protein complex out of solution and thereby identify *unknown* members of the complex. Co-IP is a powerful technique that is used regularly by molecular biologists to analyze protein-protein interactions.

Cointegrate A cointegrate is the intermediate molecule which donor DNA and target DNA covalently bind during the formation of a Holliday junction.

Cointegrate vector The modified Ti plasmid in combination with an intermediate cloning vector.

Colchicine It is plant alkaloid from the autumn crocus, *Colchicum autumnale*. Drug that prevents microtubule polymerization and facilitates depolymerization of existing microtubules by binding to tubulin subunits; its derivative Colcemid has similar effects. It blocks mitosis by arresting spindle formation.

Coleoptile The first leaf above ground level forming a sheath around the tip of the stem, so as to protect the emerging shoot (plumule) of monocotyledons like grasses and oats.

Coleorhiza Sheath formed around the emerging radicle in plants of the monocotyledons like the grass family.

Colicin A plasmid-encoded protein that is produced by enteric bacteria and binds to specific receptors on the cell envelope of sensitive target bacteria, where it may cause lysis or attack specific intracellular sites such as ribosomes.

Coliform- Gram-negative, nonspore-forming facultative rod that ferments lactose with gas formation with 48 hours at 35°C. Often an indicator organism for fecal contamination of water supplies. *Escherichia coli* and *Enterobacter* are important members.

Collagen It is a group of naturally occurring proteins found in animals, especially in the flesh and connective tissues of mammals.^[1] It is the main component of connective tissue, and is the most abundant protein in mammals,^[2] making up about 25% to 35% of the whole-body protein content. Collagen, in the form of elongated fibrils, is mostly found in fibrous tissues such as tendon, ligament and skin, and is also abundant in cornea, cartilage, bone, blood vessels, the gut, and intervertebral disc. The fibroblast is the most common cell which creates collagen.

Collenchyma Cells containing primary walls thickened at the cells corners, but thin elsewhere.

Collision theory It states that chemical reactions occur because energy is gained as particles collide.

Colloid fraction Organic and inorganic matter with very small particle size and a correspondingly large surface area per unit of mass.

Colloids Very small, finely divided solids (particles that do not dissolve) that remain dispersed in a liquid for a long time due to their small size and electrical charge.

- Colonization** Establishment of a community of microorganisms at a specific site or ecosystem.
- Colony** A clone of bacterial cells on a solid medium that is visible to the naked eye.
- Colony forming units (CFU)** The number of microorganisms that can form colonies when cultured using spread plates or pour plates, an indication of the number of viable microorganisms in a sample.
- Colony hybridization** A technique that is used to screen bacteria for presence of a specific recombinant DNA sequence. Colonies of bacteria are transferred to a filter, treated to lyse cells and denature the DNA, and then exposed to a labeled DNA probe that is complementary to part of the sequence in question. Colonies that bind the probe possess the sequence.
- Colony-stimulating factor (CSF)** An unidentified glycoprotein isolated from blood, that will apparently induce cultured lymphocytes from patients with acute myelocytic leukemia to mature. The relation of this factor to the disease process in vivo is still undetermined.
- Colostomy** The surgical creation of a new opening of the colon on the surface of the body.
- Colourless sulfur bacteria** A diverse group of nonphotosynthetic proteobacteria that can oxidize reduced sulfur compounds such as hydrogen sulfide. Many are lithotrophs and derive energy from sulfur oxidation. Some are unicellular, whereas others are filamentous gliding bacteria.
- Colt** Male horse less than four years of age.
- Columnar** Taller than it is broad. Used as a description of some types of epithelial cells.
- Combination breeding** It involves the transfer of one or few characters, usually governed by oligogenes, from one variety into another.
- Combination chemotherapy** The simultaneous use of several antitumor agents to treat a malignancy. Approach is based on the principle that, with judicious selection of drugs, the antitumor effects will be at least additive while the toxic effects will not.
- Combinatorial biology** Introduction of genes from one microorganism into another microorganism to synthesize a new product or a modified product, especially in relation to antibiotic synthesis.
- Combined available chlorine** The concentration of chlorine which is combined with ammonia (NH₃) as chloramine or as other chloro derivatives, yet is still available to oxidize organic matter.
- Cometabolism** It is defined as the simultaneous degradation of two compounds, in which the degradation of the second compound (the secondary substrate) depends on the presence of the first compound (the primary substrate). For example, in the process of metabolizing methane, propane or simple sugars, some bacteria, such as *Pseudomonas stutzeri* OX1, can degrade hazardous chlorinated solvents, such as tetrachloroethylene and trichloroethylene, that they would otherwise be unable to attack. They do this by producing the methane monooxygenase, enzyme which is known to degrade some pollutants, such as chlorinated solvents, via co-metabolism. Co-metabolism is thus used as an approach to biological degradation of hazardous solvents.
- Commensalism** A system of interaction in which two organisms live in association and one is benefited while the other is neither benefited nor harmed. An example of commensalism: cattle egrets foraging in fields among cattle or other livestock. As cattle, horses and other livestock graze on the field, they cause movements that stir up various insects. As the insects are stirred up, the cattle

egrets following the livestock catch and feed upon them. The egrets benefit from this relationship because the livestock have helped them find their meals, while the livestock are typically unaffected by it.

Commercial sterilization A process of treating canned goods aimed at destroying the endospores of *Clostridium botulinum*.

Comminution(Shredding) A mechanical treatment process which cuts large pieces of waste into smaller pieces so that they won't plug pipes or damage equipment.

Commitment complex The initial structure formed during splicing of a GU-AG intron.

Common vehicle transmission The transmission of a pathogen to a host by means of an inanimate medium or vehicle.

Common-source epidemic An epidemic that is characterized by a sharp rise to a peak and then a rapid, but not as pronounced, decline in the number of individuals infected; it usually involves a single contaminated source from which individuals are infected.

Communicable disease Any disease that can be spread from one host to another.

Community : Any grouping of populations of different organisms that live together in a particular environment .A biocenose, or community, is a group of populations of plants, animals, micro-organisms. Each population is the result of procreations between individuals of same species and cohabitation in a given place and for a given time. When a population consists of an insufficient number of individuals, that population is threatened with extinction; the extinction of a species can approach when all biocenoses composed of individuals of the species are in decline. In small populations, consanguinity (inbreeding) can result in reduced genetic diversity.

Community ecology Interactions of populations of different organisms (different species) within a particular area

Companion Cells Specialized parenchymal cells situated beside sieve tubes in the phloem of angiosperms that regulate flow of nutrients through the sieve tube.

Comparative genomics A research strategy that uses information obtained from the study of one genome to make inferences about the map positions and functions of genes in a second genome.

Competence The physiological state in which a recipient cell can take up and incorporate a large piece of donor DNA.

Competent Refers to a culture of bacteria that have been treated, for example, by soaking in calcium chloride, so that their ability to take up DNA molecule is enhanced.

Competition Rivalry between two or more species for a limiting factor in the environment that usually results in reduced growth of participating organisms..

Competitive ability The ability of a genotype to survive in a mixture of several genotypes.

Competitive exclusion principle Two competing organisms overlap in resource use, which leads to the exclusion of one of the organisms.

Competitive inhibitor A substance that inhibits an enzyme-catalyzed reaction by competing with the substrate for the active site; the inhibitor can reversibly occupy the active site but does not undergo the reaction.

Complement (C) A group of 11 serum proteins that interact sequentially with certain antigen-antibody complexes. If the antigen is part of a cell this interaction may lead to destruction of the cell.

Complement activation The sequential activation of serum components c1 through c9, initiated by an erythrocyte-antibody complex or by microbial polysaccharides and properdin, and producing an inflammatory response.

Complement fixation The process in which complement combines with an antigen-antibody complex.

Complement system A group of serum proteins that help in the formation of membrane attack complex to destroy invading pathogens.

Complementarity The property of base pairing in nucleic acid synthesis, in which the nucleotide sequence in the original strand is preserved in the newly formed complementary strand; a second round of copying restores the sequence of the original strand.

Complementary base sequence. For a given sequence of nucleic acids, the nucleic acids that are related to them by the rules of base pairing.

Complex (as a noun) Association of molecules that is held together by noncovalent interactions.

complex I, complex II, complex III, complex IV Large multimolecular complexes that make up the electron transport chain in the inner mitochondrial membrane.

Complex lipids Lipids containing phosphorus, nitrogen, and/or sulfur.

Complex medium Medium whose precise chemical composition is unknown. Also called undefined medium.

complex viruses Viruses with capsids having a complex symmetry that is neither icosahedral nor helical.

Composite transposon A DNA transposon comprising a pair of insertion sequence flanking a segment of DNA usually containing one or more genes.

Compost Organic residues which have been mixed, piled, and moistened, with or without addition of fertilizer and lime, and generally allowed to undergo thermophilic decomposition until the original organic materials are substantially altered or decomposed.

Compound A substance' composed of two or more different chemical elements.

Compound Leaf: Leaf blade divided into distinct leaflets attached via a common petiole.

Compromised host A host whose resistance to infection is impaired.

Concatemer A DNA molecule that consists of a tandem series of complete genomes. Some phage genomes form concatemers during replication as part of a strategy for replicating the full length of a linear DNA duplex.

- Concatenated dataset** A combined dataset that connects together many individual datasets into one, like links in a chain, so that analyses can be done as a single unit.
- Concerted evolution** A process whereby repetitive DNA families maintain one type of sequence within the repeat (become homogenized), through genetic mechanisms of unequal crossing over and gene conversion.
- Condensation reaction** A chemical reaction in which a molecule of water is released.
- Condenser** A lens system located below the microscope stage that directs light through the specimen.
- Conditional mutations** Mutations that are expressed only under certain environmental conditions.
- Conditional-lethal mutation** A mutation that results in a cell or organism able to survive only under permissive conditions.
- Conditioning** A learning method either using a stimulus - response, or a reward - punishment method, in which associations are made.
- Cone** These are photoreceptor cells in the retina of the eye that are responsible for color vision; they function best in relatively bright light, as opposed to rod cells that work better in dim light. Cone cells are densely packed in the fovea, but quickly reduce in number towards the periphery of the retina.
- Configuration** The spatial arrangement in which atoms are covalently linked in a molecule.
- Confocal microscopy** A light-microscopy technique that allows high resolution in thick samples.
- Conformation.** The three-dimensional arrangement adopted by a molecule, usually a complex macromolecule. Molecules with the same configuration can have more than one conformation.
- Congenital disease** A disease present at birth as a result of genetic or some condition that occurred in uterus.
- Congenital immune deficiency** The inability, due to an individual's genotype, to produce specific antibodies or T cells.
- Congruence** Taxonomic congruence focuses on deriving a consensus from the results obtained from separately analyzed data sets, whereas total evidence uses character congruence in the search for the best-fitting hypothesis for all of the available character evidence. Explicit or implicit use of taxonomic congruence is usually employed when an investigator either has both molecular and morphological data sets or has different gene-, rRNA-, or protein-sequence data sets available. Indeed, a taxonomic congruence rationale is frequently used as the basis for exploring classes of data, thus allowing comparison between the phylogenetic signal emerging from a particular data set and those of other such classes. Agreement in results of as taxonomic analysis; refers to both phenetic and cladistic results.
- Conidiophore** An aerial hyphae bearing conidiopores. An asexual, thin-walled spore borne on hyphae and not contained within a sporangium; it may be produced singly or in chains.
- Conidium (plural, conidia)** Nonmotile, asexual spore resulting from mitotic nuclear division and formed from the ends or sides of a hypha; produced in abundant numbers by the asexual phase of soil fungi in the phyla Ascomycota and Basidiomycota.

Conifer Woody trees or shrubs that are gymnosperms and bear cones. Typical examples of conifers include cedars, Douglas-firs, cypresses, firs, junipers, kauri, larches, pines, hemlocks, redwoods, spruces, and yews.

Conjugants Complementary mating types that participate in a form of protozoan sexual reproduction called conjugation.

Conjugated protein Molecule consisting of amino acids and other organic or inorganic compounds.

Conjugated vaccine A vaccine consisting of the desired antibodies and other proteins.

Conjugation Process of genetic exchange occurring in bacteria and some green algae, wherein the DNA is passed through a tube connecting adjacent cells

Conjugation mapping A technique for mapping bacterial genes by determining the time it takes for each gene to be transferred during conjugation

Conjugative plasmid Self-transmissible plasmid; a plasmid that encodes all the functions needed for its own intercellular transmission by conjugation

Connective tissue Tissue that contains relatively few cells within a large volume of extracellular matrix. Connective tissue makes up a variety of physical structures including tendons and the connective framework of fibers in muscles, capsules and ligaments around joints, cartilage, bone, adipose tissue, blood and lymphatic tissue.

Connexon (gap junction channel) Channel in the plasma membrane with a central hole about 1.5 nm in diameter. Gap junction channels only open when they contact a second channel on another cell, in this case they open and form a water-filled tube that runs all the way through the plasma membrane of the first cell, across the small gap between the cells, and through the plasma membrane of the second cell, so allowing passage of solute from the cytosol of one cell to the cytosol of the other.

Consensus sequence For a group of nucleotide or amino acid sequences that show similarity but are not identical (for example the sequences for a family of related regulatory gene sequences), an artificial, sequence that is compiled by choosing at each position the residue that is found there most often in the sequences under study.

Conservation When the substitution of one amino for another preserves the physico-chemistry properties of the original residue. For example, when a hydrophobic amino acid residue is replaced by another hydrophobic residue

Conservative replication A hypothetical mode of DNA replication in which one daughter double helix is made up of the two parental polynucleotides and the other is made up of two newly synthesized polynucleotides.

Conservative transposition Transposition that does not result in copying of the transposable element. Some transposons, such as Tn10, excise from the chromosome and integrate into the target DNA. In these cases, DNA replication of the element does not occur, and the element is lost from the site of the original chromosome.

Conserved Orthologous Set Markers (COS) Conservative molecular markers that are used as anchors for map development in comparative genomics studies.

- Consortium** Two or more members of a natural assemblage in which each organism benefits from the other. The group may collectively carry out some process that no single member can accomplish on its own.
- Constitutive enzyme** An enzyme produced regardless of how much substrate is present or regardless of growth conditions.
- Constitutive control** Control over bacterial gene expression that depends on the sequence of the promoter
- Constitutive heterochromatin** Chromatin that is permanently in a compact organization.
- Constitutive mutation** A mutation that results in continuous expression of a gene or set of genes that is normally subject to regulatory control.
- Constitutive secretion** Secretion that continues all the time, without the need for a signal such as an increase of cytosolic calcium concentration.
- Constitutive** With respect to gene expression, refers to proteins that are synthesized at a fairly steady rate at all times instead of being induced and repressed in response to changing conditions. Housekeeping genes, expressed all the time, are sometimes called constitutive genes. Proteins that are secreted all the time are said to use the constitutive route.
- Constitutively active** Mutant or modified protein that is always in the "on" state. A constitutively active enzyme is active in the absence of its normal regulators. A constitutively active GTPase activates its downstream targets in the absence of GTP exchange factors. Paradoxically, the easiest way to generate a constitutively active GTPase is to eliminate its enzymatic activity, so that it does not hydrolyze GTP and therefore remains in the active GTP-bound state.
- Constriction** This is a method used by non-venomous snakes to tightly grip and suffocate their prey, by coiling around the prey.
- Consumer** An organism, often an animal, which feeds on plants or other animals.
- Contact inhibition** Also known as density-dependent inhibition of growth. The phenomenon in which healthy cells growing in culture stop dividing and become immobilized once they have formed a contiguous monolayer covering the surface of the substrate on which they grow. Loss of contact inhibition is one measure of transformation.
- Contact stabilization** Contact stabilization is a modification of the conventional activated sludge process. In contact stabilization, two aeration tanks are used. One tank is for separate reaeration of the return sludge for at least four hours before it is permitted to flow into the other aeration tank to be mixed with the primary effluent requiring treatment.
- Contact transmission** Spread of disease by direct or indirect contact or via droplets.
- Contagious disease** A disease that is easily spread from one person to another.
- Contaminant** A substance not present in nature but released due to human activities e.g. methylisocyanate.
- Context-dependent codon reassignment** Refers to the situation whereby the DNA sequence surrounding a codon changes the meaning of that codon.

Contig Group of cloned (copied) pieces of DNA representing overlapping regions of a particular chromosome.

Continuous cell line Animal cells that can be maintained through an indefinite number of generations in vitro.

Continuous culture A bioreactor that is fed by a stream of nutrients and produces a continuous stream of effluent to be processed.

Continuous fermentation Fermentation carried out by continuous addition of fresh medium that balances with the removal of cell suspension (from the reactor).

Contour clamped homogenous electric fields (CHEF) Contour-clamped homogeneous electric field (CHEF) electrophoresis is a technique of pulsed-field gel electrophoresis that enables the resolution of large fragments of DNA that cannot be resolved by conventional gel electrophoresis. The procedure involves the application of controlled electric fields that change direction at a predetermined angle to samples of DNA that have been embedded in an agarose gel matrix and digested with a restriction endonuclease. Adjustment of the electrophoresis conditions enables the separation of DNA fragments with lengths from 10 kilobases up to 9 megabases in a size-dependent manner in agarose gels.

Contour Feathers The feathers which form the topmost layer of a bird's feathers, including the wings and tail, which gives the bird its characteristic look.

Convalescent period The period of recovery from a disease.

Conventional plant breeding Any method for producing new plant varieties that does not involve recombinant DNA.

Conventional pseudogene A gene that has become inactive because of the accumulation of mutations.

Convergent cross A cross involving more than two parents.

Convergent evolution It describes the acquisition of the same biological trait in unrelated lineages. The wing is a classic example of convergent evolution in action. Flying insects, birds, and bats have all evolved the capacity of flight independently. They have "converged" on this useful trait.

Convergent evolution Similar structural appearance in organisms, which have different lines of descent

Cooperative binding. A situation in which the binding of one ligand to a macromolecule favors the binding of another. For example, DNA cooperatively binds histone molecules, and hemoglobin cooperatively binds oxygen molecules.

Cooperative transition A transition in a multipart structure such that the occurrence of the transition in one part of the structure makes the transition likelier to happen in other parts.

Coordinate induction. The simultaneous expression of two or more genes.

Copy number The number of copies per cell of a particular gene or other DNA sequence or plasmids per bacterial cell.

Corallum The skeleton of a zoophyte, which can be calcareous or in the formation of horns. For example, the set of parallel vertical grooves which are present on the sides of salamanders and newts.

Core collection A subset of the entire germplasm collection that incorporates a representative sample of variation with a minimum of redundancy. This is an attempt to bring the entire collection to a workable size for economic or space or other constraints, and to facilitate its use, by choosing accessions that represent its most representative or useful diversity.

Core enzyme The version of *Escherichia coli* RNA polymerase, subunit composition $\alpha_2\beta\beta'$, that carries out RNA synthesis but is unable to locate promoters efficiently.

Core octamer The central component of a nucleosome made up of two subunits each of histones ,H2A, H2B, H3 and H4 around which DNA is wound.

Core promoter The position within a eukaryotic promoter where the initiation complex is assembled.

Corepressor A molecule that binds to a repressor, enabling the repressor to bind to the operator site to prevent transcription. Tryptophan is a corepressor at the *trp* operon

Cori cycle The metabolic cycle by which lactate produced by tissues engaging in anaerobic glycolysis, such as exercising muscle, is regenerated to glucose in the liver and returned to the tissues via the bloodstream.

Cork Outer tissue layer of an old woody stem produced by cork cambium, whose cells are saturated with suberin at maturity.

Cork Cambium Lateral meristematic tissue ring found in woody seed plants between the exterior of woody stems or roots and central vascular tissue. It produces cork to its exterior and phellogen to its interior.

Corm A thick food storing, vertically oriented stem enveloped by some papery nonfunctional leaves.

Corolla Collective phrase used for the petals of a flower.

Correlation When the relationship between two is of a quantitative nature, the appropriate statistical tool for discovering and measuring the relationship is known as correlation.

Cortex (1) Outer part of any organ or structure. For instance, the tissue outside the vascular issue of plants, and the tissue that forms the outer region of the brain, are called cortex.(2) Protective fungal covering of a lichen.(3) Generally parenchyma cells forming a tissue extending between the vascular tissue and epidermis.

cos site One of the cohesive single-stranded extensions present at the ends of the DNA molecules of certain strains of λ phage.

Cosmid A high-capacity cloning vector consisting of the λ *cos* site inserted into a plasmid; it is useful for cloning large DNA fragments.

Cot curve Cot curve is concerned with the measurement of the degree of reannealing of DNA strands. It is a curve drawn with X-axis having DNA concentration unit multiplied by time. Since the initial concentration is considered represented as C_0 and when multiplied with time t , it becomes " C_0t " and the graph is known as Cot curve. The graph is drawn against %reannealed versus C_0t .

Cotransduction Transfer of two or more genes from one bacterium to another via a traducing phage.

Cotransformation Uptake of two or more genes on a single DNA molecule during transformation of a bacterium.

Cotyledon A seed leaf or embryo leaf that usually absorbs or stores food.

Counter stain A stain used to give contrast in a differential stain. An example is the malachite green counterstain to the fuchsin stain in the Gimenez staining technique. Another example is eosin counterstain to haematoxylin in the H&E stain. Also in Gram staining, crystal violet stains only Gram-positive bacteria, and safranin counterstain is applied which stains all cells, even allowing the identification of Gram-negative bacteria as well.

Counter current immunoelectrophoresis (CIE) The movement of antigen and antibody toward each other through an electric field.

Counterion atmosphere A cloud of oppositely charged small ions (*counterions*) that collects around a macroion dissolved in a salt solution. Counterion atmospheres partly shield macroions from each other's charges and thus affect their interactions.

Countershading The development of dark colors on the areas exposed to the sun and light colors on the undercarriage.

Coupling phase Linkage between dominant alleles of two or more genes.

Covalent bond A chemical bond in which the electrons of one atom are shared with another atom.

Covalent- Nonionic chemical bond formed by a sharing of electrons between two atoms.

CpG island A GC-rich DNA region located upstream of approximately 56% of the genes in the human genome.

CREB An important transcription factor.

Crech Flock of birds, not necessarily belonging to the same species that flock together for protection.

Cresol A mixture of isomers from petroleum.

Crisis The phase of a fever characterized by vasodilation and sweating.

Crista Infolding of the inner mitochondrial membrane, containing components for respiratory metabolism and oxidative phosphorylation and providing a relatively large surface area on which these reactions can take place

Critical Habitat A habitat which is critical for the survival and conservation of a species, designated by a rule published in the Federal Register.

Crop Expandable pouch found in the esophagus of some birds for temporary storage of food where it is moistened and softened by the secretion called crop milk.

Cross-feeding (i) Specific type of syntrophy where two populations cooperate to metabolize a compound.
(ii) One organism consuming products excreted by another organism.

Crossing over Process by which a portion of one chromosome is exchanged with a portion of another chromosome i.e. physical exchange of material that takes place between homologous chromosomes during recombination and is manifest in the formation of chiasmata.

Crosstalk Crosstalk refers to instances in which one or more components of a signal transduction pathway affect a different pathway. This can be achieved through a number of ways with the most common form being crosstalk between proteins of signaling cascades. One example of crosstalk between proteins in a signaling pathway can be seen with cyclic adenosine monophosphate's (cAMP) role in regulating cell proliferation by interacting with the mitogen-activated protein (MAP) kinase pathway.

Crown Division Asexual type of reproduction, involving the division of the base of the stem.

Crown gall A cancerous growth on plants due to transformation of the host cells by the bacterium *Agrobacterium tumefaciens*.

Cruciform In a DNA duplex, a structure that can be adopted by a palindromic sequence, in which each strand base-pairs with itself to form an arm that projects from the main duplex and terminates in a hairpin loop. The two arms form a "cross" with the main duplex.

Cryoelectron microscopy A variation of electron microscopy in which samples are frozen in a glassy ice matrix.

Cryopreservation Storage and preservation at very low temperature (-196°C).

Cryoprotectant A chemical agent or a compound that can prevent damage to cells while they are frozen or defrosted.

Cryptic They are characteristics that help in concealing an animal.

Cryptic splice site A site whose sequence resembles an authentic splice site and which might be selected instead of the authentic site during aberrant splicing.

Cryptins Peptides produced by Paneth (Paneth cells, along with goblet cells, enterocytes, and enteroendocrine cells, represent the principal cell types of the epithelium of the small intestine) cells in the intestines. Cryptins are toxic for some bacteria, although their mode of action is not known.

Cryptococcosis An infection caused by the basidiomycete, *Cryptococcus neoformans*, which may involve the skin, lungs, brain, or meninges.

Cryptogene One of several genes in the trypanosome mitochondrial genome which specify abbreviated RNAs that must undergo pan-editing in order to become functional.

Cryptosporidiosis Infection with protozoa of the genus *Cryptosporidium*. The most common symptoms are prolonged diarrhea, weight loss, fever, and abdominal pain.

Crystallizable fragment The stem of the Y portion of an antibody molecule. Cells such as macrophages bind to the Fc region, and it also is involved in complement activation.

CTD-associated SR-like protein (CASP) A type of protein thought to play a regulatory role during splicing of GU-AG introns.

Cultivar A term used to refer to the plants found only under cultivation.

Culture medium The nutrient material prepared for growth of microorganisms in laboratory.

Culture Population of microorganisms cultivated in an artificial growth medium. A pure culture is grown from a single cell; a mixed culture consists of two or more microbial species or strains growing together

Curie The basic unit of radioactive decay. The **curie** (symbol **Ci**) is a non-SI unit of radioactivity, named after Marie and Pierre Curie. It is defined as $1 \text{ Ci} = 3.7 \times 10^{10}$ decays per second. One Curie is roughly the activity of 1 gram of the radium isotope ^{226}Ra , a substance studied by the Curies. The SI derived unit of radioactivity is the becquerel (Bq), which equates to one decay per second. Therefore: $1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq} = 37 \text{ GBq}$ and $1 \text{ Bq} \cong 2.703 \times 10^{-11} \text{ Ci}$. Another commonly used measure of radioactivity is the microcurie: $1 \mu\text{Ci} = 3.7 \times 10^4$ disintegrations per second = 2.22×10^6 disintegrations per minute.

CURL (endosome) Compartment where Uncoupling of Receptor and Ligand occurs.

Cutaneous mycosis A fungal infection of the epidermis, nails, or hair.

Cuticle Thin hyaline film derived from the exterior surfaces of epidermal cells, covering the surface of plants.

Cutin Fatty or waxy substance making up the cuticle.

Cuticle Nonliving outer covering of helminths.

Cuttings Vegetative plant parts used for asexual propagation.

C-value paradox The nonequivalence between genome size and gene number that is seen when comparisons are made between some eukaryotes.

Cyanobacteria Oxygen-producing photoautotrophic prokaryotes; also called blue-green bacteria.

Cyanogenic glycoside A chemical, found in some plants, that releases toxic hydrogen cyanide when the cells are disrupted.

Cyanophages The viruses that can kill algal cells.

Cybrid When two or more protoplasts fuse, but the nuclei may or may not fuse. If, in a binucleate heterokaryon one of the nuclei disappears then it is called cybrid or cytoplasmic hybrid as the cytoplasm remains in fused state.

Cyclic adenosine monophosphate (cAMP): nucleotide produced from ATP by the action of the enzyme adenylate cyclase. cAMP is an intracellular messenger in many cells and exerts many of its actions by activating protein kinase A

Cyclic AMP (cAMP) A modified version of AMP in which an intramolecular phosphodiester bond links the 5' and 3' carbons

Cyclic guanosine monophosphate (cGMP): nucleotide produced from GTP by the action of the enzyme guanylate cyclase. cGMP is an intracellular messenger in many cells and exerts many of its actions by activating protein kinase G.

Cyclic photophosphorylation Cyclic photophosphorylation occurs on the thylakoid membrane. In cyclic electron flow, the electron begins in a pigment complex called photosystem I, passes from the primary acceptor to ferredoxin, then to cytochrome b₆f (a similar complex to that found in mitochondria), and then to plastocyanin before returning to chlorophyll. This transport chain

produces a proton-motive force, pumping H⁺ ions across the membrane; this produces a concentration gradient that can be used to power ATP synthase during chemiosmosis. This pathway is known as cyclic photophosphorylation, and it produces neither O₂ nor NADPH. Unlike non-cyclic photophosphorylation, NADP⁺ does not accept the electrons; they are instead sent back to photosystem I.

Cyclin B One of the two proteins that make up maturation promoting factor (MPF), the other being CDK1; one of a family of proteins whose level oscillates (cycles) through the cell division cycle.

Cyclin D Protein that binds to CDK4 and 6 to form a complex that is active at the G1 control point of the cell division cycle; one of a family of proteins whose level oscillates (cycles) through the cell division cycle.

Cyclin E Protein that binds to CDK2 to form a complex that is active at the G1 control point of the cell division cycle; one of a family of proteins whose level oscillates (cycles) through the cell division cycle.

Cyclin-dependent kinase (CDKs) One of the family of protein kinases that regulate the cell cycle. Cyclin-dependent kinases are only active when bound to one of the family of cyclin proteins. For example, CDK1 associates with cyclin B and regulates the G2/M transition while CDK2 associates with cyclin E and regulates the G1/S transition.

Cyclins Proteins that regulate the cell cycle by binding to and activating specific nuclear protein kinases. cyclin-dependent kinase activations occur at three points during the cell cycle, thus providing three decision points as to whether the cycle will proceed.

Cyclobutyl dimer A cyclobutyl dimer links two molecules or regions of molecules by a four-carbon ring. Such a ring is commonly formed between adjacent pyrimidine nucleotides in DNA that has been exposed to ultraviolet light. It is especially common between thymine bases.

Cyclosis Generation of cytoplasmic currents by the action of microfilaments.

Cyclospora cayetanensis *Cyclospora cayetanensis* is an acid-fast, coccidian-like, parasitic protozoa with the size of 8-10 micrometer in diameter. *Cyclospora cayetanensis* was recently recognized as a new (intestinal) protozoan pathogen of human (1993, species name was proposed in 1994) and was identified as the cause of the prolonged diarrhoea of travelers as well as immunocompetent and immunocompromised patients.

Cyclosporin Cyclosporin A is an immunosuppressant drug widely used in organ transplantation to prevent rejection. It reduces the activity of the immune system by interfering with the activity and growth of T cells that suppresses the T-cell response.

Cys₂His₂finger A type of zinc-finger DNA-binding domain.

Cyst Resting stage formed by some bacteria, nematodes, and protozoa in which the whole cell is surrounded by a protective layer; not the same as endospore.

Cystamine Cystamine is an organic disulfide. It is formed when cystine is heated, the result of decarboxylation. Cystamine is an unstable liquid and is generally handled as the dihydrochloride salt, C₄H₁₂N₂S₂·2HCl, which is stable to 203-214 °C at which point it decomposes. Cystamine is toxic if swallowed or inhaled and potentially harmful by contact.

Cystic fibrosis (CF) Inherited disease characterized by failure of the pancreas and by thick sticky mucus in the lungs leading to fatal lung infection unless treated. Cystic fibrosis is caused by failure to make, or properly target, plasma membrane chloride channels.

Cysticercus Encysted tapeworm larvae.

Cystine Double amino acid formed by two cysteine molecules joined by a disulfide bond.

Cystitis Inflammation of the urinary bladder.

Cytidine. A pyrimidine nucleoside found in DNA and RNA.

Cytochalasin B It is a cell-permeable mycotoxin. It inhibits cytoplasmic division by blocking the formation of contractile microfilaments. It inhibits cell movement and induces nuclear extrusion.

Cytochemistry The use of compound specific stains, combined with microscopy, to determine the biochemical content of cellular structures.

Cytochrome Iron-containing porphyrin ring (e.g., heme) complexed with proteins which act as electron carriers in an electron-transport chain. Cytochromes form a critical part of the electron transport chain of mitochondria and also form part of the cytochrome P450 detoxification system in the liver.

Cytochrome c Soluble protein of the mitochondrial intermembrane space, often found loosely associated with the inner mitochondrial membrane. Cytochrome c transports electrons between components of the electron transport chain. If it is allowed to escape from mitochondria cytochrome c activates caspase 9 and hence triggers apoptosis

Cytochrome oxidase An enzyme that oxidizes cytochrome c.

Cytocidal Resulting in cell death.

Cytodifferentiation Origin of different cell types from simple undifferentiated totipotent cells during development. e.g. in vitro vascular differentiation particularly the xylem elements within the callus tissue.

Cytogenetics Study of genetic effects of chromosome behavior and structure.

Cytogenetics Study of chromosomes in relation to genetics.

Cytokines Small proteins released from human cells in responses to bacterial infection; directly or indirectly may induce fever, pain or T-cell proliferation. . Are produced by lymphocytes, monocytes, macrophages, and other cells

Cytokinesis Process of cleavage and separation of the cytoplasm at the final stage of mitosis.

Cytokinin A plant growth hormone concerned with cell division and other metabolic activities of the cell.
A plant hormone produced in root tissue

Cytology Study of cell structure by light microscopy.

Cytopathic effect (CPE) Tissue deterioration caused by virus.

Cytoplasm In prokaryotes everything inside the plasma membrane; in eukaryotes everything inside the plasma membrane and external to nucleus.

- Cytoplasmic dynein** motor protein that moves organelles along microtubules in a retrograde direction.
- Cytoplasmic inheritance** Transmission of characters through cytoplasm. It is due to the DNA present in cytoplasmic organelles. It is found in most eukaryotes and is commonly known to occur in cytoplasmic organelles such as mitochondria and chloroplasts or from cellular parasites like viruses or bacteria.
- Cytoplasmic male sterility (CMS)** **Cytoplasmic male sterility** is total or partial male sterility associated with plant biology as the result of specific nuclear and mitochondrial interactions.^[1] Male sterility is the failure of plants to produce functional anthers, pollen, or male gametes.
- Cytoplasmic matrix** The cytosol or intracellular fluid (or cytoplasmic matrix) is the liquid found inside cells. It is separated into compartments by membranes. For example, the mitochondrial matrix separates the mitochondrion into compartments.
- Cytoplasmic membrane** Selectively permeable membrane surrounding the cell's cytoplasm.
- Cytoplasmic streaming** **Cytoplasmic streaming** is the directed flow of cytosol (the liquid component of the cytoplasm) and organelles around large fungal and plant cells through the mediation of actin. This movement aids in the delivery of nutrients, metabolites, genetic information, and other materials to all parts of the cell. Cytoplasmic streaming occurs along Actin filaments in the cytoskeleton of the cell.
- Cytoplasmic transfer** The transfer of cytoplasm from a donor (with active mitochondria) into the oocytes.
- Cytoplasmic-genetic male sterility (CGMS)** While CMS is controlled by an extranuclear genome, nuclear genes may have the capability to restore fertility. When nuclear restoration of fertility genes ("Rf") is available for a CMS system in any crop, it is cytoplasmic-genetic male sterility; the sterility is manifested by the influence of both nuclear (with Mendelian inheritance) and cytoplasmic (maternally inherited) genes.
- Cytoprotoplasts** The sub-protoplasts containing the original cytoplasmic material (in part or full) but lack nucleus.
- Cytosine.** A pyrimidine base found in DNA and RNA
- Cytoskeleton** An organized network of rod like and fiberlike proteins that pervades a cell and helps give it its shape and motility. The cytoskeleton includes actin filaments, microtubules, and a diverse group of filamentous proteins collectively called intermediate filaments
- Cytosol** The fluid medium that is located inside a cell but outside the nucleus and organelles (for eukaryotes) or the nucleoid (for prokaryotes). It is a semi liquid concentrated solution or suspension.
- Cytotoxic T-cells (T_c)** The lymphocytes that mediate the lysis of target cells.
- Cytotoxicity** The toxic effects on cells that result in metabolic alterations including the death of cells.
- Cytotoxin** Bacterial toxins that kill or alter the functions of host cells. Examples of toxic agents are a chemical substance, an immune cell or some types of venom (e.g. from the puff adder or brown recluse spider).
- 2, 4 -dichlorophenoxyacetic acid (2,4-D)** A growth substance widely used as a herbicide. In plant tissue culture it is used for cell dedifferentiation and formation of callus.

D arm Part of the conserved stem-loop structure of a tRNA molecule. It has a high content of the modified base dihydrouridine.

D gene segments, or diversity gene segments They are short DNA sequences that join the V and J gene segments in rearranged immunoglobulin heavy-chain genes and in T-cell receptor β and δ chain genes.

D Loop (1) An extended loop of single-stranded DNA displaced from a duplex structure by an oligonucleotide. (2) A region within mitochondrial DNA in which a short stretch of RNA is paired with one strand of DNA, displacing the original partner DNA strand in this region. The same term is used to describe the displacement of a region of one strand of duplex DNA by a single-stranded invader in the reaction catalyzed by RecA protein.

Dabs (single-domain antibodies) Antibodies with only one (instead of two) protein chain derived from only one of the domains of the antibody structure. Dabs exploit the finding that, for some antibodies, half of the antibody molecule binds to its target antigen almost as well as the whole molecule. The potential advantages of dabs are that they can be made easily by bacteria or yeasts, and offer a way to clone antibody-like molecules into bacteria, and hence to be able to easily screen millions of antibodies. Related ideas are single-chain antigen binding technology (SCA), biosynthetic antibody binding sites (BABS), minimum recognition units (MRUs), and complementary determining regions (CDRs).

Daffodil Rice Daffodils refers to the approximately 80 species of flowering plants within the genus *Narcissus*. Native to southern Europe and northern Africa, they are the source of transgenic "golden rice" and the Alzheimer's disease treatment compound galantamine hydrobromide.

Daidzin The β -glycoside form (isomer in which glucose is attached to the molecule at the seven position of the A ring) of the isoflavone known as daidzein (aglycone form).

Dalton (symbol: **Da**) (after *John Dalton*, a British chemist) A unit of atomic mass roughly equivalent to the mass of a hydrogen atom. 1.67×10^{-24} g. Named after the famous nineteenth-century chemist, John Dalton (1766-1844), who developed the atomic theory of matter. One kilo- (kDa) or megadaltons (MDa) is equal to 1×10^3 or 1×10^6 daltons respectively. One dalton equals one-twelfth the mass of ^{12}C .

Daltonism Red and green color blindness, a recessive trait known to be X-linked.

Dark (light-independent) reaction This reactions occur in plants that use ATP and NADPH to fix atmospheric carbon dioxide and use it to make sugar, chiefly glucose. These reactions occur in stroma outside the thylakoid membrane. These reactions use the products of light-dependent reactions and perform further chemical processes on them. There are three phases to the light-independent reactions, collectively called the Calvin cycle: carbon fixation, reduction reactions, and ribulose 1,5-bisphosphate (RuBP) regeneration. The name is a misnomer as the reaction can only occur in presence of sunlight when the light dependent products are available.

Dark repair A type of nucleotide excision repair process that corrects cyclobutyl dimers. The enzymes do not require light for activation.

Darkfield illumination In light microscopy, the light that is reflected from an object rather than passing through it, resulting in a bright image on a dark ground.

Darkfield microscope A microscope that has a device to scatter light from the illuminators so that the specimen appears white against a black background. It is used to visualize very small

microorganisms or their characteristics by a system that permits light to be reflected or refracted from surface of objects being viewed.

Darwinian cloning Selection of a clone from a large number of essentially random starting points, rather than isolating a natural gene or making a carefully designed artificial one. Molecules which are more similar to those needed are selected, mutated to generate new variants, and re-selected. The cycle proceeds until the required molecule is found. The advantage of the system is that the selection is from a vast number of possibilities.

Data warehouse A collection of databases, data tables, and mechanisms to access the data on a single subject.

Datum, plural data An observation used as a basis for inference or induction.

Daughter cells The two cells that result from a cell division are referred to as daughter cells. In budding yeast only the cell derived from the bud is called the daughter cell.

Daughter strand or duplex of DNA refers to the newly synthesized DNA.

Daughterless carp A Carp which only produce male fish. This slows the growth of the population with the aim of reducing overall carp numbers. Since all fish embryos start life as males, the technology works by silencing or switching off the gene responsible for stimulating the development of female embryos.

Daunorubicin Also known as daunomycin. An antitumor antibiotic isolated from *Streptomyces peucetius*. It is believed to act by binding to DNA to block the synthesis of RNA.

DBT An acronym used to designate the Indian Department of Biotechnology.

De novo (L. "from the beginning, anew") Arising, anew, afresh, once more.

De novo methylase An enzyme that adds a methyl group to an unmethylated target sequence on DNA.

De novo methylation Addition of methyl groups to new positions on a DNA molecule.

De novo pathway A biochemical pathway that starts from elementary substrates such as a nucleotide, from simple precursors and ends in the synthesis of a biochemical.

Deacetylase An enzyme that removes acetyl groups from proteins.

Deacylated tRNA A tRNA that has no amino acid or polypeptide chain attached to it because it has completed its role in protein synthesis and is ready to be released from the ribosome.

Deadenylation-dependent decapping A process for degradation of eukaryotic mRNAs that is initiated by removal of the poly (A) tail.

Deaminating agent A mutagen that acts by removing amino groups (-NH₂) from nucleotide bases. It causes a point mutation. Also called as deaminase.

Deamination The enzymatic removal of amino groups from biomolecules such as amino acids or nucleotides. For example, when livestock are fed more lysine (amino acid) than their body needs in a given day (animals' bodies can only utilize the essential amino acids in precise amounts/ratios of their daily diet), the excess lysine is metabolized to urea and then excreted. Deamination of adenine or cytosine causes base-pairing changes. Deamination of cytosine to form uracil is a form of DNA damage.

Death domain They were originally defined in proteins encoded by genes involved in programmed cell death or apoptosis, and is now known to be involved in protein-protein interactions. It is mainly

found on proteins concerned with regulating apoptosis, such as Fas and the p75 neurotrophin receptor. When activated, death domain proteins turn on caspase 8 and hence initiate apoptosis.

Death phase The final growth phase, during which nutrients have been depleted and cell number decreases.

Debranching The enzymatic removal of side chains from a branched polymer such as glycogen.

Debridement Surgical removal of necrotic tissue. Surgical or other removal of nonviable tissue

Decarboxylation The removal of carbon dioxide (CO₂) from a biomolecule (amino acid), as in the conversion of oxalosuccinic acid (C₆) to α -ketoglutaric acid (C₅) in the third step of the Krebs cycle. E.g., decarboxylase.

Decay-accelerating factor, DAF, CD55 It is a cell-surface molecule that protects cells from lysis by complement. Its absence causes the disease paroxysmal nocturnal hemoglobinuria.

Deceleration phase The phase of declining growth rate, following the linear phase and preceding the stationary phase in most batch-suspension cultures.

Decimal reduction time (DRT) The time (in minutes) required to kill 90% of a bacterial population at a given temperature.

Decline phase (1) The fourth of four major phases of the bacterial growth curve in which cells lose their ability to divide (due to less supportive conditions in the medium) and thus die (also called death phase). (2) In the stages of a disease, the period during which the host defenses finally overcome the pathogen and symptoms begin to subside.

Declined Facing outward and downward from the pedicel or vertical axis of the plant. Axis of the flower below horizontal.

Decolorizing agent A solution used in the process of removing a stain.

Decomposer Organism that obtains energy by digesting dead bodies or wastes of producers and consumers.

Decomposition (1) The break-up of a chemical substance into two or more simpler substances. (2) The breakdown of organic material by microbes.

Decomposition reaction A chemical reaction in which bonds are broken to produce smaller parts from a large molecule.

Decontamination Process of rendering an object or area safe for unprotected people by removing or making harmless biological or chemical agents.

De-differentiation The process by which cells lose their specialization and proliferate by cell division to form a non-differentiated mass of cells which, in response to appropriate stimuli, may later differentiate again to form either the same cell type or a different one. De-differentiation occurs in response to wounding and in tissue cultures.

Deep freezing Preservation of bacterial cultures at - 50°C to -95°C.

Deep hot biosphere Theory that the entire crust of the Earth, down to a depth of several miles, is inhabited by a culture of microbes that feed on oil and methane gas deposits that are an original part of the earth.

Default pathway Constitutive secretory pathway that automatically delivers material from the golgi apparatus to the plasma membrane if no other sorting signals are present.

Defective endogenous retroviruses are partial retroviral genomes integrated into host cell DNA and carried as host genes. There are many defective endogenous retroviruses in the mouse genome.

Defective virus A virus that, by itself, is unable to reproduce when infecting its host (cell), but that can grow in the presence of another virus. The other virus provides the necessary molecular machinery that the first virus lacks.

Defensins A class of peptide that inhibits certain fungal diseases. These are produced as a natural defense by some plants. For example, the alfalfa plant produces a defensin known as alfAFP (alfalfa antifungal peptide). In addition to protecting the plant from certain diseases, the alfAFP also inhibits a fungal disease known as potato early dying complex (also called Verticillium wilt), which is caused by the fungus *Verticillium dahliae*.

Deficiency (1) It is insufficiency or absence of one or more usable forms of enzymatic, nutritional or environmental requirement, so that the development, growth or physiological functions are affected. (2) Loss of a part of chromosome.

Deficiency disease Any condition exhibiting abnormalities produced by lack of a particular component in the diet of animals and plants; examples include beriberi (due to deficiency of vitamin B1), scurvy (vitamin C), rickets (vitamin D) and kwashiorkor (protein) among humans; among plants, deficiency of magnesium causes chlorosis of the leaves.

Defined (1) Fixed conditions of medium, environment and protocol for growth. (2) Precisely known and stated elements of a tissue culture medium.

Defined synthetic medium A medium whose exact chemical composition is quantitatively known.

Definitive host An organism that harbors the adult, sexually mature form of a parasite.

Definitive identification A valid identification of a microorganism to genus and species, regardless of the method(s) used to make the identification.

Degeneracy In relation to the genetic code, the fact that more than one codon can code for the same amino acid.

Degeneracy of the genetic code The specification of one amino acid by more than one codon. It arises from the inevitable redundancy resulting from 64 triplets in a triplet code ($4 \times 4 \times 4 = 64$) encoding only 20 amino acids. Hence there is lack of an effect of many changes in the third base of the codon on the amino acid that is represented.

Degenerate code A code in which one amino acid is specified by more than one codon.

Degenerate codons Two or more codons that code for the same amino acid. For example, isoleucine is specified by the AUU, AUC, and AUA triplets. Since in this case more than one triplet codes for isoleucine, the codons are called degenerate.

Degenerate It describes multiple states that amount to the same thing; different triplet combinations of nucleotide bases (codons) that code for the same amino acid.

Degenerate Oligonucleotide Primed-PCR (DOP-PCR) A molecular marker technique that uses partially degenerated primers for polymorphism detection in comparative genomics studies.

Degeneration (1) Changes in cells, tissues or organs due to disease. (2) The reduction in size or complete loss of organs during evolution.

Degradation A gradual wearing down or away. Also, with regard to soil, a lowering of the nutrient content and associated ability to support continuing crop growth.

Degradosome A complex of bacterial enzymes, including RNAases, a helicase, and enolase (a glycolytic enzyme), which may be involved in degrading mRNA.

Degranulation Release of contents (like histamine and other preformed mediators of allergic reactions) of secretory granules from sensitized mast cells or basophils after a second encounter with an allergen.

Dehalogenation The removal of halogen atoms (chlorine, iodine, bromine, fluorine) from molecules, usually during biodegradation.

Dehiscence In fruit, spontaneous shattering of the ripe fruit to disperse the seeds. In pollen, the opening of the anther to release the pollen or to expose the ripe pollen to pollinators.

Dehydration reaction Water-losing. The process in which a hydroxyl (OH) group is removed from one subunit of a polymer and a hydrogen (H) group is removed from the other subunit.

Dehydration synthesis A chemical reaction that builds complex organic molecules.

Dehydration The removal or loss of water or body fluid.

Dehydrogenase(s) An oxidizing enzyme(s) of class oxidoreductase that catalyzes the removal of a pair of electrons (and usually one or two protons) from a substrate molecule, like the removal of hydrogen atoms in biological reactions.

Dehydrogenation The removal of hydrogen atoms from molecules. When those molecules are the components of vegetable oils/fats, a lower content percentage of saturated fats results.

Deinococcus radiodurans A species of bacteria capable of surviving 1.5 million Rads of gamma radiation (3000 times the lethal radiation dose for humans), surviving long periods of dehydration, and surviving high doses of ultraviolet radiation. *Deinococcus radiodurans* was discovered in 1956 in some canned meat. See **extremophile**.

De-ionized water Water which is free of most inorganic (not completely free, since Na is present in ample quantities) and most organic compounds.

Delaney Clause Formerly part of American federal law (1959 Delaney amendment to the Food, Drug and Cosmetic Act), it was eliminated in 1996. The Delaney Clause had set a zero-risk tolerance level for carcinogenic pesticide residues in processed foods.

Delayed early genes in phage lambda are equivalent to the middle genes of other phages. They cannot be transcribed until regulator protein(s) coded by the immediate early genes have been synthesized.

Delayed hypersensitivity (T_D) cells Specialized T cells that produce lymphokines in cell mediated (Type IV) hypersensitivity reactions.

Delayed hypersensitivity Cell-mediated hypersensitivity.

Delayed-onset mutation A mutation whose effect is not apparent until a relatively late stage in the life of the mutant organism.

Delayed-type hypersensitivity (Type IV hypersensitivity) It is a form of cell-mediated immunity elicited by antigen in the skin and is mediated by CD4 TH₁ cells. It is called delayed-type hypersensitivity because the reaction appears hours to days after antigen is injected.

Deleterious allele The allele which in homozygous state harms an individual.

Deletion A loss of one or more base pairs in DNA sequence or a part of the DNA from a chromosome, usually producing frame shift mutations. The size of a deleted material can vary from a single

nucleotide to sections containing a number of genes. Large deletions are visible as the lack of chromosomal segments. It can lead to a disease or abnormality.

Deletion map A description of a specific chromosome that uses defined mutations--specific deleted areas in the genome-- as 'biochemical signposts,' or markers for specific areas.

Deletion mutation A mutation resulting from deletion of one or more nucleotides from a DNA sequence.

Deliberate release Putting something into the outside world; in biotechnology it means putting a genetically modified organism (GMO) into field trials.

Delirium (*delirium*L, from *de* = away from + *lira* =furrow) Mental excitement with confusion and sometimes hallucinations.

Delta 12 (Δ 12) Desaturase An enzyme present within the soybean plant and in other oilseed crops (canola, maize/corn, etc.). it is involved in the synthesis "pathway" utilized by oilseed crops to synthesize (manufacture) polyunsaturated fatty acids (e.g., linoleic acid) from monounsaturated fatty acids (e.g., oleic acid) in seeds (while those seeds are developing).

Delta 15 Desaturase One of the desaturases enzymes.

Deme A group of organisms in the same taxon.

Demethylase is a casual name for an enzyme that removes a methyl group, typically from DNA, RNA, or protein.

Demineralize To remove the mineral content (salts, ions) from a substance, especially water. Removal methods include distillation and electro dialysis. The process is de-mineralization.

Denaturated DNA Duplex DNA that has been converted to single strands by breaking the hydrogen bonds of complementary nucleotide pairs. It is usually achieved by heating.

Denaturation Breakdown by chemical or physical means of the non-covalent interactions, such as hydrogen bonding, that maintain the secondary and higher levels of structure of proteins and nucleic acids. It is caused by heating, extreme pH (i.e., by acidity or basicity) changes or by exposure to chemicals and usually resulting in the loss of biological function. Denatured proteins often unfold their polypeptide chains and express changed properties of solubility. The separation of duplex nucleic acid molecules into single strands. Most commonly used by genetic engineers to describe the destruction of hydrogen bonds maintaining the double-stranded nature of all or part of a DNA molecule.

Denature To induce structural alterations that disrupt the biological activity of a molecule. Often refers to breaking hydrogen bonds between base pairs in double-stranded nucleic acid molecules to produce single-stranded polynucleotides, or altering the secondary and tertiary structure of a protein, destroying its activity.

Denatured DNA DNA converted from double- stranded to single-stranded form by a denaturation process such as heating the DNA solution. In the case of heat denaturation, the solution becomes very gelatinous and viscous.

Denatured protein A protein that has lost its native conformation by exposure to a destabilizing agent such as heat or detergent.

Denaturing Polyacrylamide Gel Electrophoresis The use of PAGE (polyacrylamide gel electrophoresis) in order to separate and analyze DNA fragments (sequences) after that DNA is first denatured. This methodology can be employed to scan DNA in order to detect point mutations.

Dendrimers Polymers (i.e., molecules composed of repeating atomic units within the molecule) that repeatedly branch (while “growing” due to addition of more atoms in a repeating pattern) until that branching is stopped by the physical constraint of contacting itself (i.e., having formed a complete, hollow sphere). Discovered during the 1970s by Donald Tomalia, dendrimers possess sites on their exterior surface to which genetic material (e.g., genes or other portions of DNA) can be “attached.” Dendrimers bearing such genetic material have shown the capacity to successfully transfer that genetic material into more than thirty types of living animal cells.

Dendrites Highly branched structures that extend from the (nucleus of) neurons to (synapse junctions with) other neurons (e.g., in human brain tissue). The primary purpose of dendrites is to process signals that are generated/ received at the synapses (e.g., from the dendrites of adjoining neurons). Neuron ribosomes are located in the dendritic spines, the dendrite projections that form synapses (the junctions between dendrites where “signal transfer” between neurons takes place). Thus, those ribosomes make the proteins that are crucial to learning and memory (e.g., accomplished via growth/changes of dendrites). Messenger RNAs are synthesized (manufactured) in the nucleus of the neuron, then transported on microtubules (filaments within the neuron cell) to the ribosomes in the dendrites, where they cause manufacture of proteins (e.g., enzymes) in response to synapse activity (i.e., signals).

Dendritic cells These are rare white blood cells derived from bone marrow and present in T-cell areas of lymphoid and other tissues that is specialized for the uptake of particulate material by phagocytosis. They have long membrane extensions that resemble the dendrites of nerve cells and act to stimulate the human immune system (T cells) to combat certain types of cancer. Nonlymphoid tissues also contain dendritic cells, but these are not able to stimulate T-cell responses until they are activated and migrate to lymphoid tissues. It is distinct from the follicular dendritic cell that presents antigen to B cells.

Dendritic epidermal T cells (dETCs), are a specialized class of $\gamma:\delta$ T cells found in the skin of mice and some other species, but not humans. All dETCs have the same $\gamma:\delta$ T-cell receptor; their function is unknown.

Dendritic langerhans cells A type of cell, located in the mucous membranes of the mouth and genital areas, that permits the human immunodeficiency virus (the virus that causes AIDS) to enter and infect the body, even when there are no cuts or abrasions through those mucous membranes.

Dendritic polymers Polymers (i.e., molecules composed of repeating atomic units within the molecule) that repeatedly branch (while “growing” due to the addition of more atoms in a repeating pattern) until that branching is stopped (e.g., by physical constraints, for those polymers within living tissues). In the absence of physical constraints, dendritic polymers can continue branching (and growing) until they form a complete (hollow) sphere. Such spheres are potentially useful for protecting and “delivering” a fragile pharmaceutical molecule to specific tissue(s) within the body.

Dendrogram A branching diagrammatic representation of a set of individuals or taxa, constructed from overall similarity of a set of characters among organisms, to indicate degree of phylogenetic relationship.

Dengue fever Viral systemic disease caused by toga virus and transmitted by *Aedes* mosquitoes, that causes severe bone and joint pain. Also called as breakbone fever.

Denitrification A chemical process (i.e., internal respiration) in which nitrates in the soil are reduced to molecular nitrogen (nitrites or into gaseous oxides of nitrogen, or even into free nitrogen), by

organisms (denitrifying bacteria) which is released to the atmosphere. It results in loss of nitrogen from ecosystems.

Density gradient centrifugation High-speed centrifugation in which molecules "float" at a point where their density equals that in a gradient of caesium chloride or sucrose. The density gradient may either be formed before centrifugation by mixing two solutions of different density (as in sucrose density gradients) or it can be formed by the process of centrifugation itself (as in CsCl and Cs₂SO₄ density gradients).

Density gradient is used to separate macromolecules on the basis of differences in their density. It is prepared from a heavy soluble compound such as CsCl.

Density-dependent inhibition It describes the limitation that eukaryotic cells in culture grow only to a limited density, because growth is inhibited, by processes involving cell-cell contacts.

Dental carries The erosion of enamel and deeper parts of teeth. Also called tooth decay.

Dental plaque A combination of bacterial cells, dextran, and debris adhering to the teeth.

Dentate Edges or margins of leaves have large tooth-like projections.

Denticle is a pigmented, hardened spike of cuticle protruding from the ventral epidermis of a *Drosophila* embryo. Short, narrow projection bearing a conidium.

Denticulate Having edges with small tooth-like projections.

Deoxy sugar A saccharide produced by replacement of an OH group by H.

Deoxynucleoside triphosphate (dNTP) Triphosphorylated ('high energy') precursor required for synthesis of DNA, where N refers to one of the four bases (A, G, T or C)

Deoxynucleotides The components of DNA: Adenine (A), Cytocine (C), Guanine (G) or Thymidine (T).

Deoxyribonuclease (DNase) An enzyme that specifically hydrolyzes (degrades) single- and double-stranded DNA by cleaving phosphodiester bonds in a DNA molecule.

Deoxyribonucleic acid (DNA) Discovered by Frederick Miescher in 1869, DNA is the chemical basis for genes. The structure of the DNA molecule was elucidated in 1953 by James Watson, Francis Crick, and Maurice Wilkins. The DNA molecule is a linear polymer made up of deoxyribonucleotide repeating units (composed of the sugar 2-deoxyribose, phosphate, and a purine or pyrimidine base). The bases are linked by a phosphate group, joining the 3' position of one sugar to the 5' position of the next sugar. Most molecules are double stranded and anti-parallel, resulting in a right-handed helix structure that is held together by hydrogen bonds between a purine on one chain and pyrimidine on the other chain. DNA is the carrier of genetic information, which is encoded in the sequence of bases; it is present in chromosomes and chromosomal material of cell organelles such as mitochondria and chloroplasts, and also present in some viruses.

Deoxyribonucleotide Building block of DNA made up of a nitrogenous base and the pentose sugar 2'-deoxyribose to which a phosphate group is attached. Also known as a deoxynucleotide.

Deoxyribose A 5-carbon furanosyl sugar with one oxygen atom less than the related sugar ribose; a component of deoxyribonucleic acid.

Depolarization (1) Any positive shift in the transmembrane voltage, whatever its size or cause. (2) The loss of membrane potential that occurs during electrical signaling in cells such as neurons.

Depth of focus Distance toward and away from an object over which components of the object remain in clear focus.

Depurination It is the removal of either of the purine bases, adenine and guanine, from a DNA molecule. Depurination is a form of DNA damage.

Derepressed state describes a gene that is turned on because a small molecule corepressor is absent. It has the same effect as the induced state that is produced by a small molecule inducer for a gene that is regulated by induction. In describing the effect of a mutation, derepressed and constitutive have the same meaning.

Derepression (1) The process of "turning on" the expression of a gene or set of genes whose expression has been repressed (turned off). Displacement of a repressor protein from a promoter region of DNA. When attached to the DNA, the repressor protein prevents RNA polymerase from initiating transcription. (2) The "turning on" of a gene.

Derivative (1) Resulting from or derived from. (2) Term used to identify a variant during meristematic cell division.

Derived character state A character state that evolved in a recent ancestor of a subset of organisms in a group being studied.

Dermatitis Inflammation of the skin (filariasis, schistosomiasis, infections with *Strongyloides* and hookworm larvae, leishmaniasis, *Sarcoptes* infections).

Dermatome Pertaining to the area of skin which is served by one sensory spinal nerve.

Dermatomycosis Any fungus infection in the skin of animals and humans.

Dermatophyte A fungus belonging to the genus *Trichophyton*, *Microsporum*, or *Epidermophyton* with the ability to invade and obtain nutrients from keratin and infect skin, hair, or nails of humans or animals.

Dermatophytosis An infection produced by a dermatophyte in the nails, hair, and skin.

Dermis The thick inner layer of the skin, below epidermis containing specialized nerve endings.

Desaturase Enzymes that catalyze the introduction of double bonds into the hydrocarbon portion of fatty acids. An enzyme (group) family that is present within the soybean plant and other oilseed crops (e.g., canola, corn/maize). One or more desaturases is involved in the synthesis "pathway" through which oilseed crops produce unsaturated fatty acids (e.g., linoleic acid). A desaturase is also involved in production of beta carotene (in some plants).

Descriptive epidemiology Analysis of all data regarding the occurrence of a disease (i.e., the number of cases of a disease, which segments of the population are affected, where the case have occurred, and over what time) to determine the cause of the disease.

Desensitization The prevention of allergic inflammatory responses by a procedure in which an allergic individual is exposed to increasing doses of allergen in hopes of inhibiting their allergic reactions. It probably involves shifting the balance between CD4 T_H1 and T_H2 cells and thus changing the antibody produced from IgE to IgG.

Desferroxamine manganese An iron chelating agent (i.e., it chemically binds to iron atoms in the blood, thus trapping the iron atoms). The molecule also acts as an hSOD mimic by capturing harmful oxygen free radicals in the blood before they damage the walls of blood vessels. Recent research indicates that desferroxamine manganese may be useful in blocking the onset of cataracts.

Desiccant Any compound used to remove moisture or water.

- Desiccate** To dry, exhaust or deprive of water or moisture. Any chemical used for this purpose is called a desiccant. An apparatus for drying and preventing hygroscopic samples from rehydrating is a desiccator. The process is desiccation.
- Desiccation** The process by which a substance is dried out and the moisture removed; desiccation is often carried out in a desiccator, which contains a substance which will take up water, *e.g.*, calcium chloride.
- Desmin** Protein that makes up the intermediate filaments in muscle cells.
- Desmosome** Mechanical attachment formed by the thickened plasma membrane of two adjacent epithelial cells, containing intermediate filaments. Desmosomes are common in tissues such as skin.
- Desolvation** In aqueous solution, the release of bound water surrounding a solute.
- Desquamation** Shedding or scaling of skin or mucous membrane.
- Desiccator** Apparatus for drying or depriving of moisture.
- Desulfovibrio** A genus of bacteria that reduces sulfate to H₂S (hydrogen sulfide). Energy is obtained by oxidation of H₂ or organic molecules. Not a strict autotroph because CO₂ cannot be used as a sole carbon source. See also **reduction (in a chemical reaction)**, **autotroph**.
- Desulphurization** (USA: desulfurization) Technology for removing sulphur from oil and coal by use of bacteria. Sulphur residues in fuels end up as sulphur dioxide when the fuel is burned, resulting in acid rain. Bacteria may oxidize sulphites (insoluble) into sulphates (soluble), which can be washed away with the bacteria.
- Detasselling** Removal of the tassel (the male inflorescence) before it sheds pollen; example in maize. An easy method of emasculation.
- Detergent** A type of small amphipathic molecule that tends to coalesce in water, with its hydrophobic tails buried and its hydrophilic heads exposed. It is widely used to solubilize membrane proteins. It reduces the surface tension of water and improves its cleaning properties (*e.g.*, Tween-20TM, a surfactant and wetting agent).
- Determinants** A group of substances that, upon becoming unequally distributed into the cytoplasm of certain groups of cells, commit those cells to a particular course of differentiation.
- Determinate growth** Growth determined and limited in time, as in most floral meristems and leaves. The differentiation process is irreversibly established. Determinate growth contrasts with the usual culture growth, which is infinite and indeterminate.
- Determinate** Growth of plant parts, the size of which is limited by cessation of meristematic activity during the year.
- Determination** Process by which undifferentiated cells in an embryo become committed to develop into specific cell types, such as neurons, fibroblasts or muscle cells.
- Determined** Describing embryonic tissue at a stage when it can develop only as a certain kind of tissue. This determination reflects a change in the internal character of the cell, and it precedes the much more readily detected process of cell differentiation.
- Detoxification** The process by which poisonous substances are rendered less harmful; for example, the liver converts ammonia into the less toxic compound urea *via* ornithine cycle, and hydrogen peroxide is split into water and oxygen by the enzyme catalase.

Development Succession of changes that takes place in an organism as a fertilized egg or meristem gives rise to an adult plant and animal. The two major aspects of development are growth and differentiation.

Deviation (1) In statistics: the difference between an actual observation and the mean of all observations.
(2) An alteration from the typical form, function or behaviour. Mutation or stress is the common reasons behind deviation.

Dexamethasone A synthetic steroid hormone that is often used as all anti-inflammatory or antiallergic agent. It can sometimes be used to induce the appearance of latent viruses in cultured cells.

Dextran A polymer of glucose, produced by yeasts and bacteria as an energy storage reservoir (analogous to fat in humans). Consists of glucose residues, joined almost exclusively by alpha-1, 6 linkages. Occasional branches (in the molecule) are formed by alpha 1, 2, alpha 1,3, or alpha 1,4 linkages. Which linkage is used depends on the species of yeast or bacteria producing the dextran.

Dextrin An intermediate polysaccharide compound resulting from the hydrolysis of starch to soluble glucose like maltose by amylase enzymes, which is ready for cell respiration, translocation or further synthesis. Dextrins possess adhesive properties and are used as adhesives on paper products.

Dextrorotatory (D) isomer Dextro means right. A stereoisomer that rotates the plane of plane-polarized light to the right or clockwise from the point of view of the observer. It is opposite of levorotatory.

Dextrose (C₆H₁₂O₆) A monosaccharide sugar of wide occurrence in plants; also known as *glucose*.

Diabetes A grouping of diseases in which the pancreas either does not synthesize (manufacture) insulin, or else its tissues are insensitive to the insulin that it does synthesize. Approximately 5–10% of all people with diabetes are unable to synthesize insulin (e.g., because their insulin-making tissue was destroyed by autoimmune disease). Approximately 90–95% of all people with diabetes are insensitive to the insulin their body synthesizes.

Diabetes It is a metabolic disorder and is of two types. **Diabetes insipidus** (*diabetes* G, a siphon, from *dia* = through + *be nai* = to go; *insipidus* L = tasteless) is due to the failure of the pituitary to secrete antidiuretic hormone (ADH); characterized by an increase in the amount of urine excreted (polyuria) and an increased thirst (polydipsia)); less common than diabetes mellitus. **Diabetes mellitus** (*mellitus* L = honeyed) results from insulin deficiency; characterized by a failure in glucose transport from the blood into cells at normal glucose concentrations, with the result excess sugar appears in the blood and urine, associated with thirst and loss of body weight; more common than diabetes insipidus.

Diacetyl (CH₃COCOCH₃) produced from carbohydrate fermentation ; chiefly responsible for the odor of dairy products.

Diacylglycerol (DAG) Two acyl groups (fatty acid chains) joined by ester bonds to a glycerol backbone. Diacylglycerol is produced by the action of phospholipase C on phospholipid and helps to activate protein kinase C.

Diacylglycerol (DAG) Two acyl groups (fatty acid chains) joined by ester bonds to a glycerol backbone. Diacylglycerol is produced by the action of phospholipase C on phospholipid. **DAG** is most commonly released from inositol phospholipids by the action of phospholipase C-β. Diacylglycerol production is stimulated by the ligation of many receptors and it acts as an intracellular signaling molecule, activating cytosolic protein kinase C, which further propagates the signal. Research during the 1990s indicated that consumption of vegetable oils (e.g., used in frying foods) containing primarily

diacylglycerols (versus typical triacylglycerols), is less likely to result in it being deposited as body fat (adipose tissue).

Diagnosis Identification of a disease.

Diagnostic procedure A test or assay used to determine the presence of an organism, substance or nucleic acid sequence alteration.

Diagnostics / Diagnostic products A test, drug, medical device or kit used to diagnose a disease or medical condition.

Diakinesis A stage of meiosis just before metaphase I, in which chromosome contraction increases; at the end of this stage the homologues are attached only at the chiasmata. The separation of homologous chromosomes is almost completed.

Diallel cross crossing of a number of genotypes in all possible combinations.

Diallel selective mating scheme A breeding scheme in which several selected purelines are mated according to the diallel scheme; the promising F₂ populations are advanced by selfing for the isolation of purelines to be used as varieties; simultaneously, the selected plants in the F₂ generations are intermated to generate populations, which will again be handled as above. This process continues.

Dialysis The separation of low molecular weight compounds from high molecular weight components in solution by diffusion through a semipermeable membrane. The kidney functions by means of this principle, which is also the basis for kidney machines used in cases of kidney disease or failure. It is frequently utilized to remove salts and biological effectors (such as nicotinamide adenine dinucleotides, nucleotide phosphates, etc.) from polymeric molecules such as protein, DNA, or RNA. Commonly used membranes have a molecular weight cutoff (threshold) of around 10,000 Daltons, but other membrane pore sizes are available.

Diapedesis It is the movement of blood cells, particularly leukocytes, out of the blood across blood vessel walls into tissues.

Diarrhoea (*diarrhoia*G, from *dia* = through + *rhoia* = flowing) Increased frequency and fluidity of the stools. Frequent passage of soft or liquid stool (no blood); may be caused by any parasite or infection normally found in any part of the intestine (*Giardia lamblia*, *Isospora belli*, *Dientamoeba fragilis*, *Balantidium coli*, *Cryptosporidium parvum*, *Enterocytozoon bienersi*, possibly other microsporidia, *Cyclospora sp.*, visceral leishmaniasis, *Plasmodium falciparum* malaria, tapeworms, trichinosis, schistosomiasis, hookworm).

Diastase An enzyme mixture, common in seeds such as barley; involved in starch hydrolysis; the mixture contains *amylases* for conversion of starch to maltose and *maltase* for conversion of maltose to glucose.

Diastereoisomers Molecules that are stereoisomers but not enantiomers of each other. Isomers that differ in configuration about two or more asymmetric carbon atoms and are not complete mirror images.

Diatom An alga or plantlike protist that lacks flagella and has a glass like outer shell.

Diauxic growth Biphasic growth on a mixture of two carbon sources in which one carbon source is used up before the other one. For example, in the presence of glucose and lactose, *E. coli* will utilize the glucose before the lactose.

Diazotroph An organism that can fix atmospheric nitrogen. The process is known as diazotrophy.

- Dibromomannitol** An alkylating agent used in the treatment of *tumors*.
- Dicentric chromosome** A chromosome having two centromeres. It is unstable and may be broken when the two centromeres are pulled to opposite poles in mitosis.
- Dicer** The ribonuclease that plays a central role in RNA interference.
- Dichlorodiphenyltrichloroethane (DDT)** A chlorinated hydrocarbon which acts as a powerful insecticide with long-lasting effects. DDT was the first major insecticide in use. Although cheap to manufacture, DDT has produced adverse ecological consequences; DDT has produced adverse ecological consequences; DDT's lack of biodegradability and the fact that it tends to accumulate in fatty tissues has resulted in its transfer from one consumer to another up the food chain, becoming concentrated at each step. One effect of this has been to endanger the top carnivorous birds whose eggshells have become paper-thin because DDT has prevented the mobilization of calcium in the oviduct, so reducing the reproductive potential of many rare species.
- Dichogamy** The condition in which the male and the female reproductive organs of a flower mature at different times, thereby making self-fertilization improbable or impossible.
- Dichotomous** Branching of hyphae into two equal branches that are each equal in diameter to the hypha from which they originated.
- Dichotomous key** Taxonomic key used to identify organisms; composed of paired (either-or) statements describing characteristics.
- Dicot** A plant in the subclass Dicotyledoneae, Class Angiospermae, characterized having two seedling cotyledons or leaves, and adult leaves with reticulated networks of veins. Currently, Eudicots are defined as all those plants and only those plants having tricolpate pollen. In the final analysis, the distinction between dicots and monocots is best made on the basis of DNA sequences.
- Dicotyledon** (Gr. *dis*, twice + *kotyledon*, a cup-shaped hollow) A plant with two cotyledons, or seed leaves. One of the two classes of plants in the Angiosperms (the other class is the monocotyledons). Dicots have broadleaves and usually have leaf veins in a netlike pattern and a tap root. Colloquially called a dicot. Examples include many crop plants (potato, pea, and beans), ornamentals (rose, ivy) and timber trees (oak, beech, lime).
- Dictyoconidium (pl. dictyoconidia)** A conidium with horizontal and vertical septa (a muriform spore).
- Dictyosome** A stack of cisternae making up the golgi complex.
- Di-deoxynucleotide (ddNTP)** A deoxynucleotide that lacks a 3'-hydroxyl group on its sugar residue, and is thus unable to form the 3'-5' phosphodiester bond necessary for chain elongation. Di-deoxynucleotides are man-made molecules used in Sanger method of DNA sequencing. Also sometimes referred to as didN.
- Dielectric constant** A dimensionless constant that expresses the screening effect of an intervening medium on the interaction between two charged particles. Every medium (such as a water solution or an intervening portion of an organic molecule) has a characteristic dielectric constant.
- DIF** Direct immunofluorescence; diffuse interstitial fibrosis; dose increase factor.
- Difference spectra** With respect to absorption spectra, plots comparing the absorption spectra of a molecule or an assembly of molecules in different states, for example, those of mitochondria under oxidizing or reducing conditions.
- Differential centrifugation** A method of separating sub-cellular particles according to their sedimentation coefficients, which are roughly proportional to their size. Cell extracts are subjected to a succession

of centrifuge runs at progressively faster rotation speeds. Large particles, such as nuclei or mitochondria, will be precipitated at relatively slow speeds; higher G forces will be required to sediment small particles, such as ribosomes.

Differential interference contrast (DIC) microscope An instrument that provides a three dimensional, magnified image.

Differential labeling Treatment of a macromolecule with a labeling reagent in the presence and absence of a molecule to which it is thought to bind, in order to identify those portion of the macromolecule that are shielded by the bound molecule.

Differential medium A solid culture medium which is used to differentiate different types of microorganisms based on their different colors, pH or shapes of colonies. Examples of differential media are: MacConkey's agar and SS agar.

Differential signaling hypothesis It proposes that qualitatively different antigens might mediate the positive and negative selection of T cells in the thymus.

Differential splicing The production of two or more mRNAs from a single pre-mRNA by joining together different combinations of exons.

Differential stain A stain that distinguishes bacterial species or various structures of an organisms on the basis of reactions to the staining procedure.

Differential white blood cell count The number of each kind of leukocyte in a sample of 100 leukocytes.

Differentially permeable Referring to a membrane, through which different substances diffuse at different rates; some substances may be unable to diffuse through such a membrane.

Differentiation (L. *differre*, to carry different ways) A process in which unspecialized cells develop structures and functions characteristic of a particular type of cell, accompanied by a modification of the new cells for the performance of particular functions. In tissue culture, the term is used to describe the formation of different cell types. A differentiated cell such as a muscle cell or a skin cell contains a full set of genes of that organism, but only expresses the genes necessary for its specific function. In animals, stem cells (both embryonic and adult) are the only cells capable of undergoing differentiation to form more specialised cell types found in the body. Also occurs in microorganisms (e.g. in sporulation).

Differentiation antigens These are proteins detected on some cells by means of specific antibodies. Many differentiation antigens have important functional roles characteristic of the differentiated phenotypes of the cell on which they are expressed, such as cell-surface immunoglobulin on B cells.

Diffraction pattern The pattern that is produced when electromagnetic radiation passes through a regularly repeating structure; it results because the waves transmitted or scattered by the structure interact destructively in most directions (creating dark zones) but constructively in a few directions (creating bright spots). For the pattern to be sharp, the radiation wavelength must be somewhat shorter than the repeat distance in the structure.

Diffraction Phenomenon in which light waves, as they pass through a small opening, are broken up into bands of different wavelengths.

Diffusion (*diffundere* = to pour out) The net movement of molecules from a region of higher concentration to a region of lower concentration as a result of random, spontaneous molecular motions; diffusion tends to distribute molecules uniformly throughout a medium.

Diffusion coefficient (D) A coefficient that indicates how quickly a particular substance will diffuse in a particular medium under the influence of a given concentration gradient.

Diffusion-controlled limit The theoretical maximum rate of an enzymatic reaction in solution, about 10^8 to $10^9 \text{ M}^{-1}\text{S}^{-1}$.

DiGeorge's syndrome It is a recessive genetic immunodeficiency disease in which there is a failure to develop thymic epithelium, and is associated with absent parathyroid glands and large vessel anomalies. It seems to be due to a developmental defect in neural crest cells. It results in deficiency of T cells.

Digest To cut DNA molecules with one or more restriction endonucleases.

Digestion (*digestio* = separating out, dividing) The enzymatic process by which food is changed chemically into materials, which are soluble and diffusible, that the cells can assimilate, store, oxidize, or use as nourishment.

Digestion (within chemical production plants) Breakdown of feed stocks by various processes (chemical, mechanical, and biological) to yield their desired building-block components for inclusion as raw materials in subsequent chemical or biological processes.

Digestion (within organisms) The enzyme enhanced hydrolysis (breakdown) of major nutrients (food) in the gastrointestinal system to yield their building-block components (to the organism), such as amino acids, fatty acids, or other essential nutrients.

Digestive system The body system that converts ingested food into material suitable for the liberation of energy or for assimilation into body tissues.

Digestive vacuole An organelle in which substrates are broken down enzymatically.

Digital microscopy Microscope that has built-in digital camera and preloaded software.

Dihaploid An individual which arises from a doubled haploid ($2n=2X$).

Dihedral symmetry A type of symmetry in which the asymmetric units are related by a twofold rotational axis that intersects another rotation axis at right angle.

Dihybrid An individual that is heterozygous for two pairs of alleles; the progeny of a cross between homozygous parents differing at two loci.

Dihybrid cross A sexual cross between two heterozygous individuals, in which the inheritance of two pairs of alleles is followed.

Dihydroxyphenylalanine (DOPA) A precursor in the biochemical pathway leading to melanin formation in animals; DOPA is not metabolized in individuals with albinism.

Dikaryotic It refers to fungal cells within hyphae that have two nuclei that have not united.

Diluent Fluid used to dilute a substance.

Dilution method A method of testing antibiotic sensitivity in which organisms are incubated in a series of tubes containing known quantities of a chemotherapeutic agent.

Dimer Structure resulting from the association of two subunits. Example: Two adjacent pyrimidines bonded together in a DNA strand, usually as a result of exposure to U.V rays.

Dimethyl sulphoxide; dimethyl sulfoxide ($\text{C}_2\text{H}_6\text{O}_\text{S}$; m.w. 78.13) A highly hygroscopic liquid and powerful solvent with little odour or colour. It is an organic co-solvent used in small quantities to dissolve

neutral organic substances in tissue culture media preparation. DMSO also has uses as a cryoprotectant.

Dimorphic Having two distinct morphological forms. For example plants producing flowers with different style length.

Dimorphism (1) The existence of two distinctly different types of individuals within a species. An obvious example is the sexual dimorphism in certain animals. (2) The ability of an organism to alter its structure when it changes habitats.

Dinoflagellate An algae or plantlike, usually with two flagella.

Dinucleotide binding fold A protein structural motif consisting of two $\beta\alpha\beta$ units, which binds a dinucleotide such as NAD^+ . Also called a Rossmann fold.

Dioecious (*di*G = two + *eikos*G = house, dwelling) Having male and female flowers on separate plants of the same species; mulberry and willow are common examples of dioecious species.

Dioxin A chemical byproduct of the manufacture of certain herbicides such as 2,4,5-trichlorophenoxyacetic acid; chemically known as 2,3,7, 8-tetrachlorodibenzo-para-dioxin (TCDD); one of the most toxic synthetic chemicals known.

Dipeptide An organic compound consisting of two amino acids, the $-\text{NH}_2$ group of one amino acid being united with the $-\text{COOH}$ group of the other.

Diphosphate of a compound, bearing a chain of two phosphates in a line (as opposed to a bisphosphate, which bears two independent phosphate groups). Adenosine diphosphate is an example.

Diphtheria (*diphthera*G = skin, leather) A severe infection caused by *Corynebacterium diphtheriae*, generally affecting the pharyngeal area. It can produce subsequent myocarditis and polyneuritis.

Diphtheria antitoxin Discovered by Emil von Behring in 1900.

Dipicolinic acid Chemical substance found in bacterial endospores that contributes to its heat resistance.

Diplobacilli Rod like bacteria that divide and remain attached in pairs.

Diplococci Cocci that divide and remain attached in pairs.

Diplococcus A pair of cocci.

Diploid (Gr. *diploos*, double + *oides*, like) (1) The status of having two complete sets of chromosomes, most commonly one set of paternal origin and the other of maternal origin. (2) An organism or cell with a double set ($2n$) of chromosomes (most commonly one of paternal origin, and the other of maternal origin), or referring to an individual containing a double set of chromosomes per cell. Somatic tissues of higher plants and animals are ordinarily diploid in chromosome constitution, in contrast with the haploid gametes. In humans, the total number of chromosomes in a diploid cell is 46.

Diploid cell A cell that contains two sets of homologous chromosomes ($2N$) of each type and hence two copies of each gene or genetic locus. In humans, this means two sets of 23, one from the father, one from the mother. Most of the cells of the body (the somatic cells) are diploid.

Diploid fibroblast strain A culture derived from fetal tissues that retain fetal capacity for rapid, repeated fetal division.

Diploidization The process of doubling chromosomes of a cell.

Diplonema (adj: diplotene) Stage in prophase of meiosis I following the pachytene stage, but preceding diakinesis, in which one pair of sister chromatids begin to separate from the other pair, i.e., the centromeres begin to disjoin.

Diplophase A phase in the life cycle of an organism in which the cells of the organism have two copies of each gene. When this state exists the organism is said to be diploid (with $2n$ chromosomes).

Diplospory A form of apomixis in which the embryo sac develops from the megaspore.

Diplotene 4th stage of division I of meiosis following pachytene, in which homologous chromosomes forming a bivalent begin to move away from each other. Chiasmata is first seen at this stage.

Dipolar bond unusual form of covalent bond found in trimethylamine N-oxide.

Dipole A molecule having both positive and negative charges.

Diprotic acid An acid having two dissociable protons.

Diphtheroid A term used to describe gram-positive bacilli that morphologically resemble *Corynebacterium diphtheriae*. *C. diphtheriae* and diphtheroids often appear as relatively short rods that tend to form aggregates of cells, sometimes resembling chinese letters or picket fences.

Direct Agglutination (DA) is a general term for techniques which use agglutination (macroscopic clumping) of particulate reagents as an indicator of the presence of an antigen-antibody reaction. Examples: Hemagglutination, Latex Agglutination, and Coagglutination.

Direct contact transmission A method of spreading infection from one host to another through some kind of close association of the hosts. Example chicken pox.

Direct coombs test uses anti-immunoglobulin to agglutinate red blood cells as a way of detecting whether they are coated with antibody *in vivo* due to autoimmunity or maternal anti-fetal immune responses.

Direct embryogenesis Embryoids form directly in culture, without an intervening callus phase, on the surface of zygotic or somatic embryos or on explant tissues (leaf section, root tip, etc.).

Direct Fluorescent Antibody (DFA) is the straightforward detection of antigens using fluorescently labeled antigen-specific antibody. Because detection of the antigen in a substrate of patient sample (cellular smear, fluid or patient-inoculated culture medium) is the goal, DFA is seldom quantitative.

Direct Fluorescent Antibody test A fluorescent-antibody test to detect the presence of an antigen.

Direct microscopic count A method of measuring bacterial growth by counting cells in a known volume of medium that fills a specially calibrated counting chamber on a microscope slide. Enumeration of cells by observation through a microscope.

Direct organogenesis Formation of organs directly on the surface of cultured intact explants. The process does not involve callus formation.

Direct readout The recognition of a DNA sequence by a binding protein that makes contact with the outside of a double helix.

Direct repair A DNA repair system that acts directly on a damaged nucleotide and repairs without cutting the DNA or excising the base.

Direct repeat A nucleotide sequence that is repeated twice or more frequently in a DNA molecule, in the same orientation. Direct repeats may be either adjacent to one another or far apart on the same molecule. For example: TATTA...TATTA, ATAAT...ATAAT.

Direct selection The selection agent or condition permits the survival and proliferation of only the variant cells, e.g., selection of cells for resistance to antibiotics.

Direct smear (stool) Approximately 2-mg suspension of feces in water or saline for the purpose of examination for parasites; primary aim is to see motility.

Direct test Identification of a pathogen.

Direct Transfer Refers to methods of inserting a gene directly into a cell's DNA without the use of a vector. One example of direct transfer is electroporation.

Direct wet mount A preparation from clinical material suspended in sterile saline or other liquid medium on a glass slide and covered with a coverslip; used for microscopic examination to detect microorganisms in clinical material and, in particular, to detect motility directly.

Directed Amplification of Minisatellite-region DNA (DAMD) A technique that uses a single primer containing only the core motif of a minisatellite.

Directed evolution A set of experimental techniques that is used to isolate molecules or to cause mutations in microbes, identify subsequent adaptations to novel environments and to obtain novel genes with improved products.

Directed mutagenesis The process of generation of nucleotide changes in cloned genes by any one of several procedures, including site-specific and random mutagenesis. Also called *in vitro* mutagenesis.

Directed sequencing Successively sequencing DNA from adjacent stretches of chromosome.

Directional cloning The technique by which DNA insert and vector molecules are digested with two different restriction enzymes to create non-complementary sticky ends at either end of each restriction fragment. This allows the insert to be ligated to the vector in a specific orientation and prevents the vector from recircularizing.

Disaccharide (C₁₂H₂₂O₁₁) (*di*G = two + *sakcharon*G = sugar) A carbohydrate consisting of two monosaccharide units that are linked by a covalent bond; for example, sucrose (table sugar) is a disaccharide formed by linking a molecule of glucose to a molecule of fructose. Examples are lactose (galactose β1 → 4 glucose) and sucrose (glucose α1 → β2 fructose).

Disarm To delete from a plasmid or virus genes that are cytotoxic or tumour inducing.

Disarming of Ti plasmid Removal of the genes *iaaM*, *iaaH* and *ipt* from T-DNA of Ti plasmid, since these genes are responsible for the production of tumors in plants by producing auxins and/or cytokinins.

Discontinuous gene A gene that is split into exons and introns.

Discontinuous replication refers to the synthesis of DNA in short (Okazaki) fragments that are later joined into a continuous strand.

Discontinuous variation Phenotypic variation involving distinct classes, such as red versus white, tall versus dwarf. See **continuous variation**.

Discordant Members of a pair showing different, rather than similar, characteristics.

Disease (L. *dis*, a prefix signifying the opposite + M.E. *aise*, comfort) The opposite of ease. Any alteration from the state of metabolism necessary for the normal development and functioning of an organism usually associated with infection by a pathogen or the malfunction or absence of one or more genes.

Disease resistance The ability to remain healthy by resisting disease or the disease agent.

Disease-associated genes Alleles carrying particular DNA sequences associated with the presence of disease.

Disease-free A plant or animal certified through specific tests as being free of specified pathogens. Disease-free should be interpreted to mean "free from any known diseases" as "new" diseases may yet be discovered to be present.

Disease-indexing Disease-indexed organisms have been assayed for the presence of known diseases according to standard testing procedures.

Disequilibrium Unsteady balance.

Disinfectant A chemical that destroys or inhibits growth of microorganisms that causes disease.

Disinfection Killing of infectious agents outside the body by direct exposure to chemical or physical agents so that they do not cause disease. High-level disinfection may kill all microorganisms with the exception of high numbers of bacterial spores; it requires extended exposure to ensure killing of most bacterial spores. It is achieved, after thorough detergent cleaning, by exposure to specific concentrations of certain disinfectants (e.g., 2% glutaraldehyde, 6% stabilized hydrogen peroxide and up to 1% peracetic acid) for at least 20 minutes. Intermediate-level disinfection does not kill spores; it can be achieved by pasteurization (75 deg. C. [167 deg. F.] for 30 minutes) or by appropriate treatment with EPA-approved disinfectants.

Disinfestation The elimination or inhibition of the activity of surface-adhering micro-organisms. Any physical or chemical process serving to destroy or remove undesired small animal forms, particularly arthropods or rodents, present upon the person, the clothing, or in the environment of an individual, or on domestic animals. Disinfestation includes delousing for infestation with *Pediculus humanus*, the human body louse.

Disjunction Separation of homologous chromosomes during anaphase I of meiosis; separation of sister chromatids during anaphase of mitosis and anaphase II of meiosis. As soon as the sister chromatids have separated, they are each called a chromosome.

Disk-diffusion test A method used to determine microbial sensitivity to antimicrobial agents in which antibiotic disks are placed on an inoculated Petri dish, incubated, and observed for inhibition of growth.

Dismutation A reaction in which two identical substrate molecules have different fates; particularly, a reaction in which one of the substrate molecules is oxidized and the other reduced.

Disomy (adj: disomic) The presence of a pair of specific chromosome. This is the normal condition, and abnormal occurrences are monosomy, trisomy and nullisomy (with respectively one chromosome of a pair, three or none). There are also abnormal disomic conditions, such as when both chromosomes of the pair were inherited from the same parent.

Dispense Portion out a nutrient medium into containers, such as test tubes, jars, Erlenmeyer flasks, Petri dishes, etc.

Dispersion forces Weak intermolecular attractive forces that arise between molecules that are close together, because the fluctuation electron distributions of the molecules become synchronized so as

to produce a slight electrostatic attraction. These forces play a role in the internal packing of many biomolecules.

Dispersive replication A hypothetical mode of DNA replication in which both polynucleotides of each daughter double helix are made up partly of parental DNA and partly of newly synthesized DNA.

Displacement replication A mode of replication which involves continuous copying of one strand of the helix, the second strand being displaced and subsequently copied after synthesis of the first daughter strand has been completed.

Displacin A chemical that displaces (removes) gene(s) from a chromosome.

Dissecting microscope A microscope with a low magnifying power of about 50X, used to examine or excise small plant or animal parts.

Dissection (L. *dissectio*, a dissecting or being dissected) Separation of a tissue by cutting for analysis or observation.

Disseminated intravascular coagulation (DIC) A phenomenon which arises due to the depletion of clotting elements in the blood; caused by many disease processes; diffuse, severe hemorrhaging can occur; without treatment, it is often fatal.

Disseminated tuberculosis Type of tuberculosis spread throughout body; now seen in AIDS patients, usually caused by *Mycobacterium avium-intercellulare*.

Dissimilation plasmids Plasmids containing genes coding for the production of the enzymes that catalyze the catabolism of certain unusual sugars and hydrocarbons.

Dissimilation The breakdown of food material to yield energy and building blocks for cellular synthesis.

Dissociation constant (K_d) (1) Measure of the tendency of a complex to dissociate. For components A and B and the binding equilibrium $A + B \rightleftharpoons AB$, the dissociation constant is given by $[A][B]/[AB]$, and the smaller the tighter is the binding between A and B. e.g., dissociation of acetic acid into acetate anion and a proton. (2) The dissociation constant (K_a) of an acid, describing its dissociation into its conjugate base and a proton.

Dissociation Separation of a molecule into two or more stable fragments. Transformation of a compound into positive and negative ions in solution.

Dissolve Pass chemicals into solution.

Distal far from the center or point of attachment.

Distance matrix A table showing the evolutionary distances between all pairs of nucleotide sequences in a dataset.

Distance method A rigorous mathematical approach to alignment of nucleotide sequences.

Distant hybridization Hybridization between individuals belonging to two different species of the same genus or of different genera.

Distillation (L. *distillatio*, a distilling process) The process of heating a mixture to separate the more volatile from the less volatile parts, and then cooling and condensing the resulting vapour so as to produce a more nearly pure or refined substance.

Distilled spirits Alcoholic beverages made by distillation of wine.

Disturbance An event or change in the environment that alters the composition and successional status of a biological community and may deflect succession onto a new trajectory, such as a forest fire or hurricane, glaciation, agriculture, and urbanization.

Disulfide bond (bridge) covalent bond between two sulfur atoms (-S-S-). In proteins disulfide bonds form by oxidation of two thiol (-SH) groups of cysteine residues in the same protein. They stabilize the three-dimensional structure of proteins, and hence the protein's normal function. They form between cysteine residues in the same or different peptide molecules. Found chiefly in extracellular proteins.

Diterpene A compound that consists of four isoprene units linked together; gibberellins are examples of diterpenes.

Ditype In fungi, a tetrad that contains two kinds of meiotic products (spores), e.g., 2AB and 2ab.

Diuresis The increased output of watery urine by the kidneys.

Diurnal Term describing the occurrence of an event at least once every 24 hours.

Divergence is the percent difference in nucleotide sequence between two related DNA sequences or in amino acid sequences between two proteins.

Divergent evolution Process in which descendants of a common ancestor species undergo sufficient change to be identified as separate species.

Divergent transcription refers to the initiation of transcription at two promoters facing in the opposite direction, so that transcription proceeds away in both directions from a central region.

Diversity (1) Refers to the genetic variation that exists within a population (of organisms) in a species. For example, black cattle and white cattle; or both toxic and nontoxic strains/serotypes of *Escherichia coli* bacteria. This diversity is due to one or more single-nucleotide polymorphisms (SNPs) in each individual's genome (DNA) within the population of organisms. (2) The ability of the immune system to produce many different kinds of antibodies and T cell receptors, each of which reacts with a different epitope (antigenic determinant).

Diversity Biotechnology Consortium A nonprofit U.S. organization formed in August of 1994 by a group of research institutions and companies. The consortium's first president was Stuart A. Kauffman of the Santa Fe Institute. The consortium's purpose is to further the use of molecular diversity as a tool in drug design, and in the study of mutating viruses.

Diversity study The use of morphological or molecular markers to assess the diversity of a set of related accessions.

Division A phylum; used in botany and microbiology. In plant taxonomy, a category of taxonomic classification that is narrower in scope than Kingdom or Phylum, but broader than Class. A Division contains one or more Classes within its bounds. Divisions may have Subdivisions defined, which in turn encompass Classes.

Division I of meiosis The first cell division of meiosis, in which the members of each pair of (duplicated) homologous chromosomes are segregated to opposite poles of the dividing cell.

Division II of meiosis The second cell cell division of meiosis, in which the chromatids of each duplicated chromosome are segregated to opposite poles of the dividing cell.

Dizygotic twins Two-egg twins, i.e., a pair of individuals that shared the same uterus at the same time, but which arose from separate and independent fertilization of two ova.

D-loop An intermediate structure formed during the Meselson–Radding model for homologous recombination. Also an intermediate formed during displacement replication.

DNA "dot-blot" Hybridization (DOT-BLOT) is a rapid technique used to detect the presence of a specific DNA in a specimen. Dots or spots of the DNA containing sample are placed onto a nitrocellulose membrane and fixed. This membrane is then hybridized to a radioactively labeled DNA segment of known sequence, specific for the pathogenic DNA being tested. If the pathogenic DNA is present in the specimen, complementary DNA sequences present on the membrane will hybridize, or anneal, producing a doublestranded DNA segment with the radioactive label incorporated into the molecule. The presence of radioactivity is detected by autoradiography.

DNA (Deoxyribonucleic acid). An organic acid and polymer composed of four nitrogenous bases-- adenine (A), guanine (G), cytosine (C), and thymine (T), linked via intervening units of phosphate and the pentose sugar deoxyribose. DNA is the genetic material of most organisms and usually exists as a double-stranded molecule in which two antiparallel strands are held together by hydrogen bonds between adenine-thymine and cytosine-guanine (according to the Watson-Crick rules). Hence a constant width for the double helix of 20 Å (2.0 nm) is maintained. In the B-form, DNA adopts a right-handed helical conformation, with each chain making a complete turn every 34 Å (3.4 nm), or once every ten bases. DNA specifies the inherited instructions of a cell. Because DNA is a very long, thin molecule, it is packaged into units called chromosomes. DNA belongs to a class of biological molecules called nucleic acids.

DNA adenine methylase (Dam) An enzyme involved in methylation of *Escherichia coli* DNA.

DNA affinity Chromatography technique for purifying sequence specific DNA binding proteins by their binding to a matrix to which the appropriate DNA fragments are attached.

DNA Amplification Fingerprinting (DAF) A variant of the RAPD technique that uses shorter, 5–8 bp primers to generate a larger number of fragments.

DNA amplification Multiplication of a piece of DNA in a test-tube into many thousands of millions of copies. The most commonly used process is the polymerase chain reaction (PCR) system, but other systems are being developed, including ligase chain reaction (LCR), nucleic acids sequence-dependent amplification, and the Q-b system.

DNA bank A service that stores DNA extracted from blood samples or other human tissue.

DNA bending A type of conformational change introduced into a DNA molecule by a binding protein.

DNA binding motif The part of a DNA-binding protein that makes contact with the double helix.

DNA bridges Large segments of DNA whose sequence (i.e., composition) is known and mapped in total. Those sequences are then utilized by scientists to piece together (bridging the DNA segments) and assemble a (more) complete map (e.g., of an organism's chromosome or genome).

DNA carrier Substance or particle that can transfer genes into a cell. These include viruses, liposomes (fat globules) and artificial chromosomes (sequences of DNA created in a laboratory) that can transport large amounts of DNA. see vectors.

DNA Chimera One DNA molecule composed of DNA from two different species.

DNA chip Also known as microarray. A high throughput screening technique based on the hybridization between oligonucleotide probes and either DNA or mRNA, carried out on miniaturized reaction surfaces like tiny glass wafer.

DNA cloning It refers to the insertion of a fragment of DNA into a cloning vector and subsequent propagation of the recombinant DNA molecule in a host organism.

DNA constructs A DNA molecule inserted into a cloning vector, usually a plasmid.

DNA cytosine methylase (Dcm) An enzyme involved in methylation of *Escherichia coli* DNA.

DNA delivery system A generic term for any procedure that transports DNA into a recipient cell.

DNA dependent DNA polymerase An enzyme that makes a DNA copy of a DNA template.

DNA dependent kinase This enzyme is part of a complex of proteins that bind to the hairpin ends of double stranded breaks in DNA, and its catalytic subunit is critical for VDJ recombination D.

DNA dependent RNA polymerase An enzyme that makes an RNA copy of a DNA template.

DNA diagnosis The use of DNA polymorphisms to detect the presence of a specific allele (often associated with a disease or syndrome) or DNA sequence.

DNA diagnosis The use of DNA polymorphisms to detect the presence of a disease gene.

DNA excision Process of cutting out damaged DNA prior to repair.

DNA fingerprint The unique pattern of DNA fragments identified originally by Southern hybridization (using a probe that binds to a polymorphic region of DNA) or now by polymerase chain reaction (PCR) (using primers flanking the polymorphic region). The pattern is determined by the number and position of specific repeated sequences. The technique has applications in forensics, paternity testing, anthropology, conservation biology and ecological research. Also known as DNA typing, profiling etc.

DNA footprinting Technique for determining the DNA sequence to which a DNA- binding protein binds.

DNA glycosylase An enzyme that cleaves the β -N-glycosidic bond between a base and the sugar component of a nucleotide as part of the base excision and mismatch repair processes. The name is a misnomer and should be *DNA glycolyase*, but the incorrect usage is now embedded in the literature.

DNA gyrase It is a Type II topoisomerase of *Escherichia coli*, responsible for relaxing the tension on the double helix owing to supercoiled twists brought about by the unwinding of the double helix without rotation; also called helix-unwinding protein.

DNA helicase (gyrase) An enzyme that catalyses the unwinding of the complementary strands of a DNA double helix.

DNA hybridization The pairing of two DNA molecules, often from different sources, by hydrogen bonding between complementary nucleotides. This technique is frequently used to detect the presence of a specific nucleotide sequence in a DNA sample.

DNA library Collection of cloned DNA molecules, representing either an entire genome (genomic library) or DNA copies of the messenger RNA produced by a cell.

DNA ligase An enzyme that covalently bonds the 5'phosphate of one nucleotide with the 3' carbon of another, thereby rejoining cut pieces of DNA. It plays an important role in DNA repair, replication and recombination processes.. DNA ligase is one of the essential tools of recombinant DNA technology, enabling (among other things) the incorporation of foreign DNA into vectors. The ligase enzyme encoded by phage T4 is commonly used in gene-cloning experiments. It requires ATP as a co-factor. T4 is used *in vitro* to join the vector and insert DNAs.

DNA looping The interaction of proteins bound at distant sites on a DNA molecule so that the intervening DNA forms a loop.

DNA marker A DNA sequence that exists as two or more readily distinguished versions and which can therefore be used to mark a map position on a genetic, physical or integrated genome map.

DNA methylation Refers to a DNA molecule that is saturated with methyl groups (i.e., methyl submolecule groups CH_3 have attached themselves to the DNA molecule's "backbone" at all possible locations on that DNA molecule). DNA methylation is used by healthy cells to turn off certain genes when those particular genes are no longer needed (e.g., turn off genes involved in juvenile development after organism reaches adulthood). Extensive methylation of the cytosine base in CG sequences is used in vertebrates to keep genes in an inactive state.

DNA methyltransferase An enzyme that attaches methyl groups to a DNA molecule.

DNA microarray A small glass surface to which an array of DNA fragments is fixed, each with a defined location. When a solution of fluorescently labelled DNA fragments (probes) is hybridized to the chip, spots to which hybridization occurs are visible as fluorescence. Initially developed by Patrick Brown during the 1980s, these microarrays enable analysis of the levels of expression of genes in an organism, or comparison of gene expression levels (e.g., between diseased and nondiseased tissues) via hybridization of messenger RNA (mRNA) to its counterpart DNA sequence, when biological samples containing DNA (e.g., in liquid) are passed over the array surface. To manufacture the DNA microarray, cellular mRNA is used to make segments of complementary DNA (cDNA) in lengths of approximately 500–5000 base pairs long, using the reverse transcriptase polymerase chain reaction (RT-PCR).

DNA mutants of bacteria are temperature sensitive; they cannot synthesize DNA at 42 degrees C, but can do so at 37 degrees C.

DNA only transposon Type of transposable element that exists as DNA throughout its life cycle. Many types move by cut- and -paste transposition.

DNA photolyase A bacterial enzyme involved in photoreactivation repair.

DNA Polymerase An enzyme that catalyzes the synthesis of DNA under the direction of a template DNA strand. The process is accomplished by catalyzing the addition of deoxyribonucleotide residues to the free 3'- hydroxyl end of a DNA chain, starting from a mixture of the appropriate triphosphorylated bases, which are dATP, dGTP, dCTP, and dTTP. DNA is always synthesized in the 5' to 3' direction. This chemical reaction is reversible and, hence, DNA polymerase also functions as an exonuclease.

DNA polymerase I The bacterial enzyme that completes synthesis of Okazaki fragments during genome replication.

DNA polymerase II A bacterial DNA polymerase involved in DNA repair.

DNA polymerase III The main DNA replicating enzyme of bacteria.

DNA polymerase α The enzyme that primes DNA replication in eukaryotes.

DNA polymerase γ The enzyme responsible for replication of the mitochondrial genome.

DNA polymerase δ The main eukaryotic DNA replicating enzyme.

DNA polymorphism The existence of two or more alternative forms (alleles) of a chromosomal locus that differ in nucleotide sequence or have variable numbers of repeated nucleotide units.

DNA polynucleotide formed from covalently linked deoxyribonucleotide units. It serves as the store of hereditary within a cell and the carrier of this information from generation to generation.

DNA primase Enzyme that synthesizes a short strand of RNA on a DNA template, producing a primer for DNA synthesis.

DNA probe Also called gene probe or genetic probe. A labelled (tagged) segment of DNA that is able to detect a specific DNA sequence in a mixture of sequences, after a DNA hybridization reaction. If the tagged sequence is complementary to any one in the mixture, the two sequences will form a double helix. The presence of this (now) "labeled" probe is detected visually or with the aid of another detection instrument. Because the composition of the DNA probes is known, scientists can riffle through a chromosome, spotting segments of DNA (i.e., genes) that seem to be linked to genetic diseases.

DNA Profiling Invented in 1985 by Alec Jeffreys, this technique is used by forensic (i.e., crime-solving) chemists to match biological evidence (e.g., a blood stain) from a crime scene to the person (e.g., the assailant) involved in that particular crime. DNA profiling involves the use of RFLP (restriction fragment length polymorphism) analysis or ASO/PCR (allele-specific oligonucleotide/ polymerase chain reaction) analysis to identify the specific sequence of bases (i.e., nucleotides) in a piece of DNA taken from the biological evidence. Since the specific sequence of bases in DNA molecules is different for each individual (due to DNA polymorphism), a criminal's DNA can be matched to that of the evidence to prove guilt or innocence. Biological evidence may include, among other things, blood, hair, nail fragments, skin, and sperm.

DNA repair A variety of mechanisms that repair errors that occur during DNA replication or accidental changes in the DNA.

DNA repair enzymes Enzymes that catalyse the repair of DNA.

DNA replicase is a DNA synthesizing enzyme required specifically for replication.

DNA replicase system The entire complex of enzymes and specialized proteins required in biological DNA replication.

DNA replication The process whereby DNA makes exact copies itself by the use of existing DNA as a template, under the action of and control of DNA polymerase. In humans and other eukaryotes, replication occurs in the cell nucleus.

DNA sequence The relative order of base pairs, whether in a DNA fragment, gene, chromosome, or an entire genome.

DNA sequencer The machines that are used for the determination of specific sequences of nucleotides in a given DNA molecule.

DNA sequencing Procedures for determining the nucleotide sequence of a DNA fragment. There are two common methods for doing this: (1) the Maxam and Gilbert technique (chemical degradation), that uses different chemicals to break the DNA into fragments at specific bases; or (2) the Sanger technique (called the di-deoxy or chain-terminating method) uses DNA polymerase to make new DNA chains, with di-deoxy nucleotides (chain terminators) to stop the chain randomly as it grows. In both cases, the DNA fragments are separated according to length by polyacrylamide gel electrophoresis, enabling the sequence to be read directly from the gel.

DNA shuffling A PCR-based procedure that results in directed evolution of a DNA sequence.

- DNA supercoiling** Additional twisting of the DNA helix upon itself, that occurs in response to the superhelical tension created when, for example, a circular DNA is partly unwound
- DNA topoisomerase** An enzyme that catalyses the introduction or removal of supercoils in DNA. The enzyme binds to DNA and reversibly breaks a phosphodiester bond in one or both strands, allowing the DNA to rotate at that point. It prevents DNA tangling during replication.
- DNA transposon** A transposon whose transposition mechanism does not involve an RNA intermediate.
- DNA tumor virus** A general term for a variety of different DNA viruses that can cause tumors after infection of an animal cell.
- DNA vaccination** When vaccinating with plasmid DNA, it was seen that an adaptive immune response to the encoded protein occurred, leading to the term **DNA vaccination**. This led to the realization that bacterial DNA, which is loaded with unmethylated CpG dinucleotides, was adjuvant for this type of vaccination.
- DNA vaccine** A gene or DNA sequence, encoding an antigenic protein, incorporated into cells of a target animal.
- DNA Vaccines** Products in which “naked” genes (i.e., pieces of bare DNA) are used to stimulate an immune response (e.g., a cellular immune response, humoral immune response, or otherwise raise antibodies against the pathogen from which the naked genes have arisen or been derived).
- DNA Vector** A vehicle (such as a virus) for transferring genetic information (DNA) from one cell to another.
- DNAa** DNA binding protein that causes the two strands of the double helix to separate in the first stages of DNA replication.
- DNAb** helicase that moves along a DNA strand, breaking hydrogen bonds, and in the process unwinding the helix.
- DNAc** DNA-binding protein that serves to bring DNAb to the DNA strands.
- DNA-RNA Hybrid** A double helix that consists of one chain of DNA hydrogen bonded to a chain of RNA by means of complementary base pairs.
- DNase (deoxyribonuclease)** An endonuclease enzyme family that catalyses the cleavage of DNA into shorter nucleotide fragments. DNase I is a digestive enzyme produced and secreted by the salivary glands, intestines, liver, and pancreas of animals. It has optimal activity (i.e., greatest ability to cut up DNA molecules) at neutral pH (neither acidic nor basic). DNase II has optimal activity between pH 4.6 and 5.5 (i.e., in slightly acidic solutions). Many other endonucleases and exonucleases are involved in DNA repair and replication.
- DNase I hypersensitive site** A short region of eukaryotic DNA that is relatively easily cleaved with deoxyribonuclease I, possibly coinciding with positions where nucleosomes are absent.
- DNases** are enzymes that attack bonds in DNA.
- Dockage** Percent impurity in seed sample.
- Docking groove** is a region near to, but distinct from the active site of a MAP kinase that is involved in binding to a target protein.
- Docking protein (signal recognition particle receptor)** receptor on the endoplasmic reticulum to which the signal recognition particle binds during the process of polypeptide chain synthesis and import into the endoplasmic reticulum.

Docking site (D domain) is a region in a target protein that used by a MAP kinase to bind to it. The docking site has a high concentration of hydrophobic residues separated from two basic residues.

Docking The initial association of a translating ribosome with the translocation channel in the membrane of the ER.

Docosahexanoic acid (DHA) One of the omega-3 (n-3) highly unsaturated fatty acids (HUFA), DHA is important in the development of the human infant's brain, spinal cord, and retina tissues. DHA aids optimal brain and nervous system development in human infants, and is required for optimal brain function throughout life. Naturally present in human breast milk and fish oil. The human body converts linolenic acid (e.g., from consumption of soybean oil) to the two highly unsaturated fatty acids (HUFA) docosahexanoic acid (DHA) and eicosapentanoic acid (EPA). Research indicates that consumption of docosahexanoic acid also helps to reduce the risk of heart disease (by lowering blood pressure) and depression (via its effect in the brain).

Dogma A Belief. The "central dogma" of molecular biology is that "DNA makes RNA makes protein"—the concept that the sequence of bases on DNA defines the sequence of bases on RNA, and the sequence of bases on RNA then defines the sequence of amino acids on protein.

Dolichol It is a lipid that consists of a long chain of isoprenoid units and is present in the membrane of the rough endoplasmic reticulum. It is part of the precursor in the synthesis of N-linked oligosaccharides. An oligosaccharide is assembled onto dolichol via a pyrophosphoryl linkage, and then transferred to particular asparagine residues of a nascent polypeptide. Thus it serves as a carrier of oligosaccharide.

Dolly The [name of the] first mammal to be created by cloning a cell from an adult animal. In this particular case, the cell came from the mammary tissue of an adult ewe. The creation of Dolly showed that the process of differentiation into adult tissue is not, as previously thought, irreversible. The result was achieved by nuclear transfer by Wilmut and Campbell in 1997. Since then, cattle and mice have also been cloned from adult cells.

Domain (1) The highest level of biological classification, superseding kingdoms. The three domains of biological organisms are the Bacteria, the Archaea, and the Eukarya. (2) Domain of a chromosome refer either to a discrete structural entity defined as a region within which supercoiling is independent of other domains, or to an extensive region, including an expressed gene that has heightened sensitivity to degradation by the enzyme DNase I. (3) A region of a protein having a distinct function. The combination of domains in a single protein determines its overall function. In small disulphide-rich and Zn²⁺-binding or Ca²⁺-binding domains the hydrophobic core may be provided by cystines and metal ions, respectively. Large globular proteins often consist of several domains, which are connected to each other by stretches of relatively extended polypeptide.

Domain duplication Duplication of a gene segment coding for a structural domain in the protein product.

Domain organisation Proteins having all the domains as the query in the same order (Additional domains are allowed).

Domain shuffling Rearrangement of segments of one or more genes, each segment coding for a structural domain in the gene product, to create a new gene.

Domestic animal diversity (DAD) The spectrum of genetic differences within each breed, and across all breeds within each domestic animal species, together with the species differences; all of which are available for the sustainable intensification of food and agriculture production.

Domestication syndrome A set of similar traits that confer adaptation to the cultivated environment. Specific traits will vary among different crops.

Domestication The process of bringing a wild species under human management.

Dominance The ability of an allele to express itself in the heterozygous state.

Dominant (1) Describing an allele whose effect with respect to a particular trait is the same in heterozygotes as in homozygotes. The opposite is *recessive*. (2) Describing the most conspicuously abundant and characteristic species of a community. (3) Describing an animal that is allowed priority in access to food, mates, etc., by others of its species because of its success in previous aggressive encounters.

Dominant (-acting) oncogene A gene that stimulates cell proliferation and contributes to oncogenesis when present in a single copy.

Dominant allele Discovered by Gregor Mendel in the 1860s, this gene produces the same phenotype when it is heterozygous as it does when it is homozygous (i.e., trait, or protein, is expressed even if only one copy of the gene is present in the genome).

Dominant gene A gene whose phenotype is when it is present in a single copy.

Dominant marker A genetic marker for which only a single allele is expressed when multiple alleles are occurring in an individual.

Dominant marker selection Selection of cells via a gene encoding a product that enables only the cells that carry the gene to grow under particular conditions. For example, plant and animal cells that express the introduced Neor gene are resistant to the compound G418, while cells that do not carry the Neor gene are killed by G418.

Dominant negative mutation Mutation that dominantly affects the phenotype by means of a defective protein or RNA molecule that interferes with the function of the normal gene product in the same cell.

Dominant selectable marker gene A gene that allows the host cell to survive under conditions where it would otherwise die.

Donor cell A cell that gives DNA to a recipient cell in recombination.

Donor junction The junction between the left 5' end of an exon and the right 3' end of an intron.

Donor plant (mother plant) An explant, graft or cutting used as a source of plant material for micro-propagation purposes.

Donor site The splice site at the 5' end of an intron.

Donor that which gives. (1) In a hydrogen bond, the donor is the atom (oxygen, nitrogen, or sulfur) to which the hydrogen is covalently bonded and that gives up some of its share of electrons to a second electron-grabbing atom. (2) In tissue grafting experiments, the grafted tissues come from a donor and are placed in a recipient or host. (3) In backcross breeding the parent from which one or few genes are transferred to the recurrent parent. It is also called as non-recurrent parent.

Dopamine (C₈H₁₁O₂N) The decarboxylation product of dihydroxyphenylalanine (DOPA).

Dormancy (F. *dormir*, from L. *dormire*, to sleep) An inactive period in the life of an animal or plant during which growth slows or completely ceases. Physiological changes associated with dormancy help the organism survive adverse environmental conditions. Annual plants survive the winter as dormant

seeds, while many perennial plants survive as dormant tubers, rhizomes, or bulbs. Hibernation and aestivation in animals help them survive extremes of cold and heat, respectively.

Dorsal (*dorsum* = the back) (1) In animals, the part that normally occurs uppermost, facing away from the ground. The back of an animal is called the *dorsal surface*. The dorsal side is normally directed upwards (dorsal fin) but backwards in primates in the upright position. (2) In plants, the part situated on the side of an organ that is directed away from the axis, for example, the upper surface of a leaf; opposite of *ventral*.

Dorsal root ganglion Group of nerve cell bodies outside the spinal cord which convey sensory impulses to the brain.

Dorsal-ventral axis is the line running from the back to the belly of an animal or from the upper side to the underside of a structure.

Dosage compensation describes mechanisms employed to compensate for the discrepancy between the presence of two X chromosomes in one sex but only one X chromosome in the other sex.

Dose The known amount of chemical or other treatment received by an organism.

Dot matrix A method for aligning nucleotide sequences.

Dot-blot Technique in which small spots, or dots, of nucleic acid are immobilized on a nitrocellulose or nylon membrane for hybridization.

Double bond A covalent bond sharing two pairs of electrons.

Double cross Cross between two single crosses (i.e., between two F₁'s from two single crosses).

Double crossingover Two simultaneous reciprocal breakage and reunion events between the same two chromatids.

Double fertilization A process, unique to flowering plants, in which two male nuclei, which have travelled down the pollen tube, separately fuse with different female nuclei in the embryo sac. The first male nucleus fuses with the egg cell to form the zygote; the second male nucleus fuses with the two polar nuclei to form a triploid nucleus that develops into the endosperm.

Double Helix The natural coiled conformation of two complementary, antiparallel DNA chains, resembling a spiral staircase in which the paired bases form the steps and the sugar-phosphate backbones form the rails. This structure was first put forward by Watson and Crick in 1953.

Double heterozygote A nucleus that is heterozygous for two genes.

Double homozygote A nucleus that is homozygous for two genes.

Double recessive An organism homozygous for a recessive allele at each of two loci.

Double reciprocal plot A plot of $1/V_0$ versus $1/[S]$, which allows a more accurate determination of V_{max} and K_m , than a plot of V_0 versus $[S]$; also called the Lineweaver-Burk plot.

Double restriction Digestion of DNA with two restriction endonucleases at the same time.

Double strand break (DSB) occurs when both strands of a DNA duplex are cleaved at the same site. Genetic recombination is initiated by double-strand breaks. The cell also has repair systems that act on double-strand breaks created at other times.

Double stranded complementary DNA (dsDNA) A double-strand DNA molecule created from a cDNA template.

Double stranded Comprising two polynucleotides attached to one another by base-pairing.

- Doubled haploid** A plant or line obtained by doubling the chromosome number of a haploid plant/individual.
- Doubled haploid technique** A technique in which homozygous lines are obtained by doubling the chromosome numbers of haploid plants extracted from heterozygous (usually F₁) plants.
- Double-displacement reaction** A reaction in which a substrate binds and a product is released in the first stage, and another substrate binds and another product is released in the second stage.
- Double-minute chromosomes** are extrachromosomal elements formed by amplification of DHFR genes in response to methotrexate treatment. They are large enough to be visible in the light microscope.
- Double-negative thymocytes** are immature T cells within the thymus that lack expression of the two co-receptors, CD4 and CD8. In a normal thymus, these represent about 5% of thymocytes.
- Double-strand break repair** A DNA repair process that mends double-stranded breaks.
- Double-stranded RNA-binding domain (dsRBD)** A common type of RNA-binding domain.
- Doubling time** A term used in tissue culture and shoot propagation for the time necessary to double the number of cells/shoots in vitro.
- Down mutation** in a promoter decreases the rate of transcription.
- Down Promoter Mutations** Those mutations that decrease the frequency of initiation of transcription. Down promoter mutations lead to the production of less mRNA than is the case in the nonmutated state.
- Down Regulating** Phrase referring to regulatory sequences, chemical compounds (e.g., transcription factors), mutations (e.g., down promoter mutations), etc. that cause a given gene to express less of the protein that it normally codes for.
- Down's syndrome** An inherited condition due to an extra chromosome 21, either as a third chromosome 21 or attached to chromosome 13, 14 or 15. Also called trisomy 21, mongolism. The genetic defect is characterized by mental retardation, slanting eyes, a broad, short skull and broad hands with short fingers. Children with Down's syndrome have a 15 fold higher incidence of leukemia than do normal children.
- Downstream** (1) In molecular biology, the stretch of nucleotides of DNA that lie in the 3' direction from the site of initiation of transcription, which is designated as +1 (remembering the convention that the sequence of a DNA molecule is written from the 5' end to the 3' end). Downstream nucleotides are marked with plus signs, e.g., +2, +10. Also, to the 3' side of a particular gene or sequence of nucleotides. When applied to signaling pathways it means in the direction in which the signal travels, for example MAP kinase is downstream of Ras enzyme. (2) In chemical engineering, those phases of a manufacturing process that follow the biotransformation stage. Usually refers to the recovery and purification of the product of a fermentation process.
- Downstream processing** A general term for all the things which happen in a biotechnological process after the biology, be it fermentation of a micro-organism or growth of a plant. It is particularly relevant to fermentation processes, which produce a large quantity of a dilute mixture of substances, products and micro-organisms. These must be separated, and the product must be concentrated and purified, and converted into a form which is useful. See **downstream**.
- DP thymocyte** is a double positive thymocyte. It is an immature T cell that expresses cell surface CD4 and CD8. Selection of DP thymocytes in the thymus yields mature T cells expressing either CD4 or CD8.

DPT vaccine A combined vaccine used to provide active immunity, containing diphtheria and tetanus toxoids and killed *Bordetella pertussis* cells.

Dracunculiasis Skin disease caused by a parasitic helminth, the guinea worm *Dracunculus medinensis*.

Draft sequence The sequence generated by the HGP as of June 2000 that, while incomplete, offers a virtual road map to an estimated 95% of all human genes. Draft sequence data are mostly in the form of 10,000 base pair-sized fragments whose approximate chromosomal locations are known.

Draining lymph node The term is used for any lymph node that is downstream of a site of infection and thus receives antigens and microbes from the site via the lymphatic system. Draining lymph nodes often enlarge enormously during an immune response and can be palpated; they were originally called swollen glands.

DRGs Diagnosis related groups; system introduced to control rising medical cost under which hospitals are reimbursed for costs of caring for patients based on the primary diagnosis of the patients and what is considered to be a fair value for treatment of usual patients with those diagnoses.

Drift Random changes in gene and genotype frequencies in small random mating populations.

Droplet infection The transmission of infection by small liquid droplets carrying microorganisms.

Droplet nucleus A tiny aerosolized particle that, because of its lack of mass, may stay suspended in air for extended periods of time. Microorganisms may remain embedded in it.

Droplet transmission Contact transmission of disease through small liquid droplets.

Drosophila melanogaster Species of small fly, commonly called a fruit fly. It reproduces rapidly, and is commonly utilized in genetics experiments due to its short life cycle (14 days) and simple genome (four chromosome pairs). Because of these factors, a large base of knowledge about *Drosophila* genetics has been accumulated by the world's scientific community. For example, of the nearly 300 "disease-causing" genes in the human genome, more than half have an analogous gene in the *Drosophila* genome. *Drosophila* was one of the first organisms to have its entire genome sequenced by man.

Drug (1) Any substance used as an ingredient in medical preparations. (2) Any substance that affects the normal body functions.

Drug delivery Method by which a therapeutic agent is delivered to its site of action. For traditional therapeutic agents this is another name for *formulation*. However, biotechnology has allowed the development of a range of new therapeutic-agent delivery systems, such as liposomes and other encapsulation techniques, and a range of mechanisms that target a therapeutic agent to a particular cell or tissue.

Drug- drug interactions Increases or decreases in the bioavailability of a drug caused by the metabolic effects of another drug.

Drug Identification Number (DIN) A number issued to a drug indicating that it is authorized for sale in Canada.

Drug resistant factors Bacterial plasmids that carry genes coding for resistance to antibiotics.

Dry anaerobic composting (DRANCO) An anaerobic digesting process for the composting of solid wastes.

Dry weight The moisture-free weight of tissue obtained by drying at high (oven-drying) or low (freeze-drying) temperatures for an interval sufficient to remove all water.

Dual culture A culture made of a plant tissue and one organism (such as a nematode) or an obligate parasite/micro-organism (such as a fungus). Dual culture techniques are used for a variety of purposes, including assessing host-parasite interactions and the production of axenic cultures.

Dual specificity kinase is a protein kinase that can phosphorylate tyrosine or threonine or serine amino acids.

Duodenum The proximal portion of the small intestine (*Strongyloides stercoralis*, *Giardia lamblia*).

Duplex DNA. Double-stranded DNA. Same as double helix.

Duplication The occurrence of a DNA segment more than once in the same chromosome or in a different chromosome.

Durham tube Small tube placed in an inverted position below the surface of growth-supportive broth and filled completely with the broth solution. Gas produced by the organism displaces the broth in the Durham tube, and the resulting gas bubble is visual evidence of gas production.

DUST A program for filtering low complexity regions from nucleic acid sequences.

Dwarfism A form of body malfunction in which the adult individual does not reach the normal height and may sometimes have other abnormalities. Such conditions can be due to a deficiency of *growth hormone (GH)* secreted by the anterior pituitary or to cartilage abnormalities due to genetical defects (*achondroplasia*) as seen in typical circus dwarfs.

Dyad A set of paired chromosomes in eukaryotic cells that are set to divide by mitosis and meiosis.

Dyad symmetry Property of a structure that can be rotated by 180° to produce the same structure.

Dynamic allele-specific hybridization (DASH) A solution hybridization technique used to type single nucleotide polymorphisms.

Dynamic instability (1) The random pattern of growth through monomer addition and regression through monomer removal among a population of polymeric molecules. (2) The property of sudden conversion from phases of growth to phases of shortening and vice versa, in a protein filament such as a microtubule or actin filament.

Dynamin is a cytosolic protein that is a GTPase and is required for clathrin-mediated vesicle formation. Although the exact role of dynamin is debated, dynamin polymers are involved in the scission of clathrin-coated pits from membranes. A variant of dynamin functions in mitochondrial septation.

Dynein Member of a family of large motor proteins that undergo ATP-dependent movement along microtubules. In cilia, dynein forms the side arms in the axoneme that cause adjacent microtubule doublets to slide past one another. Cytoplasmic dynein moves vesicles along microtubules while dynein arms power ciliary and flagellar beating by generating sliding between adjacent outer doublet microtubules.

Dysentery A severe disorder of the ileum and colon caused by the bacterium *Shigella dysenteriae* (and many other species), resulting in inflammation of the intestinal tract, abdominal cramps, diarrhea, and fever. The disease is spread by 'food, feces, fingers and flies', and can be controlled by sanitary precautions.

Dysgonic Growing poorly (bacterial cultures).

Dyspepsia (*dysG* = bad + *peptosG* = cooked) Gastric indigestion (upset stomach) due to alterations of gastric function that are caused by various disorders of the stomach.

Dysplasia A change in cell growth and behavior in a tissue in which the structure becomes disordered.

- Dyspnea** Laboured breathing, with breathlessness. Difficulty in breathing.
- Dysuria** Painful, burning or difficult urination.
- O,*P*'-DDD**. An antitumor agent that is thought to inhibit the production of steroid hormones. It is thus useful in the treatment of adrenal carcinoma.
- 3' end** The end of a nucleic acid that lacks a nucleoside at the 3' position of the terminal residue.
- 3' extension** A short single-stranded nucleotide sequence on the 3'-hydroxyl end of a double-stranded DNA molecule. Also known as 3' protruding end, 3' sticky end and 3' overhang.
- 5' end** The end of a nucleic acid that lacks a nucleotide bound at the 5' position of the terminal residue. A phosphate group is attached to the 5' carbon atom of a sugar (ribose or deoxyribose) of the terminal nucleotide of a nucleic acid molecule.
- 5' extension** A short single-stranded nucleotide sequence on the 5'-hydroxyl end of a double-stranded DNA molecule. Also known as 5' protruding end, 5' sticky end and 5' overhang.
- E site** A position within a bacterial ribosome to which a tRNA moves immediately after deacylation.
- E value** (1) Expectation value. The number of different alignments with scores equivalent to or better than *S* that are expected to occur in a database search by chance. The lower the *E* value, the more significant the score. This represents the number of sequences with a score greater-than, or equal to, *X*, expected absolutely by chance. The *E*-value connects the score ("*X*") of an alignment between a user-supplied sequence and a database sequence, generated by any algorithm, with how many alignments with similar or greater scores that would be expected from a search of a random sequence database of equivalent size. Since version 2.0 *E*-values are calculated using Hidden Markov Models, leading to more accurate estimates than before. (2) The solar energy present on other planets expressed as a percentage of the earth's solar energy.
- E. coli* (*Escherichia coli*)** A bacterium found in the intestinal tracts of most vertebrates. It is used extensively in recombinant DNA research because it has been genetically well characterized.
- E0 values** A numerical series indicative of the redox potential of molecules; protons are accepted by a molecule from any other molecule with a more positive E0 value.
- E2F-1** Transcription factor required for DNA synthesis. In quiescent cells E2F-1 is prevented from activating transcription by being bound to RB, the product of the retinoblastoma gene. E2F-1 is released when RB is phosphorylated by CDK4.
- Early development** The period of a phage infection before the start of DNA replication.
- Early endosome** It is the part of the endosomal compartment in which endocytosed molecules appear after a minute or so. Early endosomes are located near the plasma membrane, function in sorting of endocytosed molecules, and have a pH of about 6.
- Early genes** The genes are transcribed relatively early before the replication of phage DNA. They code for regulators and other proteins needed for later stages of infection.
- Early induced responses** The early induced responses or early non adaptive responses are a series of host defense responses that are triggered by infectious agents early in infection. They are distinct from innate immunity because there is an inductive phase, and from adaptive immunity in that they do not operate by clonal selection of rare antigen-specific lymphocytes.
- Early infection** It is the part of the phage lytic cycle between entry and replication of the phage DNA. During this time, the phage synthesizes the enzymes needed to replicate its DNA.

Early testing In self-pollinated crops, evaluation of the performance of early segregating generations (usually, F₂ or F₃ bulk) or F₃/F₄ individual plant progenies in order to assess the worth of purelines that would be isolated from them; in cross-pollinated crops, the estimation of general combining ability or specific combining ability of plants/progenies early in the process of inbreeding.

Early vs. late genes Those genes transcribed early in a bacteriophage-mediated infection process as compared to those genes transcribed some time later. May require different “ ρ factors” (sigma) for recognition of promoters.

Early vs. late proteins During viral infection, viral-specific proteins are synthesized at characteristic times after infection. They are called “early” and “late.” It is often under positive control of bacterial and viral sigma factors.

Earthworms (*Eisenia foetida*) These worms live in the soil and consume up to ten tons of organic matter (old crop plant stalks, husks, etc.) per acre (approximately 0.4 hectare) per year. In so doing, earthworms make the soil more fertile, since the process breaks down that organic matter into soil (when excreted by those earthworms). Earthworm tunnels also help aerate soil, which encourages healthy plant root systems.

Eastern equine encephalitis Type of viral encephalitis; infects horses more frequently than humans.

Ebola virus A filovirus that causes hemorrhagic fevers.

EC classification The Enzyme Commission’s system for classifying and numbering enzymes according to the type of reaction catalysed.

Ecdysis (ekdysisG = stripping off) The shedding of the outer covering or skin of certain animals, especially the shedding of the exoskeleton by arthropods, usually in the preadult stage. Also called as moulting.

Ecdysone A hormone secreted by the prothoracic gland of insects which brings about the moulting of the cuticle and subsequent growth (ecdysis). The steroid hormone in insects raises the metabolic rate and increases the buildup of proteins from amino acids in growing tissue. It is also called as moulting hormone as it stimulates the molting process in insects. It can also induce chromosomal puffing.

ECG Electrocardiogram. It is an instrument for recording of the electrical events of the heart (i.e. electrocardiograph).

Echinulate Surface covered with spines.

Eclectic species concept A philosophy that species are defined and formed and maintained by a variety of morphological, interbreeding, ecological, and phylogenetic factors.

Eclipse period The time during which viruses have absorbed to and penetrated the host cells but cannot yet be detected in cells.

Ecdiosis (1) Emergence of an adult insect from the pupal stage. (2) Beginning of germination of fungal spores.

Ecocentrism A view that considers the whole environment or ecosphere as important and deserving of consideration, without giving preference to organisms such as animals and humans. It states that all elements of the environment have worth and should be valued and cared for.

Ecological farming A farming system that aims to develop an integrated, humane, environmentally and economically sustainable agricultural production system.

Ecological species concept A philosophy that ecological constraints are the primary factor in forming and maintaining a species.

Ecology The study of the interactions between organisms and their natural environment, both living and non-living.

Economic trait locus (ETL) A locus influencing a trait that contributes to income. The plural form (economic trait loci) is also abbreviated as ETL.

Ecosystem A discrete unit, or community of organisms and their physical environment (living and non-living parts), that interact to form a stable system.

Ectotype A population or a strain of an organism that is adapted to a particular habitat.

Ectoderm Embryonic tissue that is the precursor of the epidermis and nervous system.

Ectodermal adult stem cells Certain stem cells present within (adult) bodies of organisms, that can be differentiated (via chemical signals) to give rise to cells of skin, hair, tooth enamel, mucous membranes, and some glandular tissues.

Ectoparasite Organism that lives on or within skin surface of another organism.

Ectoplasm Viscous, gel-like outer layer of cytoplasm of a cell.

Ectothrix Outside of hair shafts.

Eczema An itchy, scaly, blistery, or raised rash often seen in children and associated with irritation of the skin.

Edema A swelling of the body tissues caused by the capillary blood vessels passing out water into the surrounding tissues, and so increasing the intercellular fluid content; also spelt as oedema. It is one of the cardinal features of the process of inflammation.

Edible vaccines Edible substances, bearing antigens, that cause activation of an animal's immune system via that animal's GALT (gut-associated lymphoid tissues). These "edible vaccines" are derived from transgenic plants (grains, tubers, fruits, etc.) and are called as plantigens. They can also be derived from eggs (i.e., via the activation of the hen's immune system to cause that hen to secrete desired molecule(s) into the eggs it lays).

Edman degradation A systematic method of sequencing proteins, proceeding by stepwise removal of single amino acids from the amino terminus of a polypeptide chain.

EDTA Ethylene-diamine tetra-acetic acid. It is a chelating agent.

EF hand A widespread helix-loop-helix structural motif that forms a Ca²⁺-binding site.

Effective stroke Part of the beat cycle of a cilium that pushes on the extracellular medium.

Effector (1) A class of (usually small) molecules that regulates the activity of a specific protein (e.g., enzyme) molecule by binding to a specific site on the protein. Control of (existing) enzyme molecules may be achieved by combination of the effector with the enzyme. The effector molecule may either physically block the active site on the enzyme molecule, or alter the three-dimensional conformation of the enzyme molecule. That conformation change results in a change in the enzyme's catalytic activity. Effector is a general term. Effector molecules may be activators (cause an increase in the enzyme's catalytic activity) or inhibitors (cause a decrease in the enzyme's catalytic activity). A special class of effector, known as an allosteric effector, binds to the enzyme molecule at a site other than the enzyme's active site (thereby activating or inhibiting). (2) A structure or organ,

such as a muscle, that brings about an action as a result of a stimulus received through a receptor which can come from the central nervous system or from a hormone.

Effector caspase Caspase that digests cellular components in the process of apoptosis. Effector caspases are differentiated from caspases 8 and 9, which do not themselves digest cellular components but which activate effector caspases by hydrolyzing particular peptide bonds in them.

Effector cell A cell that carries out the final response or function of a particular process. The main effector cells of the immune system, for example, are activated lymphocytes and phagocytes - the cells involved in destroying pathogens, tumor cells or other cells and removing them from the body. Hence they are responsible for cell-mediated cytotoxicity.

Effector lymphocytes can mediate the removal of pathogens from the body without the need for further differentiation, as distinct from naive lymphocytes, which must proliferate and differentiate before they can mediate effector functions, and memory cells, which must differentiate and often proliferate before they become effector cells. They are also called armed effector cells, to indicate that they can be triggered to effector function by antigen binding alone.

Effector mechanisms are those processes by which pathogens are destroyed and cleared from the body. Innate and adaptive immune responses use most of the same effector mechanisms to eliminate pathogens.

Effector molecule A molecule that influences the behaviour of a regulatory molecule, such as a repressor protein, thereby influencing gene expression.

Effector site is the site that is bound by a small molecule on an allosteric protein. The result of binding is to change the activity of the active site, which is located elsewhere on the protein.

Efferent lymphatic vessel Lymphocytes leave a lymph node through the efferent lymphatic vessel.

Effervescence The property of producing large numbers of bubbles those rise to the surface with a fizzing sound, such as in beer or soda pop.

Effusion Fluid escaping into a body space or tissue.

EF-G is an elongation factor needed for the translocation stage of bacterial protein synthesis.

Egestion The evacuation of feces or unused food substances from the body.

EGF Receptor A protein embedded in the surface of the membranes of skin cells. The receptor consists of (1) an outside (of the cell membrane) enzyme that recognizes epidermal growth factor (EGF) and binds to it, and (2) an enzyme on the inside of the cell membrane, which is of the tyrosine kinase class. When free EGF comes in contact with an EGF receptor, they bind (in a lock-and-key fashion) and then enter the cell together (through the cell membrane). There EGF stimulates growth or division of the cell via ras protein and ras gene). The EGF receptor (and receptors in general) is like a facilitator who allows the EGF (a guest) to enter the cell (home).

Egg (1) The fertilized ovum (zygote) in egg-laying animals after it emerges from the body. (2). The mature female reproductive cell in sexually reproducing animals and plants i.e., Haploid female gamete in the ovule.

Egg yolk agar (EYA) This medium is used to detect the presence of enzymes including lecithinase, lipase, and protease.

Eicosanoid (1) Any fatty acid with 20 carbons. (2) A group of chemical compounds which the human body synthesizes (manufactures) from arachidonic acid, docosahexanoic acid, and other starting materials. For example, the COX-1 enzyme converts arachidonic acid to constitutive prostaglandins,

and the COX-2 enzyme converts arachidonic acid to inducible prostaglandins. One subgroup of eicosanoids is that of the prostaglandins (cyclic fatty acids that act as hormones in the body). Some others are prostacyclins, thromboxanes, leukotrienes and lipoxins.

Eicosapentanoic Acid (EPA) One of the omega-3 (n-3) polyunsaturated fatty acids (PUFA), EPA is important for the development of the human brain, retina tissue, prevention of high blood pressure, coronary heart disease (CHD), and some cancers. The human body converts linolenic acid (e.g., from consumption of soybean oil) to the two highly unsaturated fatty acids (HUFA) eicosapentanoic acid (EPA) and docosahexanoic acid (DHA).

ELAM-1 Also known as E-selectin, it is a selectin molecule that is synthesized by endothelial cells after (adjacent) tissue is infected. ELAM-1 molecules then help leukocytes leave the bloodstream to fight the infection.

Elastase An enzyme secreted by neutrophils (white blood cells that engulf pathogens) which catalyzes the cleavage (breakdown) of specific proteins that function to provide elasticity to certain tissues. May be indirectly responsible for some autoimmune diseases, such as arthritis (which results from breakdown of cartilage tissue). Elastase may also be indirectly responsible for the emphysema (caused by loss of lung elasticity) that results from prolonged smoke inhalation. When α -1 antitrypsin (anti-elastase) efficacy is reduced (via smoke), the now-unrestrained excess elastase destroys alveolar walls in the lungs by digesting elastic fibers and other connective tissue proteins.

Elastin A fibrous hydrophobic protein that is the major constituent of the yellow elastic fibres of connective tissue. It gives tissues their stretchability and resilience.

Electrical gradient It is a change in the amount of charge from one point to another.

Electrically excitable Able to produce action potentials. Shows a depolarizing response to an applied stimulus.

Electro-blotting The electrophoretic transfer of macromolecules (DNA, RNA or protein) from a gel, in which they have been separated, to a support matrix, such as a nitrocellulose sheet. A transfer usually used in techniques such as southern and northern blotting.

Electrochemical cell A device in which two half reactions occur in separate compartments linked by a wire for transporting electrons and a salt bridge for maintaining electrical neutrality; the simultaneous activity of the half- reaction forms a complete oxidation-reduction reaction.

Electrochemical gradient Driving force that causes an ion to move across a membrane due to the combined influence of a difference in its concentration on the two sides of the membrane and the electrical charge difference across the membrane. Thus the term indicates that there is a change in the concentration of both electrical charge and of a chemical species. It produces a driving force that causes the ion to move across the membrane. The driving force for oxidative phosphorylation and photophosphorylation.

Electrochemical potential The energy required to maintain a separation of charge and of concentration across a membrane. It is the partial molar free energy of a substance (chemical potential) in the presence of an electrical potential.

Electrochemical proton gradient The result of a combined pH gradient (proton gradient) and the membrane potential.

Electrochemical sensor Type of biosensor in which a biological process is harnessed to an electrical sensor system, such as an enzyme electrode. Other types couple a biological event to an electrical one via a range of mechanisms, such as those based on oxygen and pH.

Electrogenic Contributing to an electrical potential across a membrane.

Electrogenic transport The transmembrane movement of a charged substance in a way that generates a charge difference across the membrane.

Electrolyte Any compound (salt, acid, base, etc.) which in aqueous solution dissociates into ions (charged atom-sized particles). Electrolytes may either be strong (completely or nearly completely dissociated) or weak (only partially dissociated), capable of transmitting electric current in solution.

Electromagnetic radiation Electromagnetic waves, including ultraviolet (UV), X-rays, and gamma radiation (γ rays). Electromagnetic radiation is used to produce mutant cells or organisms. In the case of UV, disinfection and sterilization, in tissue culture.

Electromagnetic spectrum The entire range of wavelengths of electromagnetic radiation, most of which are not detectable by the human eye except in the visible spectrum from about 400– 700 nm wavelength. Wavelengths shorter than the visible spectrum contain large quantities of energy which can be harmful to the living beings.

Electromyography Test used to represent electrical currents associated with muscles.

Electron A negatively charged particle in motion around the nucleus of an atom. The negative charge of one electron exactly balances the positive charge of one proton.

Electron acceptor An atom or molecule that receives electrons readily from another atom (and thereby becoming reduced) in an oxidation-reduction reaction. An electron acceptor is an oxidant.

Electron carrier A protein, such as flavoprotein or a cytochrome, that can gain and lose electrons reversibly and function in the transfer of electrons from one donor molecule to an acceptor molecule until the electron is taken up by a final molecule or atom such as oxygen.

Electron crystallography A technique for determining molecular structure, in which the electron beam of an electron microscope is used to elicit diffraction from a two-dimensional crystal of the molecules of interest.

Electron density The arrangement of electrons that give rise to a diffraction pattern in X-ray crystallography.

Electron donor A molecule that readily gives up electrons to another atom (and thereby becoming oxidized) in an oxidation-reduction reaction. An electron donor is a reductant.

Electron gun Source of electrons in electron microscopes.

Electron microscope (EM) An instrument that uses a focused beam of electrons to magnify images of specimens. The technique is used for greatly magnifying and visualizing very small entities such as viruses and even large molecules. The technique uses beams of electrons instead of light rays. The photograph of an image taken with an EM is called electron micrograph.

Electron shells Regions of an atom corresponding to different energy levels.

Electron spin resonance (also called electron paramagnetic resonance, or EPR) A form of spectroscopy that is sensitive to the environment of unpaired electrons in a sample.

Electron transfer Movement of electrons from substrates to oxygen via the carriers of the respiratory (electron transfer) chain.

Electron transport chain A series of electron acceptor/donor molecules that transfer electrons from one compound to another, generating ATP by oxidative phosphorylation. They transport electrons from the reduced carriers NADH and FADH_2 (thus reoxidizing them) to oxygen. The entire complex forms

a carrier that uses the energy of NADH and FADH₂ oxidation to transport hydrogen ions up their electrochemical gradient out of the mitochondrion. The energy released during electron movement can be used to power various processes. Electron-transport chains present in the inner mitochondrial membrane and in the thylakoid membrane of chloroplasts generate a proton gradient across the membrane that is used to drive ATP synthesis.

Electron transport system (ETS) A collective term describing a sequence of membrane-associated electron carriers, generated by the citric acid cycle, that use the energy from electron flow to transport protons against a concentration gradient across the inner mitochondrial membrane.

Electronic configuration The arrangement of electrons in shells or energy levels in an atom.

Electron-transport phosphorylation Synthesis of ATP involving a membrane-associated electron transport chain and the creation of a proton-motive force. Also called oxidative phosphorylation.

Electrophile An electron-deficient group with a strong tendency to accept electrons from an electron-rich group (nucleophile). Typical electrophilic centers include carbonium ions, free radicals, epoxides and some metal cations. Electrophilic centers are believed to be reactive sites of most, if not all, chemical *carcinogens*.

Electrophoresis A technique for separating charged molecules - such as DNA, RNA or protein - based on the differential movement of charged particles through an appropriate matrix (such as agarose gel or polyacrylamide gel) when subjected to an electric field. When a current is applied, the molecules will travel through the supporting matrix from one end to the other end at different speeds depending on their charge and size. Smaller molecules with a more negative charge will travel faster and further through the gel toward the anode of an electrophoretic cell. They may be visualized by staining and quantitated. Electrophoresis is also used to study bacteria and viruses, nucleic acids, and some types of molecules, including amino acids.

Electroporation (1) An electrical treatment of cells that induces "micropores" (tiny holes) in the surface of cells or protoplasts suspended in a solution (water), through which DNA can enter the cell. (2) The introduction of DNA or RNA into protoplasts or other cells by the momentary disruption of the cell membrane through exposure to an intense electric field. Note: Although the precise mechanism of electroporation is poorly understood, pores are thought to form by the local polarization of the cell membrane when it is exposed to a high electric potential. These openings persist for a variable amount of time, depending upon the temperature at which the cell is treated. Macro-molecules, such as DNA or RNA, enter through these openings either through diffusion or through electrophoretic movement. The membrane openings then re-seal, capturing introduced DNA and preventing escape of the cell contents. The process is utilized to introduce a foreign gene into the genome of an organism. In 1995, the U.S. company Dekalb Genetics Corp. received a patent for producing genetically engineered corn via introduction of a foreign gene into corn cells via electroporation.

Electrostatic catalysis A catalytic mechanism in which the distribution of charges about the catalytic site lowers the free energy of a reaction's transition state.

Electrostatic interactions Ionic bonds that form between oppositely charged chemical groups or ions.

Element A chemical substance that cannot be separated into different substances by ordinary chemical methods; comprises atoms of a single kind.

Elementary body An infectious form of *Chlamydia* or a cellular inclusion body of a viral disease.

Elementary reaction A simple one-step chemical process, several of which may occur in sequence in a chemical reaction.

Elephantiasis Condition caused by inflammation and obstruction of the lymphatic system, resulting in hypertrophy and thickening of the surrounding tissues usually involving the extremities and external genitalia (often as a result of filariasis). Caused by the helminth *Wuchereria bancrofti*.

Elicitors The compounds of biological origin that stimulate the production of secondary metabolites.

ELISA (enzyme-linked immunosorbent assay) A sensitive technique for accurately determining specific molecules in a mixed sample. The amount of protein or other antigen in a given sample is determined by means of an enzyme-catalysed colour change, avoiding both the hazards and expense of radioactive techniques. An antibody (primary) specific to the test protein is adsorbed onto a solid substrate, and a known amount of the sample is added; all molecules of the test protein in the sample are bound by the antibody. A second antibody specific for a second site on the test protein is added; this is conjugated with an enzyme, which catalyses a colour change a fourth reagent. The colour change is measured photometrically and compared against a standard curve to give the concentration of protein in the sample. ELISA is widely used for diagnostic and other purposes. It can readily measure less than a nanogram (10^{-9} g) of a protein. This assay is more sensitive than simple immunoassay (tests).

ELISPOT assay is an adaptation of ELISA in which cells are placed over antibodies or antigens attached to a plastic surface. The antigen or antibody traps the cells' secreted products, which can then be detected using an enzyme-coupled antibody that cleaves a colorless substrate to make a localized colored spot.

Elite Germplasm Refers to germplasm that is adapted (selectively bred) and optimized to new surroundings (i.e., environment). For example, corn/maize (*Zea mays* L.), which is native to Mexico, has been adapted and optimized to grow in field conditions in many of the world's countries.

Ellagic Acid A naturally occurring plant phenol (phytochemical) that, when consumed by humans, has been shown to help inhibit some cancers. Ellagic acid is naturally present in strawberries, the pomegranate (*Punica granatum*), etc.

Elongase An enzyme that adds acetyl units to a fatty acid previously synthesized by fatty acid synthase.

Elongation factors (EF in prokaryotes, eEF in eukaryotes) are Specific nonribosomal proteins that associate with ribosomes cyclically, during addition of each amino acid to the polypeptide chain. Elongation factor G (EF-G) brings about the movement of the peptidyl tRNA from the A site to the P site of the ribosome. Elongation factor tu (EF-tu) is a GTPase.

Elongation is the stage in a macromolecular synthesis reaction (replication, transcription, or translation) when the nucleotide or polypeptide chain is being extended by the addition of individual subunits.

Elongator A yeast protein, possibly with histone acetyltransferase activity, involved in the elongation phase of transcription.

ELSI The ethical, legal, and social implications that arise as a result of developments in genetic engineering or biotechnology.

Eluant the solution used to wash a chromatographic column.

Eluate The fluid or the effluent that has passed through (eluted from) a chromatographic column.

Elution Process of extraction of a molecule that has bound to a chromatographic matrix, by means of a solvent.

EMAS Eco-Management and Audit Scheme.

Emasculation Removal of immature anthers (or androecium) from a hermaphrodite flower.

EMB Eosin-methylene blue (agar plate).

Embden-Meyerhof-Parnas pathway (Embden-Meyerhof pathway; EMP pathway) A pathway that degrades glucose to pyruvate; the six-carbon stage converts glucose to fructose-1,6-bisphosphate, and the three-carbon stage produces ATP while changing glyceraldehyde-3-phosphate to pyruvate.

Embryo (Gr. *en*, in + *bryein*, to swell) Earliest multicellular stage in the development of an organism from a fertilized ovule. Formed from the zygote by cell division. In mammals, this occurs in the first months in the uterus. In plants, it is the structure that develops in the megagametophyte, as a result of the fertilization of an egg cell, or without fertilization. In aseptic cultures, adventitious embryos show polarization, followed by the growth of a shoot from one end and a root from the other end. In the *Assisted Human Reproduction Act* it is defined as a human organism during the first 56 days of its development following fertilization or creation, excluding any time during which its development has been suspended. It includes any cell derived from such an organism that is used for the purpose of creating a human being.

Embryo cloning The creation of identical copies of an embryo by embryo splitting or by nuclear transfer from undifferentiated embryonic cells.

Embryo culture The *in vitro* culture of zygotic mature or immature embryos on nutrient media.

Embryo multiplication and transfer (EMT) The cloning of animal embryos and their subsequent transfer to recipients (via artificial embryonation). The cloned embryos can be clones of an embryo or of an adult.

Embryo Rescue Refers to the tissue culture techniques/technologies utilized to enable the fertilized embryo resulting from a "wide cross" (between two sexually incompatible plant species) to grow and mature into a seed producing plant that would otherwise be lost due to endosperm abortion during early stage of embryo development.

Embryo sac A large thin-walled space within the ovule of the seed plant in which the egg and, after fertilization, the embryo develop; the mature female gametophyte in angiosperms. Generally it is a seven-celled structure. The seven cells are two synergids, one egg cell, three antipodal cells (each with a single haploid nucleus) and one endosperm mother cell with two haploid nuclei. Also known as megagametophyte.

Embryo sexing The determination of the sex of an embryo, typically by means of PCR involving amplification from a small sample of embryonic tissue, using primers specific for a locus on the Y chromosome.

Embryo splitting The splitting of young embryos into several sections, each of which develops into an animal. A form of animal cloning, i.e., of producing animals that are genetically identical. In practice, the number of identical (identical organisms) that can be produced from a single embryo is less than 10.

Embryo technology Generic name for any modification of mammalian embryos. It encompasses embryo cloning, embryo splitting, *in vitro* fertilization, and embryo storage.

Embryo transfer (ET) The process of implantation of embryos from a donor animal, or developed by *in vitro* fertilization into the uterus of a recipient animal.

Embryogenesis (1) Development of an embryo from a fertilized egg, or zygote. (2) *In vitro* formation of plants from plant tissues, through a pathway closely resembling normal embryogeny from the zygote; if this development in culture involves somatic cells and not the zygote, it can be indicated by using the term *adventitious embryogenesis* or *somatic embryogenesis*. The generation of embryos has two stages: initiation and maturation. Initiation needs a high level of the group of plant hormones called auxins; maturation needs a lower level. Other chemicals have to be at suitable levels. The procedure involves the explanting of a piece of plant tissue and putting it on a high-auxin medium, where the cells grow into a mass of callus. This is then transferred to a maturation medium, where the callus starts to initialize organs, ultimately growing a root and a shoot.

Embryoid An embryo-like body comparable to zygotic embryo developing *in vitro*. It forms a complete, self-contained platelet with no vascular connection with the callus. In plant tissue culture embryoid is produced by dividing somatic cells as a consequence of differentiation process like embryogenesis and organogenesis.

Embryology The study of the early stages in the development of an organism. In these stages a single highly specialized cell, the egg, is transformed into a complex many celled organism resembling its parents.

Embryonic stem (ES) cells Cell lines derived from early embryos that have the potential to differentiate into all types of somatic cells as well as to form germ line cells, and hence whole animals, when injected into early embryos. It can be grown in culture, genetically modified and inserted into a blastocyst to develop a transgenic animal. Researchers are looking at the great potential stem cells have in developing new treatments for disease and injury. ES cells can be genetically manipulated in tissue culture and then inserted into mouse blastocysts to generate mutant lines of mice; most often, genes are deleted in ES cells by homologous recombination and the mutant ES cells are then used to generate gene knockout mice. They have also been used to clone sheep, and could soon be used to replace body parts in humans.

Emendation The correction of a previously published misspelt scientific name.

Emerging virus Viruses that were previously endemic (low levels of infection in localized areas) or had "cross species barriers" and expanded their host range to other species.

Emesis Vomiting.

Emetic Inducing vomiting.

EMIT Enzyme-multiplied Immunoassay.

Empysema The pulmonary disorder involving over distention and destruction of the air spaces in the lungs.

Empirical Relating to or based upon practical experience, trial and error, direct observation or observation alone, without benefit of scientific method, knowledge or theory.

Empyema Accumulation of pus in a body cavity, particularly empyema of the thorax or chest.

Emulsification The process of mixing two liquids, which do not dissolve in each other.

Emulsion A stable dispersion of one liquid in a second, immiscible (i.e., nonmixable) liquid. For example, milk is an emulsion of oil (fat) in water, and latex paint is an emulsion of paint resin in water. Certain ingredients (e.g., β -conglycinin protein) help enable a greater content of the first liquid to be dispersed in the second liquid. Certain ingredients (e.g., β -conglycinin protein) make a given

emulsion more stable (i.e., prevent the two liquids from separating over an extended period of time).

Enamel The hard substance covering the crown of a tooth.

Enanthema A mucous membrane eruption; typically occurs in relation to the skin eruptions that are symptoms of acute viral or coccal disease.

Enantiomers From the Greek word enantios, this means opposite. Enantiomers are a pair of nonidentical, nonsuperimposable mirror-image molecules. This means that molecules are made up of the same atoms, i.e., they have the same molecular formula, but the constituent groups that are attached to a carbon atom can be arranged in two different ways (forms) around the carbon atom. This gives rise to an asymmetric molecule that can exist in either of two mirror-image forms whose mirror images are not superimposable. A pair of these molecules is known as enantiomers. The four attached groups are all different from each other. The enantiomers of a compound rotate polarized light in opposite direction, hence also called as optical isomers.

Enantiomorphs Isomers that are mirror images of one another.

Enantiopure Refers to a compound (e.g., a pharmaceutical) that consists of only one of that compound's two possible enantiomers. Sometimes expressed in relative terms. For example, 98% enantiopure would refer to a compound that consists of 98% (of) desired enantiomer.

Encapsidation The process by which a virus' nucleic acid is enclosed in a capsid. See **capsid, coat protein**.

Encapsulated bacteria These bacteria have thick carbohydrate coats that protect them from phagocytosis. Encapsulated bacteria can cause extracellular infections and are effectively engulfed and destroyed by phagocytes only if they are first coated with antibody and complement produced in an adaptive immune response.

Encapsulating agents Anything which forms a shell around an enzyme or bacterium, although the agents used are usually polysaccharides such as alginate or agar. The agents are inert and allow nutrients and oxygen to diffuse into and out of the sphere readily, and are easy to convert from gel (solid) to sol (liquid) or solution form by altering the temperature or the concentration of ions.

Encapsulation (1) Any method of getting something, usually an enzyme or bacterium, into a small package or capsule while it is still working or alive. It is a method for immobilizing cells for use in a bioreactor. (2) Active process of walling off a parasite by the host through the formation of a connective tissue capsule (trichinosis).

Encephalitis (enkephalosG = brain, from en = in + kephale = head + -itis = inflammation) Inflammation of the brain.

Encode To specify, after decoding by transcription and translation, the sequence of amino acids in a protein.

Encystment Formation of a cyst i.e resistant external wall by protozoa to enable them to survive drying and adverse environmental conditions; encysted forms are infective to humans.

End labeling It describes the addition of a radioactively labeled group to one end (5' or 3') of a DNA strand or RNA molecule. A commonly used method is to use T4 polynucleotide kinase to introduce a ³²P atom onto the end of a DNA molecule.

End modification The chemical alteration of the end of a DNA or RNA molecule.

End product inhibition Describes the ability of a product of a metabolic pathway to inhibit the activity of an enzyme that catalyzes an early step in the pathway.

Endangered A species with such a low population number that it is in danger of extinction.

Endangered species A plant or animal species in immediate danger of extinction because its population numbers have reached a critical level or its habitats have been drastically reduced.

Endemic Found only in a limited region. Native to a particular continent, country, or geographic area. Noun, **endemism** -- the characteristic of occurring naturally only in a limited geographic area. (1) Describing a plant or animal species or taxonomic group whose distribution is restricted to one or a few localities because of such factors as isolation or response to soil or climatic conditions; this species is said to be endemic to the place. (2) The constant presence of a disease or infectious agent within a given geographic area; it may also refer to the usual prevalence of a given disease within such area. Hyperendemic expresses a constant presence at a high level of incidence, and holoendemic a high level of prevalence with infections beginning early in life and affecting most of the population, e.g., malaria in some places.

Endergonic reaction (endonG = within + ergonG = work) A chemical reaction that requires an input of energy before it can proceed (that is, for which ΔG is positive); endergonic reactions never occur spontaneously.

End-modification enzyme An enzyme used in recombinant DNA technology that alters the chemical structure at the end of a DNA molecule.

Endocarditis Inflammation of the lining of the heart (endocardium), usually involving leaflets of the heart valves where destruction of valves or distortion of them by formation of vegetations may lead to serious physiological disturbances and death; also, an inflammation of the endocardial surface (much less common).

Endocrine cell Specialized animal cell of endocrine gland that secretes a hormone into the blood. Usually part of a gland, such as the thyroid or pituitary gland.

Endocrine gland (endonG = within + krineinG = to separate or distinguish) Any gland in an animal that manufactures hormones and secretes them directly into the bloodstream to act at distant sites in the body, known as target organs or cells. For example, adrenalin, produced in the adrenal glands, is carried to the heart (and other muscles) when needed during periods of stress. The endocrine glands are: the pituitary, thyroid, adrenals, pancreas, ovaries (in females), and testes (in males). Endocrine glands are found in some invertebrates as well as in vertebrates.

Endocrine hormones The products secreted by the endocrine glands. These help control long-term bodily processes, such as growth, lactation, sex cycles, and metabolic adjustment. The endocrine system and the nervous system are interdependent and often referred to collectively as the neuroendocrine system. For example, the juvenile hormone, found in insects and annelids, affects sexual maturation. There is currently great interest among scientists in the potential use of such hormones in the control of destructive insects.

Endocrine interference Interference with the normal balance hormones.

Endocrinology The branch of science that studies the endocrine glands, hormones, and hormone-like substances.

Endocytic exocytic cycle The processes of endocytosis and exocytosis that, respectively, add and remove plasma membrane from the cell, resulting in no overall change in the cells surface area and volume.

Endocytic vesicles are membranous particles that transport proteins through endocytosis; also known as clathrin-coated vesicles.

Endocytosis (endonG = within + kytosG = cell) The process by which the plasma membrane invaginates and forms vesicles (endosomes) whose contents from outside of the cell can be brought into the cell. Also called receptor-mediated endocytosis. The entity under consideration binds to a receptor(s) located in the plasma (cell) membrane, which then invaginates (infolds), hence taking up the entity via “endosomes” (formed by pinching off an infold to form a “bag”) into vesicles located within the cell. It is one route to deliver essential metabolites to cells (e.g., low-density lipoprotein), and it is a means to modulate the cell’s responses to many protein hormones and growth factors (e.g., insulin, epidermal growth factor, and nerve growth factor). Phagocytosis and pinocytosis are two kinds of endocytosis. It is a route by which certain proteins targeted for destruction can be taken up and delivered to the cell’s lysosomes. For example, phagocytic cells have receptors enabling them to take up antigen-antibody complexes for subsequent destruction by the phagocytic cell. This route is also exploited by certain viruses (e.g., used by the AIDS virus and the Semliki Forest Virus) and toxins to gain entry into cells through the otherwise impervious cell membranes. Disorders of endocytosis can lead to disease states (e.g., high cholesterol levels in the blood of people whose low-density lipoprotein receptors are impaired). Drugs (e.g., certain painkillers) can be targeted to specific receptors via receptor mapping (RM) and receptor fitting (RF) for greater efficacy.

Endoderm The internal layer of cells of the gastrula, which will develop into the alimentary canal (gut) and digestive glands of the adult.

Endodermal Adult Stem Cells. Certain stem cells present within (adult) bodies of organisms, that can be differentiated (via chemical signals) to give rise to cells of tongue, tonsils, the bladder/urethra, digestive tract, liver, pancreas, lung tissues, etc.

Endodermis (Gr. *endon*, within + *derma*, skin) The layer of living cells, with various characteristically thickened walls and no intercellular spaces, which surrounds the vascular tissue of certain plants and occurs in nearly all roots and certain stems and leaves. The endodermis separates the cortical cells from cells of the pericycle.

Endoenzyme An enzyme that acts within the cell producing it.

Endogamy The fusion of reproductive cells from closely related parents, i.e., inbreeding.

Endogenote The part of the bacterial chromosome that is homologous to a genome fragment (exogenote) transferred from the donor to the recipient cell in the formation of a merozygote.

Endogenous (Gr. *endon*, within, + *genos*, race, kind) Developed or added from within the cell or organism.

Endogenous (or indigenous) anaerobes Anaerobes that comprise part of the indigenous microflora of animals (including humans).

Endogenous infection An infection caused by opportunistic microorganisms already present in the body.

Endogenous pyrogens Cytokines that can induce a rise in body temperature are called endogenous pyrogens. They are different from exogenous substances like endotoxins from gram-negative bacteria that induce fever by triggering endogenous pyrogen synthesis and release.

Endogenous retrovirus (ERV) An active or inactive retroviral genome integrated into a host chromosome. Integrated retrovirus DNA (provirus) is derived from infection of the germline of an ancestral animal. All animals are thought to carry numerous endogenous (but nonfunctional) retroviruses, some of which were inserted many millions of years ago. The most common of these are *type C RNA viruses*. Endogenous *xenotropic viruses* are transmitted genetically; they are noninfectious in cells of other species of origin, but are often infectious in cells of other species. Endogenous ecotropic viruses are

infectious in cells of the species of origin and may be transmitted by either genetic or epigenetic mechanisms. Many scientists now believe that all mammalian and avian cells contain virogenes to produce endogenous viruses, but the physiological function of such viruses is still unknown. Most of the endogenous viruses have not been shown to be oncogenic.

Endoglycosidase An enzyme capable of hydrolyzing (breaking) interior bonds in the oligosaccharide molecular branches of a glycoprotein molecule. That is, the enzyme is capable of cutting a sugar-to-sugar bond anywhere within the sugar polymer molecule (depending, of course, on the specificity of the enzyme). This is in contrast to an exoglycosidase, which must cut away at the polymer from the outside, i.e., from the free end, one unit (or section, as the case may be) at a time. See **hydroxylation reaction**.

Endomembrane system Organelles in eucaryotic cells; so called because of their interaction.

Endometritis Inflammation or infection of the lining of the uterus.

Endometrium The lining of the uterus.

Endomitosis Duplication of chromosomes without division of the nucleus, resulting in increased chromosome number within a cell. Chromosome strands separate, but the cell does not divide. This results in polyploidy.

Endonucleases A class of enzymes capable of hydrolyzing (breaking) the interior phosphodiester bonds of DNA or RNA chains; that is, it acts at points other than the terminal bonds. These enzymes are important tools in recombinant DNA technology, as opposed to cleavage (by exonucleases) at the terminal bonds (ends) of a chain.

Endoparasite Parasite that lives within the body of a host.

Endopeptidase An enzyme that breaks a polypeptide chain at an internal peptide linkage. See **protease**.

Endophthalmitis Inflammation of internal tissues of eye; may rapidly destroy the eye.

Endophyte A microorganism (fungus or bacterium) that lives inside vascular tissues of plants (in spaces between plant cells). At least one company has incorporated the gene for a protein toxic to insects (taken from *Bacillus thuringiensis*) into an endophyte to confer insect resistance to a crop plant. When endophyte-infested fescue grass is fed to cattle, sheep, horses, or rabbits, it is generally toxic to those animals, due to mycotoxin(s) or alkaloids produced by that endophyte.

Endoplasm Fluid, inner layer of cytoplasm that streams during cytoplasmic streaming.

Endoplasmic reticulum (ER) (Gr. *endon*, within + *plasma*, anything formed or moulded; L. *reticulum*, a small net) A highly specialized, complex network (reticulum) of branching, intercommunicating tubules (surrounded by membranes) that extends from the outer membrane of the nuclear envelope almost to the plasma membrane, in the cytoplasm of most animal and plant cells. The two types of ER recognized are: rough ER and smooth ER. Rough ER is covered with many ribosomes; ER without or with fewer ribosomes attached is called smooth. This nomenclature comes about because of the appearance of the ER under high magnification. The rough ER is very well developed to facilitate cells carrying on abundant synthesis of lipids and membrane-bound protein, because proteins are synthesized (manufactured) in ribosomes.

Endopolyploidy The result of nuclear divisions without subsequent cytoplasmic division (cytokinesis); the polyploids so obtained are called endopolyploids. Example polytene chromosome.

Endoprotease An enzyme that cleaves the peptide bonds between amino acids within a protein. Cleavage is usually at one or more specific sites.

Endoreduplication Chromosome reproduction during interphase. 4-chromatid chromosomes (diplochromosomes) are seen during this phase.

Endorphins A small protein produced in the nervous system of vertebrates exhibiting actions similar to morphine. These consist of 16-27 amino acids and are derived by cleavage of the large polypeptide pro-opiomelanocortin (POMC). Discovered during the 1970s by U.S. and Scottish scientists, these hormones are produced in the brain, and act as natural painkillers. For example, runners and long distance walkers achieve something of a "high" due to endorphins released during long runs or walks.

Endoscopy Procedure involving the passing of a flexible hollow optical tube into the body cavities or passages to the interior -such as the esophagus, trachea, ears, anus, Urinary tract, or genital tract- for the purpose of visualizing hidden tumors or other abnormalities. Also useful for obtaining diagnostic samples.

Endoskeleton (endonG = within + skeletosG = hard) In vertebrates, an internal scaffold of bone to which muscles are attached.

Endosome Membrane bounded organelle in animal cells that carries endocytosed molecules and molecules delivered from the trans-Golgi network and passes many of them on to lysosomes for degradation. These are the organelle to which newly formed endocytotic vesicles are translocated and with which they fuse. Antigen taken up by phagocytosis generally enters the endosomes, the acidified vesicles present in cells. Protein antigens entering by this route are presented by MHC class II molecules.

Endosperm (endonG = within + spermaG = seed) the interior portion of a plant seed, beneath the outer hull (the portion that people tend to eat, in food crops). In grains (e.g., rice or corn/maize), the endosperm consists primarily of starch (carbohydrate) a food supply in which the embryo is embedded. In legumes (e.g., beans), the endosperm contains mainly protein, a small amount of carbohydrates, and sometimes vegetable oil. It develops from the fusion of a male nucleus with the polar nuclei in the embryo sac; the endosperm is either digested by the growing embryo or retained in the mature seed to nourish the germinating seedling. In most diploid plants, e.g., cereals, the endosperm is triploid (3n), but in some (e.g., lily) it is often consumed as the seed matures.

Endosperm mother cell One of the seven cells of the mature embryo sac, containing the two polar nuclei and, after reception of a sperm cell, gives rise to the primary endosperm cell from which the endosperm develops.

Endospore A highly resistant, dormant inclusion thick-walled body formed within certain bacteria. It is very resistant to being killed by heat and various other chemical and physical agents. To kill spores, temperatures above boiling point (70-80 C for 10 min.) are usually needed. For this, pressure cookers and autoclaves are required. Endospores have survival value since the spore can remain for long periods of time in a nongrowing state and then, under appropriate conditions, can be induced to germinate and regenerate the original cell. Endospore formation may be viewed as being akin to hibernation, i.e., a kind of "bacterial hibernation."

Endospore septum A cell membrane without a cell wall that grows around the core of an endospore.

Endostatin An antiangiogenesis human protein discovered by Judah Folkman. In concert with angiostatin, it causes certain cancer tumors in mice to shrink

Endosymbiont theory A theory that states that the mitochondria and chloroplasts of eukaryotic cells are derived from symbiotic prokaryotes i.e organelles arose from procaryotic cells living inside a host procaryote.

Endothelial (endonG = within + theleG = nipple) Describes the innermost layer of tissue that lines the heart, blood vessels and lymph vessels of vertebrates.

Endothelial cells These are the flat, sort of plate-shaped cells that line the surface of all blood vessels, heart, lymphatics and other body cavities that do not open to the outside the body. Endothelial cells possess transmembrane (through the cell membrane) molecules known as adhesion molecules, which selectively allow the passage (from bloodstream to tissues) of some molecules (leukocytes, monocytes, nutrients, hormones etc.) essential for tissue growth and function. Endothelial cells are packed much tighter together in the capillaries that provide blood to the brain. This tighter packing limits the size and kind of molecules that can pass into the brain. This blood-brain barrier serves to protect the sensitive brain tissue from pathogens or harmful molecules (e.g., toxins). The endothelium is involved in the recovery and recycling of old red blood cells. It also produces nitric oxide, which causes neighboring smooth muscle (blood vessel) cells to relax so that those (neighboring) blood vessels dilate and the body's blood pressure is lowered, and two compounds, prostacyclin and Von Willebrand factor, that prevent blood clotting.

Endothelin A peptide that causes arteries to contract (which consequently causes blood pressure to increase).

Endothelioma A malignant tumor arising in endothelial cells that line blood vessels and lymph vessels.

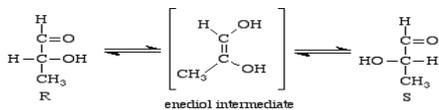
Endothermic reaction A chemical reaction that takes up heat (that is for which ΔH is positive), as in photosynthesis.

Endothrix A fungus growing inside the hair shaft producing arthroconidia.

Endotoxin A lipopolysaccharide (fat/sugar complex; poison, also known as LPS) which forms an integral part of the cell wall of gram negative bacteria. It is a potent inducer of cytokine synthesis and the proximal cause of endotoxic shock. It is only released when the cell is ruptured. It can cause, among other things, septic shock and tissue damage. Pharmaceutical preparations are routinely tested for the presence of endotoxins. This is one reason why pharmaceuticals must be prepared in a sterile environment. LPS is an example of an endotoxin.

End-product (feedback) inhibition The inhibition of the first enzyme in a pathway by the end product of that pathway.

Enediol intermediate A reaction intermediate containing a carbon-carbon double bond and a hydroxyl group attached to each carbon.



Energy charge (Daniel Atkinson,1970) the fractional degree to which the AMP-ADP-ATP system is filled with high-energy phosphates (phosphoryl groups). It is a quantity that indicates the state of a cell's energy reserves. It is equal to the cell's reserves of the free energy sources, ATP and ADP (taking into account that ADP stores less free energy than ATP) divided by the total supply of ATP and its breakdown products, ADP and AMP. Thus, Energy charge = $([\text{ATP}] + 1/2[\text{ADP}]) / ([\text{ATP}] + [\text{ADP}] + [\text{AMP}])$.

Energy coupling The transfer of energy from one process to another.

Energy currency Source of energy that the cell can use to drive processes that would otherwise not occur because their free energy is positive. Energy currencies can be coenzymes such as ATP and NADH,

which give up energy on conversion to, respectively, ADP and NAD⁺, or electrochemical ion gradients such as the hydrogen ion gradient across the mitochondrial membrane and the sodium gradient across the plasma membrane.

Energy level The energy of an electron and its position relative to the atomic nucleus.

Energy-rich crops The plants which are very efficient in converting CO₂ into biomass.

Energy The capacity of a body or system to do work; potential energy is at rest, as in a chemical compound; kinetic energy is in any of many forms of motion, such as light radiation or muscular contraction. In plants and animals, the energy is stored in ATP (short-term storage), and starch and fat (long-term storage).

Engineered antibodies Chimeric monoclonal antibodies produced via genetic engineering of human antibody-producing cells (clones). For example, the genes coding for antilymphoma binding sites from a rat have been inserted into human antibody-producing cells to yield rat (antigen) binding sites mounted on human antibody "stems."

Enhanceosome A complex of transcription factors that assembles cooperatively at an enhancer. It is a structure formed by DNA bending that comprises a collection of proteins involved in activation of the RNA polymerase II transcription initiation complex, thus regulates gene expression.

Enhancer (1) A substance or object that increases a chemical activity or a physiological process. (2) A DNA sequence that increases the transcription of a eukaryotic gene when they are both on the same DNA molecule, located some distance away in either direction up to several kilobases from the gene concerned. These sequences usually act as enhancers when on the 5' side (upstream) of the gene in question. However, some enhancers are active when placed on the 3' side (downstream) of the gene. In some cases enhancer elements can activate transcription of a gene with no (known) promoter. It is also known as enhancer element; enhancer sequence. It is possible that DNA looping brings enhancer-bound proteins into proximity with the gene's promoter.

Enkephalins A class of hormones produced in the brain that acts as natural painkillers. Discovered by John Hughes and Hans Kosterlitz in 1975, they are some of the endorphins.

Enoyl-acyl protein reductase An enzyme that is utilized by bacteria in their synthesis (manufacture) of fatty acids.

Enrichment culture A selective culture medium and incubation conditions used for preliminary isolation that favors the growth of a particular microorganism. It contains the necessary nutrients for growth of all organisms contained in the specimen. No inhibitory factors are contained within these media. It may also be referred to as nonselective media.

Ensiling The fermentation of (usually chopped up) agricultural vegetation in order to preserve it. It is carried out for 1–2 weeks, using either indigenous microorganisms (e.g., *Lactobacillus* spp.) or introduced microorganisms (to speed up the process, yield product containing more nutrients for livestock, etc.), in the absence of oxygen (to prevent the growth of aerobic mold fungi). When indigenous microorganisms are used, *Lactobacillus* spp. become the dominant microorganisms present, and heat is generated by the microorganisms within the vegetative mass (optimum temperature is 25–30°C, which is 77–86°F). Lactic acid produced by the microorganisms inhibits the growth of bacteria that would normally decay the vegetation.

ENT Ear, nose, and throat.

Enteric bacteria A large group of gram-negative, rod-shaped bacteria characterized by a facultatively aerobic metabolism. Many of them are commonly found in the intestines of animals.

Enteric fever Typhoid fever; paratyphoid fever.

Enterics The common name for bacteria in the family Enterobacteriaceae.

Enterobacteriaceae A select group of aerobic, oxidase negative organisms.

Enterocrinin A gastrointestinal hormone that controls the secretion of intestinal juice.

Enterogastrone A hormone secreted by the mucosa of the duodenum that decreases gastric secretions and movement in response to the ingestion of fat.

Enterohemorrhagic strain of *E. coli* The several dozen (approximately 60 known) serotypes (strains) of *E. coli* bacteria that cause internal hemorrhaging in humans that ingest those bacteria. The toxin produced by these particular *E. coli* bacteria attacks the human kidney, which often leads to kidney failure and/or death.

Enteroinvasive Capable of invading the mucosal surface and sometimes the deeper tissues of the bowel.

Enteroinvasive strain Strain of *E. coli* with a plasmid gene for a surface antigen (K antigen) that enables it to attach to and invade mucosal cells.

Enterokinase An enzyme secreted by the wall of the small intestine, whose function is to catalyze the conversion of inactive trypsinogen in the pancreatic juice to active trypsin.

Enteropathogenic *Escherichia coli* (EPEC) Specific serotypes of *E. coli* isolated from feces of patients with diarrhea, usually associated with nursery epidemics.

Enterotoxigenic Producing an enterotoxin (e.g., enterotoxigenic *Escherichia coli*).

Enterotoxin The category (i.e., intestinally active) of exotoxin, produced by certain bacterial strains and/or serotypes, which attack the body's internal organs causing cramps, diarrhoea and nausea. For example, the serotype of *Escherichia coliform* bacteria known as *E. coli* O157:H7 attacks the kidneys and other internal organs of humans, also causing internal bleeding and sometimes death.

Enterovirus One of the three major groups of picornaviruses that infect nerve and muscle cells, the respiratory tract lining and skin.

Enthalpy (H) The heat content of a system. A thermodynamic quantity (function of state) of a substance is given by $H = E + PV$, where E is the internal energy, P the pressure, and V the volume. It is equal to the heat change in constant-pressure reactions, such as most reactions in biological systems.

Enthalpy change (ΔH) In a reaction, it is approximately equal to the difference between the energy used to break bonds and the energy gained by the formation of new ones.

Entner-Doudoroff pathway (ED pathway) A pathway that converts glucose to pyruvate and glyceraldehyde-3-phosphate by producing 6-phosphogluconate and then dehydrating it. It is alternate to glycolysis and pentose phosphate pathway. This pathway was first reported in 1952 by Michael Doudoroff (1911–1975) and Nathan Entner.

Entropy (S) ($enG = in + troposG = \text{change in manner}$) Thermodynamic quantity that measures the degree of disorder in a system; the higher the entropy, the greater the disorder; a measure of energy that has become so randomized and uniform in a system that the energy is no longer available to do work.

Enucleated oocyte/ ovum (cytoplast) An egg cell from which the nucleus has been removed mechanically.

Envelope closed sheet enclosing a volume. The term is used to describe, among other things, the double membrane layer enclosing certain organelles, and the outer membrane of certain viruses.

Enveloped virus Virus with capsid surrounded by a lipid membrane (the envelope), which is derived from the host cell plasma membrane when the virus buds from the cell.

Environment The aggregate of all the external conditions including the medium, substrate, climatic conditions, other organisms, light and pH etc. affecting the life and development of an organism.

Environmental Protection Agency (EPA) The U.S. regulatory agency for biotechnology of microbes.

Environmental stewardship The view that humans have a duty to manage and care for the whole natural environment; that we are responsible for the continued health of the whole ecosystem, not just the parts that benefit the human race. It involves integrating and applying environmental values into a process.

Enzootic Referring to a temporal pattern of disease occurrence in an animal population that is marked by predictable regularity with little change over time; for example, the pattern of hanta virus infection in deer mice.

Enzymatic Activity of an enzyme which is a substance produced by a living organism and acting as a catalyst to promote a specific biochemical reaction.

Enzyme (Gr. *en*, in + *zyme*, yeast or leaven) A biochemical catalyst, usually a protein but in certain cases a specialized molecule of RNA, that promotes chemical reactions without itself being consumed in the process. It is naturally produced by living cells to catalyze biochemical reactions. Each enzyme is highly specific with regard to the type of chemical reaction that it catalyzes, and to the substances (called substrates) upon which it acts. This specific catalytic activity and its control by other biochemical constituents are of primary importance in the physiological functions of all organisms. Enzymes may, and usually do, contain additional nonprotein components called coenzymes that are essential for catalytic activity. The names of most individual enzymes are usually derived from the substrate on which they act, with the suffix -ase.

Enzyme bioreactor A reactor in which a chemical conversion reaction is catalyzed by an enzyme.

Enzyme denaturation The loss of enzyme (catalytic) activity due to loss of the correct functional structure of the protein. Denaturation may be caused by factors such as exposure to heat and organic solvents, degradation of the enzyme molecule by proteases, oxygen, and acid or alkaline pH.

Enzyme derepression Commonly known as induction (of an enzyme). Initially a repressor protein is bound to a specific region of DNA. This binding inhibits transcription to mRNA, thus blocking the synthesis of the protein (enzyme) specified by the mRNA. When present, the inducer molecule binds to the repressor protein and inactivates it. Thus the inhibition caused by the repressor protein is overcome and mRNA can be synthesized, which consequently leads to synthesis of the mRNA-specified protein (enzyme). The word derepression is sometimes used because the repressor protein is, by itself, active in repressing protein (enzyme) synthesis. Its repressive action is mitigated (derepressed) by the inducer molecule. Hence, derepression (or unrepression) of repression equals induction.

Enzyme electrode A type of biosensor, in which an enzyme is immobilized onto the surface of an electrode. When the enzyme catalyses its reaction, electrons are transferred from the reactant to the electrode, and so a current is generated. There are two types of enzyme electrodes: ampometric, where the electrode is kept as near zero voltage as possible. When the enzyme catalyses its reaction, electrons flow into the electrode, and so a current flows; and potentiometric, when the electrode is held at a voltage which counteracts the voltage determined by the enzyme's tendency to push electrons into its. Usually enzymes transfer their electrons inefficiently to the electrode, so a mediator compound is coated onto the electrode to help the transfer.

Enzyme engineering Enhancing the activity or changing the substrate specificity of enzymes by changing their amino acid sequences, e.g., through site directed mutagenesis.

Enzyme Immunoassay (EIA) is the general term for an expanding technical arsenal of testing which allows a full range of quantitative analyses for both antigen and antibodies. These tests use color-changed products of enzyme-substrate interaction (or inhibition) to measure the antigen-antibody reaction. Examples of EIA procedures are EMIT, ELISA, MAC, MEIA.

Enzyme Multiplies Immunoassay Technique (EMIT), is a homogeneous (single phase) EIA procedure in which the antigen being measured competes for a limited number of antibody binding sites with enzyme labeled antigen. The reagent antibody has the ability to block enzymatic activity when bound with the reagent enzyme-antigen complex preventing its formation of product in the presence of substrate. The free antigen-enzyme complexes resulting from competition with measured antigen in the sample forms color-change products proportional to the concentration of antigen present in the specimen.

Enzyme poison Substance that can permanently inactivate enzymes, e.g., cyanide.

Enzyme repression Inhibition of enzyme synthesis caused by the availability of the product of that enzyme. On a molecular level a repressor molecule (which could be for e.g., the amino acid arginine) combines with a specific repressor protein that is present in the cell. This repressor molecule/repressor protein complex is then able to bind to a specific region of DNA at the initial end of the gene which is called the operator region. It is in this region where the synthesis of mRNA is initiated. The repressor "roadblock" thus stops the synthesis of mRNA, and therefore the synthesis of the protein is also blocked.

Enzyme saturation A state in which the substrate concentration is so high that essentially all the enzyme molecules are in ES form.

Enzyme stabilization using antibodies A method of stabilizing enzymes by binding antibodies to them. The antibodies should not block the active site of the enzyme, as otherwise the protein is stabilized but is inactive as a catalyst. Monoclonal antibodies are usually used as they bind to specific bits of the protein surface. If the enzyme tries to unfold into an inactivate structure, it must not only overcome its own binding energy but also throw off all the bound antibodies; this requires more energy, and so is a correspondingly slower process.

Enzyme technology Involves the production, isolation, purification and use of enzymes. Immobilization of enzymes in different matrices with a view to enhance their efficiency, reusability or hygiene.

Enzyme-linked Immuno Assays (EIA) Enzyme-Linked Immuno Assays (EIA) are use to measure the amount of a particular substance by virtue of its binding to a specific antibody. Examples of EIA include ELISA and Western blotting.

Enzyme-linked Immunosorbent Assay (ELISA) is a sensitive, heterogeneous (multiple phase) analytical technique for quantitation of antigen or antibody in which enzyme-labeled antibody or antigen is bound to a solid support (e.g., tubes, beads, microtiter plate wells, plastic tines or fins). After addition of patient specimen and substrate, antigen, antibody or complex are detected by a color change indicating the presence of the product of an enzyme-substrate reaction. It is of mainly two types Direct ELISA and Indirect ELISA.

Enzyme-linked receptor Major type of cell-surface receptor in which the cytoplasmic domain either has enzymatic activity itself or is associated with an intracellular enzyme. In both cases enzymatic activity is stimulated by ligand binding to the receptor.

Enzyme-substrate complex A temporary union of an enzyme and its substrate.

Eophyll Term applied to first few leaves with green, expanded lamina developed by seedlings; transitional type leaves developed before formation of adult leaves.

Eosinophil A type of polymorphonuclear *granulocyte* that comprises about 2-5 percent of the total *leukocytes* in the blood. *Bone marrow* contains about 200 times more eosinophils than blood and some tissues (intestinal walls, skin, external genitalia, lungs) contain as much as 500 times more. Their concentration is regulated by *adrenal hormones*. Eosinophil granules contain many of the same enzymes as do *neutrophils*, with the major exception of lysozyme and phagocytin. They circulate in the blood for a number of hours (three to eight) and then migrate into the tissue where they reside. They kill parasites that are too large to be phagocytized by secreting substances that kill the parasites (hookworms, trichinosis, etc.), inhibit histamine release from mast cells, and secrete chemicals that neutralize histamine. Allergy causes an increase in eosinophils. GM-CSF stimulates eosinophil production. The functions of eosinophils are *phagocytosis*. They may also play a role in allergic reactions. They take up the stain eosin.

Eosinophilia Formation of large numbers of eosinophilic leukocytes caused by some type of immune response; usually found in helminth infections, particularly with tissue invasion (visceral larva migrans, trichinosis, filariasis, schistosomiasis, ascariasis, strongyloidiasis).

Eosinophilic cerebrospinal fluid pleocytosis Increased eosinophils in cerebrospinal fluid (Angiostrongylus and Baylisascaris infections; coenurosis, cysticercosis, echinococcosis; Fasciola, Gnathostoma, Paragonimus, Schistosoma, Toxocara, Toxoplasma, and Trichinella infections; possibly: Dirofilaria, Onchocerca, and Ascaris infections).

Eosinophilic meningitis Inflammation of membranes of brain or spinal cord accompanied by an increased number of eosinophils, usually associated with particular helminth infections (angiostrongyliasis, gnathostomiasis, cysticercosis, and schistosomiasis).

Eotaxin-1 and eotaxin-2 These are chemokines that act specifically on eosinophils.

Epicotyl (Gr. *epi*, upon + *kotyledon*, a cup-shaped hollow) The upper portion of the axis of a plant embryo or seedling, above the cotyledons. The shoot apical meristem is located here.

Epidemic disease A disease acquired by many people in a given area in a short time.

Epidemic Disease that spreads rapidly and infects many people in a community or area (usually within a short time frame). The number of cases indicating presence of an epidemic will vary according to the infectious agent, size and type of population exposed, previous experience or lack of exposure to the disease, and time and place of occurrence; epidemicity is thus relative to usual frequency of the disease in the same area, among the specified population, at the same season of the year. A single case of a communicable disease long absent from a population or the first invasion by a disease not previously recognized in that area requires immediate reporting and epidemiologic investigation; two cases of such a disease associated in time and place are sufficient evidence of transmission to be considered an epidemic. Some examples are: epidemic keratoconjunctivitis (eye disease caused by an adenovirus), epidemic relapsing fever (caused by *Borrelia* spp.), epidemic typhus (caused by *Rickettsia prowazekii*) etc.

Epidemiology The study of the incidence and prevalence of disease in populations i.e the science dealing with when and where diseases occur and how they are transmitted.

Epidermal growth factor (EGF) A protein of 53 amino acids that greatly increases growth/reproduction of epidermal (skin) cells. This protein also increases growth of wool in sheep and growth in more than

50% of human tumors. High concentrations of epidermal growth factor are found in human tears. EGF was discovered by Stanley Cohen.

Epidermis (Gr. *epi*, upon + *derma*, skin) (1) The outmost layer of cells of the body of an animal. In invertebrates the epidermis is normally only one cell thick and is covered by an impermeable cuticle. In vertebrates the epidermis is the thinner of the two layers of skin. (2) The outermost layer of cells covering a plant. It is overlaid by a cuticle and its functions are principally to protect the plant from injury and to reduce water loss. Some epidermal cells are modified to form guard cells or hairs of various types. In woody plants the functions of the shoot epidermis are taken over by the periderm tissues and in mature roots the epidermis is sloughed off and replaced by the hypodermis.

Epidermoid carcinoma A malignant tumor arising from the skin.

Epididymitis Inflammation of the epididymis characterized by fever and pain on one side of the scrotum; seen as a complication of prostatitis and cystitis.

Epigastric Relating to the area of the abdomen that lies between the margins of the ribs.

Epigeal germination For dicots, germination in which the cotyledons appear above ground and function as true leaves. In Liliium, A pattern of rapid germination in which the seed quickly produces a cotyledon above ground followed soon by true leaves. The first bulb structure may only be formed much later in the first growing season. Physiologically, this means the epigeal cotyledons power the growing seedlings by photosynthesizing. The hypogeal cotyledons support the growing seedlings by providing nutrition from stored reserve, in the way that the endosperm does; or else the hypogeal cotyledons may contribute little or nothing to the growth of the seedling, if there is some other source of stored reserve. I would expect seeds having little endosperm to germinate in an epigeal pattern. Seeds with generous reserves in the endosperm or cotyledons would not be constrained to rapidly produce a green leaf, so have the option through evolution of first building a sturdy protected plant underground.

Epigenesis Describes the developmental process whereby each successive stage of normal development is built up on the foundations created by the preceding stages of development; an embryo is built up from a zygote, a seedling from an embryo, and so on.

Epigenetic Pertaining to modifying the expression of genes by potentially reversible chemical modification of the DNA chains, specifically by methylation of cytosine bases. Involved in differentiation of embryonic stem cells into specialized tissues. They consist of changes in the properties of a cell that are inherited but that do not represent a change in genetic information. Responsible for the apparent heritability of some acquired traits.

Epigenetic variation Variations that are stable through mitotic divisions, but not through meiosis. They are non-hereditary and reversible phenotypic variation; often the result of a change in gene expression. Such changes are transmitted to clonal but not to sexual progeny.

Epiglottitis Inflammation of the epiglottis, a structure that prevents aspirating swallowed food and fluids into the tracheobronchial tree; a serious infection because the swollen epiglottis may block the airway.

Epilepsy (epilepsisG, from *epi* = upon + *lambanein* = to seize) A nervous condition due to abnormalities in the brain cortex that results in seizures ranging from a sense of numbness in certain body areas (*petit mal*) to extreme muscular convulsions and hysterics (*grand mal*). Epileptics exhibit large, abnormal brain waves, which can be detected on an electroencephalogram (EEG).

Epimastigote Developmental stage of the family Trypanosomatidae. The base of the flagellum is in front of the nucleus; as the flagellum passes through the body to emerge as the free flagellar portion, it is attached to the body by the undulating membrane (old term: crithidia).

Epimerase An enzyme capable of the reversible interconversion of two epimers.

Epimerization Reaction that alters the steric arrangement around one atom, as in a sugar molecule.

Epimers Two stereoisomers differing in configuration at one asymmetric centre, in a compound having two or more asymmetric/ chiral centres.

Epinasty A process by which the growth of branches or petioles is abnormally pointing downward. This phenomenon is caused by the more rapid growth of the upper side. Epinasty may result from either nutritional deficiencies or irregularities at the plant growth regulator level. Not to be confused with wilting, as epinastic tissues are turgid.

Epiphysis The ossified part of the end of a mammalian limb bone or vertebra which, during growth, is separated by a plate of cartilage from the rest of the ossified bone. When growth is complete, the epiphysis fuses with the rest of the bone.

Epiphyte A plant that grows upon another plant, but is neither parasitic on it nor rooted in the ground.

Episome An independent genetic element (DNA) that occurs inside bacterium in addition to the normal bacterial cell genome. The episome can replicate either as an autonomous unit or as one integrated into the host genome. The step of integration may be governed by a variety of factors and so the term episome has lost favour and been superseded by the wider term plasmid. Plasmids and F factors are episomes.

Episome transfer Transfer between cells of some or all of a bacterial chromosome by integration into a plasmid.

Epistasis Interaction between genes at different loci, e.g., one gene suppresses the effect of another gene that is situated at a different locus. Suppressed genes are said to be hypostatic. Dominance is associated with members of allelic pairs, whereas epistasis is interaction among products of non-alleles.

Epithelial cell Any cell that forms part of the outer covering of an organism or organ.

Epithelial projections Projections that anchor the epidermis (surface skin) to the dermis (subsurface tissue). Growth of these projections is increased by epidermal growth factor during the wound healing process.

Epithelioma A malignant tumor consisting mainly of cells from the epithelium and primarily derived from the skin or mucous surfaces.

Epithelium (epi = on, above, or upon + thele = nipple) A thin layer of cells forming a tissue that covers the internal and external surfaces of the body, glands, nerves, breasts, and the linings of the respiratory, gastrointestinal, urinary, and genital systems. Plural epithelia. It serves to enclose and protect the other tissues, to produce secretions and excretions, and to function in assimilation.

Epitope A specific chemical domain on an antigen that stimulates the production of, and is recognized by, an antibody. Each epitope on a molecule such as protein elicits the synthesis of a different antibody (thereby causing an immune response). Also known as antigenic determinant. A T-cell epitope is a short peptide derived from a protein antigen. It binds to an MHC molecule and is recognized by a particular T cell. B-cell epitopes are antigenic determinants recognized by B cells and are typically discontinuous in the primary structure.

Epitope spreading It describes the fact that responses to auto antigens tend to become more diverse as the response persists. This is also called determinant spreading or antigen spreading.

Epizootic A disease affecting a large number of animals simultaneously.

EPPO See **European Plant Protection Organization**.

Epsilometer test (E test) A newer version of the diffusion test that uses a plastic strip containing a gradient of concentration of antibiotic to determine antibiotic sensitivity and estimate MIC (Minimum inhibitory concentration).

Epsilon (ϵ) In the context of immunoglobulins, ϵ (epsilon) is the heavy chain of IgE.

EPSPSynthase (Enolpyruvyl-shikimate phosphate synthase) An enzyme produced by virtually all plants and internally transported into their cells' chloroplasts. It is essential for the biosynthesis (creation) of the aromatic (ring-shaped molecule) amino acids tyrosine, phenylalanine, and tryptophan, which are essential to the plant's growth. Some (glyphosate-containing and sulfosate containing) herbicides kill unwanted plants (e.g., weeds) by inhibiting EPSP synthase. By incorporating a gene that causes (over-) production of EPSP synthase (soybeans, cotton, etc.), crops survive post-emergence application(s) of glyphosate- containing herbicide.

Epstein-Barr virus (EBV) It is a herpesvirus that selectively infects human B cells by binding to complement receptor 2 (CR2, also known as CD21). It causes infectious mononucleosis and establishes a lifelong latent infection in B cells that is controlled by T cells. Some B cells latently infected with EBV will proliferate in vitro to form lymphoblastoid cell lines. It is thought to be the case of *Burkitt's lymphoma* and some forms of postnasal *carcinoma*.

Equational division Mitotic-type division that is usually the second division in the meiotic sequence; somatic mitosis and the non-reductional division of meiosis. A chromosome division in which the two chromatids of each duplicated chromosome separate longitudinally, prior to being incorporated into two daughter nuclei.

Equatorial plate The figure formed by the chromosomes in the centre (equatorial plane) of the spindle in mitosis.

Equilibrium constant (K_{eq}) Ratio of forward and reverse rate constants for a reaction and equal to the association constant; a constant characteristic for each chemical reaction.

Equilibrium density gradient centrifugation A procedure used to separate macro-molecules based on their density (mass per unit volume). In this technique a mixture of molecules is subjected to ultracentrifugation in a concentrated solution of a dense, fast-diffusing substance such as CsCl that forms a density gradient as the centrifuge spins. Centrifugation is continued to equilibrium, thereby separating the mixture according to the densities of its component molecules.

Equilibrium dialysis The affinity of an antibody for its antigen can be determined by equilibrium dialysis, a technique in which antibody in a dialysis bag is exposed to varying amounts of a small antigen able to diffuse across the dialysis membrane. The amount of antigen inside and outside the bag at the equilibrium diffusion state is determined by the amount and the affinity of the antibody in the bag.

Equilibrium The point in a process at which the forward and reverse reaction rates are exactly balanced so that it undergoes no net change. The state of a system in which no further net change is occurring; the free energy is at a minimum. For example, equilibrium is reached in a chemical reaction when the forward and reverse rates are equal. e.g., $2H_2O \rightleftharpoons OH^- + H_3O^+$.

Equilibrium voltage Transmembrane voltage that will exactly balance the concentration gradient of a particular ion.

Equimolar Identical molar concentrations. See **molarity**

Equivalent treatments Different methods that have the same effect on controlling microbial growth.

ER lumen The space enclosed by the membrane of the endoplasmic reticulum (ER).

ER resident protein Protein that remains in the endoplasmic reticulum (ER) or its membranes and carries out its function there, as opposed to proteins that is present in the ER only in transit.

ER retention signal Short amino acid sequence on a protein that prevents it moving out of the endoplasmic reticulum (ER). Found on proteins that are resident in the ER and function there.

ER signal sequence N-terminal signal sequence that directs proteins to enter the endoplasmic reticulum (ER). It is cleaved off by signal peptidase after entry.

Eradicant Any biocide (e.g., a fungicide) used to cure an established infection.

ERCP Endoscopic retrograde cholangiopancreatography.

Erect Facing upward, flower axis parallel to the pedicel or vertical axis of the plant.

Ergosterol (C₂₈H₄₃OH) A white crystalline pro vitamin D (sterol) that occurs in small amounts in the fats of animals; converted into vitamin D₂ (calciferol) by the action of ultraviolet radiation; M.P. 163°C.

Ergot A toxin produced in sclerotia by the fungus *Claviceps purpurea* that causes ergotism, a disease characterized by hallucinations, and contraction of arteries and uterine muscle.

Ergotamine A mycotoxin (metabolite produced by a fungus, that is toxic to animals and humans) produced by the fungus (*Claviceps* spp.) known as ergot. Ergotamine is an alkaloid vasoconstrictor, whose consumption can lead to severe constriction of blood vessels in the brain and extremities, causing hallucinations and dry gangrene. Humans whose bodies are deficient in vitamin A are especially vulnerable to ergotism ("ergot poisoning").

Erlenmeyer flask A conical flat-bottomed laboratory flask with a narrow neck, designed by E. Erlenmeyer. Widely used for culturing micro-organisms.

E-rosettes are human T cells that will bind to treated red blood cells from sheep; the many red blood cells bound to each T cell give it the appearance of a rosette and increase its buoyant density so that the T cells can be isolated by gradient centrifugation. E-rosetting is often used for isolating human T cells.

Erp57 It is a chaperone molecule involved in loading peptide onto MHC class I molecules in the endoplasmic reticulum.

Error variance Variance due to factors beyond the control of experimenter. It is used as the denominator in F-test.

Error-prone Synthesis occurs when DNA incorporates noncomplementary bases into the daughter strand.

Erwinia sps. *Erwinia caratovora* is a species of bacteria that can cause significant postharvest losses to potato farmers, when it infects potatoes and causes "soft rot" (spoilage). *Erwinia uredovora* is a soil bacteria used in genetic transformation of rice for enhanced vitaminA content. One of the genes of the procarotenoid pathway is transferred to rice (*Oryza sativa*) cells along with two genes from Dafodill plant.

Erysipelas An acute cellulitis caused by group A streptococci.

Erythema (erythemaG = a flush) Redness of the skin from various causes.

Erythema infectiosum A mild facial rash in children that has a "slapped cheek" appearance; usually caused by parvovirus B19.

Erythrasma A minor, superficial skin infection caused by *Corynebacterium minutissimum*.

Erythroblastosis fetalis is a severe form of Rh hemolytic disease in which maternal anti-Rh antibody enters the fetus and produces a hemolytic anemia so severe that the fetus has mainly immature erythroblasts in the peripheral blood.

Erythrocyte (erythrosG = red + kytosG = hollow vessel) A red blood cell of vertebrates, containing large amounts of hemoglobin; transports oxygen and carbon dioxide to and from tissues; during the process of maturation, an erythrocyte loses its nucleus (in mammals) and mitochondria, and its endoplasmic reticulum is reabsorbed; also called red blood corpuscle.

Erythrocyte ghost Membranes derived from erythrocytes, which retain their original shape but are devoid of cytoplasm.

Erythrocytic cycle Developmental cycle of malarial parasites within red blood cells.

Erythrogenic toxin A substance, produced by some streptococci, that causes erythema.

Erythropoiesis The formation of red blood cells from certain stem cells. Stimulated by the protein erythropoietin within the bone marrow.

Erythropoietin (EPO) A glycoprotein hormone produced in the kidney and the liver in response to low oxygen concentrations in the blood, which stimulates stem cells in the bone marrow to increase the number of red blood cells. Erythropoietin can be used to help correct a variety of anemia. It controls the rate of red blood cell production.

ES (embryonic stem) cell Cell derived from a very early embryo. ES cells have not yet determined their developmental fate and can therefore, depending on the conditions, generate the entire range of tissue types.

ES complex The enzyme substrate complex, whose formation is a key component of the Michaelis-Menten model of enzyme action. Also called as the Michaelis complex.

Escape More commonly disease escape. Phenomenon of susceptible plants avoiding disease attack. Also plants showing escape.

Eschar A dry scar, particularly one related to a burn.

Escherichia coli A Rod like, Gram negative bacterium commonly found in the intestinal tracts of most vertebrates. It is used extensively in recombinant DNA research because of its small genome size, normal lack of pathogenicity, and ease of growth in the laboratory. In environmental studies, it is a key indicator of water pollution due to human sewage effluent. In 1993, Burt D. Ensley and coworkers at Amgen discovered a way to genetically engineer *E. coli* to produce indigo from glucose starting material. *E. coli* has 4,288 genes.

Escherichia coliform 0157:H7 The particular strain (serotype) of *Escherichia coliform* (*E. coli*) bacteria that causes often-fatal diarrhea, internal bleeding, and kidney damage in humans.

Esophagitis Inflammation of the esophagus.

ESR Erythrocyte sedimentation rate.

Essential amino acid An amino acid that cannot be synthesized by humans (and other vertebrates) and therefore has to be ingested with feed or food. Histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine are essential for humans.

Essential element Any of a number of elements required by living organisms to ensure normal growth, development and maintenance.

Essential fatty acids The group of polyunsaturated fatty acids of plants that are required in the human diet, because the human body cannot synthesize (manufacture) them, yet must have them for proper functioning (of the body's metabolism, immune system function, etc.). These include linoleic acid, linolenic acid, arachidonic acid, and docosahexanoic acid. If humans and other higher animals do not consume enough essential fatty acids per day, they suffer decreased growth rates, increased susceptibility to infection, impaired reproduction, kidney damage, and other diverse physiological effects.

Essential gene is one whose deletion is lethal to the organism. See **lethal locus**.

Essential nutrient Any substance required by living organisms to ensure normal growth, development and maintenance and cannot be synthesized by that organism.

Essential requirement A nutrient is essential when it is mandatory for growth, development and reproduction. In tissue culture, it comprises inorganic salts, including all of the elements necessary for plant metabolism; organic factors (amino acids, vitamins); usually also endogenous plant growth regulators (auxins, cytokinins and often gibberellins); as well as a carbon source (sucrose or glucose).

Established cell line consists of cells derived from a single origin that can be grown indefinitely in culture (they are said to be immortalized). The cells usually have had chromosomal changes in order to adapt to culture conditions.

Established culture (1) An aseptic viable explant used for micropropagation of plants. (2) A suspension culture subjected to several passages with a constant cell number per unit time.

Ester A molecule formed by the condensation reaction of an alcohol group with an acidic group; most phosphate groups are esters.

Ester bond Bond formed between the hydrogen of an alcohol group and the hydroxyl of a carboxyl group by the elimination of water.

Ester group A portion of a molecule with the formula $-\text{COOR}$, where R is an alkyl group.

Ester linkage The bonding between two organic molecules (R) as R-CO-O-R .

Esterases A class of enzymes involved in the hydrolysis (digestion) of fats and other esters.

Estimated breeding value (EBV) Twice the expected progeny difference. The difference is doubled because breeding value is a reflection of all the genes of an animal, in contrast to progeny difference, which is a reflection of a sample half of an animal's genes. The predicted performance of the offspring of the mating between any two animals is the average of their EBVs (averaged because each parent makes an equal contribution to each offspring).

Estradiol An estrogen produced by the follicle cells of the vertebrate ovary; promotes estrus, the development of the endometrium, and stimulates ICSH secretion; in Old English, also spelt as oestradiol.

Estrone (oestrosG = frenzy + genosG = origin) A female sex hormone, secreted by the ovaries, that promotes estrus and helps to regulate the pituitary gland's production of luteinizing hormone (LH) and follicle stimulating hormone (FSH). Estrone causes proliferation of breast tissue (cells) and is

also responsible for the development of female secondary sex characteristics (e.g., smaller body size, lack of facial hair, and higher pitch voice in humans) and is involved in the repair of the uterine wall after menstruation. Research indicates that lack of estrogen (e.g., in post-menopausal women) makes humans more prone to colon cancer and heart disease, but less prone to the “hormone dependent” cancers (ovarian cancer, uterine cancer, etc.).

Estrous cycle In mammals, the periodic cycle in which periods of estrus correspond to ovulation events; in Old English, also spelt as oestrous cycle.

Estrus (oestrus = frenzy) The period of maximum female sexual receptivity. Associated with ovulation of the egg. Being “in heat”.

EST-SNP Single nucleotide polymorphism analysis targeted to expressed sequence tag sites.

EST-SSR Microsatellite analysis targeted to expressed sequence tag sites.

ETEC Enterotoxigenic Escherichia coli. Strains of E. coli that produce a cholera-like toxin; have been implicated as causes of diarrhea.

Ethambutol A synthetic antimicrobial agent that interferes with the synthesis of RNA.

Ethanol (ethyl alcohol) (C₂H₆O; f.w. 46.07) Commonly used to disinfect plant tissues, glassware utensils and working surfaces in tissue culture manipulations. The concentration used is 70% (v/v) for disinfecting and 95% (v/v) when flaming tools. Ethanol is also used to dissolve water-insoluble additions (addendums) to culture media.

Ethephon (2-chloroethyl) phosphonic acid (ClC₂PO₃H₆; f.w. 144.50) Through a spontaneous degradation of ethephon, ethylene is produced. Ethephon is a synthetic compound commonly used to treat cultured cells or unripened fruit with ethylene.

Ether A molecule containing two carbons linked by an oxygen atom. Chemical formula ROR', where R and R' are alkyl groups.

Ethics A branch of philosophy that deals with morality. It is concerned with distinguishing between right and wrong human actions, both at an individual and societal level. Ethics may also apply to the rules or standards that specify how particular members of an organisation should conduct themselves.

Ethidium bromide A type of intercalating agent that causes mutations by inserting between adjacent base pairs in a double-stranded DNA molecule. It binds to DNA and fluoresces when viewed under ultraviolet light. Used as a stain for DNA.

Ethmoid sinus Air-filled cavity in the ethmoid bone located below the orbit of the eye and beside the nose.

Ethyl (-CH₂CH₃) Hydrophobic chemical group derived from ethane (CH₃CH₃).

Ethylene (CH₂ = CH₂) A gaseous plant hormone (growth regulator) that inhibits elongation in most growing tissues and promotes leaf abscission and fruit ripening and other physiological responses in some plants. Plants cells produce ethylene from the amino acid methionine. Also known as ethene.

Ethylenediamine tetraacetic acid (EDTA) A chelating compound. In tissue culture it is used to keep nutrients, such as iron, bound in a form that leaves them still available to the plant but which prevents them from precipitating out.

Ethylmethane sulfonate (EMS) A mutagen that acts by adding alkyl groups to nucleotide bases.

Etiolated Pale or weak due to lack of light. Blanched.

Etiolation An abnormal increase in stem elongation, accompanied by poor or absent leaf development.

Physiological etiolation is caused by a lack of chlorophyll, and is typical of plants growing under low light intensity or in complete darkness. It can also be caused due to disease causing microbes.

Etiological agent (of a disease) The microorganism (or other agent) that causes the disease.

Etiology The science (study) of the cause (source) of a disease.

Eubacteria Prokaryotic organisms; they possess peptidoglycan cell walls.

Eucaryote (eukaryote) Organism composed of one or more cells with DNA enclosed within a distinct membrane-bounded nucleus and cytoplasm. Includes all forms of life except viruses and prokaryotes (bacteria, archaea). Eucaryotic cells (e.g., human cells) are much larger and more complex than prokaryotic cells (e.g., bacteria). The cells of all higher organisms, plant and animal, are eucaryotic, so those higher (complex) organisms are often referred to as eucaryotes. Most eucaryotic organisms cannot survive temperatures greater than 131°F (55°C). However, one called the Pompeii worm (*Alvinella pompejana*) can withstand long-term exposure in water up to a temperature of 176°F (80°C). See **prokaryotes**

Euchromatin (euG = good + chromaG = colour) comprises all of the genome in the interphase nucleus except for the heterochromatin. The euchromatin is less tightly coiled than heterochromatin, and contains the active or potentially active genes. It is lightly staining portion of chromatin, not easily visible by light microscopy; “normal” chromatin, as opposed to the more condensed heterochromatin.

Eudicot All those plants having tricolpate pollen. These plants have a distinct trait in their pollen grains of exhibiting three colpi or grooves paralleling the polar axis. Example dandelions, cabbage etc.

Eugenics First formulated by Francis Galton, who was a contemporary of Gregor Mendel in the 19th century, eugenics is the concept that a species can be “improved” by encouraging reproduction of only those organisms in that species that possess “desired” traits i.e selective breeding. This belief became popular in a number of countries during the early 20th century. Margaret Sanger, founder of America’s Planned Parenthood organization, referred to African- Americans as “human weeds” and called for “more children from the fit, less from the unfit.”

Euglenoid An alga or plant like sps., usually with a single flagella and a pigmented eyespot (stigma).

Eugonic Growing luxuriantly (bacterial cultures).

Eukarya The phylogenetic domain containing all eukaryotic organisms.

Eukaryota One of the three great Kingdoms of Life, along with the Eubacteria and the Archaea. The Kingdom of living organisms made up of cells that contain a discrete nucleus. Most eukaryotic cells also contain various organelles such as mitochondria, and in green plants, chloroplasts. Eukaryota encompasses the Animalia, the Plantae or Chlorophyta (green plants), the Fungi, the Protista (single cell organisms), and others.

Eukaryotic organism whose cells contain distinct nuclei and other organelles; includes all known organisms except prokaryotes (bacteria and cyanobacteria). For example algae, fungi, plants and animals.

Euploid A cell carrying an exact multiple of the haploid chromosome number. For example, a diploid possesses twice the haploid number of chromosomes. See **haploid, diploid**.

European corn borer (ECB) Also known as pyralis. Latin name *Ostrinia nubilalis*, it is an insect whose larvae (caterpillars) eat and bore into the corn/maize plant (*Zea mays* L.). In doing so, they act as vectors

(i.e., carriers) of the fungi known as *Aspergillus flavus* (source of aflatoxin), *Fusarium moniliforme* (source of fumonisin) or *Aspergillus parasiticus* (source of aflatoxin). ECB control can be effected by some of the following methods: (1) Spraying of conventional synthetic chemical pesticides (2) Spraying of pesticides produced via promulgation of *Bacillus thuringiensis* (Bt) bacteria. (3) Incorporating a (protoxin) gene from *Bacillus thuringiensis* (Bt) into the DNA of the corn plant, so that the plant itself produces Bt protoxin.

European Medicines Evaluation Agency (EMEA) A London-based agency of the European Union (EU) that began operation in 1995. It coordinates drug licensing and safety matters throughout the nations of the EU. Its licensing/approval process is compulsory throughout the EU.

European Patent Convention An international patent treaty signed in 1973, by which the countries of Europe agreed to recognize and honor the patents granted by each country, plus those patents granted by the European Patent Office (EPO). Plant varieties or animal breeds were initially excluded from patentability by the European Patent Convention. In 1998, the European parliament removed that exclusion.

European Patent Office (EPO) The Munich, Germany-based agency of the European Union (EU) — established in 1977 — that is responsible for common patent protection matters for all of the (EU) member countries, plus the non-EU countries of Switzerland and Liechtenstein. The European Patent Office originally did not allow a “plant or animal breed” to be patented, whereas its U.S. counterpart — the U.S. Patent and Trademark Office (USPTO) — does allow patenting of microbes, plants, and animals (e.g., those which have been genetically engineered by man). In 1998, the European Parliament removed that exclusion, and in 1999, the European Patent Court issued a ruling which caused the European Patent Convention to allow patents on novel plants, thus making the two patent systems compatible.

European Plant Protection Organization (EPPO) One of the international SPS standard-setting organizations that develops plant health standards, guidelines, and recommendations (e.g., to prevent transfer of a plant disease or plant pest from one country to another). Its secretariat is in Paris, France. EPPO, one of the organizations within the International Plant Protection convention (IPPC), covers the countries of Europe.

Euthanasia The act of painless killing to relieve human suffering from an incurable disease.

Eutrophication Death of organisms in a lake or pond due to an overabundance of algae that consume all of the dissolved oxygen in the water. This usually happens when the water becomes rich in mineral and organic nutrients, often due to fertilizer run off from farms.

Evaluation Measurement of the characteristics that is important for production and adaptation, either of individual animals or of populations, most commonly in the context of comparative evaluation of the traits of animals or of populations.

Evaluation The process of assessing the performance (yield, quality, disease and insect resistance, etc.) of newly developed strains of a crop through appropriate multilocation trials.

Evapotranspiration (L. *evaporare*, e, out of, + *vapor*, vapour + F. *transpirer*, to perspire) The process of water loss in vapour form from a unit surface of land both directly and through leaf surfaces during a specific period of time.

Event Refers to each instance of a genetically engineered organism. For example, the same gene inserted by man into a given plant genome at two different locations (loci) along that plant's DNA would be considered two different events. Alternatively, two different genes inserted into the same locus of

two same-species plants would also be considered two different events. Generally speaking, the world's regulatory agencies confer new biotech-derived product approvals in terms of events.

Evolution A law of biology that states that all living organisms on this planet are related through descent from a common ancestor (Darwin's theory of evolution). It is a process by which the present diversity of plant and animal life arose from the earliest organisms by accumulating genetic changes that enable its members to successfully adapt to environmental conditions and to better exploit food resources, a process believed to have been continuing for at least 3000 million years.

Evolutionary clock A molecular clock that determines the rate at which mutations accumulate in a given gene for evolution to occur.

Evolutionary developmental biology (evolution of development or informally, *evo-devo*) is a field of biology that compares the developmental processes of different organisms to determine the ancestral relationship between them, and to discover how they evolved. It addresses the origin and evolution of embryonic development; how modifications of development and developmental processes lead to the production of novel features, such as the evolution of feathers; the role of developmental plasticity in evolution etc.

Evolutionary distance In phylogenetic trees, the sum of the physical distance on a tree separating organisms; this distance is inversely proportional to evolutionary relatedness.

Ewing's sarcoma A malignant *tumor* arising in *bone marrow*. It occurs most often in cylindrical bones, and the most prominent symptoms are pain, fever, and an increase in the number of *leukocytes* in the blood.

Ex situ conservation A conservation method which entails the actual removal of *germplasm* resources (seeds, pollen, sperm, individual organisms) from the original habitat or natural environment.

Ex situ conservation of farm animal genetic diversity All conservation of genetic material *in vivo*, but out of the environment in which it developed, and *in vitro* including, *inter alia*, the cryoconservation of semen, oocytes, embryos, cells or tissues. Note that *ex situ* conservation and *ex situ* preservation are considered here to be synonymous.

Ex vitro (L. "from glass") Organisms generally plants, removed from tissue culture and transplanted to soil or potting mixture. The term is also commonly used to describe the manipulations of genes outside the body for gene therapy. Ex. Exvivo gene therapy.

Ex vivo gene therapy The delivery of a gene or genes to the isolated cells of an individual. After culturing, the transformed cells are introduced back into the individual by transfusion, infusion or injection, to alleviate a genetic disorder.

Ex vivo testing The testing of a substance by exposing it to (excised) living cells (but not to the whole, multicelled organism) in order to ascertain the effect of the substance (for example, pharmaceutical) on the biochemistry of the cell.

Ex vivo therapy Removal of cells (e.g., certain blood cells) from a patient's body, alteration of those cells in one or more therapeutic ways, followed by reinsertion of the altered cells into the patient's body.

Exanthem Skin eruption as symptom of an acute disease, usually viral.

Exchange reaction A chemical reaction that has both synthesis and decomposition components.

Excinuclease The endonuclease-containing protein complex that excises a segment of damaged DNA during excision repair.

Excision (1) The natural or *in vitro* enzymatic release (removal) of a DNA segment from a chromosome or cloning vector. (2) Cutting out and preparing a tissue, organ, etc., for culture. (3) Removing adventitious shoots from callus tissue.

Excision of phage or episome or other sequence describes its release from the host chromosome as an autonomous DNA molecule.

Excision repair DNA repair processes that involve the removal of a damaged or incorrect segment of DNA and its replacement by the synthesis of a new strand using the complementary strand of DNA as template.

Excision The cutting out of a piece of damaged or defective DNA by enzymes. DNA damage might be constituted by the presence of a thymine dimer which inactivates that part of the DNA. The region of the dimer is cut out and then repaired.

Excitation movement of an electron to an outer orbit of a higher energy level.

Excitatory amino acids (EAAs) Amino acids present in the brain (when released by certain immune system cells) that can kill brain cells when in excess (e.g., results from strokes, which cause the release of too many EAAs in the brain). Another source of harmful EAAs (e.g., glutamate) is the disease known as multiple sclerosis. Some spiders paralyze their prey with venom that contains substance that blocks the action of EAAs; thus, pharmaceuticals based on an active ingredient in that venom may someday be used to prevent brain damage in stroke and in multiple sclerosis victims.

Excited state An energy-rich state of an atom or a molecule, produced by the absorption of radiant energy.

Exciton transfer A mode of decay of an energetically excited molecule, in which electronic energy is transferred to a nearby unexcited molecule. Also known as resonance energy transfer.

Excoriate To physically scratch or remove the skin.

Excrete To transport an unwanted compound like toxins, nitrogenous wastes etc. out of a cell.

Exergonic reaction (exL = out + ergonG = work) A chemical reaction that proceeds with the release of free energy in the form of heat (that is, for which ΔG is negative); exergonic reactions occur spontaneously. It is thermodynamically favoured.

Exfoliative cytology The microscopic examination of cells that have flaked off of (primarily) interior body surfaces to determine if a hidden *tumor* is present. Exfoliative cytology is a very powerful technique for discovering tumors, but it is useful only in those cases where the exfoliated cells can be readily obtained by a physician. The most common application is the *Pap smear*, where the exfoliated cells are from the uterus.

Exine The outer layer of the pollen wall. (Pronounced eks - een)

Exit site (E site) The ribosome binding site that contains the free tRNA prior to its release.

Exoantigen test In vitro immunodiffusion test method for identifying fungal hyphae as histoplasma, blastomyces, or coccidioides.

Exocrine gland In animals, a gland that secretes through a duct.

Exocyst is a complex of 8 proteins that is found at sites on the plasma membrane where secretion occurs. It tethers secretory vesicles to the membrane as the first step in the process of membrane fusion.

Exocytosis An active process of secreting proteins from a cell into the medium, in which vesicles containing excretory or secretory materials are actively carried to the periphery of the cell, and

released to the outside when the vesicle membrane fuses with the cell membrane; opposite of endocytosis.

Exoenzyme An enzyme that is synthesized in a cell but crosses the cell membrane and release their contents from the eukarotic cell.

Exoerythrocytic cycle Portion of the malarial life cycle occurring in the vertebrate host in which sporozoites, introduced by infected mosquitoes, penetrate the parenchymal liver cells and undergo schizogony, producing merozoites, which then initiate the erythrocytic cycle.

Exogamy The fusion of reproductive cells from distantly related or unrelated organisms, i.e., outbreeding.

Exogenote Chromosomal fragment homologous to an endogenote (the genetic complement of the partial zygote formed as a result of gene transfer during the process of recombination in bacteria) and donated to a merozygote.

Exogenous (Gr. *exe*, out, beyond + *genos*, race, kind) Produced or originating from outside, or due to external causes.

Exogenous DNA DNA that has been derived from a source organism and has been cloned into a vector and introduced into a host cell. Also referred to as foreign DNA or heterologous DNA.

Exogenous viruses Viruses those are foreign to the primary host cells. This category includes all viruses except the comparatively small class of endogenous *viruses*

Exoglycosidase An enzyme that hydrolyzes (cuts) only a terminal (end) bond in the oligosaccharide (molecular) branch(es) of a glycoprotein.

Exon A sequence of DNA within a eucaryotic gene that codes for an amino acid sequence. The name comes from the fact that exons are the only parts of an RNA transcript that are present outside the nucleus. An exon is usually adjacent to a noncoding DNA segment called an intron.

Exon amplification A procedure that is used to amplify exons.

Exon skipping Aberrant splicing in which one or more exons are omitted from the spliced RNA.

Exon theory of genes An 'introns early' hypothesis that holds that introns were formed when the first DNA genomes were constructed.

Exon trapping A method, based on cloning, for identifying the positions of exons in a DNA sequence. The method involves the insertion a genomic fragment into a vector whose function depends on the provision of splicing junctions by the fragment.

Exonic splicing enhancer (ESE) A nucleotide sequence that plays a positive regulatory role during splicing of GU-AG introns.

Exon-intron boundary The nucleotide sequence at the junction between an exon and an intron.

Exonuclease An enzyme that removes a terminal nucleotide (3' or 5') in a polynucleotide chain by hydrolyzing a terminal phosphodiester bond. Exonucleases remove the nucleotides in a successive way, one by one, and are highly specific in their action. 5' exonucleases require a free 5' end and degrade the molecule in the 5'-3' direction. 3' exonucleases require a free 3' end and degrade the molecule in the opposite direction.

Exonuclease III An *E. coli* enzyme that removes nucleotides from the 3'-hydroxyl ends of double stranded DNA. Also known as exodeoxyribonuclease III.

Exopeptidase A type of protein-splitting enzyme that hydrolyzes the terminal peptide bonds rather than those bonds within the chain; such enzymes complete the digestion of protein prior to absorption into the bloodstream; opposite of endopeptidase.

Exophthalmos (exG = out + ophthalmosG = eye) Prominence of the eyes.

Exopolysaccharide A high-molecular-weight polymer that is composed of sugar residues and is secreted by a micro-organism into the surrounding environment.

Exoskeleton A skeleton present on the outside of an organism as in arthropods or molluscs. Some vertebrates possess an exoskeleton in addition to an endoskeleton, for example, armadillos and turtles. The exoskeleton may lie outside the epidermis (as in arthropods) or inside (as in vertebrates, such as scaly fish, tortoises etc).

Exosome A multiprotein complex of several exonucleases involved in degradation of mRNA in eukaryotes.

Exosporium A lipid- protein membrane formed outside the coat of some endospores by the mother cell.

Exothermic reaction A chemical reaction that releases heat (that is, for which ΔH is negative), as in respiration.

Exotic Alien, being from another place or part of the world. A variety or species introduced from a foreign country.

Exotic germplasm Germplasm that has not been adapted (selectively bred) to the environment intended (for its offspring, via selective breeding by man).

Exotic libraries Collections of elite crop lines containing defined genomic regions from wild species, to provide pre-breeding material for modern varieties.

Exotic species This term is commonly used in publications and literature, and is similar to the terms alien species, foreign species, introduced species, non indigenous species, and non native species. Other definitions include (1) An introduced, non native species, or a species that is the result of direct or indirect, deliberate or accidental introduction of the species by humans, and for which introduction permitted the species to cross a natural barrier to dispersal. (2) In North America, often refers to those species not present in a bioregion before the entry of Europeans in the 16th century, or present in later parts of that region and later introduced to an ecosystem by human-mediated mechanisms.

Exotoxin Proteins (toxins) produced by certain bacteria that are released into their surroundings (growth medium). Produced by primarily Gram-positive bacteria. Diphtheria toxin was the first one discovered. Other exotoxins cause botulism, tetanus, gas gangrene, and scarlet fever. Exotoxins are generally more potent and specific in their actions than endotoxins.

Expected progeny difference (EPD) The predicted performance of the future offspring of an animal for a particular trait, calculated from measurement(s) of the animal's own performance and/or the performance of one or more of its relatives, for the trait in question and/or for one or more correlated traits. Typically, the prediction is expressed as a deviation from a well-defined base population, assuming the animal in question is mated to a sample of animals whose average genetic merit equals that of the base population. The predicted performance of the offspring of the mating between any two animals is the sum of their EPDs.

Experiment The test of a hypothesis. A successful experiment is one in which one or more alternative hypotheses are demonstrated to be inconsistent with experimental observation and are thus rejected.

Experimental allergic encephalomyelitis (EAE) It is an inflammatory disease of the central nervous system that develops after mice are immunized with neural antigens.

Experimental epidemiology The study of a disease using controlled experiments.

Explant An actively dividing plant tissue excised and prepared for culture in a nutrient medium that can be induced to produce callus tissue or organs like leaf, roots etc. in tissue culture.

Explant donor The source plant or mother plant from which is taken the explant used to initiate a culture.

Explantation The removal of cells, tissues or organs of animals and plants for observation of their growth and development in appropriate culture media.

Exploration A trip for collection of germplasm of cultivated and related wild species.

Explosion Method [to introduce foreign (new) genes into plant cells] A technique for gene-into-cell introduction in which the gene (genetic material) is driven into plant cells by the force of explosion (vaporization) of a drop of water (to which the gene and gold particles have been added). The explosion is caused by application of high-voltage electricity to the drop of gene-laden water; the water is then vaporized explosively, driving the "shot" (gold particles) and genetic material through the cell membrane. The plant cell then heals itself (reseals the hole where the gene entered), incorporates the new gene into its genetic complement, and produces whatever product (e.g., a protein) for which the newly introduced gene codes.

Exponent The number or quantity placed as a superscript to the right of another number or quantity, indicating how many times the number is to be multiplied by itself. For example, 10^4 means that 10 is to be multiplied by 10 four times and is hence equal to $10 \times 10 \times 10 \times 10 = 10,000$.

Exponential growth Growth of a microorganism where the cell number doubles within a fixed time period.

Exponential phase The growth stage where cells undergo their maximum rate of cell division. The exponential phase follows the lag phase, and precedes the linear growth phase.

Exportins A class of transport receptors that bind their cargo and associate with RanGTP in the nucleus. The trimeric complex translocates across the nuclear envelope into the cytoplasm, where hydrolysis of GTP bound to Ran results in release of cargo.

Express To translate the cell's genetic information stored in the DNA (gene) into a specific protein (synthesized by the cell's ribosome system). Certain proteins (i.e., when present in relevant cells) regulate the expression (e.g., increase/decrease/timing) of some genes. Production of an observable phenotype by a gene-usually by directing the synthesis of a protein

Expressed sequence tag (EST) A short strand of DNA that is a part of a cDNA copy of an mRNA. The EST is complementary to the mRNA and can be used to identify genes corresponding to the mRNA. Used in locating and mapping genes. Physically, the EST is composed of cRNA [i.e., the gene's "message" after the "junk DNA" (introns) have been edited out], produced by the analogous gene in (simple) model organisms such as (traditionally) *Caenorhabditis elegans* nematode, which has been sequenced/mapped. Functions of the "labeled" genes are (at least initially) inferred from (known function) *C. elegans* genes. See **cDNA, sequence tagged site**

Expression library A population of different DNA molecules encoding peptides, that has been cloned into one kind of expression vector.

Expression site in a trypanosome genome is a locus near a telomere that can express the VSG gene that is located there.

Expression system Combination of host and vector which provides a genetic context for making a cloned gene function, i.e., produces peptide, in the host cell.

Expression The process of converting genetic information into RNA and protein for use in the cell. Every gene is not expressed at the same level and at the same time. Expression patterns, easily analyzed using microarray technology, can give a lot of information about the roles genes play in different situations, such as disease and health.

Expression vector A cloning vector that has been constructed in such a way that, after insertion of a DNA molecule, its coding sequence is properly transcribed and the RNA is translated. The cloned gene is put under the control of a promoter sequence for the initiation of transcription, and often also has a transcription termination sequence at its end. Such promoters are termed *high level*; examples include P1 (the leftward promoter of phage λ) and the promoter of the yeast PGK (phosphoglycerate kinase) gene.

Expressivity Degree of expression of a trait controlled by a gene. A particular gene may show different degrees of expression in different individuals.

Exserted Describes stamens with filaments longer than perianth segments.

Extant Existing or living at the present time, in contrast to extinct (no longer living).

Extein sequences remain in the mature protein that is produced by processing a precursor via protein splicing. The functional component of a discontinuous protein.

Extension (in nucleic acids) The nucleic acid strand elongation (lengthening) that occurs in a polymerization reaction. Single-stranded DNA region consisting of one or more nucleotides at the end of a strand of duplex DNA. Also called as protruding end; sticky end; overhang; cohesive end.

Extensor surfaces The surface of a joint involved in extension or straightening of a limb.

External domain is the part of a plasma membrane protein that extends outside of the cell. Upon internalization, the protein's external domain extends into the lumen (the topological equivalent of the outside of the cell) of an organelle.

External node The end of a branch in a phylogenetic tree, representing one of the organisms or DNA sequences being studied.

Extinct breed A breed where it is no longer possible to recreate the breed population. Extinction is absolute when there are no breeding males (semen), breeding females (oocytes), nor embryos remaining.

Extinction coefficient (ϵ_λ) A coefficient that indicates the ability of a particular substance in solution to absorb light of wavelength λ . The molar coefficient, ϵ_M , is the absorbance that would be displayed by a 1M solution in a 1cm light path.

Extinction The irreversible condition of a species or other group of organisms of having no living representatives in the wild, which follows the death of the last surviving individual of that species or group. Extinction may occur on a local or global level; it can result from various human activities, including the destruction of habitats or the overexploitation of species that are hunted or harvested as a resource.

Extra arm of tRNA lies between the TyC and anticodon arms. It is the most variable in length in tRNA, from 3-21 bases. tRNAs are called class 1 if they lack it, and class 2 if they have it.

Extracellular enzyme An enzyme released from a cell to break down large molecules.

Extracellular matrix (ECM) is a relatively rigid layer of insoluble polysaccharides (such as glycosaminoglycans or cellulose) and proteins (such as collagen) that fill the spaces between cells in multicellular organisms. These glycoproteins connect to plasma membrane proteins. Serves as a structural element in tissues and also influences their development and physiology.

Extracellular medium aqueous medium outside cells. For a unicellular organism the extracellular medium is the outside world. For a multicellular organism such as a human being the extracellular medium is the fluid between the cells.

Extrachromosomal gene A gene in a mitochondrial or chloroplast genome.

Extrachromosomal genome in a bacterium is a self-replicating set of genes that is not part of the bacterial chromosome. In many cases, the genes are necessary for bacterial growth under certain environmental conditions.

Extrachromosomal resistance Drug resistance of a microorganism due to the presence of resistance “R” plasmids.

Extrachromosomal Things that are not part of the chromosomes; DNA units in the cytoplasm that control cytoplasmic inheritance.

Extrachromosomes Self-replicative genetic elements separate from main chromosome(s) of a cell. This definition usually excludes viruses, but the division is somewhat arbitrary. In bacteria, plasmids are the principal extrachromosomes; they encode functions which are not essential to the growth and division of the host cell. In eukaryotes, extrachromosomes may be either essential or dispensable. They may inhabit (i) the nucleus, e.g., extrachromosomal rDNA molecules, yeast 2 μ m plasmid; (ii) the cytosol, e.g., dsRNA molecules in fungi; or (iii) the cytoplasmic organelles, e.g., mitochondrial DNA, chloroplast DNA. Eukaryotic extrachromosomal elements may be recognized genetically by their failure to show segregation at meiosis. The genes present on these extrachromosomes are called extranuclear genes.

Extragenic DNA DNA that can neither be identified as coding for protein or RNA nor as being promoters or enhancers regulating transcription. Also called as non-coding DNA and junk DNA.

Extramedullary cranial ganglion Outside the medulla oblongata (brain stem), in reference to the cranial nerves.

Extravasation The movement of cells or fluid from within blood vessels to the surrounding tissues is called extravasation.

Extreme halophile An organism whose growth is dependent on large amounts (generally >10%) of NaCl.

Extreme homozygote A homozygote isolated from a hybrid, usually produced by crossing two or more parents, that has either all the positive or all the negative alleles for a trait for which the hybrid was heterozygous.

Extreme thermophile An organism whose optimum growth temperature is at least 80°C.

Extremophilic Bacteria Bacteria that live and reproduce outside (either colder or hotter) the typical temperature range of 40°F (4°C) to 140°F (60°C). They are also found at areas of high pressure (e.g., at the ocean bottom), salt saturation, (e.g., the Dead Sea), pH lower than 2 (e.g., coal deposits), pH higher than 11 (e.g., sewage sludge), high levels of radiation, etc.

Extremozymes Enzymes within the microorganisms (e.g., extremophilic bacteria) that populate extreme environments. Since extremozymes can catalyze reactions under high pressure, high temperatures, etc., they are increasingly being used as catalysts for industrial processes.

- Extrorse** Facing outward; e.g., describing the anther-sac opening facing away from the ovary.
- Exudate** Fluid that has passed out of blood vessels into adjacent tissues or spaces; high protein content.
- Exude** Slowly discharge; leak liquid material (exudate such as tannins or oxidized polyphenols) through pores or cuts, or by diffusion into the medium.
- Eyespot** A pigmented area capable of detecting the presence of light. The area is light sensitive but cannot form image.
- 10 nm fiber** is a linear array of nucleosomes, generated by unfolding from the natural condition of chromatin.
- 30 nm fiber** is a coiled coil of nucleosomes. It is the basic level of organization of nucleosomes in chromatin.
- 5' end** The end of a nucleic acid that lacks a nucleotide bound at the 5' position of the terminal residue.
- 5-Fluorouracil** It is an antimetabolite that is converted by intracellular enzymes to 5-fluorodeoxyuridine monophosphate. This nucleotide inhibits the enzyme thymidylate synthetase, which converts deoxyuridinemonophosphate to thymidinemonophosphate. 5-Fluorouracil thus inhibits the synthesis of DNA.
- F factor** A bacterial episome that confers the ability to function as a genetic donor in conjugation; the fertility factor in bacteria. Also known as fertility plasmid or sex-factor plasmid because it permits mating between F^+ and F^- bacteria.
- F plasmid** is an episome that can be free or integrated in *E. coli*, and which in either form can sponsor conjugation.
- F_0F_1 – ATPase** (Also called ATP synthase) A multisubunit protein consisting of proton-translocating membrane – embedded component (F_0) linked to a soluble catalytic component (F_1) that catalyzes ATP synthesis in the presence of a proton motive force.
- F_0F_1 complex** (Also called F_0F_1 ATP synthase) the enzyme complex in the inner mitochondrial membrane that uses energy from the transmembrane proton gradient to catalyze ATP synthesis. The F_0 portion of the complex spans the membrane, and the F_1 portion, which performs the ATP synthase activity, projects into the mitochondrial matrix.
- F_1 Generation** (first filial generation) The offspring produced from crossing two parental lines or individuals.
- F_1** The first filial generation in a cross between any two parents (P_1); the first generation of descent from a given mating; also known as first filial hybrids. They tend to be more healthy, productive, and uniform than their parents.
- F_2 Generation** (second filial generation) The offspring produced from self crossing or intercrossing individuals in the F_1 generation.
- F_2** The second filial generation, produced by crossing two members of the F_1 , or by self-pollinating the F_1 . The "grandchildren" of a given mating. It is also called as second filial generation.
- FA** Fluorescent antibody. An antibody labeled with a fluorescent marker.
- Fab fragment** IgG antibody molecules can be cleaved into three fragments by the enzyme papain. Two of these are identical Fab fragments, so called because they are the fragment with specific antigen binding. The Fab fragment consists of the light chain and the N-terminal half of the heavy chain held together by an inter chain disulfide bond. Another protease, pepsin, cuts in the

same general region of the antibody molecule as papain but on the carboxy-terminal side of the disulfide bonds. This produces the F (ab')₂ fragment, in which the two arms of the antibody molecule remain linked.

Facilitated diffusion The diffusion of a polar substance across a plasma membrane from an area of higher concentration to an area of lower concentration mediated by carrier proteins (permeases). It is a energy independent process and is also called as passive diffusion or passive transport.

Factor B, factor D, factor H, factor I, and factor P are all components of the alternative pathway of complement activation. Factor B plays a role very similar to that of C2b in the classical pathway. Factor D is a serine protease that cleaves factor B. Factor H is an inhibitory protein with a role similar to decay-accelerating factor. Factor I is a protease that breaks down various components of the alternative pathway. Factor P, or properdin, is a positive regulatory component of the alternative pathway. It stabilizes the C3 convertase of the alternative pathway on the surface of bacterial cells.

Factor IX A protein factor in the blood serum that is instrumental in the cascade of chemical reactions (involving 17 blood components) that leads to clot formation, following a cut or other wound to body tissue. A deficiency of Factor IX is the cause of the disease known as hemophilia B (approximately 15% of all hemophilia patients).

Factor VIII Also known as antihemophilic globulin (AHG) or antihemophilic Factor VIII. A protein factor in the blood serum that is instrumental in the "cascade" of chemical reactions (involving 17 blood components in the intrinsic pathway) that leads to clot formation following a cut or other wound to body tissue. Also, a deficiency of AHG is the cause of the classical type of hemophilia sometimes known as hemophilia A (approximately 85% of all hemophilia patients).

Factorial mating A mating scheme in which each male parent is mated with each female parent. Made possible in animals by means of *in vitro* embryo production. Such a mating scheme substantially reduces the rate of inbreeding in a selection programme.

Facultative aerobe. An organism that can use molecular oxygen in its metabolism but that also can live anaerobically.

Facultative anaerobe An organism that will grow under both aerobic or anaerobic conditions i.e., with or without oxygen (O₂). A bacterium that carries on aerobic metabolism when oxygen is present but shifts to anaerobic metabolism when oxygen is absent. See **aerobe, anaerobe**.

Facultative CAM The ability to switch from C₃ to CAM (Crassulacean acid metabolism) photosynthesis when water availability decreases.

Facultative cells Cells that can live either in the presence or absence of oxygen.

Facultative halophile An organism capable of growth in, but not requiring, 1% to 2% salt.

Facultative heterochromatin Chromatin that has a compact organization in some, but not all cells, thought to contain genes that are inactive in some cells or at some periods of the cell cycle. For example, one mammalian X chromosome in females.

Facultative Literally means "optional"; an adjective used to describe that an environmental factor is optionally (not necessarily) required for an organism to grow. For example, a facultative anaerobe can normally grow in the presence of oxygen but alternatively, it can also grow without oxygen.

Facultative parasite. An organism that normally lives as a saprophyte but under certain conditions can live as a parasite.

Facultative psychrophile An organism that grows best at temperatures below 20°C but can also grow at temperatures above 20°C.

Facultative saprophyte Mainly a parasitic organism with the ability to survive for a part of its life cycle as a saprophyte and be cultured on artificial media.

Facultative thermophile An organism that can grow both above and below 37°C.

FAD (flavin adenine dinucleotide) A co-enzyme important in various biochemical (oxidation-reduction) reactions. It comprises a phosphorylated vitamin B2 (riboflavin) molecule linked to the nucleotide adenine monophosphate (AMP). It functions as a hydrogen acceptor in dehydrogenation reactions, being reduced to FADH₂. This in turn is oxidized to FAD by the electron transport chain, thereby generating ATP (two molecules of ATP per molecule of FADH₂).

FADH₂ (reduced flavin adenine dinucleotide) Activated carrier molecule that is produced by the citric acid cycle.

Faeces (faeces, plural of faex = dregs) The bodily waste material that is formed in the large intestine and eliminated via the anus. Faeces contain a mixture of excretory material from the liver (e.g., bilirubin which gives the faeces their characteristic colour), food material which has passed straight through the gut, dead bacteria, dead cells and mucus.

Falcate (Of spores) sickle-shaped.

Fallow Previously cultivated land kept free from crops or weeds during at least one growing season.

Fallow The practice of leaving land either uncropped and weed-free, or with volunteer vegetation during at least one period when a crop would normally be grown; objective may be to control weeds, accumulate water, and/or available plant nutrients.

False-negative A negative assay result that should have been positive.

False-positive A positive assay result that should have been negative.

Familial traits The traits shared by members of a family. These include the hereditary as well as the environmentally influenced traits.

Family (*Familia* in Latin) A category of taxonomic classification that is narrower in scope than order but broader than genus. A family contains one or more genera within its bounds. Plant family names usually end in -aceae, e.g., Amaryllidaceae. Families may have Subfamilies defined, which in turn encompass Genera.

Fanconi's aplastic anemia A genetic defect in which all blood components show a reduced proliferation. About 10 percent of children with this disorder develop acute monomyelocytic *leukemia*. A rare form that accounts for less than 4 percent of all leukemias.

FAO Food and Agriculture Organization of the United Nations.

Faraday the electrical charge of one mole of electrons

Farm animal genetic resources Those animal species that are used, or may be used, for the production of food and agriculture, and the populations within each of them. These populations within each species can be classified as wild and feral populations, landraces and primary populations, standardized breeds, selected lines, and any conserved genetic material.

Farmer's right Rights provided to the farmers in the form of some reward for the maintenance of crop genetic diversity, which is the basis of all food and agriculture production in the world.

Farmer's lung It is a hypersensitivity disease caused by the interaction of IgG antibodies with large amounts of an inhaled allergen in the alveolar wall of the lung, causing alveolar wall inflammation and compromising gas exchange.

Farnesyl transferase An enzyme utilized by the *ras* gene (Rat sarcoma) to help "signal" certain cells to divide/grow .

Fas ligand A cell-surface member of the TNF (tumor necrosis factor) family of proteins. Binding of Fas ligand to Fas activates caspase 8 and hence triggers apoptosis in the Fas-bearing cell.

Fas protein (Fas) Membrane-bound receptor that initiates apoptosis in the receptor-bearing cell after binding to its ligand (Fas ligand).

Fascia Membranous covering of muscle.

Fasciated (Latin *Fasiculus*= a bundle) Having the apical meristem expanded from the normal point to a fan or cylindrical shape. Having two similar structures fused side by side into a single structure. Usually, a teratological abnormality.

Fasciation Hyperplastic symptoms characterized by a fusing (and flattening) of such plant organs as stems.

Fasciculation Hyperplastic symptom characterized by a clustering of such plant organs as shoots into structures as witches' brooms

Fast component of a reassociation reaction is the first to renature and contains highly repetitive DNA.

FASTA The first widely used algorithm for database similarity searching. The sequence format begins with a single-line description followed by lines of sequence data. This format can be used as query input when searching through bioinformatic tools such as BLAST or ClustalW.

Fastidious Having special requirement for growth and development.

Fastidious Referring to microorganisms that have special nutritional needs that are difficult to meet in the laboratory.

Fat cell (adipocytes) Connective-tissue cell that produces and stores fat (triacylglycerols) in animals.

Fatigue Exhaustion in muscles resulting from excretion or overstimulation following a period of activity.

Fats Energy storage substances produced by animals and some plants (e.g., soybeans), which consist of carbon, hydrogen and oxygen, with relatively more carbon and hydrogen and less oxygen than a carbohydrate; a combination of fatty acids and glycerol that form predominantly triglyceride molecules (although some diglyceride molecules are also often present in fats). Two separate components of plant cells are involved in the synthesis (manufacturing) of plant fats (lipids); the plastid and the endoplasmic reticulum. The content levels of individual fatty acids vary somewhat with the diet of the animal (i.e., for animal fat) and vary somewhat with the plant's growing conditions (i.e., for plant fat also known as vegetable oil). No natural fat is either totally saturated or unsaturated. When eaten, fats are generally not absorbed directly through the intestinal wall. They are first emulsified, and then hydrolyzed by the lipase enzyme. When fats are oxidized in cells, they provide energy for the body. Some of the energy is released as heat and some is stored in the form of adenosine triphosphate (ATP), which "fuels" metabolic processes.

Fat-soluble vitamin Any of several vitamins, including vitamins A, D, E and K that are soluble in organic solvents but insoluble in water.

Fatty acid (C_nH_{2n+1}COOH) A long-chain aliphatic hydrocarbon (composed of only carbon and hydrogen) with an oxygen-containing carboxylic acid group at one end, found in natural fats and oils. Fatty

acids can be saturated (containing no carbon-carbon double bond), monounsaturated (containing one carbon-carbon double bond), or polyunsaturated (containing multiple carbon-carbon double bonds). Fatty acids are abundant in cell membranes and (after extraction/purification) are widely used as industrial emulsifiers, e.g., phosphatidylcholine (lecithin). In general, fats possessing the highest levels of saturated fatty acids tend to be solid at room temperature, and those fats possessing the highest levels of unsaturated fatty acids tend to be liquid at room temperature.

Fatty acid synthetase A group of seven related enzymes that catalyze synthesis (manufacturing) of fatty acids within the soybean plant (*Glycine max* (L.) Merrill).

Fauna The total of all animals of a specified region or time.

Favic chandeliers Terminal hyphal branches that is irregular, broad, and antler-like in appearance. Especially characteristic of *Trichophyton schoenleinii*.

Favourable cases The number of outcomes which result in the happening of a desired event are called favorable cases.

Favus Dermatophyte infection of the scalp produced by *Trichophyton schoenleinii*.

F-Box Proteins Proteins produced (manufactured) within some eucaryotic cells that play an essential role in the degradation (i.e., breakdown) of cellular regulatory proteins, after those regulatory proteins have "completed their job" in the cell.

FC Flow cytometry.

Fc fragment IgG antibody molecules can be cleaved into three fragments by the enzyme papain. One of these is the Fc fragment, so-called for Fragment crystallizable. The Fc fragment consists of the C-terminal halves of the two heavy chains disulfide-bonded to each other by the residual hinge region. See Fab fragments.

Fc receptors One of a family of receptors specific for the invariant constant region (Fc region) of immunoglobulins (other than IgM and IgD); different Fc receptors are specific for IgG, IgA, IgE and their subclasses. They include the Fc γ and Fc ϵ receptors.

Fc γ receptors (Fc γ RI, RII, RIII Fc γ receptors) are cell-surface receptors that bind the Fc portion of IgG molecules. Most Fc γ receptors bind only aggregated IgG, allowing them to discriminate bound antibody from free IgG. They are expressed on phagocytes, B lymphocytes, NK cells, and follicular dendritic cells. They have a key role in humoral immunity, linking antibody binding to effector cell functions.

Fc ϵ -receptor (Fc ϵ RI) The high-affinity Fc ϵ -receptor (Fc ϵ RI) on the surface of mast cells and basophils binds free IgE. When antigen binds this IgE and crosslinks Fc ϵ RI, it causes mast-cell activation.

Feature table A table within an entry in a molecular sequence database describing the location of features of interest within the sequence itself.

Febrile Relating to fever.

Feces The unabsorbed residue of the digestive process, along with sloughed epithelium, mucus, and bacteria.

Fecundity The number of young ones produced by an organism during the entire course of its life i.e reproductive potential of an organism.

Fed-batch fermentation Culture of cells or micro-organisms where nutrients are added periodically to the bioreactor.

Federal Coordinated Framework for Regulation of Biotechnology The legal framework created by the U.S. government in 1986, which divided regulation of biotechnology among the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, and the U.S. Food and Drug Administration.

Federal Insecticide Fungicide and Rodenticide Act (FIFRA) A law enacted by the U.S. Congress in 1972. During 1994, the U.S. Environmental Protection Agency (EPA) proposed that the substances produced by plants (e.g., genetically engineered crops) for their defense against pests and diseases would be regulated by EPA under FIFRA.

Feedback A process in which the result of a process modifies the mechanisms carrying out that process to increase or decrease their rate. In negative feedback a change in some parameter activates a mechanism that reverses the change in that parameter; an example is the effect of tryptophan on expression of the *trp* operon. In positive feedback a change in some parameter activates a mechanism that accelerates the change; an example is the effect of depolarization on the opening of voltage-gated sodium channels.

Feedback inhibition A regulatory mechanism in which a biochemical pathway is regulated by the amount of the product that the pathway produces; also known as end-product inhibition. Inhibition of the first enzyme in a metabolic pathway by the end product of that pathway. This is a method of shutting down a metabolic pathway that is producing a product that is no longer needed.

Feeder layer A layer of cells upon which are cultured a fastidious cell type.

Feedforward activation The activation of a later step in a reaction sequence by the product of an earlier step.

Feedforward Control process in which a change in a parameter is predicted, and mechanisms initiated that will act to reduce the change in that parameter.

Feedstock Raw or starting material(s) used for the production of chemicals; or growth substrates of microbes (e.g., yeasts or bacteria that require a solid phase on which to attach themselves). For example, crude oil is the feedstock for the production of gasoline and diesel fuel in a refinery.

Female sterile mutation In *Drosophila*, it is one in that causes sterility in the female, often because of abnormalities in oogenesis.

FEN1 The 'flap endonuclease' involved in replication of the lagging strand in eukaryotes.

Fenestra In nematodes: A window or transparent spot; in some Heteroderidae, a thin-walled region of the vulval cone.

Fenestrate Having a fenestra.

Fenestration The area in which the fenestra occurs.

Feral Domestic or introduced animals living in wild conditions, or plants that have become wild.

Feral plant Domesticated plants reverting to the wild type outside the cropped area

Fermentation (Latin *fermentare*, to cause to rise) A term first used with regard to the foaming that occurs during the manufacture of wine and beer. The process dates back to at least 6,000 B.C. when the Egyptians made wine and beer by fermentation. The term "fermentation" is now used to refer to many different processes. Three typical definitions are given below: (1) A process in which chemical changes are brought about in an organic substrate through the actions of enzymes elaborated (produced) by microorganisms. (2) An enzymatic transformation of organic substrates (feedstocks), especially carbohydrates, generally accompanied by the evolution of gas. (3) The breakdown of carbon compounds by cells or organisms without using molecular oxygen. One product of the

pathway is always the energy- rich compound adenosine triphosphate (ATP). The other products are of many types: alcohol, glycerol, and carbon dioxide from yeast fermentation of various sugars; butyl alcohol, acetone, lactic acid, and acetic acid from various bacteria; citric acid, gluconic acid, antibiotics, vitamin B12 and B2 from mold fermentation. Microbes are usually incubated under specific conditions in large tanks called fermenters. Fermentation is a specific type of bioprocessing.

Fermentation substrates Materials used as food for growing micro-organism. The fermentation substrates and the trace materials needed, together with chemicals added to make the fermentation easier, form the culture medium.

Fermentor A large growth vessel used to culture microorganisms (specially prokaryotic cells) on a large scale, frequently for the production of some commercially valuable product.

Ferredoxin An important iron-containing protein acting as an electron carrier in the electron transport system that operates in the light reactions of photosynthesis, especially in noncyclic photophosphorylation. It was first found in an anaerobic bacterium

Ferrell cell A large-scale, three-dimensional pattern of atmospheric circulation in each hemisphere, located at mid-latitudes between the Hadley and polar cells.

Ferritin An iron-protein complex (a metalloprotein) that occurs in living tissues. Functions in absorption of iron through the intestinal mucosa; serves as a storage protein for iron in the liver and spleen.

Ferrobacteria Also called iron bacteria. They oxidize iron in the form $\text{Fe}(\text{OH})_3$ as a source of energy and then deposit it in the environment by secretion. The energy obtained from these reactions is used to carry on processes in which the basic substances needed by the bacterium are manufactured. Ferrobacteria are not disease producers (i.e., pathogenic), but they are important as scavengers. Ferrobacteria have been active through long periods of geologic time. For example, the great Mesabi iron (ore) seam of America's Lake Superior region is thought to be a product of ferrobacteria activity.

Ferrochelatase A mitochondrial enzyme that catalyzes the incorporation of iron into the protoporphyrin molecule.

ferredoxin protein component of the electron transport system of chloroplasts.

Ferrous Sulfate The most commonly used inorganic iron source, which is 20 percent iron and 18.8 percent sulfur. It is not effective as a soil-applied material because it quickly reverts to an unavailable form.

Fertigation Application of plant nutrients in irrigation water

Fertile An organism capable of breeding and reproduction.

Fertility factor (F) A type of transmissible (i.e., can enter other cells) plasmid that is often found in *Escherichia coli* (*E. coli*).

Fertilization (*L. fertilis*, to bear, capable of producing fruit) The union of two gametes (both haploid) from opposite sexes to form a diploid zygote; it involves the fusion of nuclei of gametes (karyogamy) and the fusion of cytoplasm (plasmogamy). Typically, each gamete contains a haploid set of chromosomes. Hence, after fusion of the nuclei, the resulting nucleus contains a diploid set of chromosomes. Several categories are distinguished: 1. Self-fertilization (selfing) - fusion of male and female gametes from the same euploid organism. 2. Cross-fertilization (crossing) - fusion of male and female gametes from different euploid individuals. 3. Double fertilization - in angiosperms, the fusion of one male gamete with the ovum at about the same time as the second male gamete fuses with the female polar nuclei (or secondary nucleus) to form the endosperm.

Fertilizer Analysis The percent composition of a fertilizer as determined in a laboratory and expressed as total N, available phosphoric acid (P_2O_5) equivalent, and water-soluble potash (K_2O) equivalent.

Fertilizer Any substance that is added to soil in order to increase its productivity. Fertilizers can be of natural origin, such as composts, or they can be inorganic (artificial fertilizer) chemical, particularly nitrates and phosphates.

Fetal antigens substances (primarily proteins, *glycoproteins and polysaccharides*) found in health almost exclusively in embryonic tissues and fetuses. They are rather loosely described as antigens because of the immune reaction they provoke in laboratory animals and in most cases, in mature animals of the same species. Many fetal antigens have been observed in adults with malignant tumors.

Fetal tissue The tissue from the unborn offspring of a human in the post-embryonic period (from eight weeks after fertilization to birth), after major structures have been outlined.

Fetus (Latin for pregnant) An animal embryo during the later stages of its development in the womb. In humans, a developing individual is referred to as a fetus from the end of the second month of gestation (beginning on the 57th day following fertilization or creation) until birth; also spelt as foetus.

Feulgen's test A histochemical test in which the distribution of DNA in the chromosomes of dividing cell nuclei can be observed. A tissue section is first treated with dilute hydrochloric acid to remove the purine bases of the DNA, thus exposing the aldehyde groups of the sugar deoxyribose. The section is then immersed in Schiff's reagent, which combines with the aldehyde groups to form a magenta-coloured compound.

Fever (febris = fever, through O.E. féfor) Rise of body temperature above normal, or diseases characterized by this phenomenon.

FI Hybrid The first generation of offspring produced by crossing two parents of different genotypes.

FIA Refers to immunodiagnostic tests that are based on fluorescence tracers (labels).

Fiber FISH A specialized form of FISH that enables high marker resolution.

Fibres Elongated cells with tapering, pointed ends; the cells interlock to form a strong, rigid tissue; pits in the walls are usually very narrow and not very numerous.

Fibril Microscopic to sub-microscopic cellulose thread that is part of the cellulose matrix of plant cell walls.

Fibrillar collagen Type of collagen molecule which assembles into rope-like structures. Collagens type I (common in skin), II, III, V and XI are of this type.

Fibrin The ordered fibrous array of fibrin monomers, called a fibrin-platelet clot (blood clot), which spontaneously assembles from fibrin monomers (which themselves are formed by the thrombin-catalyzed conversion of fibrinogen into fibrin). Fibrinogen itself is the product of a controlled series of zymogen activation steps (enzymatic cascade) triggered initially by substances released from body tissues as a consequence of trauma (harm).

Fibrinogen A large soluble protein found in blood plasma that is formed in the liver and is converted to insoluble fibrin during the process of blood clotting; also known as fibrin.

Fibrinolysin A kinase produced by Streptococci.

Fibrinolytic agents Bloodborne compounds that activate fibrin in order to dissolve blood clots.

Fibroblast growth factor (FGF) It was first described by Dr. Gospodarowicz and fellow researchers at the University of California, San Francisco in the mid-1970s. It is a protein that stimulates the

formation/development of blood vessels and fibroblasts (precursors to collagen, the connective tissue “glue” that holds cells together). It opposes apoptosis and promotes cell division in target cells. FGF also is mitogenic (causes cells to divide and multiply) for both fibroblasts and endothelial cells, and attracts those two cell types (i.e., chemotactic). Plays critical roles in determining cell fate during development.

Fibroblasts cell found in connective tissue. Fibroblasts synthesize collagen and other components of the extracellular matrix, which gives skin its strength. Because fibroblasts do not express antigens on their cell surfaces (free standing, separated), fibroblasts possess potential for use in making artificial organs (e.g., artificial pancreas for diabetics), since recipient immune systems cannot recognize the fibroblast cells as foreign. Fibroblasts are relatively easy to grow in cell culture and often are used for this purpose.

Fibronectin High-molecular weight adhesive glycoprotein that forms a link between the epithelial cells and the connective tissue matrix (essential for blood clotting) and is involved in the guidance of migrating cells during embryogenesis. Integrins on the cell surface are receptors for fibronectin. Research has indicated that fibronectin may solve the problem of getting new cells to stick to existing tissue, once a growth factor has caused them to grow (e.g., when growth factor is administered after a serious wound to tissue).

Fibrosarcoma A malignant tumor of adult connective tissues.

Fibrosis (fibraL = a fibre) Formation of scar tissues.

Fibrous Composed of profusely branched roots with many lateral rootlets but with no main or tap root development.

Fibrous proteins Insoluble proteins of elongate shape that serve in a protective or structural role; contain polypeptide chains that generally share a common secondary structure.

Fibrous root Root system in which both primary and lateral roots have approximately equal diameters. Opposite is tap root.

Field Capacity Soil water content after the soil has been saturated and allowed to drain freely for 24 to 48 hours. Free drainage occurs because of the force of gravity pulling on the water. When water stops draining, we know that the remaining water is held in the soil with a force greater than that of gravity.

Field collection (field genebank) Is a collection of living plants (e.g. fruit trees, glass house crops and perennial field crops). Germplasm which would be otherwise be difficult to maintain as seed can be kept in field collections.

Field Inversion Gel Electrophoresis (FIGE) A chromatographic procedure for the separation of a mixture of molecules by means of a two-dimensional electrical field, applied across a gel matrix containing those molecules. For example, FIGE is commonly used to separate mixtures of large DNA molecules by their size and (electrical) charge. FIGE can be used to separate (resolve) DNA molecules up to 2000 Kbp in length.

Field Water Capacity (FC) The content of water, on a mass or volume basis, remaining in a soil 2 or 3 days after having been wetted with water and after free drainage is negligible .

FIFRA The Federal Insecticide, Fungicide, and Rodenticide Act.

Filament The stalk or support of the anther. Part of the stamen.

Filamentous Long, cylindrical, and threadlike; hyphae forming.

Filariform larvae Slender, infective larvae of *Strongyloides stercoralis* and hookworm.

File transfer protocol (FTP) An agreed method used by two or more computer systems for exchanging data files over local or a wide area computer communications networks.

Filial generation (F₁, F₂) Each generation of offspring in a breeding program, designated F₁, F₂, etc.

Filiform Thread-shaped.

Filler Epithelial Cells Skin cells that initially form under a scab in the wound healing process, in response to stimulation by epidermal growth factor (EGF).

Filopodium (plural **filopodia**) Thin, spike-like protrusion with an actin filament core, generated on the leading edge of a crawling animal cell.

Filovirus A filamentous virus that displays unusual variability in shape. Two filoviruses, the Ebola virus and the Marburg virus, have been associated with human disease.

Filter bioreactor; mesh bioreactor Cells are grown on an open mesh of an inert material, which allows the culture medium to flow past it but retains the cells. This is similar in idea to membrane and hollow fibre reactors, but can be much easier to set up, being similar to conventional tower bioreactors, but with the meshwork replacing the central reactor space.

Filter sterilization Process of sterilizing a liquid by passage through a filter with pores so small that they prevent the passage of micro-organisms and microbial spores.

Filtering Also known as masking. The process of hiding regions of (nucleic acid or amino acid) sequence having characteristics that frequently leads to spurious high scores.

Filterpaper disk method Method of evaluating the antimicrobial properties of a chemical agent using filterpaper disks placed on an inoculated agar plate.

Filtration (1) Separation of solids from liquids by using a porous material that only allows passage of the liquid or of solids of a smaller than the pore size of the filter. The material passing the filter forms the filtrate. (2) Removal of cell aggregates to obtain a filtrate of single cells that can be utilized as plating inocula; a 0.45µm filter removes bacteria.

Fimbriae Proteinaceous fingerlike surface structures on a bacterial cell used for adherence to host surfaces.

Fine adjustment Focusing mechanism of a microscope that very slowly changes the distance between the objective lens and the specimen.

Fine-filter Of or referring to an approach to conservation biology that focuses on genes, populations, and species.

Fingerprinting In genetics, the identification of multiple specific alleles on a person's DNA to produce a unique identifier for that person.

Finished DNA Sequence High-quality, low error, gap-free DNA sequence of the human genome. Achieving this ultimate 2003 HGP goal requires additional sequencing to close gaps, reduce ambiguities, and allow for only a single error every 10,000 bases, the agreed-upon standard for HGP finished sequence.

First law of thermodynamics The law stating that in all processes, the total energy of the universe remains constant. It is neither be created nor destroyed. It is, therefore, possible to account for any change in the internal energy of a system ΔE by an exchange of heat (q) and/or work (w) with the surroundings. $\Delta E = q - w$.

- First set rejection** When tissue or organ grafts are placed in an unmatched recipient, they are rejected by a first set rejection, which is an immune response by the host against foreign antigens in the graft.
- First-order reaction** A reaction in which the rate of reaction is directly proportional to the concentration of one of the reactants, either product or substrate. Compare second-order reaction.
- Fischer convention** A system for describing the absolute configurations of chiral molecules by relating their structures to that of D- or L- glyceraldehyde.
- Fischer projection formulas** A graphical convention for representing the stereoisomers in a plane. The tetrahedron of bonds on a carbon is represented as a plane cross, where the bonds to the right and left are assumed to be pointing toward the viewer and the bonds to the top and bottom are assumed to be pointing away from the viewer. Fischer projections of monosaccharides are oriented with the carbonyl group at the top; the chiral carbon farthest from the carbonyl group (which is the one that determines whether the sugar is the D or L form) is then drawn with its hydroxyl to the right for the D form and to the left for the L form.
- Fission** (L. *fissilis*, easily split) Division of a cell into two cells by splitting. Asexual reproduction involving the division of a single-celled individual into two new single-celled individuals of equal size. In addition it describes the division of a single membrane-bound organelle into two and the process whereby a vesicle breaks away from a membrane.
- Fission yeast** Common name often given to the yeast *Schizosaccharomyces pombe*, a common experimental organism. It divides to give two equal-sized cells.
- Fistula** Abnormal communication between two surfaces or between a viscus or other hollow structure and the exterior.
- Fitness** The ability of an organism or allele to survive and reproduce. The number of offspring left by an individual, often compared with the average of the population or with some other standard, such as the number of offspring left by a particular genotype.
- Fitz-Hugh-Curtis syndrome** Inflammation of the capsule of the liver that may be seen in course of gonococcal or chlamydial infection in the female.
- Five kingdom system** Classification system in which organisms are assigned to one of five kingdoms: Animalia, Plantae, Fungi, Protista, or Monera.
- Fixation** (1) With respect to the genetic composition of a population, when all the alleles at a locus except one are eliminated from a population. The remaining allele, now occurring with a frequency of 100%, is said to have been fixed. (2) The uptake of the gaseous form of a compound, including CO₂ in photosynthesis and N₂ in nitrogen fixation, by organisms for use in metabolic functions.
- Fixation, Nitrogen** Conversion of molecular nitrogen (N₂) to ammonia and subsequently to organic nitrogen utilizable in biological processes.
- Fixative** A chemical reagent such as formaldehyde or osmium tetroxide used to preserve cells for microscopy. Samples treated with these reagents are said to be "fixed", and the process is called fixation.
- Fixed macrophage** A macrophage that is located in a certain organ or tissue - for example, in liver, lungs, spleen, or lymph - nodes.
- Fixing (chemical elements)** Combining elements so that a critical element can enter the food chain. See Nitrogen fixation; Calvin-Benson cycle.
- Fixing (in slide preparation)** The process of attaching the specimen to the slide.

Flaccid (flaccidL, from flaccus = flabby) Relaxed; flabby, Body becomes soft and weak, lacking firmness.

Flagella (flagellumL = whip) A protein-based, flexible, whip-like organ of locomotion found on some microorganisms. With these, microorganisms are able to swim. Flagella are usually very long and there is usually only one or two per cell. The tails of sperm cells are examples of flagella. Flagella are used in the swimming motion of bacteria toward sources of nutrients in a process called chemotaxis (sl: flagellum; adj: flagellate). Eucaryotic flagella are longer versions of cilia. Bacterial flagella are smaller and completely different in construction and mechanism of action.

Flagellar staining A technique for observing flagella by coating the surface of flagella with a dye or a metal like silver.

Flagellate A member of the protozoan phylum Mastigophora that uses flagella for locomotion. Having one or more flagella.

Flagellin Protein that is the bacterial flagellum.

Flagship species A charismatic species that may be emphasized in conservation efforts because it helps to garner public support for a conservation project.

Flame cell Primitive, ciliated excretory cell in trematodes; the movement of the cilia on this cell within the miracidium larva (within a schistosome egg) indicates egg viability.

Flaming A technique for sterilizing instruments by heating on a flame after dipping in alcohol (usually 95% (v/v) ethanol) thus heat-sterilizing the tool surface.

Flanking Flanking means sequences that border something. Flanking primers are located on either side of a DNA sequence of interest.

Flanking region The DNA sequences extending on either side of a specific locus or gene.

Flanking sequence A segment of DNA molecule that either precedes or follows the region of interest on the molecule.

Flash Grazing A relatively short grazing period usually involving high grazing pressure.

Flat sour spoilage Thermophilic spoilage of canned goods not accompanied by gas production.

Flatulence (flatusL = a blowing) Excess of gas in the digestive tract (stomach and intestines).

Flatworm A primitive, unsegmented, hermaphroditic and often parasitic worm belonging to the phylum Platyhelminthes.

Flavin adenine dinucleotide (FAD) The coenzyme of some adenine dinucleotide (FAD) oxidation-reduction enzymes; it contains riboflavin. It functions in the removal and transfer of hydrogen ions and electrons from substrate molecules. See **flavin**.

Flavin An enzyme that contains, as tightly bound prosthetic groups, either flavin mononucleotide (FMN) or flavin adenine dinucleotide (FAD). One of a group of pale yellow, greenly fluorescing biological pigments widely distributed in small quantities in plant and animal tissues. Flavins are synthesized only by bacteria, yeast, and green plants; for this reason, animals are dependent on plant sources for riboflavin (vitamin B2), the most prevalent member of the group.

Flavin mononucleotide (FMN) A coenzyme that functions in the transfer of electrons in the electron transport chain. Riboflavin phosphate, a coenzyme of certain oxidoreduction enzymes.

Flavin nucleotides Nucleotide coenzymes (FMN and FAD) containing riboflavin.

Flavin-linked dehydrogenases Dehydrogenases are enzymes (involved in removing hydrogen atoms from their substrate) requiring one of the riboflavin coenzymes, FMN or FAD.

Flavone A water-soluble aromatic molecule (i.e. contains a benzene ring as a core molecule), yellowish pigment related to the anthocyanins. It is significant in the communication of legume plant to *Rhizobium* and *Bradyrhizobium*.

Flavonoids Any phenylpropanoid-derived compound that is linked to 3 acetate units and condensed into a multiple-ringed structure; that are typically beneficial to the health of humans that consume them. Hundreds of flavonoids are naturally produced (by plants) in common human foods. For example, the three isoflavones (genistein, daidzein, and glycitein) produced in seeds of the soybean plant (*Glycine max* (L.) Merrill) are flavonoids, and they confer several health benefits to humans that consume them. Coffee, tea, and chocolate products contain a number of antioxidant flavonoids (i.e., polyphenols). Other subcategories of flavonoids are flavones, flavonols, flavanols, aurones, chalcones, etc.

Flavonols A group of phytochemicals, consisting of a subcategory of the flavonoid “family” of phytochemicals. Flavonols are typically beneficial to the health of humans that consume them, and are found in citrus fruits such as grapefruit, oranges, etc. However, at least one flavonol (quercetin glycoside) is found in tomato peels.

Flavoprotein An enzyme containing a flavin nucleotide as a prosthetic group; acts as an intermediate carrier in respiratory chains between dehydrogenases and cytochromes.

Flavr Savr Transgenic tomato developed by using antisense technology.

Flesh-eating bacteria A strain of Group A streptococcus which, in severe cases, can destroy tissue as fast as surgeons can cut it out. The rapid destruction of tissue caused by these bacteria is localized, so it is unlikely to be caused by a general over stimulation of the immune system by, for example, superantigen exotoxin A. Instead, the invasive strains of streptococcus A probably have other toxin(s) such as exotoxin B, an enzyme (i.e. cysteine protease) that destroys tissue by breaking down protein.

Flexure A turn or fold.

Flipase An enzyme that catalyzes the translocation of a membrane lipid across a lipid bilayer (a flip-flop).

FLO Flocculation.

Floccose Cottony; like raw, fuzzy cotton.

Flocculant Agent that causes small particles to aggregate (flocculate).

Flocculation Removal of colloidal material during water purification by addition of a chemical (alum) that causes the colloidal particles to coalesce (such as clay).

Flocculation test Antigen-antibody test in which a precipitin end product forms macroscopically or microscopically visible clumps.

Floccule Micro-organism aggregate or colloidal particle floating in or on a liquid. Contaminated liquid media are usually cloudy, illustrating this flocculation phenomenon.

Flora Plant or bacterial life forms of a region or geological period.

Florets Small or reduced flowers; often found in grasses and the Asteraceae family.

Florigen A hypothetical flowering hormone, that may be produced in leaves and moves to the bud to stimulate flowering; florigen has never been identified or isolated.

Floury-2 A gene in corn/maize (*Zea mays* L.) that (when present in the DNA of a given plant) causes that plant to produce seed that contains higher-than-traditional levels of the amino acids methionine and tryptophan.

Flow cytometer An instrument that separates and counts cells; it detects cells by the presence of a fluorescent tag on the cell surface.

Flow cytometry A technique used to sort cells or other biological materials by detection of the light-absorbing or fluorescing properties of cells or subcellular fractions (chromosomes) passing in a narrow stream through a laser beam. An absorbance or fluorescence profile of the sample is produced. Automated sorting devices, used to fractionate samples, sort successive droplets of the analyzed stream into different fractions depending on the fluorescence emitted by each droplet. The cells are categorized first by size and then computer analyzed to sort the mixture of cellular elements into cell type by size.

Flow karyotyping Use of flow cytometry to analyze and separate chromosomes according to their DNA content.

Flower The organ in an angiosperm that comprises the group of structures used for sexual reproduction. The parts of a flower are arranged in whorls. The lowest whorl comprises the sepals; the next whorl comprises the petals; the third whorl comprises the male reproductive organs (stamens) and the outer most whorl comprises the female reproductive organs (the pistil: ovary, style, and stigma).

FLpter value The unit used in FISH to describe the position of a hybridization signal relative to the end of the short arm of the chromosome.

Fluid mosaic model A hypothetical scheme for the structure of cell membranes proposed by S.J. Singer and G.L. Nicolson (1972). The model postulates that integral proteins are embedded in the lipid bilayer and are free to move laterally in the plane of the membrane. In this model, the surface membranes of cells are dynamic fluid structures in which the membrane components may migrate laterally in the membrane plane.

Fluidity is a property of membranes; it indicates the ability of lipids to move laterally within their particular monolayer. Transformed cells grow as a compact mass of rounded-up cells that grows in dense clusters, piled up on one another. They appear as a distinct focus on a culture plate, contrasted with normal cells that grow as a spread-out monolayer attached to the substratum.

Fluid-phase endocytosis Type of endocytosis in which small vesicles bud off internally from the plasma membrane, carrying extracellular fluid and dissolved material into the cell.

Fluke A flatworm belonging to the class Trematoda (*Clonorchis*, *Paragonimus*, *Fasciola*, and *Schistosoma* spp.). It can be an internal or external parasite.

Fluorescein A fluorescent dye.

Fluorescein Fluorescent dye that fluoresces green when illuminated with blue light or ultraviolet light.

Fluorescence activated cell sorter (FACS) A machine used to sort cells from a mixed group of cells. The desired cells are first labeled with a specific fluorescent dye, and then passed through a flow chamber that is illuminated by a laser beam, which causes the labeled cells to fluoresce glow. The molecules of the fluorescent dye, which "stick" to only one type of cell in the mixture, contain chromophores that can be elevated to an excited, unstable state via irradiation with specific wavelength(s) of light. Those chromophores remain in that excited state for a maximum of 10^{-9} seconds before releasing their energy by emitting light, and returning to their unexcited "ground" state. Individual cells can be characterized and separated by the machine called a fluorescence-

activated cell sorter (FACS®) that measures cell size, granularity, and fluorescence due to bound fluorescent antibodies as single cells pass in a stream past photodetectors.

Fluorescence in situ hybridization (FISH) A method for detecting the presence of a particular gene (e.g., in a biological sample), which utilizes a fluorescein-“tagged” DNA probe. When the DNA probe hybridizes to that particular gene, the “tag” fluoresces (thereby indicating positively the presence in sample of that particular gene). It is used in physical mapping that uses fluorescein tags to detect hybridization of probes with metaphase chromosomes and with the less-condensed somatic interphase chromatin.

Fluorescence microscope Microscope designed to view material stained with fluorescent dyes. Similar to a light microscope but the illuminating light is passed through one set of filters before the specimen, to select those wavelengths that excite the dye, and through another set of filters before it reaches the eye, to select only those wavelengths emitted when the dye fluoresces.

Fluorescence polarization immunoassay (FPIA) a technique which takes advantage of the increased polarization (non-random propagation of emission) of fluorescent light emissions when a fluorescently labeled antigen is bound by reagent antibody. The higher the concentration of unlabeled patient antigen present in the test mixture, the less bound fluorescent antigen is present and, consequently, the lower the polarization of the fluorescent light emission. Standard calibration yields quantitative results.

Fluorescence recovery after photobleaching (FRAP) A technique used to study the mobility of nuclear proteins. The technique assesses the diffusion of membrane components from the rate at which the fluorescently labeled component moves into an area previously bleached by a pulse of laser light.

Fluorescence The property of giving out light when molecules are excited by incident light; emitted light is always of a shorter wavelength than the incident light. The light absorbed by a substance at a given wavelength is radiated as a light of longer wavelength. All cells will naturally fluoresce, at least a bit. Human colon cancer cells, and precursor cells, fluoresce much more (and emit much more red light when they fluoresce) than noncancerous cells; which may lead to a new and better means of early detection.

Fluorescent antibody Immunoglobulin molecule which has been coupled with a fluorescent molecule so that it exhibits fluorescence. FA allows a competent technologist to identify visually the site of the antigen-antibody reaction thereby indicating specificity.

Fluorescent dye molecule that absorbs at one wavelength and responds by emitting light at another wavelength. The emitted light is of longer wavelength (and hence of lower energy) than the light absorbed.

Fluorescent Emission of light by a substance (or a microscopic preparation) while acted on by radiant energy, such as ultraviolet rays, as in the immunofluorescent procedure.

Fluorescent in situ hybridization (FISH) A technique for locating markers on chromosomes by observing the hybridization positions of fluorescent labels.

Fluorescent labeling The labeling of probes or primers with fluorescent tags in order to enable detection of variation in DNA fragments.

Fluorescent probe Probe whose response is based on the fluorescence intensity of individual cells or cell components.

Fluorescent resonance energy transfer (FRET) Technique of monitoring the closeness of two fluorescently labeled molecules (and thus their interaction) in cells.

Fluorescent-antibody technique A diagnostic tool using antibodies labeled with fluorochromes and viewed through a fluorescence microscope.

Fluorochrome A dye that becomes fluorescent or self-luminous after exposure to ultraviolet light. Example propidium iodide (PI) is used to stain DNA.

Fluorophore A molecule which fluoresces, give off light energy, when excited by an external light source.

Fluoroquinolone Synthetic antibacterial agents that inhibit DNA synthesis.

Flush end An end of a double-stranded DNA molecule where both strands terminate at the same nucleotide position with no single-stranded extension.

Flux (1) With reference to a chemical pathway, the rate (in moles per unit time) at which reactant 'flows through' the metabolic pathway to emerge as a product. (2) The rate of transport per unit area.

fMet N-formylmethionine, methionine modified by the attachment of a formyl group; fmet is the first amino acid in all newly made bacterial polypeptides.

FMN (flavin mononucleotide) Riboflavin phosphate, a coenzyme of certain oxidation-reduction enzymes.

Focal adhesion kinase (FAK) cytoplasmic tyrosine kinase present at cell-matrix junctions (focal adhesions) in association with the cytoplasmic tails of integrins (Integrins are transmembrane receptors that mediate the attachment between a cell and the tissues that surround it, such as other cells or the extracellular matrix).

Focal adhesion, focal contact (adhesion plaque) A type of anchoring cell junction, forming a small region on the surface of a fibroblast or other cell that is anchored to the extracellular matrix. Attachment is mediated by transmembrane proteins such as integrins, which are linked, through other proteins, to actin filament in the cytoplasm.

Focal contact Points at which a locomoting cell makes contact with its substrate.

Focal infection A systemic infection that began as an infection in one place.

Focal species One of a group of species selected as a priority for conservation efforts and chosen because its ecological requirements differ from other species in the group, thereby helping to ensure that as many different species as possible receive protection.

Foetus Pre-natal stage of a viviparous animal, between the embryonic stage and parturition.

Fog Fine particles of liquid suspended in the air, such as of water in a fog chamber used for acclimatizing recent *ex vitro* transplants.

Fold-back The structure formed when a double-stranded DNA molecule containing an inverted repeat sequence is denatured and then allowed to re-anneal at low DNA concentrations. The repeated sequence permits the formation of a double-stranded region within each of the separated strands of the original molecule.

Folded genome The condensed intracellular state of the DNA in the nucleoid of a bacterium. The DNA is segregated into domains, and each domain is independently negatively supercoiled.

Folded leaf A layer of alpha-helices wrapped around a single hydrophobic core but not with the simple geometry of a bundle.

Folding domain A segment of a polypeptide that folds independently of other segments.

Folding pathway The series of events, involving partially folded intermediates, that results in an unfolded protein attaining its correct three-dimensional structure.

Folic acid (C₁₉H₁₉O₆N₇) A water-soluble vitamin of the B complex group and designated as vitamin B₉; widely distributed in biological world; the important sources are liver, kidney, yeast and wheat; a yellow crystalline substance, insoluble in fat solvents and inactivated by sunlight; carries out enzymatic synthesis of pyrimidines, purines and amino acids. Deficiency of folic acid is believed to be the most common form of vitamin undernutrition. In man, folic acid deficiency leads to megaloblastic anemia and gastrointestinal disorders. Folic acid must proceed through two cellular reductions to become tetrahydrofolic acid, which is its active form. Folic acid antimetabolites such as methotrexate and aminopterin block the enzymes that carry out these reductions.

Follicle (folliculus = small ball) Any enclosing cluster of cells that protects and nourishes a cell or structure within. Thus a follicle in the ovary contains a developing egg cell, while a hair follicle envelops the root of hair. (1) In a mammalian ovary, one of the spherical chambers containing an oocyte. (2) A dry fruit formed by a single carpel splitting along a line, usually ventral, to liberate its seeds. (3) Peripheral lymphoid tissues, such as lymph nodes and Peyer's patches, contain large areas of B cells called follicles, which are organized around follicular dendritic cells

Follicle stimulating hormone (FSH) A glycoprotein hormone, secreted by the anterior pituitary gland in mammals, that stimulates, in female mammals, ripening of specialized structures in the ovary (Graafian follicles) that produce ova and, in males, the formation of sperm in the testis. It is a major constituent of fertility drugs.

Follicular center cell lymphoma is a type of B-cell lymphoma that tends to grow in the follicles of lymphoid tissues.

Follicular dendritic cells of lymphoid follicles are cells of uncertain origin. They are characterized by long branching processes that make intimate contact with many different B cells. They have Fc receptors that are not internalized by receptor-mediated endocytosis and thus hold antigen:antibody complexes on the surface for long periods. These cells are crucial in selecting antigen-binding B cells during antibody responses.

Folliculitis Also called pimple or pustule. Local infection produced when hair follicles are invaded by pathogenic bacteria.

Fomite A non living object that can spread infection such as clothing, dishes, or paper money.

Fontanelles Soft area between the cranial bones of an infant's skull, indicative of areas not yet ossified.

Food An organic substance (carbohydrate, protein, or fat) furnishing energy or building material for protoplasm; whether processed, semi-processed or raw, which is intended for human consumption. It includes drinks, chewing gum and any substance which has been used to manufacture, prepare or treat "food". It excludes cosmetics, tobacco and substances used only as drugs.

Food and Drug Administration (FDA) The federal agency charged with approving all pharmaceutical and food ingredient products sold within the U.S. In 1992, prior to approval of any of the biotechnology derived food crop plants, the FDA decided that food crops produced via "biotechnological (i.e., recombinant) technologies" must meet the same rigorous safety standards as those created via "traditional breeding methods," both categories of which are regulated by the FDA. Historically, new food crops created via "traditional breeding technologies" (e.g., crossing with wild type in order to confer disease resistance, increased yield, etc. on the resultant domesticated plant varieties/strains) have sometimes contained unexpectedly high levels of known (and naturally occurring) toxins (e.g., solanine, a naturally occurring toxin in potatoes and some other plants, psoralene, a naturally occurring toxin in celery, etc.). The major laws under which the agency has regulatory powers include the Food, Drug, and Cosmetic Act; and the Public Health Service Act.

Food biotechnology The application of biotechnology to the production of food. For example low fat , low cholesterol food, high protein biscuits etc

Food chain a group of organisms interrelated by the fact that each member of the group feeds upon on the one below it.

Food good manufacturing practice (FGMP) The Food and Drug Administration's (FDA's) approval mechanism for a process to manufacture a given food or food additive. It is implemented instead of specific regulations (such as those used to dictate processes in simple food manufacture, as in beef packing), due to the newness of the technology, and may later be superceded due to further ces in the technology.

Food infection Microbial infection resulting from ingestion of contaminated food.

Food irradiation A technology that provides a specific dose of ionizing radiation from a source such as a radioisotope (e.g., Cobalt 60), or from machines that produce accelerated electron beams or x-rays. Doses for irradiation of food and material are: low, 1 or less kiloGrays (kGy), used for disinfestation of insects from fruit, spices and grain; and parasite disinfection from fish and meat; medium, 1-10 kGy (commonly 1-4kGy), used for pasteurization and the destruction of bacteria and fungi; and high, 10-50 kGy, used for sterilization of food as well as medical supplies (including IV fluids, implants, syringes, needles, thread, clips and gowns).

Food poisoning Also called enterotoxocosis. An acute disorder of the gut caused by food contaminated with bacteria or their toxins (e.g., botulism) or by some chemical.

Food processing enzyme Enzyme used to control food texture, flavour, appearance and, to a certain extent, nutritional value. Amylases break down complex polysaccharides to simplex sugars; proteases tenderize meat proteins. Biotechnology can assist the development of new food enzymes by finding or engineering enzymes which fit better with the other processes which the food must undergo, like cooking or canning.

Food web A set of interconnected food chains by which energy and materials circulate within an ecosystem.

Foot cell The base of the conidiophore, where it merges with the hyphae, giving the impression of a foot; typically seen in *Aspergillus* spp.

Footprinting A technique used by researchers to determine precisely where (on a DNA molecule) certain DNA-binding proteins make specific contact with a DNA molecule. The DNA-protein complex is subjected to digestion with a nonspecific nuclease, which cleaves at the residues that are not protected by protein. For example, certain types of drugs act by binding tightly to certain DNA molecules in specific locations (e.g., in order to halt cancerous growth of cells).

Foraging The search and consumption of forage.

Forced cloning The insertion of foreign DNA into a cloning vector in a predetermined orientation.

Foreground selection A selection method in developing enriched crops using DNA-based markers for indirect selection.

Foreign DNA A DNA molecule that is incorporated into either a cloning vector or a chromosomal site.

Forensics The use of DNA for identification. Some examples of DNA use are to establish paternity in child support cases; establish the presence of a suspect at a crime scene, and identify accident victims.

Forespore A structure consisting of chromosome, cytoplasm, and endospore membrane inside a bacterial cell.

Form genus A non-phylogenetic category, equivalent to genus, distinguished on the basis of one or more morphological features. In the Deuteromycotina, form genera are used to classify anamorphs; such form genera are based primarily on the characteristics (including mode of development) of the conidia, conidiophores, and conidiomata.

Form species A non-phylogenetic category, equivalent to species, distinguished on the basis of one or more morphological features of an anamorph, treated as if it were an independent entity, especially for indexing or identification purposes; of importance chiefly in the Ascomycetes and Uredinales.

forma specialis Literally "special form". A taxonomic rank in which the taxa are distinguished on a physiological basis, particularly on the basis of adaptation to (or pathogenicity for) one or more specific hosts. In mycology, *forma specialis* is a taxonomic rank lower than form, subvariety, variety and subspecies, and higher than physiological race.

Formaldehyde dehydrogenase An enzyme which catalyzes the oxidation of formaldehyde to formic acid (formate at intracellular pH). It requires NAD (nicotinamide-adenine dinucleotide) as an electron acceptor. It is important in the metabolism of methanol.

Formalin A 37% solution of formaldehyde in water.

Formulation (1) For traditional therapeutic agents, this refers to the method by which a therapeutic agent is delivered to its site of action. **(2)** For tissue culture, *see* medium; medium formulation.

Formyl methionine (fmet) Methionine modified by the attachment of a formyl group; fmet is the first amino acid in all newly made bacterial polypeptides.

Fortify To add strengthening components or beneficial ingredients to a nutrient medium.

Forward mutation A mutation from the wild (natural) type to a new mutant type. Example low yielding to high yielding rice plants.

FOSHU A Japanese government designation meaning "Foods of Specified Health Use." Introduced in the early 1980s, these are foods or food ingredients that meet the following specific criteria: 1. Must improve human nutrition and health. A benefit to human health and nutrition must be proven for that food/ingredient. 2. An appropriate daily dose (amount to be consumed) must be confirmed by doctors or dietitians. 3. The food/ingredient must guarantee balanced nourishment. 4. The active component (e.g., phytochemical) must be scientifically confirmed regarding its quantitative and qualitative definition, and its chemical and/or physical features. 5. The active component must not lower nutritional value (e.g., of the food it is added to). 6. The food/ingredient must be consumed in a normal fashion (i.e., eaten or drunk, not as pill or powder form). 7. The active component must be of natural origin. Some of the foods/ingredients designated "FOSHU" have been those containing polyphenols, anthocyanins, and diacylglycerols.

Fosmid A high-capacity vector carrying the F plasmid origin of replication of *E.coli* and a λ *cos* site of a phage vector.

Fouling The coating or plugging (by materials or micro-organisms) of equipment, thus preventing it from functioning properly.

Foundation on economic trends A small organization that lobbies against agricultural biotechnology.

Foundation seed Seed produced from breeder seed. It is the source of registered and certified seeds.

Founder animal In transgenic research, an organism that carries a transgene in its germ line and can be used in matings to establish a pure-breeding transgenic line, or one that acts as a breeding stock for transgenic animals.

Founder principle The possibility that a new, small, isolated population may be genetically different from the "parent" population, because the founding individuals (being a small, random sample from the large, "parent" population) could be quite different from typical members of the "parent" population.

Four-base cutter; four-base-pair-cutter; four-cutter A type II restriction endonuclease that binds (and subsequently cleaves) DNA at sites that contain a sequence of four nucleotide pairs that is uniquely recognised by that enzyme. Because any sequence of four bases occurs more frequently by chance than any sequence of six bases, four-base cutters cleave more frequently than do six-base cutters. Thus, four-base cutters create smaller fragments than six-base cutters.

FPIA Fluorescence polarization immunoassay.

Fractionation Separation of the components of a mixture of molecules, through differences in their chemical and physical properties, by cold homogenization and step wise centrifugation at different gravitational field.

Fragile site A position in a chromosome that is prone to breakage because it contains an expanded trinucleotide repeat sequence.

Fragment Banding Pattern Bands made when many copies of the same DNA fragment move together through an electrophoresis gel. The pattern of bands reveals the number of different size fragments in a sample.

Fragmentation Breaking of the hyphae into pieces, each of which is capable of forming a new organism. Arthroconidia are formed in this manner.

Frameshift A shift (displacement) of the reading frame of codons in a DNA or RNA molecule. Frameshifts generally result from the addition or deletion of one or more nucleotides to or from the DNA or RNA molecule, resulting in an abnormal amino acid sequence.

Frameshift mutagen An agent that alters the transcription of DNA by, in effect, either deleting a base from the polymer or inserting an additional one. The most common frameshift mutagens are large, planar aromatic hydrocarbons that intercalate between adjacent bases in the DNA double helix so that they are mistaken for an additional base during transcription. The most effective frameshift mutagens have a reactive site so that they can permanently attach themselves to the polymer.

Frameshift mutation A mutation resulting from insertion or deletion of a group of nucleotides that is not a multiple of three and which therefore changes the frame in which translation occurs.

Frameshift suppressor A mutant tRNA that contains either two or four bases in the anticodon loop and can suppress the effects of a particular frameshift mutation in a gene.

Frameshifting The movement of a ribosome from one reading frame to another at an internal position within a gene.

Framework regions The V domains of immunoglobulins and T-cell receptors contain relatively invariant framework regions that provide a protein scaffold for the hypervariable regions that make contact with antigen.

Frankia An actinomycetes bacterium capable of forming nodules with some non-legumes such as Alnus and Casuarina tree species.

Fraternal twin Siblings born at the same time as the result of fertilization of two ova by two sperm. They share the same genetic relationship to each other as any other siblings.

Free energy (G) (Also known as Gibbs free energy). The component of the total energy of a system that can do work at a constant temperature and pressure and defined by the equation, $G = H - (T \Delta S)$, where H is the heat content (enthalpy), T the thermodynamic temperature, and S the entropy; takes into account changes in both energy and entropy. The change in free energy (ΔG) for a process, such as a chemical reaction, takes into account the changes in enthalpy and entropy and indicates whether the process will be thermodynamically favored at a given temperature. For spontaneous processes, $\Delta G < 0$, whereas for a process at equilibrium, $\Delta G = 0$. Free energy is a key variable calculated and monitored for different (proposed) drug molecules or drug/target interactions during rational drug design activities (e.g., molecular modeling).

Free energy of activation (ΔG^\ddagger) The free energy of the transition state minus the free energies of the reactants in a chemical reaction.

Free fatty acids (F.F.A.) Individual fatty acid molecules within a vegetable oil, which exist in an uncombined-with-glycerine molecular state. The presence of F.F.A. can be caused by naturally occurring noncombination (e.g., in some varieties of oilseeds), sprouting of the oilseeds prior to processing into vegetable oil, or breakdown of the fat (oil) during processing or usage.

Free radical A molecule with an unpaired electron in the outer orbit or "extra" electron; designated X. Free radicals are natural byproducts of metabolism and are involved in the body's defense against microorganisms. But, if in excess, they damage body cells and tissues and, thus play a role in degenerative disorder such as heart ailments and cancer. Free radicals are highly reactive, unstable molecules that normally attach to cellular proteins and DNA. It may be an atom or groups of atoms containing an unpaired electron. Usually free radicals are formed in radiation as intermediates. During an ionizing radiation, an electron is ejected from a water molecule as: $H_2O \rightarrow H_2O^+ + e^-$. This high energy electron may be picked up by another water molecule as: $e^- + H_2O \rightarrow H_2O^-$. In this way, an ion pair, H_2O^+ and H_2O^- , are formed. Each ion then may, in the presence of another water molecule, form a hydrogen ion and a free radical. The H^+ and OH^- will combine to form water. The H^{\bullet} and OH^{\bullet} free radicals are very reactive. In fact, many of them react to form H_2O_2 . In cells containing catalase and peroxidases, hydrogen peroxide formation may not be significant. In the absence of such enzymes, hydrogen peroxide formation in cells may be important biologically. Free radicals may be formed from nearly any cellular component which ionizes to contribute to the indirect effect of radiation. They are also formed in the body as a result of exposure to smoking pollution and sunlight. Also called as Reactive Oxygen Species, Singlet Oxygen, or Oxygen Free Radical. See **radical**

Free ribosome Ribosome that is free in the cytosol, unattached to any membrane. It is the site of synthesis of all proteins encoded by the nuclear DNA other than those proteins that are destined to enter the endoplasmic reticulum.

Free water Water released by a cell when freezing occurs in intercellular spaces.

Free-energy change (ΔG) The amount of free energy released (negative ΔG) or absorbed (positive ΔG) in a reaction at constant temperature and pressure. A large negative value of ΔG indicates that the reaction has a strong tendency to occur.

Free-living conditions Natural or greenhouse conditions where the plantlets are transferred from in vitro conditions to soil mixtures. In such instances, plantlets must manufacture their own food supply for survival.

Freeze- fracture electron microscopy Technique for studying membrane structure, in which the membrane of a frozen cell is fractured along the interior of the bilayer, separating it into the two monolayers with the interior faces exposed.

Freeze-drying The process of drying a tissue or an organ in a frozen state under vacuum. Tissues are freeze-dried to measure their dry weight or to preserve them for future analysis. Freeze-drying is the standard way of preserving micro-organisms for long periods of time.

Freeze-etching Technique in which water is evaporated under vacuum from the freeze fractured surface of a specimen before observation by electron microscopy.

Freeze-fracturing Technique in which a cell is first frozen and then broken with a knife so that the fracture reveals structures inside the cell when observed by electron microscope.

Frequency distribution A graph showing either the relative or absolute incidence of classes in a population. The classes may be defined by either a discrete or a continuous variable; in the latter case, each class represents a different interval on the scale of measurement.

Frequency polygon The curve obtained by joining the middle points of the tops of the rectangles in a histogram by straight lines.

Fresh weight The weight, including the water content, of any biomaterial, a plant or plant part just excised from the main body.

FRET Fluorescence Resonance Energy Transfer - a real time PCR DNA detection system, using flanking primers.

Friability A term indicating the tendency for plant cells to separate from one another.

Friable A term commonly used to describe a crumbling or fragmenting callus. A friable callus is easily dissected and readily dispersed into single cells or clumps of cells in solution.

Frictional coefficient A coefficient that determines the frictional force on a particular particle (such as a molecule) in a particular medium at a given velocity. In the context of electrophoresis or centrifugation, it determines how fast a chemical species will move in a particular medium in response to an applied electrical field or centrifugal force.

Fructan A general term utilized to refer to any carbohydrate in which fructosyl-fructose (molecule) linkages constitute the majority of the molecule's glycosidic bonds (i.e., between atoms in the molecule).

Fructification 1. Synonymous with fruiting body. 2. The formation or development of a fruiting body.

Fructose (C₆H₁₂O₆) A monosaccharide found in many plants; also called fruit sugar. Common table sugar (sucrose) is made up of one molecule each of glucose and fructose.

Fructose oligosaccharides A "family" of oligosaccharides, some of which help foster the growth of bifidobacteria in the lower colon of monogastric animals (humans, swine, etc.). Those bifidobacteria generate certain short-chain fatty acids, which are absorbed by the colon and result in a reduction of triglyceride (fat) and cholesterol levels in the bloodstream, thereby lowering risk of coronary heart disease and thrombosis. Research indicates they also promote absorption of calcium from foods (in the large intestine). Fructose oligosaccharides are classified as a "water soluble fiber" (by the European Union's government food regulatory agencies), because humans cannot digest them.

Fruit The structure that develops after fertilization. In angiosperms, it develops from a carpel or aggregation of carpels.

Fruiting body A specialized macroscopic, spore-producing structure that is composed of slime and bacterial cells, is often brightly colored, and may be visible to the naked eye. Formed by some fungi (e.g., mushrooms) and mycobacteria. Fruiting bodies are distinct in size, shape, and coloration for each species.

FTA - ABS test Fluorescent Treponemal Antigen-Antibody absorption test; indirect fluorescent antibody stain used to detect antibodies directed against whole cell antigens of *Treponema pallidum* (syphilis bacillus).

FTA Fluorescent treponemal antibody.

Fugacious (of plant organs) Withering or falling quickly.

Fugitive species A species whose persistence depends on its being able to disperse from one place to another as environmental conditions change.

Full gene sequence The complete order of bases in a gene. This order determines which protein a gene will produce.

Fully methylated site is a palindromic sequence that is methylated on both strands of DNA.

Fumarase (fum) An enzyme that catalyzes the hydration (addition of hydrogen atoms) of fumaric acid to maleic acid, as well as the reverse dehydration reaction (removal of hydrogen atoms).

Fumaric acid (C₄H₄O₄) A dicarboxylic organic acid produced commercially by chemical synthesis and fermentation; the trans isomer of maleic acid in the 7th step of the Krebs cycle, the reaction being catalyzed by fumarate hydratase.; colorless crystals, melting point 87°C (191°F); used to make resins, paints, varnishes and inks, in food as a mordant (dye fixer/stabilizer), and as a chemical intermediate. Also known as boletic acid.

Fumigant A gas or volatile substance that is used to disinfect certain areas of various pests.

Fumigation Any process by which the killing of animal forms, especially arthropods and rodents, is accomplished by the use of gaseous agents.

Fumonisin Mycotoxins that are primarily produced by the fungus *Fusarium moniliforme* (e.g., in insect-damaged corn/maize). Consumption of fumonisins by horses and swine can be fatal to those animals. Consumption of fumonisins by other animals (including humans) can result in tumors (e.g., cancer of the esophagus, in humans).

Functional group The specific atom or group of atoms that confers a particular chemical property on a biomolecule. It participates in interactions with other substances. Common functional groups in biochemistry are acyl, amino, amido, carbonyl, carboxyl, diphosphoryl, ester, ether, hydroxyl, imino, phosphoryl and sulfhydryl groups.

Functional analysis The area of genome research involved in identifying the functions of genes whose sequence is known.

Functional complementation The introduction into a mutant organism of a DNA fragment that restores the wild-type phenotype of the organism.

Functional diversity Genetic diversity as assessed by variation in transcribed regions of the genome that is known to be associated with a biological function.

Functional domain A region of eukaryotic DNA around a gene or group of genes that can be delineated by treatment with deoxyribonuclease I.

Functional food Ordinary food that has components or ingredients added to give it a specific medical or physiological benefit, other than a purely nutritional effect. Also known as nutraceutical.

Functional genomics Study of the functions of all specific gene sequences and their expression in time and space in an organism. Typically, functional genomic study follows after discovery of gene sequences found via structural genomics study. Some methods utilized to determine which

traits/functions result from which gene(s) are: 1. Site-directed mutagenesis (SDM), to compare two same-species organisms possessing two different genes at the same site on the genome. 2. Antisense DNA sequence, to compare two same-species organisms (one of which has gene at same site "turned off" via antisense DNA). 3. Reporter gene, to compare two same species organisms (with two different genes at same site on genome) via a "reporter" gene adjacent to gene/site, to detect presence of desired trait/function. 4. Chemical genetics, to compare two same-species organisms (one of which has gene at same site on DNA molecule at least partially inactivated by a specific chemical). 5. "Silencing" or "knocking out" a particular gene via other methods than antisense or chemical genetics, to compare.

Functional group (1) A molecule, or portion of a molecule, that will react with other molecule(s) and confers a particular chemical property on that biomolecule. For example, "hedgehog proteins" must first add a cholesterol molecule (to themselves) before they can carry out their task of directing/controlling tissue differentiation during mammal embryo development (into various organs, limbs, etc.). An "acetyl (functional) group" must be added to a choline molecule in order for the body to have the critical neurotransmitter acetylcholine. (2) A subset of the species in a community that function in similar ways, but do not necessarily use the same resources.

Functional markers DNA markers derived from functionally characterized sequence motifs. They are superior to random DNA markers like RFLPs, SSRs and AFLPs owing to complete linkage with trait locus alleles.

Functionally redundant genes fulfill the same function in the same time and place, so that mutation of every member of the set is necessary to show a deficient phenotype.

Fungemia Presence of viable fungi in blood.

Fungi are single-celled and multicellular eukaryotic organisms, including the yeasts and molds that can cause a variety of diseases. The organisms that belong to the Kingdom Fungi; eucaryotic chemoheterotrophs. Immunity to fungi is complex and involves both humoral and cell-mediated responses.

Fungicide A chemical or physical agent that kills or inhibits the growth of fungi. (Note some substances termed "fungicides" are fungistatic in their action. Example benomyl, captan etc.)

Fungistasis Inhibition of fungal growth or reproduction that is not lethal

Fungistat A substance that prevents fungal growth without killing the fungus.

Fungus (plural: fungi) An organism that is either filamentous or unicellular and lacks chlorophyll. It has a true nucleus enclosed in a membrane and chitin in the cell wall. It includes molds, toadstools, rusts, mildews, smuts, ergot and mushrooms. Under certain conditions (temperature, humidity, etc.), some fungi can produce mycotoxins via their metabolism.

Funiculitis Inflammation of the spermatic cord (as in filariasis).

FUO Fever of unknown origin.

Furanose A simple sugar containing the 5-membered furan ring as a result of intramolecular hemiacetal formation.

Furcated Forked.

Furfural; furfuraldehyde Used industrially as a solvent and as a raw material for synthetic resin.

Furuncle also called as boil. A large, deep, pus-filled infection.

Fusarium A genus of fungus, also known as “scab,” that infests certain grains (e.g., wheat *Triticum aestivum*, corn or maize *Zea mays* L., etc.) during growing seasons in which climate (e.g., high humidity, cool weather) and other conditions combine to enable rapid growth/proliferation of the fungus. Example *Fusarium moniliforme*

Fuseau A fusiform or spindle-shaped, multiseptate macroconidium.

Fusiform Spindle shaped (i.e. being wider in the middle and narrowing toward the ends).

Fusion biopharmaceuticals Biopharmaceutical proteins formed as a result of fusion proteins. Their advantages are; synergistic activities in one molecule; thus when the molecule binds to a cell, it does two things at once;- the adverse effect or poor stability of one molecule may be offset by the properties of the other; and- one molecule acts as a targeting mechanism to bring the other to the site where it is meant to act. See **fusion protein, immunotoxin**.

Fusion gene A hybrid gene created by joining portions of two different genes (to produce a new protein) or by joining a gene to a different promoter (to alter or regulate gene transcription).

Fusion protein A protein consisting of all or part of the amino acid sequences (known as the “domain”) of two or more gene. The resulting protein thus combines portions from two different parent proteins. Also known as hybrid protein or chimeric protein. For example, by fusing a difficult-to-study gene with the β -galactosidase gene, the (protein) product that results can easily be measured (assayed) using chromatography.

Fusion toxin A fusion protein that consists of a toxic protein (domain) plus a cell receptor binding region (protein domain). The cell receptor portion (of the total fusion toxin molecule) delivers the toxin directly to the (diseased) cell, thus sparing other healthy tissues from the effect of the toxin.

Fusogen (1) An agent that induces fusion of protoplasts in somatic hybridization.e.g., PEG (polyethylene glycol). (2) Any compound, virus, etc., that causes cells to fuse together. For example, one of the effects of the HIV (i.e., AIDScausing) viruses is to cause the T cells of the human immune system to fuse (causing collapse of the immune system).

Futile Cycle An enzyme-catalyzed set of cyclic reactions that results in release of thermal energy (heat) through the hydrolysis of ATP (adenosine triphosphate). The hydrolysis of ATP is normally coupled to other cycles and reactions in which the energy released ismetabolically used. However, futile cycles would appear to waste the energy of ATP as heat, except when one is shivering to keep warm. The production of heat by shiveringis an example of the futile cycle. See pseudocycle

G (guanosine) Guanine linked to the sugar ribose. Guanosine is a nucleoside.

G or Free energy that can be extracted from a system to drive reactions.

G protein-coupled recetor or GPCR A cell surface protein with seven transmembrane helices that interacts with an associated G protein on ligand binding.

G proteins G proteins are intracellular proteins that bind GTP and convert it to GDP in the process of cell signal transduction. There are two kinds of G protein, the heterotrimeric (α , β , γ) receptor-associated G proteins, and the small G proteins, such as Ras and Raf, that act downstream of many transmembrane signaling events.

G₀ phase Condition of a cell whose division has been arrested at G₁ and which is considered to be withdrawn from the cell cycle.

- G₁ phase** Interval between the end of mitosis and the start of the S phase.
- G₁-cdk** Complex formed in vertebrate cells by a G₁-cyclin and the corresponding cyclin-dependent kinase (cdk).
- G₂ phase** Gap 2 phase of the eukaryotic cell-division cycle, between the end of DNA synthesis and the beginning of mitosis.
- GABA (γ -amino butyric acid)** γ -amino acid that acts to open chloride channels in the plasma membrane of sensitive nerve cells. Usually called γ -amino butyric acid rather than γ -amino butyrate, even though the latter ($-\text{OOC}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{NH}_3^+$) is the form in which it is found at neutral pH.
- G-actin** The thin filamentous muscle protein acting along with myosin, which is responsible for contraction and relaxation of muscle. After polymerization it forms *F-actin*.
- GAG or Glycosaminoglycan** Long, linear, highly charged polysaccharide composed of a repeating pair of sugars, one of which is always an amino sugar. Mainly found covalently linked to a protein core in extracellular matrix proteoglycans. Examples include chondroitin sulfate, hyaluronic acid, and heparin.
- Gain-of-function mutation** A mutation that results in an organism acquiring a new function.
- Gametangium** Fungal structure that contains one or more gametes.
- Gamete** Haploid sex cells; either a sperm or an egg, serving for sexual reproduction.
- Gametocyte** A male or female sex cell.
- Gametophore** Leafy stalk on which the gametangium (sex organ) is borne.
- Gametophyte** Haploid plant that produces gametes.
- Gamma Diversity** This term refers to the measure of biodiversity, which means the total species richness within an area.
- Gamma garden** A place where gamma rays are emitted from a source (Co 60 or Cs 137) and are used to induce mutations in living organisms.
- Gamma globulin** Also known as immune serum globulin.
- Gamma rays** A type of electromagnetic radiation with wavelengths shorter than 10^{-10} meters, shorter than the wavelengths of x-rays. Gamma rays thus carry more energy than do x-rays and, when used for radiotherapy, deliver more energy to tumors.
- Ganglion** An aggregation of neuron cell bodies.
- Ganglioneuroma** A malignant tumor arising in adult nerve cells and fibers outside the central nervous system.
- Ganglioside** Any glycolipid having one or more sialic acid residues in its structure. Found in the plasma membrane of eukaryotic cells and especially abundant in nerve cells.
- Gangrene** Tissue death from loss of blood supply.

Gap 2 (G2) Period of the cell division cycle between the completion of S phase and the start of cell division or M phase.

GAP (GTPase activating protein) A family of regulatory proteins that speeds up the rate at which GTPases hydrolyze GTP.

Gap 0 (G0) Describes the quiescent state of cells that have left the cell division cycle.

Gap 1 (G1) Period of the cell division cycle that separates mitosis from the S phase.

Gap A space introduced into an alignment to compensate for insertions or deletions in one sequence relative to another

Gap genes Also called segmentation genes. The gap genes are the first set of zygotic genes activated after fertilization. Its expression results in the formation of broad bands in the embryo. Example of gap gene is Kruppel gene.

Gap junction or Gap junction channel Array of plaque-like connections between the plasma membranes of adjacent cells. And also communicating cell-cell junction that allows ions and small molecules to pass from the cytoplasm of one cell to the cytoplasm of the next.

Gap junction Type of cell junction that allows solute to pass from the cytosol of one cell to the cytosol of its neighbor without passing through the extracellular medium. Gap junctions consist of many paired gap junction channels or connexons.

Gap period One of two intermediate periods within the cell cycle.

Gaping The open width of space, created by forcefully opening the jaws or mandibles of a vertebrate.

Gapped DNA A duplex DNA molecule with one or more internal single stranded regions.

GAPs or GTPase activating proteins A set of proteins that are intermediates in the Ras signal transduction pathway.

Gas chromatography Chromatographic technique in which the stationary phase is a solid or an immobile liquid and the mobile phase is gaseous. The gaseous samples are separated based on their differential adsorption to the stationary phase.

Gas Gangrene A deep wound infection, destructive of tissue, often caused by a combination of two or more species of *Clostridium*.

Gas vacuole A subcellular organelle, found only in prokaryotes, which consists of clusters of hollow, cylindrical, gas-filled vesicles (gas vesicles).

Gastrocnemius muscle Muscle at the back of the shin. When it contracts the toes move down.

Gastroenteritis Inflammation of the stomach and intestine.

Gastrulation The stage in animal embryogenesis during which the embryo is transformed from a ball of cells to a structure with a gut (a gastrula).

Gated channel A membrane ion channel that can open or close in response to signals from outside or within the cell.

Gated transport Transport of fully folded proteins through intracellular pores that open to allow their passage.

Gates and fences model A model for membrane structure that includes cytoskeletal proteins that prevent or limit the free diffusion of other membrane proteins.

Gating The opening and closing of an ion channel in response to a signal such as mechanical stimulation, ligand binding, presence of a signaling molecule, or a change in membrane voltage.

GC box One or more copies of the sequence GGGCGG upstream of the transcription start site that act as a promoter for some eukaryotic housekeeping genes.

GC contents The percentage of nucleotides in a genome that are G or C.

GC-rich area Many DNA sequences carry long stretches of repeated G and C which often indicate a gene-rich region.

GDP Guanosine diphosphate; guanosine with two phosphates attached to the 5_ carbon of ribose.

GEF (guanine nucleotide exchange factor) Protein that accelerates the rate at which GDP leaves a GTPase to be replaced by GTP, thus switching the GTPase from its inactive state to its active state.

GEFS (generalized epilepsy with febrile seizures) Relatively common form of childhood epilepsy, usually clearing up spontaneously. GEFS+ is the less common condition in which the seizures still occur past the age of 6 years.

Gel electrophoresis A type of electrophoresis in which the supporting medium is a thin slab of gel held between glass plates. The technique is widely used for separating proteins and nucleic acids.

Gel filtration chromatography A technique that makes use of certain polymers that can form porous beads with varying pore sizes. In columns made from such beads, it is possible to separate molecules, which cannot penetrate beads of a given pore size, from small molecules that can. Also called gel-exclusion or molecular sieve chromatography.

Gel Inert polymer, usually made of agarose or polyacrylamide, that separates macromolecules such as nucleic acids or proteins during electrophoresis.

Gel retardation analysis A technique that identifies protein-binding sites on DNA molecules by virtue of the effect that a bound protein has on the mobility of the DNA fragments during gel electrophoresis.

Gel stretching A technique for preparing restricted DNA molecules for optical mapping.

Gelsolin Type of actin-binding protein that binds to and fragments actin filaments.

Gemma Cluster of cells that get detached from parent body and possess the ability to develop into a completely new organism or plant. Seen in liverworts and mosses.

Gene A gene is a molecular unit of heredity of a living organism.

Gene activator protein A gene regulatory protein that when bound to its regulatory sequence in DNA activates transcription.

Gene amplification The duplication of a particular gene within a chromosome two or more times.

Gene Bank It is a way of preserving plants and seeds for their germplasm.

Gene chip technology Development of cDNA microarrays from a large number of genes. Used to monitor and measure changes in gene expression for each gene represented on the chip.

Gene chip Tiny glass wafer to which cloned DNAs are attached. Also known as microarrays or DNA chips.

Gene cloning Isolation of a desired gene from one organism and its incorporation into a suitable vector for the production of large amounts of the gene.

Gene cluster A region of DNA containing multiple copies of genes, usually tRNA or rRNA genes, whose products are required in large amounts.

Gene control region DNA sequences required to initiate transcription of a given gene and control the rate of initiation.

Gene conversion Process by which DNA sequence information can be transferred from one DNA helix (which remains unchanged) to another DNA helix whose sequence is altered. It occurs occasionally during general recombination.

Gene duplication An event, such as aberrant crossover which gives rise to two copies of a gene on the same chromosome.

Gene expression The process by which a gene's coded information is converted into the structures present and operating in the cell. Expressed genes include those that are transcribed into mRNA and then translated into protein and those that are transcribed into RNA but not translated into protein (e.g., transfer and ribosomal RNAs).

Gene family Group of genes that share sequence similarity and usually code for proteins with a similar function.

Gene flow The natural flow of genes within a population or from one population to another by interbreeding or migration.

Gene fragment A gene relic consisting of a short isolated region from within a gene.

Gene knockout A genetic engineering process that deletes or inactivates a specific gene in an animal.

Gene library Storage of DNA by inserting restriction enzyme fragments in a bacterium, yeast, or phage.

Gene locus (pl. loci) Gene's position on a chromosome or other chromosome marker; also, the DNA at that position. The use of locus is sometimes restricted to mean expressed DNA regions.

Gene mapping Determination of the relative positions of genes on a DNA molecule (chromosome or plasmid) and of the distance, in linkage units or physical units, between them.

Gene name Official name assigned to a gene. According to the Guidelines for Human Gene Nomenclature developed by the HUGO Gene Nomenclature Committee, it should be brief and describe the function of the gene. Ex. Abg- Aubergine.

Gene Ontology A controlled vocabulary of terms relating to molecular function, biological process, or cellular components developed by the Gene Ontology Consortium. A controlled vocabulary allows scientists to use consistent terminology when describing the roles of genes and proteins in cells.

Gene Pool Total number of all alleles in all the sex cells present in the individuals of a population.

Gene prediction Predictions of possible genes made by a computer program based on how well a stretch of DNA sequence matches known gene sequences

Gene probe cDNA or genomic DNA fragment used to detect a specific DNA sequence to which it is complementary in sequence. The probe is tagged in some way to make it easy to detect. The tag could be, for example, a radioactive isotope or a fluorescent dye.

Gene product The biochemical material, either RNA or protein, resulting from expression of a gene. The amount of gene product is used to measure how active a gene is; abnormal amounts can be correlated with disease-causing alleles.

Gene regulatory protein General name for any protein that binds to a specific DNA sequence to alter the expression of a gene.

Gene repressor protein A gene regulatory protein that prevents the initiation of transcription.

Gene segments The V domains of the polypeptide chains of antigen receptors are encoded in sets of gene segments that must first undergo somatic recombination to form a complete V-domain exon. There are three types of gene segment: V gene segments that encode the first 95 amino acids, D gene segments that encode about 5 amino acids, and J gene segments that form the last 10-15 amino acids of the V region. There are multiple copies of each type of gene segment in the germline DNA, but only one is expressed for each type of receptor chain in a receptor-bearing lymphocyte.

Gene splicing The enzymatic attachment of one gene, or part of a gene, to another.

Gene substitution The replacement of an allele that at one time was fixed in the population by a second allele, this second allele arising by mutation and increasing in frequency until itself reaching fixation.

Gene superfamily A group of two or more evolutionarily related multigene families.

Gene symbol Symbols for human genes are usually designated by scientists who discover the genes. The symbols are created using the Guidelines for Human Gene Nomenclature developed by the HUGO Gene Nomenclature Committee. Gene symbols usually consist of no more than six upper case letters or combination of uppercase letters and Arabic numbers. Gene symbols should start with the first letters of the gene name. For example, the gene symbol for insulin is "INS." A gene symbol must be submitted to HUGO for approval before it can be considered an official gene symbol.

Gene Synthesizer Machine producing specific DNA sequences.

Gene targeting A gene can be specifically disrupted by a technique known as **gene targeting** or gene knockout. Usually this involves homologous recombination in embryonic stem cells followed by the preparation of chimeric mice by injection of these cells into the blastocyst.

Gene testing Also known as genetic testing and genetic screening

Gene therapy An experimental procedure aimed at replacing, manipulating, or supplementing nonfunctional or malfunctioning genes with healthy genes.

Gene transfer Incorporation of new DNA into an organism's cells, usually by a vector such as a modified virus. Used in gene therapy.

Gene tree A phylogenetic tree that shows the evolutionary relationships between a group of genes or other DNA sequences.

General acid catalysis In acid catalysis and base catalysis a chemical reaction is catalyzed by an acid or a base. The acid is often the proton and the base is often a hydroxyl ion.

General base catalysis A catalytic mechanism in which partial proton abstraction by a base lowers the free energy of a reaction's transition state.

General recombination, general genetic recombination Recombination that takes place between two homologous chromosomes.

General transcription factor or GTF Any of the proteins whose assembly around the TATA box is required for the initiation of transcription of most eukaryotic genes.

Generalist Any organism that can survive in wide-ranging habitat.

Generalized transduction Type of transduction in which a fragment of DNA from the degraded chromosome of an infected bacteria cell is accidentally incorporated into a new phage particle during viral replication and thereby transferred to another bacterial cell.

Generation time Time needed for a population to double in number or biomass.

Genes-within-genes It refers to a gene whose intron contains a second gene.

Genetic anticipation A pattern of inheritance of a genetic disease, in which the age of onset of symptoms decreases with each generation.

Genetic code Set of rules specifying the correspondence between nucleotide triplets (codons) in DNA or RNA and amino acids in proteins.

Genetic counseling Provides patients and their families with education and information about genetic-related conditions and helps them make informed decisions.

Genetic discrimination Prejudice against those who have or are likely to develop an inherited disorder.

Genetic distance A measure to quantify the genetic relatedness between individuals or populations.

Genetic drift Fluctuations in genetic variation between generations as a result of random processes.

Genetic engineering or Genetic engineering technology Also known as recombinant DNA technology. Array of techniques that facilitate the manipulation and duplication of pieces of DNA for industrial, medical and research purposes.

Genetic fingerprinting A technique in which an individual DNA is analyzed to reveal the pattern of repetition of particular nucleotide sequences throughout the genome. The unique pattern of DNA fragments are identified by Southern hybridization or polymerase chain reaction.

Genetic footprinting A technique for the rapid functional analysis of many genes at once.

Genetic fusion A technique of genetic engineering that allows transposition of genes from one location on a chromosome to another location; the coupling of genes from two different operons.

Genetic homology The similarity of DNA base sequences among organisms.

Genetic illness Sickness, physical disability, or other disorder resulting from the inheritance of one or more deleterious alleles. Ex. Cystic fibrosis and sickle cell disease.

Genetic immunity Inborn or innate immunity.

Genetic immunization Genetic immunization is a novel technique for inducing adaptive immune responses. Plasmid DNA encoding a protein of interest is injected into muscle; for unknown reasons, it is expressed and elicits antibody and T-cell responses to the protein encoded by the DNA.

Genetic information Also known as bioinformatics. The hereditary information contained in a sequence of nucleotide bases in chromosomal DNA or RNA.

Genetic linkage The physical association between two genes that are on the same chromosome.

Genetic map Also known as linkage map. A diagram showing the relative sequence and position of specific genes along a chromosome.

Genetic marker A gene or other identifiable portion of DNA whose inheritance can be followed.

Genetic mosaic An organism in which different cells contain different genetic sequence. This can be the result of a mutation during development or fusion of embryos at an early developmental stage.

Genetic polymorphism Difference in DNA sequence among individuals, groups, or populations (e.g., genes for blue eyes versus brown eyes).

Genetic predisposition Susceptibility to a genetic disease. May or may not result in actual development of the disease.

Genetic profile The banding pattern revealed after electrophoresis of the products of PCRs directed at a range of microsatellite loci.

Genetic recombination Process in which DNA molecules are broken and the fragments are rejoined in new combinations. Can occur in the living cell – for example through crossing over during meiosis-or in vitro using purified DNA and enzymes that break and ligate DNA strands.

Genetic redundancy The situation that occurs when two genes in the same genome perform the same function.

Genetic screening Testing a group of people to identify individuals at high risk of having or passing on a specific genetic disorder.

Genetic testing Analyzing an individual's genetic material to determine predisposition to a particular health condition or to confirm a diagnosis of genetic disease.

Genetic transformation Transfer of extracellular genetic information (DNA) among and between species with the use of vectors (i.e. bacterial or viral).

Genetically modified Organism (GMO) Organism with a genome that has been modified by modern molecular techniques, usually by the addition of novel gene(s) or by swapping in new DNA to replace existing gene(s).

Genetics Branch of biology involving the study of heredity, which deals with the differences and resemblances of organisms entailing from the interaction of their genes and the habitat.

Genital herpes Also known as Herpes simplex virus type 2.

Genital wart Also called condyloma An often malignant wart associated with sexually transmitted viral disease having a very high association rate with cervical cancer.

Genofund Genetic resource available for plant breeding. Also commonly known as Germplasm bank.

Genome Complete set of genes in an organism.

Genome expression The series of events by which the biological information carried by a genome is release and made available to the cell.

Genome project Research and technology-development effort aimed at mapping and sequencing the genome of human beings and certain model organisms.

Genome-wide repeat A sequence that recurs at many dispersed positions within a genome.

Genomic DNA DNA constituting the genome of a cell or an organism. Often used in contrast to cDNA (DNA prepared by reverse transcription from messenger RNA). Genomic DNA clones represent DNA cloned directly from chromosomal DNA, and a collection of such clones from a given genome is a genomic DNA library.

Genomic DNA library or Genomic library Collection of bacterial clones each of which contains a different fragment of foreign genomic DNA.

Genomic imprinting Situation where a gene is either expressed or not expressed in the embryo depending on which parent it is inherited from.

Genomics The science of studying the DNA sequences and properties of entire genomes.

Genotype Genetic constituent of organisms expressed in terms of genes coding for particular traits.

Genotype The genetic constitution of an organism, as distinct from its physical characteristics, or phenotype.

Genus Classification category located between a family and species.

Geographic Information Systems (GIS) A set of computer software designed to capture, organize, store, and analyze geographically referenced (spatial) information.

Geometric isomers Isomers related by rotation about a double bond; also called cis and trans isomers.

Geosmin An alcohol produced by actinomycetes that has an earthy odor.

GERL (Golgi-ER-Lysosome) Acid phosphatase-rich region of the Golgi maturing face, thought to be involved in the production of lysosomes and/or presecretory granules.

Germ cell Sperm and egg cells and their precursors. Germ cells are haploid and have in human only one set of chromosomes (23 in all), while all other cells have two copies (46 in all).

Germ line The continuation of a set of genetic information from one generation to the next.

Germ Living substance (in relation to disease) capable of developing into an organ, part or organism as a whole.

Germ plasm Aggregate of all genes of a species or organism groups.

Germ-free, gnotobiotic Mice that are raised in the complete absence of intestinal and other flora are called germ-free or gnotobiotic mice. Such mice have very depleted immune systems, but they can respond virtually normally to any specific antigen, provided it is mixed with a strong adjuvant.

Germicidal Capable of killing microorganisms.

Germicidal lamp An ultraviolet light (wavelength-260 nm) capable killing bacteria.

Germinal centers **Germinal centers** in secondary lymphoid tissues are sites of intense B-cell proliferation, selection, maturation, and death during antibody responses. Germinal centers form around follicular dendritic cell networks when activated B cells migrate into lymphoid follicles. They can be divided by morphology into the dark zone, which is rich in proliferating B lymphocytes, and a light zone, which contains FDCs and centrocytes

Germination Commencement or resumption of growth of a spore or seed. Read more on steps of seed germination.

Germination percentage The percentage of seeds that germinate under favourable conditions.

Germ-line cell A type of animal cell that is formed early in embryogenesis and may multiply by mitosis or may produce, by meiosis, cells that develop into gametes (egg or sperm cells).

Germline configuration Immunoglobulin and T-cell receptor genes are said to be in the germline configuration in the DNA of germ cells and in all somatic cells in which somatic recombination has, not occurred.

Germline diversity The germline diversity of antigen receptors is due to the inheritance of multiple gene segments that encode V domains; such diversity is distinguished from the diversity that is generated during gene rearrangement or after receptor gene expression, which is somatically generated.

Germ-line Mutation Mutation occurring in the cells from which gametes are derived.

Germline theory One theory of antibody diversity, the **germline theory**, proposed that each antibody was encoded in a separate germline gene. This is now known not to happen in people, mice, and most other organisms, but appears to happen in Elasmobranchs, which have rearranged genes in the germline.

Gharial An Asian crocodile with a very narrow jaw.

Gi or Inhibitory G protein G protein that can regulate ion channels and inhibit the enzyme adenylyl cyclase.

GI (GenBank) A GI or "GenInfo Identifier" is a sequence identifier that can be assigned to a nucleotide sequence or protein translation. Each GI is a numeric value of one or more digits. The protein translation and the nucleotide sequence contained in the same record will each be assigned different GI numbers. Every time the sequence data for a particular record is changed, its version number increases and it receives a new GI. However, while each new version number is based upon the previous version number, a new GI for an altered sequence may be completely different from the previous GI.

Giardiasis A gastrointestinal disorder caused by the flagellated protozoan *Giardia intestinalis*.

Gibberellin Group of plant hormones possessing different effects on growth, which are mostly related to enhancement of stem elongation.

Gibbon ape leukemia virus A type C RNA virus that produces leukemia in certain primates.

Gibbs free energy (G) The energy associated with a chemical reaction that can be used to do work. The free energy of a system is the sum of its enthalpy (H) plus the product of the temperature (Kelvin) and the entropy (S) of the system: $G=H-TS$

Giga Prefix denoting 10^9 . (from Greek gigas, giant).

Gigabase pair 1,000,000 kb, 1,000,000,000 bp.

Gill Arches Cartilaginous arches located on each side of the pharynx to provide support to the gills of aquatic animals like pisces, tadpole larva, urodela etc.

Gill Slits A narrow external opening connected with the pharynx, to allow passage of water, which helps in cleaning the gills.

Gill The respiratory organ of primary aquatic animals. Its basic function is to help the animal to extract the oxygen dissolved in water.

Gills Flattened plates of compact mycelium radiating to the outer region of the stalk on the bottom portion of the mushroom cap.

Gingivitis The mildest form of periodontal disease, characterized by inflammation of the gums.

Gingivostomatitis Lesions of the mucous membranes of the mouth.

Girdling Phenomenon involving the discarding of a band of tissues which extend to the inner side of the vascular cambium on the woody plant stem.

Gizzard A strong muscular chamber found in the lower stomach of animals (like Birds) that facilitates food grinding.

Glial cell Supporting cell of the nervous system, including oligodendrocytes and astrocytes in the vertebrate central nervous system and Schwann cells in the peripheral nervous system.

Glioma A generally benign tumor arising from several types of specialized connective tissue in the brain and spinal cord.

Global alignment When two nucleic acid or amino acid sequences are lined up along their entire length.

Global regulation A general down-regulation in protein synthesis that occurs in response to various signals.

Globin The polypeptide components of myoglobin and hemoglobin.

Globoside A globoside is a type of glycosphingolipid with more than one sugars as the side chain (or R group) of ceramide. The sugars are usually a combination of N-Acetylgalactosamine, D-glucose or D-galactose. A glycosphingolipid that has only one sugar as the side chain is called a cerebroside.

Globular protein Any protein with an approximately rounded shape. Such proteins are contrasted with highly elongated, fibrous proteins such as collagen. Ex. Collagen

Globulin The protein type to which antibodies belong. Ex. Immunoglobulins and Cryoglobulins.

Glomerules A coiled cluster of capillaries in the nephron.

Glomerulonephritis Also called Bright's disease. Inflammation of and damage to the glomeruli of the kidneys.

Glucocorticoid receptor Intracellular receptor usually proteins to which glucocorticoid hormone binds.

Glucocorticoids The steroid hormones cortisol and corticosterone, which are secreted by the adrenal cortex. In addition to other functions, they promote gluconeogenesis in response to low blood sugar levels.

Gluco-genic amino acids Amino acids with carbon chains that can be metabolically converted into glucose or glycogen via gluconeogenesis. Ex. Serine, valine etc.

Gluco-genic In energy metabolism, refers to substances (such as some amino acids) that can be used as substrates for glucose synthesis.

Gluconeogenesis The biosynthesis of a carbohydrate from simpler, noncarbohydrate precursors such as oxaloacetate or pyruvate.

Glucose carrier Plasma membrane protein that carries glucose into or out of cells. Some cells, such as skeletal muscle cells, will only translocate glucose carriers to their membranes when protein kinase B is active.

Glucose Six-carbon sugar that plays a major role in the metabolism of living cells. Stored in polymeric form as glycogen in animal cells and as starch in plant cells. It is a reducing sugar and an also sugar.

Glucose transporter A membrane protein that is responsible for transporting glucose across a cell membrane. Different tissues may have glucose transporters with different properties.

Glucose-alanine cycle An interorgan metabolic pathway that transports nitrogen to the liver in which pyruvate produced by glycolysis in the muscles is converted to alanine and transported to the liver. There the alanine is converted back to pyruvate and its amino group is used to synthesize urea for excretion. The pyruvate is converted, via gluconeogenesis, to glucose, which is returned to the muscles.

Glutamine-rich domain A type of activation domain.

Glutaraldehyde Small reactive molecule with two aldehyde groups that is often used as a cross-linking fixative.

GlyCAM-1 **GlyCAM-1** is a mucinlike molecule found on the high endothelial venules of lymphoid tissues. It is an important ligand for the L-selectin molecule expressed on naive lymphocytes, directing these cells to leave the blood and enter the lymphoid tissues.

Glycan Another term for polysaccharide; a polymer of monosaccharide units joined by glycosidic bonds.

Glyceride Compound formed by attaching units to a glycerol backbone. Triacylglycerols (previously called triglycerides) and phospholipids are glycerides.

Glycerol An alcohol; $C_3H_5(OH)_3$ or small organic molecule that is the parent compound of many small molecules in the cell, including phospholipids.

Glycerophosphate shuttle A metabolic pathway that uses the interconversion of dihydroxyacetone and 3-phosphoglycerol to transport cytosolic reducing equivalents into the mitochondria.

Glycerophospholipid An amphipathic lipid with a glycerol backbone; fatty acids are ester-linked to C1 and C-2 of glycerol, and a polar alcohol is attached through a phosphodiester linkage to C-3.

Glycocalyx (Cell coat) Carbohydrate-rich layer that forms the outer coat of a eukaryotic cell. Composed of the oligosaccharides linked to intrinsic plasma membrane glycoproteins and glycolipids, as well as glycoproteins and proteoglycans that have been secreted and reabsorbed onto the cell surface.

Glycoconjugate A molecule, such as glycolipid or glycoprotein, that contains covalently linked carbohydrate.

Glycoforms Glycoproteins that differ in the sequence, location and number of covalently attached carbohydrates.

Glycogen phosphorylase Enzyme that releases glucose-1-phosphate monomers from glycogen. The glucose-1-phosphate is then converted to glucose-6-phosphate, which can be used in respiration or dephosphorylated to glucose for release into the blood.

Glycogen phosphorylase kinase (phosphorylase kinase) Kinase that is activated by the calcium–calmodulin complex and phosphorylates glycogen phosphorylase, activating the latter enzyme.

Glycogen Polysaccharide composed exclusively of glucose units used to store energy in animal cells. Large granules of glycogen are especially abundant in liver and muscle cells.

Glycogen storage disease An inherited disorder of glycogen metabolism affecting the size and structure of glycogen molecules or their mobilization in the muscle and/or liver.

Glycogenic Describing amino acids whose metabolism may lead to gluconeogenesis.

Glycogenolysis The enzymatic degradation of glycogen to glucose-6-phosphate.

Glycolipids Complex molecules containing one or more carbohydrate residues and one or more fatty acids connected by ester or amide linkages.

Glycolysis An ATP-generating metabolic process that occurs in nearly all living cells in which glucose is converted in a series of steps to pyruvic acid.

Glycoprotein Any protein with one or more oligosaccharide chains covalently linked to amino acid side chains. Most secreted proteins and most proteins exposed on the outer surface of the plasma membrane are glycoproteins.

Glycosaminoglycan (GAG) Long, linear, highly charged polysaccharide composed of a repeating pair of sugars, one of which is always an amino sugar. Mainly found covalently linked to a protein core in extracellular matrix proteoglycans. Example- chondroitin sulfate, hyaluronic acid and heparin.

Glycosidase Enzyme that hydrolyzes a glucosidic linkage between two sugar molecules.

Glycoside A molecule containing a saccharide and another molecule linked by a glycosidic bond to the anomeric carbon in the α -configuration (α -glycoside) or β configuration (β -glycoside).

Glycosidic bonds Bonds between a sugar and another molecule (typically an alcohol, purine, pyrimidine, or sugar) through an intervening oxygen or nitrogen atom; the bonds are classified as O-glycosidic or N-glycosidic, respectively.

Glycosylation The process adding one or more sugars to a protein or lipid molecule.

Glycosylphosphatidylinositol (GPI) linked protein A protein that is anchored in a membrane via covalently linked glycosylphosphatidylinositol (GPI) group.

Glycosylphosphatidylinositol anchor (GPI anchor) Type of lipid linkage by which some membrane proteins are bound to the membrane.

Glyoxylate $\text{CHO}^- \text{COO}^-$; an intermediate in various metabolic pathways including the glyoxylate shunt.

Glyoxylate cycle A pathway that uses some of the enzymes of the TCA cycle and some enzymes whereby acetate can be converted into succinate and carbohydrates.

Glyoxylate shunt Pathway found in plants and bacteria that allows acetyl-CoA to be converted into glucose.

Glyoxysome Membrane enclosed organelle found in plant cells and involved mainly in triglyceride metabolism.

GM (genetically modified) Organism with a genome that has been modified by modern molecular techniques, usually by the addition of novel gene(s) or by swapping in new DNA to replace existing gene(s).

GNRPs (Guanine nucleotide-releasing proteins) A set of proteins that are intermediates in the Ras signal transduction pathway.

Goldman equation An equation expressing the quantitative relationship between the concentrations of charged species on either side of a membrane and the resting transmembrane potential.

Golgi apparatus (Golgi complex) or Golgi bodies Membrane bounded organelle in eukaryotic cells in which proteins and lipids transferred from the endoplasmic reticulum are modified and sorted. It is the site of synthesis of many cell wall polysaccharides in plants and extracellular matrix glycosaminoglycans in animal cells.

Gonads The testes or ovaries (sex glands) found in the animal reproductive organ.

Gonorrhea A sexually transmitted disease caused by *Neisseria gonorrhoeae*.

Goodness of fit A measure of the agreement between an observed distribution and a theoretical distribution, specified a priori or fitted to the observations.

Goodpasture's syndrome Goodpasture's syndrome is an autoimmune disease in which autoantibodies against basement membrane or type IV collagen are produced and cause extensive vasculitis. It is rapidly fatal.

Gorget A small patch on the throat of an organism which is distinguished by its color, texture and thickness quality.

Gout A disease characterized by elevated levels of uric acid, usually the result of impaired uric acid excretion. Its most common manifestation is painful arthritic joint inflammation caused by the deposition of sodium urate.

G-protein or GTP –binding protein Protein with GTPase activity that binds GTP, which activates the protein. The intrinsic GTPase activity eventually converts the GTP to GDP which inactivates the protein. These GTPases act as molecular switches in, for example, intracellular signaling pathways. One family is composed of three different subunits (heterotrimeric GTP-binding proteins). The members of the other, very large family are monomeric GTP-binding proteins, these are commonly referred to as monomeric GTPases.

G-protein-linked receptor Cell-surface receptor that associates with an intracellular trimeric GTP-binding protein (G protein) after receptor activation by an extracellular ligand. These receptors are seven-pass transmembrane proteins.

Gq Isoform of trimeric G protein that activates phospholipase C β and therefore generates a calcium signal.

G-quartet A cyclic tetramer of hydrogen-bonded guanine groups. Stacks of G-quartets result from the antiparallel association of G-rich telomeric DNA hairpin structures.

Graft rejection Tissue and organ grafts between genetically distinct individuals almost always elicit an adaptive immune response that causes **graft rejection**, the destruction of the grafted tissue by attacking lymphocytes.

Graft tissue Tissue that is transplanted from one site to another.

Graft Unification of the scion (shoot) of one plant and stock (root) of another plant.

Graft-versus-host, GVH, graft-versus-host disease, GVHD When mature T lymphocytes are injected into a nonidentical immunoincompetent recipient, they can attack the recipient, causing a graft-versus-host (GVH) reaction; in human patients, mature T cells in allogeneic bone marrow grafts can cause graft-versus-host disease (GVHD).

Gram molecular weight The weight in grams of a compound that is numerically equal to its molecular weight; the weight of 1 mole.

Gram stain Differential stain that divides bacteria into two groups, Gram-positive and Gram-negative, based on the ability to retain crystal violet when decolorized with an organic solvent such as ethanol. The cell wall of Gram-positive bacteria consists chiefly of peptidoglycan and lacks the outer membrane of Gram-negative cells.

Gram-negative bacterium A bacterium that does not take up Gram stain, indicating that its cell wall is surrounded by a complex outer membrane that excludes Gram stain.

Gram-negative cell wall A peptidoglycan layer surrounded by a lipopolysaccharide outer membrane.

Gram-positive bacterium A bacterium that takes up Gram stain, indicating that its outermost layer is a cell wall.

Gram-positive cell wall Composed of peptidoglycan and teichoic acids.

Grana or Granum Distinctive structures within the chloroplast formed by the stacking of the thylakoid membranes.

Granule An inclusion that is not bounded by a membrane and contains compacted substances that do not dissolve in the cytoplasm.

Granulocyte Category of white blood cell distinguished by conspicuous cytoplasmic granules. Includes neutrophils, basophils, and eosinophils.

Granulocyte-macrophage colony-stimulating factor, GM-CSF Granulocyte-macrophage colony-stimulating factor (GM-CSF) is a cytokine involved in the growth and differentiation of myeloid and monocytic lineage cells, including dendritic cells, monocytes and tissue macrophages, and cells of the granulocyte lineage.

Granulocytic leukemia Also known as myelocytic leukemia.

Granulolytes A family of leukocytes that accounts for as much as 68 percent of white cells in the blood. The major types of granulocytes are neutrophils, basophils and eosinophils.

Granuloma A granuloma is a site of chronic inflammation usually triggered by persistent infectious agents such as mycobacteria or by a nondegradable foreign body. Granulomas have a central area of macrophages, often fused into multinucleate giant cells, surrounded by T lymphocytes.

Granuloma inguinale Also called donovanosis. A sexually transmitted disease caused by *Calymmatobacterium granulomatis*.

Granulomatous hypersensitivity Cell-mediated hypersensitivity reaction that occurs when macrophages have engulfed pathogens but have failed to kill them.

Granulomatous inflammation A special kind of chronic inflammation characterized by the presence of granulomas.

Granzymes Granzymes are serine proteases produced by cytotoxic T cells and are involved in inducing apoptosis in the target cell.

Gratuitous inducer Inducer of transcription that is not itself metabolized by the resulting enzymes.

Graves' disease Graves' disease is an autoimmune disease in which antibodies against the thyroid-stimulating hormone receptor cause overproduction of thyroid hormone and thus hyperthyroidism.

Gravitational Water After rain, the water draining into the pores of the soil is called gravitational water.

Gray crescent Band of pale pigmentation that appears in the egg of some species of amphibian opposite the site of sperm entry following fertilization. Caused by rotation of the egg cortex and associated pigment granules. Marks the future dorsal side.

Grb2 (growth factor receptor binding protein number 2) Linker protein that has an SH2 domain and is therefore recruited to phosphotyrosine, e.g., on receptor tyrosine kinases. Grb2 in turn recruits SOS, bringing SOS to the plasma membrane where it can act as a guanine nucleotide exchange protein (GEF) for Ras.

Greek-key a topology for a small number of beta sheet strands in which some interstrand connections going across the end of barrel or, in a sandwich fold, between beta sheets.

Green-sulfur-bacteria Anoxygenic phototrophs containing chlorosomes and bacteriochlorophyll *c*, *c*₂, *d* or *e* and light harvesting chlorophyll.

Green fluorescent protein Fluorescent protein made by the jellyfish *Victoria victoria*. Unlike other colored or fluorescent proteins, it contains no prosthetic groups and therefore will fluoresce when expressed by any cell in which the gene is successfully inserted and expressed.

Griseofulvin A fungistatic antibiotic.

Ground Meristem The meristem producing all the primary tissues of the plant except the epidermis and the stele.

Ground state The normal, stable form of an atom or molecule; as distinct from the excited state.

Ground water Portion of the water below the surface of the ground at a pressure equal to or greater than atmospheric.

- Group I intron** An intron in an rRNA molecule whose self-splicing reaction requires a guanine nucleotide and generates a cyclized intron product.
- Group II intron** An intron in a eukaryotic rRNA molecule whose self-splicing reaction does not require a free nucleotide and generates a lariat intron product.
- Group III intron** A type of intron found in organelle genes.
- Group transfer potential** A measure of the ability of a compound to donate an activated group (such as a phosphate or acyl group); generally expressed as the standard free energy of hydrolysis.
- Group translocation** In prokaryotes, active transport in which a substance is chemically altered during transport across the plasma membrane.
- Growth cone** Migrating motile tip of growing nerve cell axon or dendrite.
- Growth factor** Extracellular polypeptide signal molecule that can stimulate a cell to grow or proliferate. Examples are epidermal growth factor (EGF) and platelet-derived growth factor (PDGF). Most growth factors also have other actions.
- Growth factor receptor binding protein number 2 (Grb2)** Linker protein that has an SH2 domain and is therefore recruited to phosphotyrosine, e.g., on receptor tyrosine kinases. Grb2 in turn recruits SOS, bringing SOS to the plasma membrane where it can act as a guanine nucleotide exchange protein (GEF) for Ras.
- Growth fork** The region on a DNA duplex molecule where synthesis is taking place. It resembles a fork in shape, since it consists of a region of duplex DNA connected to a region of unwound single strands.
- Growth** In microbiology, an increase in both cell number and cellular constituents.
- Growth of Plants** Growth proceeds in an irreversible sigmoidal increase in size (slow, fast, slow, adult plant).
- Growth rate constant** Slope of \log_{10} of the number of cells per unit volume plotted against time.
- Growth rate** The rate at which growth occurs, usually expressed as the generation time.
- Growth regulator** Signal molecule that helps coordinate growth and development.
- Growth yield coefficient** Quantity of biomass carbon formed per unit of substrate carbon consumed.
- Gs** G protein that, when activated, activates the enzyme adenylyl cyclase and thus stimulates the production of cyclic AMP.
- GTP (guanosine 5'-triphosphate)** Nucleoside triphosphate produced by phosphorylating GDP (guanosine diphosphate). Like ATP it releases a large amount of free energy on hydrolysis of its terminal phosphate group. It has a special role in microtubule assembly, protein synthesis, and cell signaling.
- GTPase activating protein (GAP)** Protein that binds to a GTP-binding protein and inactivates it by stimulating its GTPase activity so that it hydrolyzes its bound bound GTP to GDP.

GTPase Enzyme activity that converts GTP to GDP.

GTP-binding protein, G protein Protein with GTPase activity that binds GTP, which activates the protein. The intrinsic GTPase activity eventually converts the GTP to GDP which inactivates the protein. These GTPases act as molecular switches in, for example, intracellular signaling pathways. One family is composed of three different subunits (heterotrimeric GTP-binding proteins). The members of the other, very large family are monomeric GTP-binding proteins; these are commonly referred to as monomeric GTPases.

Gua-Ag intron The commonest type of intron in eukaryotic nuclear genes. The first two nucleotides of the intron are 5'-GU-3' and last two are 5'-AG-3'.

Guanazole An antitumor agent that inhibits the enzyme ribonucleoside diphosphate reductase. It thus blocks the conversion of ribonucleoside diphosphates to their deoxy derivatives, thereby inhibiting the synthesis of DNA.

Guanine (G) A purine base found in DNA or RNA.

Guanine methyltransferase The enzyme that attaches a methyl group to the 5' end of a eukaryotic mRNA during the capping reaction.

Guanine nucleotide exchange factor (GEF) Protein that binds to a GTP-binding protein and activates it by stimulating it to release its tightly bound GDP, thereby allowing it to bind GTP in its synthesis.

Guanine nucleotide releasing protein (GNRPs) A set of proteins that are intermediates in the Ras signal transduction pathway.

Guano Large deposits of substances composed chiefly of the feces of birds or bats.

Guanosine A purine nucleoside found in DNA and RNA.

Guanosine diphosphate (GDP) Guanosine with two phosphates attached to the 5_′ carbon of ribose.

Guanosine triphosphate (GTP) Guanosine with three phosphates attached to the 5_′ carbon of ribose.

Guanylate cyclase An enzyme that converts GTP to the intracellular messenger cyclic GMP (cGMP). One isoform of guanylate cyclase is activated by NO.

Guanylyl transferase The enzyme that attaches a GTP to the 5' end of a eukaryotic mRNA at the start of the capping reaction.

Guard Cell Pair of specialized cells surrounding the stomata. These help in transpiration.

Guide RNA of gRNA Small RNA molecules that pair with an immature mRNA to direct its posttranscriptional editing.

Gular Fluttering A cooling mechanism adopted by birds, in which they flap their flap membranes rapidly in the throat to increase evaporation.

Gular Pouch A bare sac or pouch that can be expanded to accommodate a large prey, or for the show off during courtship display.

Gumma A rubbery mass of tissue characteristic of tertiary syphilis.

Gut-associated lymphoid tissues, GALT The **gut-associated lymphoid tissues (GALT)** are lymphoid tissues closely associated with the gastrointestinal tract, including the palatine tonsils, Peyer's patches, and intraepithelial lymphocytes. The GALT has a distinctive biology related to its exposure to antigens from food and normal intestinal microbial flora.

Guthrie test Test for phenylketonuria. Newborn babies' blood is tested for the presence of phenylalanine at unusually high concentration.

Guttation Exudation of water from the leaves in the form of droplets due to root pressure.

Gymnosperm Type of plants in which the seeds are not enclosed in the ovary during the development.

Trimeric G protein Protein that links a class of metabotropic cell surface receptors with downstream targets. Trimeric G proteins comprise an α -subunit that binds and hydrolyzes GTP and a $\beta\gamma$ subunit that dissociates from the α -subunit while the latter is in the GTP-bound state. Important G proteins are G_q, which activates phospholipase C β , and G_s, which activates adenylate cyclase.

γ globulins, gamma globulins Plasma proteins can be separated on the basis of electrophoretic mobility into albumin and the α , β , and γ globulins. Most antibodies migrate in electrophoresis as **γ globulins (or gamma globulins)**, and patients who lack antibodies are said to have agammaglobulinemia.

$\gamma:\delta$ T-cell receptor, $\gamma:\delta$ T cells Most T lymphocytes have $\alpha:\beta$ heterodimeric T-cell receptors, but some bear a distinct **$\gamma:\delta$ T-cell receptor** composed of different antigen recognition chains, γ and δ , assembled in a $\gamma:\delta$ heterodimer. Cells bearing these receptors are called **$\gamma:\delta$ T cells** and their specificity and function are not yet clear.

H (hemagglutination) spikes Antigenic projections from the outer lipid bilayer of influenza virus.

H antigens, histocompatibility antigens H antigens or histocompatibility antigens Also known as major histocompatibility antigens when they encode molecules that present foreign peptides to T cells and as minor H antigens when they present polymorphic self peptides to T cells.

H H is the relative entropy of the target and background residue frequencies. (Karlin and Altschul, 1990). H can be thought of as a measure of the average information (in bits) available per position that distinguishes an alignment from chance. At high values of H, short alignments can be distinguished by chance, whereas at lower H values, a longer alignment may be necessary.

H⁺ Positively charged subatomic particle that forms part of an atomic nucleus. Hydrogen has a nucleus composed of a single proton (H⁺).

H-2, histocompatibility-2 The major histocompatibility complex of the mouse is called H-2 (for histocompatibility-2). Haplotypes are designated by a lower-case superscript, as in H-2b.

Habitat 1. The physical conditions that surround a species, or species population, or assemblage of species, or community.

Habitat Compression When local population is forced or restricted within a set boundary, to accommodate more species.

Habitat Expansion Increase in the habitat (overall area) for distribution of the species.

Habitat Patch A location that encompasses a distinct habitat type.

Habitat Selection Habitats chosen over other habitats to suit climatic and environmental conditions.

Habituation The acquired ability of cells to grow and divide independently of growth regulators.

Hacking Part of the wildlife conservation rehabilitation program, where the animals or birds released in the wild for the first time, are periodically provided with food until they become independent.

Hairpin loop A single-stranded complementary region of DNA or RNA that folds back on itself and base-pairs into a double helix.

Half-life or half time For a chemical reaction, the time at which half the substrate has been consumed and turned into product. It is also referred as the analogous point in other processes, such as the radioactive decay of an isotope.

Half-life or half time The time required for the disappearance of one half of a substance.

Half-reaction The single oxidation or reduction process, involving an electron donor and its conjugate electron acceptor, that occurs in electrical cells but requires link with another such reaction to form a complete oxidation-reduction reaction.

Halobacteria Bacteria that thrive in and may require high salinity.

Halogen Any of the five elements F, Cl, Br, I, and At that form part of group VII A of the periodic table.

Halophile Organism requiring or tolerating a saline environment.

Halotolerant An organism capable of growing in the presence of NaCl but not requiring it.

Hammerhead An RNA structure with ribozyme activity that is found in some viruses.

Hanging drop A special type of wet mount often used with dark-field illumination to study mobility of organisms.

Hansen's disease Also known as leprosy; caused by *Mycobacterium leprae*, it exhibits various clinical forms ranging from tuberculoid to lepromatous.

Hantavirus pulmonary syndrome (HPS) The "Sin Nombre" hantavirus responsible for severe respiratory illness.

Haplogroup One of the major sequence classes of mitochondrial DNA present in the human population.

Haploid A single set of chromosomes (half the full set of genetic material) present in the egg and sperm cells of animals and in the egg and pollen cells of plants. Human beings have 23 chromosomes in their reproductive cells.

Haploinsufficiency The situation where inactivation of a gene on one of a pair of homologous chromosomes results in a change in the phenotype of the mutant organism.

Haplotype A way of denoting the collective genotype of a number of closely linked loci on a chromosome.

Hemizygous Having only one copy of a particular gene. For example, in humans, males are hemizygous for genes found on the Y chromosome.

Hapten A molecule that is too small to stimulate an immune response by itself but can do so when coupled to a larger, immunogenic carrier molecule (usually a protein).

Hardening off Gradual acclimatization of in vitro grown plants to in vivo conditions. Adapting plants to outdoor conditions by gradually withholding water, lowering the temperature, increasing light intensity, or reducing the nutrient supply.

Hardwood The wood of both dicot trees and shrubs are termed as hardwood. A dicot wood generally contains fibers.

Harmonic mean Harmonic mean is defined as the reciprocal of the arithmetic mean of the reciprocal of the individual observations.

Hashimoto's thyroiditis Hashimoto's thyroiditis is an autoimmune disease characterized by persistent high levels of antibody against thyroid-specific antigens. These antibodies recruit NK cells to the tissue, leading to damage and inflammation.

HAT Also known as histone acetyltransferase.

Hatchling A young one that has just been hatched from an egg.

Haustrorium Organ bearing semblance to a root, which is used by a parasite to penetrate into the host plant to absorb nutrients.

Haworth perspective formulas A method for representing cyclic chemical structures so as to define the configuration of each substituent group; the method commonly used for representing sugars.

Haworth projection A conventional planar representation of a crystallized monosaccharide molecule. The hydroxyls that are represented to the right of the chain in a Fischer projection are shown below the plane in Howorth projection.

Head group Hydrophilic group found in phospholipids. The head group is attached to the glycerol backbone by a phosphodiester link. Examples are choline and inositol.

Heartwood Darker colored non-living wood, whose cells have stopped conducting water.

Heat fixation Technique in which air-dried smears are passed through an open flame so that organisms are killed, adhere better to the slide, and take up dye more easily.

Heat Many plants, (e.g.: aroids) when inflorescence is ready for pollination, generate heat by oxidizing large amounts of stored food, mainly fats (up to 1/4 of their total weight a day). The heat (up to 30°C above ambient temp.) causes bad smelling amines to emanate attracting pollinating insects (flies, etc.). A common fuel is known to be salicylic acid (similar to aspirin). Since many of these plants flower in late fall, trapped pollinating insects are kept warm during the night to be released, loaded with pollen in, the morning.

Heat Sensitive Pit An IR, receptor organ located on each side of the head, below a line from the eye to the nostril of some snakes, especially the vipers. It helps the snake detect their warm blooded prey.

Heat shock protein (stress-response protein) Protein synthesized in increased amounts in response to an elevated temperature or other stressful treatment, and which usually helps the cell to survive the stress. Prominent examples are hsp60 and hsp70.

Heavy chain (H chain) The larger of the two types of polypeptide in an immunoglobulin molecule.

Heavy isotopes Forms of atoms that contain greater numbers of neutrons than the most common form (e.g., ^{15}N , ^{13}C).

Heavy metals Those metals which have densities $> 5.0 \text{ Mg m}^{-3}$. These include the metallic elements Cu, Fe, Mn, Mo, Co, Zn, Cd, Hg, Ni, and Pb. Al and Se have densities < 5 but are also considered heavy metals.

Heel prick test (Guthrie test): Test for phenylketonuria. Newborn babies' blood is tested for the presence of phenylalanine at unusually high concentration.

HeLa cell Line of human epithelial cells that grows vigorously in culture. Cell line originally derived from the uterine carcinoma cells of a patient named Henrietta Lacks.

Helicase Enzyme that helps unwind the DNA double helix during replication.

Helix A spiral structure with a repeating pattern.

Helix cap A protein structural element in which the side chain of a residue preceding or succeeding a helix folds back to form a hydrogen bond with the backbone of one of the helix's four terminal residues.

Helix-loop-helix (HLH) DNA binding structural motif present in many gene regulatory proteins. Should not be confused with the helix-turn-helix.

Helix-loop-helix motif A binding motif that is found in calmodulin and some other calcium-binding proteins as well as in some DNA-binding proteins. It consists of two α helix segments connected by a loop.

Helix-turn-helix motif A DNA-binding motif that is responsible for sequence specific DNA-binding in many transcription factors. It consists of two α helix segments connected by a β turn; one of the helices occupies the DNA major groove and makes specific base contacts.

Helminth A parasitic roundworm or flatworm.

Helper CD4 T cells **Helper CD4 T cells** are CD4 T cells that can help B cells make antibody in response to antigenic challenge. The most efficient helper T cells are also known as $\text{T}_\text{H}2$ cells, which make the cytokines IL-4 and IL-5. Some experts refer to all CD4 T cells, regardless of function, as helper T cells.

Helper phage A phage that is introduced into a host cell in conjunction with related cloning vector, in order to provide enzymes and other proteins required for replication of the cloning vector.

Helper T Cell Type of T cell that helps stimulate B cells to make antibodies and activates macrophages to kill ingested microorganisms.

Hemagglutination inhibition test Serological test used to diagnose measles, influenza, and other viral diseases, based on the ability of antibodies to viruses to prevent viral hemagglutination.

Hemagglutinin, hemagglutination A hemagglutinin is any substance that causes red blood cells to agglutinate, a process known as hemagglutination. The hemagglutinins in human blood are antibodies that recognize the ABO blood group antigens. Influenza and some other viruses have hemagglutinin molecules that bind to glycoproteins on host cells to initiate the infectious process.

Hemangioma A benign tumor of the blood vessels.

Hemangiosarcoma A malignant tumor containing both endothelial cells from the linings of blood or lymph vessels and fibroblasts.

Hematopoiesis, hematopoietic stem cells, hematopoietic growth factors Hematopoiesis is the generation of the cellular elements of blood, including the red blood cells, leukocytes, and platelets. These cells all originate from pluripotent hematopoietic stem cells whose differentiated progeny divide under the influence of hematopoietic growth factors.

hematopoietic lineage A hematopoietic lineage is any developmental series of cells that derives from hematopoietic stem cells and results in the production of mature blood cells.

Heme An iron-porphyrin complex found in hemoglobin and cytochromes. Hemiacetal. The product formed by the condensation of an aldehyde with an alcohol; it contains one oxygen linked to a central carbon in a hydroxyl fashion and one oxygen linked to the same central carbon by an ether linkage.

Heme protein A protein containing a heme as a prosthetic group.

Hemiacetal The product of the reaction between an alcohol and the carbonyl group of an aldehyde.

Hemicelluloses Polysaccharide component of the plant cell wall that links cellulose fibrils together.

Hemidesmosome Specialized anchoring cell junction between an epithelial cell and the underlying basal lamina.

Hemiketal The product of the reaction between an alcohol and the carbonyl group of ketone.

Hemimethylated With respect to DNA, refers to the condition in which one strand of the duplex is methylated and the other is not. Newly replicated DNA is hemimethylated; normally a methylase enzyme then methylates appropriate bases in the new strand.

Hemoflagellate A parasitic flagellate found in the circulatory system of its host. Ex. *Trypanosoma cruzi*

Hemoglobin A heme protein in erythrocytes; functions in oxygen transport. A tetra heme chromo protein, a respiratory pigment in vertebrates.

Hemolysins Enzymes that lyse red blood cells.

Hemolysis The lysis of red blood cells.

Hemolytic anemia Loss of red blood cells through their lysis (destruction) in the bloodstream.

Hemolytic cleavage Cleavage of a bond in which each participating atom requires one of the electrons that formed the bond.

Hemolytic disease of the newborn Also known as erythroblastosis fetalis. Disease in which a baby is born with enlarged liver and spleen caused by efforts of these organs to destroy red blood cells damaged by maternal antibodies; when mother is Rh-negative and baby is Rh-positive.

Hemopoiesis Generation of blood cells, mainly in the bone marrow.

Hemopoietic cancers Cancers of the blood-forming organs, that is, leukemias and lymphomas.

Hemorrhagic uremic syndrome (HUS) Infection with O157:H7 strain of *Escherichia coli* causing kidney damage and bleeding in the urinary tract.

Henderson-Hasselbalch equation An equation relating the pH, the pK_a , and the ratio of the concentrations of the proton-acceptor (A^-) and proton-donor (HA) species in a solution.

Equation: $pH = pK_a + \log \left(\frac{[A^-]}{[HA]} \right)$ ($[A^-]$ = molar concentration of a conjugate base)

Hepadnavirus A small, enveloped DNA virus with circular DNA; one such virus causes hepatitis B.

Hepatitis A (Formerly called infectious hepatitis) Common form of viral hepatitis caused by a single-stranded RNA virus transmitted by the fecal-oral route.

Hepatitis An inflammation of the liver, usually caused by viruses but sometimes by an amoeba or various toxic chemicals.

Hepatitis B (Formerly called serum hepatitis) Type of hepatitis caused by a double-stranded DNA virus usually transmitted in blood stream.

Hepatitis C (Formerly called non-A, non-B hepatitis) Type of hepatitis distinguished by a high level of the liver enzyme alanine transferase; usually mild or inappropriate infection but can be severe in compromised individuals.

Hepatitis D (Formerly called delta hepatitis) Severe type of hepatitis caused by presence of both hepatitis D and hepatitis B viruses; hepatitis D virus is an incomplete virus and cannot replicate without presence of hepatitis B viruses as a helper.

Hepatitis E Type of hepatitis transmitted through focally contaminated water supplies.

Hepatocyte The major cell type of liver tissue.

Hepatoma A tumor of the liver.

Heptad repeat A sequence of seven residues that is repeated in the same polymer.

Heptamer Recombination signal sequences (RSS) flanking gene segments consist of a seven-nucleotide heptamer and a nine-nucleotide nonamer of conserved sequence, separated by 12 or 23 nucleotides. RSSs form the target for the site-specific RAG-1:RAG-2 recombinase that joins the gene segments

Herbaceous Stems and branches that are soft, and not hard and woody. Ex. Grass, carrot etc.

Herbarium Collection of plant specimens, which are pressed, dried, mounted on paper, identified and then labeled.

Herbivore Plant eating organisms.

Herd immunity The presence of immunity in most of a population.

Hereditary angioneurotic edema **Hereditary angioneurotic edema** is the clinical name for a genetic deficiency of the C1 inhibitor of the complement system. In the absence of C1 inhibitor, spontaneous activation of the complement system can cause diffuse fluid leakage from blood vessels, the most serious consequence of which is epiglottal swelling leading to suffocation.

Hereditary cancer Cancer that occurs due to the inheritance of an altered gene within a family.

Heredity Transmission of traits from parents to offsprings.

Heritability Ability of organisms to inherit a particular trait to the offspring.

Hermaphroditic Organism that have, as well as are capable of reproducing using both male and female reproductive organs.

Herpes gladiatorium Herpesvirus infection that occurs in skin injuries of wrestlers; transmitted by contact or on mats.

Herpes labialis Fever blisters (cold sores) on lips.

Herpes meningoencephalitis A serious disease caused by herpesvirus that can cause permanent neurological damage or death and that sometimes follows a generalized herpes infection of ascends from the trigeminal ganglion.

Herpes pneumonia A rare form of herpes infection seen in burn patients, AIDS patients and alcoholics.

Herpes saimiri A similar herpesvirus that causes tumors in certain primates but not in the natural host.

Herpes simplex A family of acute diseases, caused by herpesviruses, most commonly marked by groups of watery blisters on the skin and mucous membranes, such as the borders of the lips (herpes genitalis). Disseminated herpes simplex and herpes encephalitis are very serious infections of the newborn.

Herpes simplex virus type 1 (HSV-1) A type that most frequently causes fever blisters (cold sores) and other lesions of the oral cavity, and less often causes genital lesions.

Herpes simplex virus type 2 (HSV-2) Also called herpes hominis virus. A virus type that typically causes genital herpes, but which can also cause oral lesions.

Herpes zoster A herpesvirus that causes chicken pox and herpes zoster (shingles); also the disease called shingles. The latter results from activation of a latent infection and produces eruptions along the paths of nerves in the skin.

Herpesviruses A family of DNA viruses that are cause of, among other things, a group of skin infections known as herpes simplex and herpes zoster. The DNA of herpesviruses has a mass of about 8.5 to 100×10^6 daltons. The two major herpesviruses are known as herpes simplex virus I and II (HSV I and II). HSV I is responsible for infections of the mouth, lip (cold sores), cornea, and genital areas and is thought to be one of the most widely distributed viruses in humans. HSV II is most frequently responsible for infections of the genital area and is venereally transmitted. Other herpesviruses include Epstein-Barr virus, cytomegalovirus and herpes virus saimiri. Many of the herpesviruses are suspected of being involved in the etiology of tumors.

Heterocaryon Cell with two or more genetically different nuclei; produced by the fusion of two or more different cells.

Heterochromatin Highly condensed regions of chromosomes that are not usually transcriptionally active.

Heterocyst Thick walled, transparent, slightly enlarged cell located in the filaments of certain cyanobacteria.

Heterodimer Protein complex composed of two different polypeptide chains.

Heteroduplex analysis Transcript mapping by analysis of DNA-RNA hybrids with a single-strand-specific nuclease such as S1.

Heteroduplex DNA Duplex DNA containing complementary strands derived similar sequences, often as a product of genetic recombination.

Heterofermentation Any fermentation in which there is more than one major end-product. . Synonym of heterolactic fermentation

Heterogeneity The ability of the immune system to produce many different kinds of antibodies, each specific for a different antigenic determinant.

Heterogenous DNA A segment of DNA consisting of imperfectly complementary strands.

Heterogenous nuclear RNAs (hnRNAs) Larger nuclear RNAs of variable length, most of which are degraded within the nucleus and many of which represent unspliced mRNA precursors.

heterokaryon Hypha that contains at least two genetically dissimilar nuclei.

Heterokaryosis Condition pertaining to certain cells in fungi, which feature two or more nuclei of different mating types.

Heterolactic fermentation A type of lactic acid fermentation in which sugars (e.g. lactose, glucose) are fermented to a range of products.

Heterologous probe A DNA probe that is derived from one species and used to screen for a similar DNA sequence from another species.

Heterolytic cleavage Cleavage of a bond in which one of two chemically bonded atoms requires both of the electrons that formed the bond.

Heterophagosome Digestive vacuole resulting from the ingestion of foreign substances by the cell.

Heteropolymer A polymer containing more than one type of monomeric unit.

Heteropolysaccharide A polysaccharide containing more than one type of sugar.

Heterosis Increased vigour of first generation plants over their parents.

Heterospory Formation of both megaspores and microspores.

Heterothallic Hyphae that are incompatible with each other. Each requiring contact with another hypha of compatible mating type which, upon fusion, forms a dikaryon or a diploid.

Heterotic groups Groups of germplasm that when crossed maximize heterosis. Heterosis is a phenomenon that heterozygotes in a population often have higher fitness than the homozygotes.

Heterotrimeric G protein Also known as G protein.

Heterotrophic nitrification Biochemical oxidation of ammonium to nitrite and nitrate by heterotrophic microorganisms.

Heterotrophs Organisms that can not synthesize their organic compounds entirely from inorganic precursors but most consume at least some organic compounds made by other organisms. In particular, these organisms cannot use CO₂ as a carbon source.

Heterotrophy Organism capable of deriving carbon and energy for growth and cell synthesis from organic compounds generally. Also obtain energy and reducing power equivalents from organic compounds.

Heterotropic enzyme An allosteric enzyme requiring a modulator other than its substrate.

Heterozygosity The condition of having one or more pairs of different alleles on homologous chromosomes.

Heterozygote Diploid cell or individual having two different alleles of one or more specified genes.

Heterozygous Having two different alleles for a given trait.

Hexachlorophene A chlorinated phenol used as an antiseptic.

Hexamethylmelamine An alkylating agent used in the treatment of tumors.

Hexokinase Enzyme that phosphorylates glucose on the number 6 carbon.

Hexose A simple sugar with a backbone containing six carbon atoms. high-energy compound: A compound that on hydrolysis undergoes a large decrease in free energy under standard conditions.

Hexose monophosphate pathway A metabolic pathway present in a wide range of prokaryotic and eukaryotic microorganisms as well as in plants and animals; it involves the oxidative decarboxylation of glucose 6-phosphate, via 6-phosphogluconate, to ribulose 5-phosphate, followed by a series of reversible, non-oxidative interconversions whereby hexose and triose phosphates are formed from pentose phosphates. Also called: HMP pathway, HMP shunt; oxidative pentose phosphate pathway, pentose phosphate pathway/cycle, phosphogluconate pathway; Warburg-Dickens pathway.

Heymann's nephritis An excellent model for membranous glomerulonephritis is **Heymann's nephritis**, a disease induced by injecting animals with tubular epithelial tissue.

Hib vaccine Vaccine against *Haemophilus influenzae* b.

Hibernation An inactive state resembling deep sleep in which certain animals living in cold climates pass the winter. In hibernation, the body temperature is lowered and breathing and heart rates slow down. Hibernation protects the animal from cold and reduces the need for food during the season when food is scarce.

Hierarchical clustering A method for analyzing transcriptomes based on comparisons between the expression levels of pairs of genes.

High endothelial venules, HEVs, high endothelial cells **High endothelial venules (HEVs)** are specialized venules found in lymphoid tissues. Lymphocytes migrate from blood into lymphoid tissues by attaching to and migrating across the **high endothelial cells** of these vessels.

High frequency of recombination (Hfr) strain A strain of F⁺ bacteria in which the F plasmid is incorporated into the bacterial chromosome.

High mobility group N (HMGN) protein A group of nuclear proteins that influence chromatin structure.

High-density lipoprotein (HDL) A type of lipoprotein particle that functions mainly to scavenge excess cholesterol from tissue cells and transport it to the liver, where it can be excreted in the form of bile acids.

High-efficiency particulate air (HEPA) filter A screen like membrane that removes particles larger than 0.3 μm from air.

High-energy bond A chemical bond that releases energy when hydrolyzed; the energy can be used to transfer the hydrolyzed product to another compound.

Highly conserved sequence DNA sequence that is very similar across several different types of organisms.

Highly repetitive DNA Also known as satellite DNA and short tandem repeats (STRs). Clusters of nearly identical sequences of up to 10 bp that are repeated thousands of times: these sequences are present at >10⁶ copies per haploid genome.

High-mannose oligosaccharide Chain of sugars attached to a glycoprotein which contains many mannose residues. It is generated by a trimming of the original mannose-rich oligosaccharide that leaves most of the mannose residues with no subsequent addition of further sugars.

High-performance liquid chromatography (HPLC) Type of chromatography that uses columns packed with tiny beads of matrix; the solution to be separated is pushed through under high pressure.

High-temperature short-time (HIST) pasteurization Pasteurizing at 72°C for 15 seconds.

High-throughput sequencing A fast method of determining the order of bases in DNA.

High-zone tolerance Tolerance to injected protein antigens occurs at low or high doses of antigen. Tolerance induced by the injection of high doses of antigen is called high-zone tolerance, whereas tolerance produced with low doses of antigen is called low-zone tolerance.

Hill coefficient (n_H) A coefficient that indicates the degree of cooperativity of a cooperative transition; it is the maximum slope of a Hill plot of the transition.

Hill equation A mathematical expression for the degree of saturation of ligand to a molecule with multiple binding sites as a function of the ligand concentration.

Hill reaction The evolution of oxygen and the photoreduction of an artificial electron acceptor by a chloroplast preparation in the absence of carbon dioxide.

Hinge region The hinge region of antibody molecules is a flexible domain that joins the Fab arms to the Fc piece. The flexibility of the hinge region in IgG and IgA molecules allows the Fab arms to adopt a wide range of angles, permitting binding to epitopes spaced variable distances apart.

Histamine It is a vasoactive amine stored in mast cell granules. Histamine released by antigen binding to IgE molecules on mast cells causes dilation of local blood vessels and smooth muscle contraction,

producing some of the symptoms of immediate hypersensitivity reactions. Antihistamines are drugs that counter histamine action.

Histidine-kinase-associated receptor Type of transmembrane receptor found in the plasma membrane of bacteria, yeast and plant cells, and involved, for example, in sensing stimuli that cause bacterial chemotaxis. Associated with a histidine protein kinase on its cytoplasmic side.

Histocompatibility antigens Antigens on the surface of human cells.

Histocompatibility It is literally the ability of tissues (Greek: histos) to get along with each other. It is used in immunology to describe the genetic systems that determine the rejection of tissue and organ grafts resulting from immunological recognition of histocompatibility (H) antigens

Histogram A histogram is a diagrammatic representation, which contains a set of rectangles, each being constructed to represent the size of the class-interval by its width and the frequency in each class-interval by its height.

Histology The study of tissues of organisms. It includes its structure, arrangement, functions, make up, etc.

Histone acetylation Modification of chromatin structure by attachment of acetyl groups to core histones.

Histone acetyltransferase (HAT) An enzyme that catalyzes the sequence-specific acetylation of histones so as to regulate gene transcription.

Histone code The correlation between the pattern of histone modification and the transcriptional activity of the associated DNA.

Histone deacetylase (HDAC) An enzyme that removes acetyl groups from core histones.

Histone octamer Two molecules each of histones H2A, H2B, H3, and H4, the whole forming a nucleosome.

Histones Group of five basic proteins that associate with DNA in the cell nucleus to form chromatin made up of different proportion of Lysine & Arginine residues.

Histoplasmosis Also known as Darling's disease. Fungal respiratory disease endemic to the central and eastern United States, caused by the soil fungus *Histoplasma capsulatum*.

HIV Human immunodeficiency virus, the retrovirus that causes AIDS.

HLA HLA, the acronym for Human Leukocyte Antigen, is the genetic designation for the human MHC. Individual loci are designated by upper-case letters, as in HLA-A, and alleles are designated by numbers, as in HLA-A*0201.

HLA-DM The invariant HLA-DM molecule in humans is involved in loading peptides onto MHC class II molecules. It is encoded in the MHC within a set of genes resembling MHC class II genes. A homologous protein in mice is called H-2M.

HMG protein A member of the high mobility group (HMG) of nonhistone chromosomal proteins whose abundant charged groups give them high electrophoretic mobility.

hn RNA Also known as heterogenous nuclear RNA.

hnRNP Protein (heterogenous nuclear ribonuclear protein) Any of a group of proteins that assemble on newly synthesized RNA, organizing it into a more compact form.

Hodgkin's disease A form of lymphoma characterized by progressive, painless enlargement of lymph nodes, fever, anemia and cachexia. Enlargement of the lymph nodes is generally accompanied by the presence of characteristic types of lymphocytes (Sternberg-Reed cells) and eosinophils.

Hold Fast Filament like organ of attachment present in algae that holds the algae to the substrate.

Holliday intermediate An intermediate in genetic recombination in which two double-stranded DNA molecules are joined by virtue of a reciprocal crossover involving one strand of each molecule.

Holliday junction X-shaped structure observed in DNA undergoing recombination, in which the two DNA molecules are held together at the site of crossing-over, also called a cross-strand exchange.

Holliday structure An intermediate structure formed during recombination between two DNA molecules.

Holocentric chromosome A chromosome that does not have a single centromere but instead has multiple kinetochores spread along its length.

Holoenzyme A catalytically active enzyme including all necessary subunits, prosthetic groups, and cofactors.

Holomorph Whole fungus consisting of all sexual and asexual stages in its life cycle.

Holotype A single specimen used as standard type to name, describe and illustrate, and represent a set of species and subspecies.

Home Range The habitat that an animal normally lives and uses for daily activities.

Homeobox A conserved DNA sequence of 180 base pairs encoding a protein domain found in many proteins that play a regulatory role in development.

Homeodomain DNA-binding domain that defines a class of gene regulatory proteins important in animal development.

Homeostasis The process of maintaining internal stability (steady state) of the physiological system of animals, in course of varying external conditions.

Homeothermy The capacity to maintain a steady state body temperature remaining warm-blooded under all climatic situations, as seen in Birds and Mammals.

Homeotic genes or Homeotic selector genes Genes that contain homeo box elements and typically are involved in controlling the pattern of organismal development. Homeotic mutations, which scramble portions of this pattern, affect homeotic genes. The nuclear DNA-binding proteins encoded by these genes presumably serve as transcriptional regulators for the coordinated expression of groups of genes.

Homeotic mutation Mutation that causes cells in one region of the body to behave as though they were located in another, causing a bizarre disturbance of the body functioning.

Homeotic selector genes Insect genes that specify the identities of body segments.

Homofermentation Any fermentation in which there is only one major end-product. Synonym of homolactic fermentation.

Homokaryon Fungal hypha in which all nuclei are genetically identical.

Homokaryosis Condition in fungi, wherein all nuclei in the mycelium are genetically identical.

Homolactic acid fermentation A pathway in which pyruvic acid is directly converted to lactic acid using electrons from reduced NAD (NADH).

Homolog A member of a chromosome pair in diploid organisms or a gene that has the same origin and functions in two or more species.

Homologous chromosome Chromosome containing the same linear gene sequences as another, each derived from one parent.

Homologous end-joining A pathway in which DNA with double-strand breaks is repaired nonmutagenetically through recombination with an intact homologous chromosome.

Homologous genes Genes that share a common evolutionary ancestor.

Homologous genetic recombination Recombination between two DNA molecules of similar sequence, occurring in all cells; occurs during meiosis and mitosis in eukaryotes.

Homologous proteins Proteins having sequences and functions similar in different species; for example, the hemoglobins.

Homologous recombination Genetic recombination that requires extensive sequence homology between the recombination DNA molecules. As for example-meiotic recombination by crossing over in eukaryotes.

Homology searching A technique in which genes with sequences similar to that of an unknown gene are sought, the objective being to gain an insight into the function of the unknown gene.

Homology Similarity in DNA or protein sequences between individuals of the same species or among different species.

Homoplasy A term in cladistic analysis that refers to the proportion of parallelisms and reversals on a phylogenetic tree. Also used for different DNA fragments of identical size that cannot be distinguished by gel electrophoresis.

Homoplasy The situation that occurs when the same character state evolves independently in two lineages.

Homopolymer A polymer that is made of only one kind of monomer. As for example-starch, made only of glucosyl units. Polymers that include more than one kind of monomer, like polypeptides and nucleic acids, are called heteropolymers.

Homopolymeric tailing Also known as tailing. In this procedure, homopolymer sequences of one type, e.g. poly(dA), are added to the 3'-ends of one of the populations of DNA molecules, while complementary homopolymer sequences, e.g. poly(dT), are added to the 3'-ends of the other population of DNA molecules. The two types of molecules are then annealed to form mixed dimeric circles.

Homopolysaccharide A polysaccharide consisting of one type of monosaccharide unit.

Homothallic Hyphae that are self-compatible in that sexual reproduction occurs in the same organism by meiosis and genetic recombination; fusion of hypha results in a dikaryon or diploid.

Homotropic enzyme An allosteric enzyme that uses its substrate as a modulator.

Homozygote Diploid cell or organism having two identical alleles of a specified gene or set of genes.

Homozygous Possessing two identical alleles on a homologous chromosome pair at the same locus.

Hoogsteen base pair Also known as Watson-Crick base pair. A form of base pairing in which thymine or uracil atom N3 hydrogen bonds to adenine atom N7 and adenine N6 hydrogen bonds to thymine or uracil O4.

Hookworm A disease caused by two species of small roundworms, *Ancylostoma duodenale* and *Necator americanus*, whose larvae burrow through skin and feet, enter the blood vessels, and penetrate lung and intestinal tissue.

Horizon Also known as soil horizon. A soil horizon is a layer parallel to the soil surface, whose physical characteristics differ from the layers above and beneath.

Horizontal gene transfer Transfer of a gene from one species to another.

Horizontal laminar flow unit An enclosed work area that has sterile air moving across it. The air moves with uniform velocity along parallel flow lines. Room air is pulled into the unit and forced through a HEPA (High Energy Particulate Air) filter, which removes particles 0.3 μm and larger.

Horizontal transmission The transfer of a virus from one member of a species to another or to a member of another species by postembryonic infection. Horizontal transmission is the normal mode for the spread of many viruses, but is apparently uncommon for oncogenic viruses.

Hormone A chemical substance synthesized in small amounts by an endocrine tissue and carried in the blood to another tissue, where it acts as a messenger to regulate the function of the target tissue or organ.

Hormone receptor A protein that is located on the cell membrane or inside the responsive cell and that interacts specifically with the hormone.

HRE or Hormone-responsive element A DNA site that binds an intracellular hormone-receptor complex; binding of the complex to a hormone-responsive element affects the transcription of specific genes.

Hormones of Plants Chemical-organic substances that regulate growth, flowering, etc. released by the action of light (phytochromes), water, temperature, or other influences. Some hormones act locally

while others are transported to distant tissues, where they produce specific physiological responses; others act within the same tissue where they are produced. **ABA (abscisic acid):** *Growth inhibitor*; brings about dormancy in buds, maintains dormancy in seeds (until washed out), and brings about stomatal closure, promotes yellowing of leaf; ABA levels increase during early seed development preventing premature germination; opposes growth hormones, among other effects. Travels short distances in leaves and fruits. **Cytokinins:** *Promote growth*; Stimulates cell division; kindle growth in lateral buds, and block leaf senescence. Chemically related to adenine. Transported from roots upward in vascular system. **IAA (indoleacetic acid) or Auxin:** (Gk. auxein, to increase) *Promotes growth*; controls cell elongation (increases number of H⁺-pump in tonoplast - extension of vacuole), inhibit growth of lateral buds (apical dominance), orient root/shoot growth, promotes cell division, root growth, at low concentration prevents abscission of leaves and fruits, among other effects. Excess auxin-dosage causes death due to growth beyond sustainability. Tryptophan is the precursor of IAA; IAA occurs in the tips of shoots, leaf primordia, young leaves and is transported down to the root tips of the vascular cylinder. **Ethylene:** *Promotes maturation*; a simple hydrocarbon involved in the ripening of fruit (transported via air-currents), leaf/flower abscission, and senescence (collapse of lytic compartment); (H₂C = CH₂). Plays a major role as a perhormone by communicating to neighboring plants attacks of herbivores, triggering the production of defensive chemicals. **Gibberellines:** *Promote growth*; stimulate both cell division and cell elongation, causes bolting (without the need to expose plant to cold or long days), new leaves, branches, flowering, larger and looser fruits, among other effects. Seeds need higher levels to germinate (conversion of starch to sugars); low levels in young plants cause dwarfism, high levels the opposite; is transported up-/downward in vascular system. Auxin and gibberelline stimulate plant growth by increasing the extensibility of cell walls.

Hormone-sensitive lipase Also known as hormone-sensitive triacylglycerol lipase. An adipose tissue enzyme that releases fatty acids from triacylglycerols in response to a hormonally generated increase in cAMP.

Host cell A cell used for growth and reproduction of a virus.

Host Organism capable of supporting the growth of a virus or other parasite.

Host range The species, strains or cell types that a pathogen can infect.

Host specificity The range of different hosts in which a parasite can mature.

Host Organism that serves as a habitat for another organism. A host may provide nutrition for a parasite, alternatively with mutualism the host benefits.

Host-induced restriction and modification A genetic system found in bacteria whereby a genetic element (often a plasmid) encodes both an enzyme for the methylation of DNA at a specific base sequence and an endonuclease that cleaves unmethylated DNA at that sequence. The system thus restricts the DNA that can survive in the cell to DNA that is modified by methylation at the correct sequences.

Host-versus-graft disease, HVGD **Host-versus-graft disease (HVGD)** is another name for the allograft rejection reaction. The term is used mainly in relation to bone marrow transplantation

Hot-air sterilization Sterilization by the use of an oven at 170°C for approximately 2 hours.

Housekeeping enzyme Also known as constitutive enzyme. Ex. Glucose-6-phosphate dehydrogenase.

Housekeeping gene Gene that is transcribed in to mRNA in nearly all the cells of a eukaryotic organism; in bacterial cells a housekeeping gene is one that is always being transcribed. Ex. Actin & Ubiquitin.

Housekeeping protein A protein that is continually expressed in all or at least most cells of a multicellular organism. Ex. GAPDH

Hox complex Two tightly linked clusters of genes in *Drosophila* (the bithorax and Antennapedia complex) that control the differences between the different segments of the body. Homologous Hox complexes are found in other animals, where they also determine pattern along the anteroposterior axis.

Hox gene A gene encoding a transcription factor that includes a homeodomain.

HPV vaccine Vaccine against cervical cancer, 99% of which are caused by the Human papilloma virus (HPV).

HSP 70 chaperone A family of proteins that bind to hydrophobic regions in other proteins in order to aid their folding.

Hsp or Heat shock protein Also known as molecular chaperon.

HSP High-scoring segment pair. Local alignments with no gaps that achieve one of the top alignment scores in a given search.

HTH motif Also known as helix-turn-helix motif.

Hub A protein that has many interactions within a protein interaction map.

Human Genome Initiative Collective name for several projects begun in 1986 by DOE to create an ordered set of DNA segments from known chromosomal locations, develop new computational methods for analyzing genetic map and DNA sequence data, and develop new techniques and instruments for detecting and analyzing DNA. This DOE initiative is now known as the Human Genome Program. The joint national effort, led by DOE and NIH, is known as the Human Genome Project.

Human genome project The publicly funded project responsible for one of the draft human genome sequences and which continues to study the functions of human genes.

Human immunodeficiency virus, HIV The **human immunodeficiency virus (HIV)** is the causative agent of the acquired immune deficiency syndrome (AIDS). HIV is a retrovirus of the lentivirus family that selectively infects macrophages and CD4 T cells, leading to their slow depletion, which eventually results in immunodeficiency.

Human leukocyte antigen (HLA) complex Human cell surface antigens.

Human papillomavirus Virus that attacks skin and mucous membranes, causing papillomas or warts.

Humanization The genetic engineering of mouse hypervariable loops of a desired specificity into otherwise human antibodies. The DNA encoding hypervariable loops of mouse monoclonal antibodies or V regions selected in phage display libraries is inserted into the framework regions of

human immunoglobulin genes. This allows the production of antibodies of a desired specificity that do not cause an immune response in humans treated with them.

Humic acid Dark-colored organic material extracted from soil by various reagents (e.g., dilute alkali) and that is precipitated by acid (pH 1 to 2).

Humic substances Series of relatively high-molecular-weight, brown-to-black substances formed by secondary synthesis reactions. The term is generic in a sense that it describes the colored material or its fractions obtained on the basis of solubility characteristics, such as humic acid or fulvic acid.

Humification Process whereby the carbon of organic residues is transformed and converted to humic substances through biochemical and chemical processes.

Humoral immunity, humoral immune response Humoral immunity is the antibody-mediated specific immunity made in a humoral immune response. Humoral immunity can be transferred to unimmunized recipients by using immune serum containing specific antibody

Humus Fine organic substance, composed of partial or full decomposed animal or plant matter, and found in soil.

Hyaluronic acid A mucopolysaccharide that holds together certain cells of the body.

Hyaluronidase Also known as spreading factor. A bacterially produced enzyme that digests hyaluronic acid, which helps hold the cells of certain tissues together, thereby making tissues more accessible to microbes.

Hybrid (or chimeric) plasmid A plasmid that contains DNA from two different organisms.

Hybrid dysgenesis The event that occurs when females from laboratory strains of *Drosophila melanogaster* are crossed with males from wild populations, the offspring resulting from such crosses being sterile and having chromosomal abnormalities and other genetic malfunctions.

Hybrid Heterozygous progeny of two parents differing in one or more inheritable attributes.

Hybrid sterility Inability of hybrids to produce viable offspring. Ex. Mule i.e. offspring Horse.

Hybrid vigour Also known as Heterosis.

Hybridization Natural formation or artificial construction of a duplex nucleic acid molecule by complementary base pairing between two nucleic acid strands derived from different sources.

Hybridization probing A technique that uses a labeled nucleic acid molecule as a probe to identify complementary or homologous molecules to which it base pairs.

Hybridoma Cell line used in the production of monoclonal antibodies. Obtained by fusing antibody-secreting B cells with cells of a lymphocyte tumor.

Hybridomas Monoclonal antibodies are most commonly produced from **hybridomas**. These are hybrid cell lines formed by fusing a specific antibody-producing B lymphocyte with a myeloma cell that is selected for its ability to grow in tissue culture and for an absence of immunoglobulin chain synthesis.

Hydathode Specialized leaf structure located at the leaf's tip, from which the water is forced out when root pressure increases.

Hydatid cyst An enlarged cyst containing many tapeworms heads.

Hydration shell Cloud of water molecules that surrounds an ion in solution.

Hydration The molecular state of being surrounded by and interacting with several layers of solvent water molecules, that is solvated by water.

Hydrocarbon Compound that has only carbon and hydrogen atoms.

Hydrocarbon tail Long chain of carbon atoms with attached hydrogens found in phospholipids and triacylglycerols. The tail represents all of a molecule of fatty acid except the carboxyl group.

Hydrogen bond A weak, noncovalent, attractive force between one electronegative atom and a hydrogen atom that is covalently linked to a second electronegative atom.

Hydrogen ion gradient Energy currency. Hydrogen ions are more concentrated outside bacteria and mitochondria than inside, and this chemical gradient is supplemented by a voltage gradient pulling hydrogen ions in. If hydrogen ions are allowed to rush in down their electrochemical gradient, they release 17,000 J/mol.

Hydrogen-oxidizing bacterium Facultative lithotrophs that, in the absence of an oxidizable organic source, oxidize H_2 for energy and synthesize carbohydrates with carbon dioxide as their source of carbon.

Hydrolases Enzymes (proteases, lipases, phosphatases, nucleases, for example) that catalyze hydrolysis reactions.

Hydrologic cycle Also known as water cycle.

Hydrolysis Breakage of a covalent bond by the addition of water.—H is added to one side, —OH to the other.

Hydronium ion (H_3O^+) Water molecule associated with an addition proton.

Hydronium ion The hydrated hydrogen ion (H_2O^+).

Hydropathy A measure of the combined hydrophobicity and hydrophilicity of an amino acid residue; it is indicative of the likelihood of finding that residue in a protein interior.

Hydropathy index A scale that expresses the relative hydrophobic and hydrophilic tendencies of a chemical group.

Hydropathy plot Running average of side chain hydrophobicity along a polypeptide chain. From the hydrophathy plot one can predict, e.g., membrane-spanning domains in integral membrane proteins.

Hydrophilic or Hydrophilic substance A substance whose high polarity allows it to readily interact with water molecules and thereby dissolve in water.

Hydrophobic A molecule or part of a molecule that will associate with other hydrophobic molecules in preference to water.

Hydrophobic collapse A driving force in protein folding, resulting from the tendency of hydrophobic residues to avoid contact with water and hence form the protein core.

Hydrophobic effect Tendency of hydrophobic molecules or parts of molecules to cluster together away from water, such as hydrophobic amino acid residues in the center of a protein, or the fatty acid chains in lipid bilayers.

Hydrophobic force Force exerted by the hydrogen-bonded network of water molecules that brings two nonpolar surfaces together by excluding water between them.

Hydrophobic interaction chromatography A procedure in which molecules are selectively retained on a nonpolar matrix by virtue of their hydrophobicity.

Hydrophobic interactions The association of nonpolar groups, or compounds, with each other in aqueous systems, driven by the tendency of the surrounding water molecules to seek their most stable (disordered) state.

Hydrophobic substance A substance whose nonpolar nature reduces its ability to be solvated by water molecules. Hydrophobic substances tend to be soluble in nonpolar solvents but not in water.

Hydrostatic pressure Pressure exerted by standing water.

Hydroxide OH⁻

Hydroxyapatite A calcium phosphate gel used, in the case of nucleic acids, to selectively absorb duplex DNA-RNA from a mixture of single-stranded and duplex nucleic acids.

Hydroxyl (-OH) or hydroxyl group Chemical group consisting of a hydrogen atom linked to an oxygen, as in an alcohol.

Hydroxyurea An antitumor agent that inhibits the enzyme ribonucleoside diphosphate reductase. It thus blocks the conversion of ribonucleoside diphosphates to their deoxy derivatives, thereby inhibiting the synthesis of DNA.

Hygroscopic water Water adsorbed by a dry soil from an atmosphere of high relative humidity.

Hymenium Layer of fertile cells producing spores in a fungus fruiting body.

Hyoid Apparatus An anatomy terminology for the upper throat bones of the tongue and connective tissues.

Hyperacute graft rejection **Hyperacute graft rejection** of an allogenic tissue graft is an immediate reaction caused by natural preformed antibodies that react against antigens on the graft. The antibodies bind to endothelium and trigger the blood clotting cascade, leading to an engorged, ischemic graft and rapid loss of the organ

Hyperammonemia Elevated levels of ammonia in the blood, a toxic situation.

Hyperbaric chamber An apparatus to hold materials at pressures greater than 1 atmosphere; used to oxygenate gangrenous tissue.

Hyperbolic curve The graphical representation of the mathematical equation that describes the noncooperative binding of a ligand to a molecule.

Hypercholesterolemia High levels of cholesterol in the blood, a risk factor for heart disease. Familial hypercholesterolemia usually results from an inherited defect in the LDL receptor.

Hyperchromic effect The large increase in light absorption at 260 nm occurring as a double-helical DNA is melted (unwound).

Hyper eosinophilia **Hyper eosinophilia** is an abnormal state in which there are extremely large numbers of eosinophils in the blood.

Hyperglycemia Elevated levels of glucose in the blood.

Hyperimmune serum Also known as convalescent serum. A preparation of immune serum globulins having high titers of specific kinds of antibodies.

Hyperimmunization Repetitive immunization to achieve a heightened state of immunity is called hyperimmunization.

Hypermutation An increase in the mutation rate of a genome.

Hyperparasite Parasite that feeds on another parasite.

Hyperplasia The abnormal proliferation of cells, as in a callus or tumor.

Hypersensitivity A characteristic reactivity associated with an allergic response to an antigen (allergen). There are two types: immediate hypersensitivity, mediated by the immunoglobulin IgE, and delayed hypersensitivity, mediated by lymphocytes.

Hypersensitivity reactions, hypersensitivity diseases, hypersensitivity Immune responses to innocuous antigens that lead to symptomatic reactions upon reexposure are called **hypersensitivity reactions**. These can cause **hypersensitivity diseases** if they occur repetitively. This state of heightened reactivity to antigen is called **hypersensitivity**. Hypersensitivity reactions are classified by mechanism: type I hypersensitivity reactions involve IgE antibody triggering of mast cells; type II hypersensitivity reactions involve IgG antibodies against cell surface or matrix antigens; type III hypersensitivity reactions involve antigen:antibody complexes; and type IV hypersensitivity reactions are T cell-mediated.

Hyperthermophile A prokaryote having a growth temperature optimum of 80 °C or higher.

Hypertonic Describes any medium with a sufficiently high concentration of solutes to cause water to move out of a cell due to osmosis.

Hypervariable region Any of three small regions within the variable region of an immunoglobulin light or heavy chain that show the highest variability from molecule to molecule. These regions determine the specificity of the antigen-binding site.

Hypervariable residue An amino acid residue occupying a position in a protein that is occupied by many different residues among evolutionarily related proteins. The opposite of a hypervariable residue is an invariant residue.

hypha (plural, hyphae) Long and often branched tubular filament that constitutes the vegetative body of many fungi and funguslike organisms. Bacteria of the order Actinomycetes also produce branched hyphae.

Hypochromism With respect to DNA, a reduction in the absorbance of ultraviolet light of wavelength of about 260 nm that accompanies the transition from random-coil denatured strands to a double-strand helix. It can be used to track the process of denaturation or renaturation.

Hypocotyl Portion between the cotyledon and the radicle in a seedling or embryo.

Hypodermis Cell layer following the epidermal layer and distinct from the cortical parenchyma cells in some plants.

Hypogynous Condition featuring attachment of flower parts below the ovary.

Hypolimnion Deep part of lake - low temperature and low oxygen concentrations because of low light penetration and consequent low photosynthetic activity

Hypostracum The shell located below all other shell layers in some mollusks.

Hypothesis A tentative explanation for an observed condition or event.

Hypotonic solution A solution containing a concentration of dissolved material lower than that within a cell.

Hypoxanthine Purine that is used to make the nucleotide inosine. Inosine can pair with any of uracil, cytosine, or adenine.

Hypoxia A condition in which the oxygen level in the blood is lower than the normal.

α -Helix A common secondary structure in proteins, in which the polypeptide chain is coiled, each turn of the helix taking 3.6 amino acid residues. The nitrogen atom in each peptide bond forms a hydrogen bond with the oxygen four residues ahead of it in the polypeptide chain.

IAP family Intracellular protein inhibitors of apoptosis.

iC3b The inactive complement fragment **iC3b** is produced by cleavage of C3b and is the first step in C3b inactivation.

ICAMs, ICAM-1, ICAM-2, ICAM-3 The **ICAMs** (intercellular adhesion molecules) are cell-surface ligands for the leukocyte integrins and are crucial in the binding of lymphocytes and other leukocytes to certain cells, including antigen-presenting cells and endothelial cells. They are members of the immunoglobulin superfamily. **ICAM-1** is the most prominent ligand for the integrin CD11a:CD18 or LFA-1. It is rapidly inducible on endothelial cells by infection, and plays a major role in local inflammatory responses. **ICAM-2** is constitutively expressed at relatively low levels by endothelium. **ICAM-3** is expressed only on leukocytes and is thought to play an important part in adhesion between T cells and antigen-presenting cells, particularly dendritic cells.

Iccosomes Iccosomes are small fragments of membrane coated with immune complexes that fragment off the processes of follicular dendritic cells in lymphoid follicles early in a secondary or subsequent antibody response.

I-cell disease A hereditary deficiency in a lysosomal hydrolase that leads to the accumulation of glycosaminoglycan and glycolipid inclusions in the lysosomes.

Ichthyology A branch of zoology dedicated to the systematic study of fishes.

ICOS ICOS It is a CD28-related protein that is induced on activated T cells and can enhance T-cell responses. It binds a ligand known as LICOS, which is distinct from the B7 molecules.

Icosahedral symmetry or Icosahedrons The symmetry displayed by a regular polyhedron that is composed of 20 equilateral triangular faces with 12 corners.

ID₅₀ The bacterial concentration required to produce a demonstrable infection in 50% of the test host populations.

Identical twin Twins produced by the division of a single zygote; both have identical genotypes.

Identity The extent to which two (nucleotide or amino acid) sequences are invariant.

Idiotypic network Each immunoglobulin molecule has the potential of binding a variety of antibodies directed at its unique features or idiotype. An idiotype is made up of a series of idiotopes from idiotype epitopes.

Idiotypic network Lymphocyte antigen receptors can recognize one another through idiotope - anti-idiotope interactions, forming an idiotypic network of receptors that may be important for the generation and maintenance of the receptor repertoire. The proposed components of idiotype networks exist, but their functional significance is uncertain.

IFN Abbreviation for Iso known as interferons.

Ig superfamily Large family of proteins that contain immunoglobulin domains or immunoglobulin-like domains. Most are involved in cell-cell interactions or antigen recognition.

Ig, immunoglobulin Ig standard abbreviation for **immunoglobulin**. Different immunoglobulin isotypes are called IgM, IgD, IgG, IgA, and IgE

IgA IgA is the class of immunoglobulin characterized by α heavy chains. IgA antibodies are secreted mainly by mucosal lymphoid tissues.

IgD IgD is the class of immunoglobulin characterized by δ heavy chains. It appears as surface immunoglobulin on mature naive B cells but its function is unknown.

IgE IgE is the class of immunoglobulin characterized by ϵ -heavy chains. It is involved in allergic reactions.

IgG IgG is the class of immunoglobulin characterized γ heavy chains. It is the most abundant class of immunoglobulin found in the plasma

IgM IgM is the class of immunoglobulin characterized by μ heavy chains. It is the first immunoglobulin to appear on the surface of B cells and the first to be secreted. It is the heaviest among all.

Ig α , Ig β Also known as B-cell antigen receptor

Illegitimate recombination Recombination between two double-stranded DNA molecules which have little or no nucleotide sequence similarity.

Illness phase In an infectious disease, the period during which the individual experiences the typical signs and symptoms of the disease.

Illuviation Deposition of soil material removed from one horizon to another in the soil.

Image processing Computer treatment of images gained from microscopy that reveal information not immediately visible to the eye.

Imaginal disc Group of cells that are set aside in the *Drosophila* embryo and which will develop into an adult structure, e.g. eye, leg, wing.

Imago Sexually mature adult stage in the life of certain insects.

Imidazole carboximides A family of alkylating agents used in the treatment of tumors. One of the most effective is 5-(3,3-dimethyl-1-triazeno)imidazole-4-carboximide. They appear to be especially good in the treatment of melanoma.

Imidazoles Antifungal drugs that interfere with sterol synthesis.

Imine A molecule containing a nitrogen atom attached to a carbon atom by a double bond. The nitrogen is also covalently linked to a hydrogen.

Immunofluorescence A cytological technique in which a specific fluorescent antibody is used to label an antigen. Frequently used to determine the location of an antigen in a tissue or a cell.

Imino acid Organic molecule containing both carboxyl ($-\text{COOH}$) and imino ($-\text{NH}-$) groups. Proline is an imino acid although it is usually called an amino acid.

Immature A young animal or bird, capable of feeding itself, but has yet not reached the stage of sexual maturity.

Immature B cells **Immature B cells** are B cells that have rearranged a heavy- and a light-chain V-region gene and express surface IgM, but have not yet matured sufficiently to express surface IgD as well.

Immature dendritic cells Tissues throughout the body contain immature dendritic cells, which only leave the tissues in response to an inflammatory mediator or an infection. Also known as dendritic cells.

Immature secretory vesicle Secretory vesicle that appears to have just pinched off the golgi stack. Its structure resembles that of a cisterna of the trans Golgi network.

Immediate reaction, immediate hypersensitivity reactions During allergic reactions, there are normally two phases: the first happens almost immediately and is called the immediate reaction. Hypersensitivity reactions that occur within minutes of exposure to antigen are called immediate hypersensitivity reactions; such reactions are antibody mediated.

Immersion oil Substance used to avoid refraction at a glass-air interface when examining objects through a microscope.

Immobile Essential Element Element that cannot be removed from mature tissues. This means if young tissues become deficient in these elements they develop a deficiency, even though this element is present in the older tissues.

Immobilization Conversion of an element from the inorganic to the organic form in microbial or plant biomass.

Immobilized cells Cells entrapped in matrices such as alginate, agarose, polyacrylamide designed for use in bioreactors for production of metabolites.

Immortalization Production of cell line capable of an unlimited number of cell divisions. Can be the result of a chemical or viral transformation or of fusion of the original cells with cells of a tumor line.

Immune clearance When amounts of antigen are injected into the blood, they are initially removed slowly by normal catabolic processes that also degrade plasma proteins. However, if the antigen elicits an antibody response, then antigen is removed at an accelerated rate as antigen:antibody complexes, a process known as **immune clearance**.

Immune complex (Type III) hypersensitivity An exaggerated or inappropriate reaction by the immune system to a foreign substance, elicited by antigens in vaccines, on microorganisms, or on a person's own cells.

Immune complex disorder Also known as immune complex (Type III) hypersensitivity. A disorder caused by antigen-antibody complexes that precipitate in the blood and injure tissues; elicited by antigens in vaccines, on microorganisms, or on a person's own cells.

Immune complex The binding of antibody to a soluble antigen forms an immune complex. Large immune complexes form when sufficient antibody is available to cross-link the antigen; these are readily cleared by the reticuloendothelial system of cells bearing Fc and complement receptors. Small, soluble immune complexes that form when antigen is in excess can be deposited in and damage small blood vessels.

Immune cytolysis Process in which the membrane complex of complement produces lesions on cell membranes through which the contents of the bacterial cells leak out.

Immune deviation Immune deviation is a term used to describe the polarization of an immune response to one dominated by TH1 or TH2 by the injection of antigen

Immune lymphocytes Lymphocytes that have been sensitized by prior exposure, either *in vivo* or *in vitro*, to antigens. Such lymphocytes are then able to mount an immune response against cells, including tumor cells, to which they were sensitized.

Immune modulation It is a general term encompassing various alterations in an immune response.

Immune response genes, Ir genes, immune response gene defect **Immune response genes (Ir genes)** are genetic polymorphisms that control the intensity of the immune response to a particular antigen. Virtually all Ir phenotypes are due to the differential binding of peptide fragments of antigen to MHC molecules, especially MHC class II molecules. The term is little used now. An immune response gene defect is usually, but not always, due to failure to bind an immunogenic peptide, so that no T-cell response is observed.

Immune response Response made by the immune system when a foreign substance or microorganism enters its body.

Immune RNA A type of RNA, extracted from lymphoid tissues, that some scientists suggest can transfer cell-mediated immunity from one individual to another. Its effects are claimed to be tumor specific but not species-specific, so that RNA from an immunized animal donor could theoretically transfer tumor immunity to human patients. It has received only very limited testing in humans.

Immune serum globulin The serum fraction containing immunoglobulins (antibodies).

Immune surveillance It has been proposed that most tumors that arise are detected and eliminated by immune surveillance mediated by lymphocytes specific for tumor antigens. There is little evidence for the efficacy of this proposed process, but it remains an important concept in tumor immunology.

Immune system The immune system is the name used to describe the tissues, cells, and molecules involved in adaptive immunity, or sometimes the totality of host defense mechanisms.

Immunity The ability of a human or animal body to resist infection by microorganisms or their harmful products such as toxins.

Immunization Immunization is the deliberate provocation of an adaptive immune response by introducing antigen into the body.

Immunoaffinity chromatography A procedure in which a molecule is separated from a mixture of other molecules by its ability to bind specifically to an immobilized antibody.

Immunoassay A procedure for detecting and in some cases qualifying the activity of a macromolecule by using antibody or mixture of antibodies that reacts specifically with that substance.

Immunobiology Immunobiology is the study of the biological basis for host defense against infection.

Immunoblotting Immunoblotting is a common technique in which proteins separated by gel electrophoresis are blotted onto a nitrocellulose membrane and revealed by the binding of specific labeled antibodies.

Immunocompromised Referring to an individual whose immune defenses are weakened due to fighting another infectious disease or because of an immunodeficiency disease or an immunosuppressive agent.

Immunocytochemistry A technique that uses antibody probing to locate the position of a protein in a tissue.

Immunodeficiency diseases Immunodeficiency diseases are a group of inherited or acquired disorders in which some aspect or aspects of host defense are absent or functionally defective.

Immunodeficiency Inborn or acquired defects in lymphocytes (B or T cells).

Immunodiffusion It is the detection of antigen or antibody by the formation of an antigen:antibody precipitate in a clear agar gel.

Immunoelectron microscopy An electron microscopy technique that uses antibody labeling to identify the positions of specific proteins on the surface of a structure such as a ribosome.

Immunoelectrophoresis Immunoelectrophoresis is a technique in which antigens are first separated by their electrophoretic mobility and are then detected and identified by immunodiffusion.

Immunofluorescence, Indirect immunofluorescence **Immunofluorescence** is a technique for detecting molecule using antibodies labeled with fluorescent dyes. The bound fluorescent antibody can be detected by microscopy, or by flow cytometry depending on the application being used. Indirect immunofluorescence uses anti-immunoglobulin antibodies labeled with fluorescent dyes to detect the binding of a specific unlabeled antibody

Immunofluorescent microscopy, immunohistochemistry, immunoelectronmicroscopy There are three ways of detecting molecules in tissues: immunofluorescent microscopy that reveals the presence of any molecule against which you have a specific antibody; immunohistochemistry, in which one links an enzyme that produces a change in a molecule that is visible under the microscope; and immunoelectronmicroscopy, in which different sized gold particles are linked to antibodies and detected as bound gold particles.

Immunogen, immunogenic Any molecule that can elicit an adaptive immune response on injection into a person or animal is called an immunogen. In practice, only proteins are fully immunogenic because only proteins can be recognized by T lymphocytes

Immunogenetics **Immunogenetics** was originally the analysis of genetic traits by means of antibodies against genetically polymorphic molecules such as blood group antigens or MHC proteins. Immunogenetics now refers to the genetic analysis, by any technique, of molecules important in immunology.

Immunoglobulin A protein made in a B plasma cell and usually secreted; it interacts specifically with a foreign agent. Synonymous with antibody. It is composed of two heavy and two light chains linked by disulfide bonds. Immunoglobulins can be divided into five classes (IgG, IgM, IgA, IgD, and IgE) based on their heavy-chain component.

Immunoglobulin domains, Ig domains, immunoglobulin fold, immunoglobulin-like domains Many proteins are partly or entirely composed of protein domains known as immunoglobulin domains or Ig domains because they were first described in antibody molecules. Immunoglobulin domains are characteristic of proteins of the immunoglobulin superfamily, which includes antibodies, T-cell receptors and MHC molecules. The immunoglobulin domain consists of a sandwich of two β sheets held together by a disulfide bond and called the immunoglobulin fold. There are two main types of immunoglobulin domain: C domains and V domains. Domains less closely related to the canonical Ig domains are sometimes also called immunoglobulin-like domains.

Immunoglobulin fold A disulfide-linked domain consisting of a sandwich of a three-stranded and a four-stranded and four-stranded antiparallel β -sheet that occurs in antibody molecules.

Immunoglobulin repertoire The immunoglobulin repertoire, also known as the antibody repertoire, is the total variety of immunoglobulin molecules in the body of an individual.

Immunoglobulin superfamily, Ig superfamily Many proteins involved in antigen recognition and cell-cell interaction in the immune system and other biological systems are members of a protein family called the immunoglobulin superfamily, or Ig superfamily, because their shared structural features

were first defined in immunoglobulin molecules. All members of the immunoglobulin superfamily have at least one immunoglobulin or immunoglobulin-like domain.

Immunogold electron microscopy Electron microscopy technique in which cellular structures or molecules of interest are labeled with antibodies tagged with electron-dense gold particles. These show up as black spots on the image.

Immunohistochemistry The detection of antigens in tissues by means of visible products produced by the degradation of a colorless substrate by antibodylinked enzymes is called **immunohistochemistry**. This technique has the advantage that it can be combined with other stains to be viewed in the light microscope, whereas immunofluorescence microscopy requires a special dark-field or UV microscope.

Immunological disorder Disorder that results from an inappropriate or inadequate immune system.

Immunological escape Resistance of cancer cells to immune rejection.

Immunological ignorance It describes a form of self tolerance in which reactive lymphocytes and their target antigen are both detectable within an individual, yet no autoimmune attack occurs. Most autoimmune diseases probably reflect the loss of other lymphocytes known as regulatory or suppressor T cells.

Immunological memory When an antigen is encountered more than once, the adaptive immune response to each subsequent encounter is speedier and more effective, a crucial feature of protective immunity known as immunological memory. Immunological memory is specific for a particular antigen and is long-lived.

Immunological surveillance A hypothetical process in which it is postulated that malignant cells continually arise in complex organisms, such as man, but normally are efficiently detected and eliminated by the organism's immune system. A tumor would thus occur when one such cell escapes detection and proliferates without hindrance.

Immunologically privileged sites Allogeneic tissue placed in certain sites in the body, such as the brain, does not elicit graft rejection. Such sites are called immunologically privileged sites. Immunological privilege results from the effects of both physical barriers to cell and antigen migration, and soluble immunosuppressive mediators such as certain cytokines.

Immunology Immunology is the study of all aspects of host defense against infection and of adverse consequences of immune responses.

Immunophilins Immunophilins are proteins with peptidyl-prolyl cis-trans isomerase activity that bind the immunosuppressive drugs cyclosporin A, tacrolimus, and rapamycin.

Immunoprecipitation analysis Soluble proteins, or membrane proteins solubilized in detergents, can be labeled and then detected by immunoprecipitation analysis using specific antibodies. The immunoprecipitated labeled protein is usually detected by SDS-PAGE followed by autoradiography. When proteins that do not react directly with the antibody used are nevertheless precipitated, they are said to co-immunoprecipitate.

Immunoreceptor tyrosine-based activation motifs, ITAMs, immunoreceptor tyrosine-based inhibitory motifs, ITIMs The T and B cell antigen receptors are associated with transmembrane molecules with immunoreceptor tyrosine-based activation motifs (ITAMs) in their cytoplasmic domains. These

tyrosine-containing motifs are sites of tyrosine phosphorylation and of association with tyrosine kinases and other phosphotyrosine-binding moieties involved in receptor signaling. Related motifs with opposing effects are immunoreceptor tyrosine-based inhibitory motifs (ITIMs), which recruit phosphatases to the receptor site that remove the phosphate groups added by tyrosine kinases.

Immunoregulation The ability of the immune system to sense and regulate its own responses is called immunoregulation.

Immunoscreening The use of an antibody probe to detect a polypeptide synthesized by a cloned gene.

Immunosuppression Inhibition of the immune response.

Immunosuppressive drugs Compounds that inhibit adaptive immune responses are called immunosuppressive drugs. They are used mainly in the treatment of graft rejection and severe autoimmune disease.

Immunotherapy Using the immune system to treat disease, for example, in the development of vaccines. May also refer to the therapy of diseases caused by the immune system.

Immunotoxins These are antibodies that are chemically coupled to toxic proteins usually derived from plants or microbes. The antibody targets the toxin moiety to the required cells. Immunotoxins are being tested as anticancer agents and as immunosuppressive drugs

Imperfect Flower Flowers lacking either carpels or stamens or both.

Imperfect Fungi Those fungi that do not sexually reproduce or their sexual reproduction behavior has never been monitored.

Impermeable Membrane Membranes that do not permit the passage of any substances across them.

Impetigo A highly contagious pyoderma caused by staphylococci, streptococci or both.

Importins A class of proteins involved in importing molecules into the nucleus.

Imprint control element A DNA sequence found within a few kb of clusters of imprinted genes, which mediates the methylation of the imprinted regions.

Imprinting A phenomenon in which the disease phenotype depends on which parent passed on the disease gene. For instance, both Prader-Willi and Angelman syndromes are inherited when the same part of chromosome 15 is missing. When the father's complement of 15 is missing, the child has Prader-Willi, but when the mother's complement of 15 is missing, the child has Angelman syndrome.

Improved seed Seeds of genetically pure improved plant varieties.

In situ hybridization Technique in which a single-stranded RNA or DNA probe is used to locate a gene or a messenger RNA molecule in a cell or tissue by hybridization.

In situ In Latin means 'in place'. Meaning in the natural place or in the original place.

In vitro Carrying out growth of cells in artificially maintained media, such as test tubes, flasks, etc. instead of inside a living organism.

In vitro mutagenesis Techniques used to produce a specified mutation at a predetermined position in a DNA molecule.

In vitro packaging Synthesis of infective λ phages from a preparation of λ proteins and a concatamer of λ DNA molecules.

In vitro Term used by biochemists to describe a process taking place in an isolated cell-free extract. Also used by cell biologists to refer to cells growing in culture (*in vitro*), as opposed to in an organism (*in vivo*).

In vivo In the body, in a living organism, as opposed to *in vitro*; when a study or an experiment is done in the living organism, it is done *in vivo*.

Inactivation (of voltage gated channels) Long term closure, often because of blockage of the open channel with a plug that is attached to the cytosolic face of the protein.

Inactivator An inhibitor that reacts irreversibly with an enzyme so as to inactivate it.

Inapparent infection Also known as subclinical infection. An infection that does not cause a noticeable illness.

Inborn errors of metabolism Human mutations that result in specific derangements of intermediary metabolism. Usually the problem is an enzyme that is inactive, overactive, too scarce, or too abundant; symptoms may result from the insufficient production of necessary metabolite and/or from the accumulation of another metabolite to toxic levels.

Inbred Progeny formed by self pollination in a plant or by artificial pollination by closely related individuals.

Inbreeding Cross between closely related plants and animal species.

Inbreeding Depression Condition in which individuals with common ancestry exhibit low fertility and poor performance.

Incidence rate The number of new cases of a particular disease per 100,000 population seen in a specific period of time.

Incidence The fraction of the population that contracts a disease during a particular length of time.

Incipient Plasmolysis The point at which the protoplasm just begins to stop exerting pressure on the cell wall, when the plant cell membrane shrinks after losing water.

Inclusion blennorrhoea A mild chlamydial infection of the eyes in infants.

Inclusion body An aggregation of reticulate bodies within chlamydias. Also a form of cytopathic effect consisting of viral components, masses of viruses, or remnants of viruses.

Inclusion conjunctivitis A chlamydial infection that can result from self-inoculation with *Chlamydia trachomatis*.

Inclusion Material held inside a cell, often consisting of reserve deposits.

Incompatibility Failure of fertilization due to defective or deficient pollen tube and cytoplasmic factors.

Incomplete digestive system A digestive system with one opening for intake of food and elimination of waste.

Incomplete dominance It refers to a pair of alleles, neither of which displays dominance, the phenotype of a heterozygote being intermediate between the phenotypes of the two homozygotes.

Incubation Patch The featherless patch developed on the abdomen of certain brooding birds, that becomes thick due to high levels of vascularity. This patch comes under direct contact with the eggs during incubation period.

Incubation period The time interval between the actual infection and first appearance of any signs or symptoms of disease.

Indel A position in an alignment between two DNA sequences where an insertion or deletion has occurred.

Independent assortment During meiosis each of the two copies of a gene is distributed to the germ cells independently of the distribution of other genes.

Informed consent An individual willingly agrees to participate in an activity after first being advised of the risks and benefits.

Independent Event An event is said to be independent if its happening is not affected by the happening of other events and if it does not affect the happening of other events.

Index case The first case of a disease to be identified.

Index of refraction A measure of the amount that light rays bend when passing from one medium to another.

Indicator organism An organism such as *Escherichia coli* whose presence indicates the contamination of water by fecal matter.

Indigenous A species that occurs naturally in an area; a synonym for native species.

Indirect contact Transmission of pathogens by fomites.

Indirect Coombs test The indirect Coombs test is a variation of the direct Coombs test in which an unknown serum is tested for antibodies against normal red blood cells by first mixing the two and then washing out the serum from the red blood cells and reacting them with anti-immunoglobulin antibody. If antibody in the unknown serum binds to the red blood cells, agglutination by anti-immunoglobulin occurs.

Indirect FA test A fluorescent-antibody test to detect the presence of specific antibodies.

Indirect fecal-oral transmission Transmission of disease in which pathogens from feces of one organism infects another organism.

Indirect immunofluorescence Also known as immunofluorescence.

Indirect or passive agglutination test Test using soluble antigens attached to latex or other small particles.

Indirect readout The ability of a DNA-binding protein to detect its target base sequence through the sequence-dependent conformation and/or flexibility of its DNA back bone rather than through direct interaction with its bases.

Indirect immunofluorescence microscopy Form of light microscopy in which a fluorescent secondary antibody is used to label a preapplied primary antibody specific for a particular protein or subcellular structure. Also called secondary immunofluorescence microscopy.

Induced dipole A molecule has an induced dipole if an external electric field induces an asymmetric distribution of charge within it.

Induced fit A change in the conformation of an enzyme in response to substrate binding that renders the enzyme catalytically active; also used to denote changes in the conformation of any macromolecule in response to ligand binding such that the binding site of the macromolecule better conforms to the shape of the ligand.

Induced fit model A model for how enzymes interact with substrates to achieve catalysis. According to this model, the empty active site of the enzyme only roughly fits the substrates, and the entry of substrate causes the enzyme to change its shape so as to both tighten the fit and cause the substrate to adopt an intermediate state that resembles the transition state of the uncatalyzed reaction. This is currently the dominant model for enzymatic catalysis.

Induced mutation Mutation induced artificially by exposing plants or calli to ionizing radiations or mutagenic chemicals.

Inducer Molecule which, when bound to the repressor, causes a conformational change that prevents the repressor from binding to the operator.

Inducers Molecules that cause an increase in a protein activity when added to cells.

Inducible enzyme Enzyme synthesized (induced) in response to the presence of an external substance (the inducer).

Inducible NO synthase, iNOS Macrophages and many other cells have an inducible NO synthase, or iNOS, that is induced by many different stimuli to activate NO synthesis. This is a major mechanism of host resistance to intracellular infection in mice, and probably in humans as well.

Inducible operon Operon that is transcribed only when a specific substance is present. E.g. Lac operon in *E. coli*.

Inducible proteins Those, which are synthesized in different amounts depending on cellular signals.

Induction The synthesis of enzymes initiated by exposure of a cell to the enzymes' normal substrates, analogs of the substrates, and sometimes to apparently unrelated chemicals. The phenomenon is particularly apparent in the synthesis of microsomal mixed-function oxidases following exposure of certain cells to foreign chemicals.

Inductive interaction In developmental biology, a change in the developmental fate of one tissue caused by an interaction with another tissue. Such an interaction is called an inductive interaction.

Induration A raised, hard, red region on the skin resulting from tuberculin hypersensitivity.

Indusium Umbrella shaped membranous tissue covering, located on the fern sorus.

Industrial microbiology Branch of microbiology concerned with the use of microorganisms to assist in the manufacture of useful products or disposal of waste products. Ex. Alcohol, antibiotics, beverages etc.

Inert Inactive.

Infant botulism Also known as “floppy baby” syndrome. Form of botulism in infants often associated with ingestion of honey.

Infection disease A disease caused by pathogens.

Infection Growth of an organism within another living organism.

Infection thread Cellulosic tube in a root hair through which rhizobia can travel to reach and infect root cells.

Infectious hepatitis Also known as hepatitis A.

Infectious mononucleosis or glandular fever It is the common form of infection with the Epstein-Barr virus. It consists of fever, malaise, and swollen lymphnodes

Inferior Ovary Ovary appearing to have its floral parts like calyx, corolla and stamens attached to the top of it. The appearance is due to the union of the floral parts.

Inferred tree A tree obtained by phylogenetic analysis.

Infestation The presence of helminthes (worms) or arthropods in or on a living host.

Inflammation The response of the body to infection or irritation; it is characterized by redness, heat, swelling and pain. Redness and heat are the result of increased blood supply to the area. Swelling results from loss of blood plasma to the tissue spaces, which compresses nerve endings and causes pain. Leukocytes also crowd the tissue space for phagocytosis of bacteria or cellular debris and to wall off the infection in order to prevent its spread. As the inflammation subsides, repair of the damaged tissue begins.

Inflammation, inflammatory response, inflammatory cells, inflammatory infiltrate Inflammation is a general term for the local accumulation of fluid, plasma proteins, and white blood cells that is initiated by physical injury, infection, or a local immune response. This is also known as an inflammatory response. Acute inflammation is the term used to describe early and often transient episodes, whereas chronic inflammation occurs when the infection persists or during autoimmune diseases. Many different forms of inflammation are seen in different diseases. The cells that invade tissues undergoing inflammatory responses are often called inflammatory cells or an inflammatory infiltrate.

Inflammatory response Local response of a tissue to injury or infection-characterized by tissue redness, swelling, heat, and pain. Caused by invasion of white blood cells, which release various local mediators such as histamine.

Inflorescence Discrete group of flowers attached to a common axis in a specific order.

Influenza Viral respiratory infection caused by orthomyxoviruses that appears as epidemics.

Informational macromolecules Biomolecules containing information in the form of specific sequences of different monomers; for example, many proteins, lipids, polysaccharides, and nucleic acids.

Infrared (IR) The portion of the electromagnetic spectrum with wavelengths from about 0.75 μm to 1 mm.

Ingroup A putatively monophyletic group that is the prime subject of a cladistic analysis.

Inherit In genetics, to receive genetic material from parents through biological processes.

Inhibition constant (K_i) The dissociation constant for an enzyme-inhibitor complex.

Inhibition domain The part of a eukaryotic repressor that makes contact with the initiation complex.

Inhibition Prevention of growth or function.

Inhibitor A substance that reduces an enzyme's activity by affecting its substrate binding or turnover number.

Inhibitor-resistant mutant A mutant that is able to resist the toxic effects of an antibiotic or other type of inhibitor.

Inhibitory G Protein (G_i) G protein that can regulate ion channels and inhibit the enzyme adenylyl cyclase.

Inhibitory neurotransmitter Neurotransmitter that opens transmitter-gated Cl⁻ or K⁺ channels in the postsynaptic membrane of a nerve or muscle cell and thus tends to inhibit the generation of an action potential.

Initial velocity (of a reaction) Rate at which an enzyme converts substrate to product in the absence of product, that is, at the onset of a reaction.

Initiating segment That part of the F plasmid that is transferred to the recipient cell in conjugation with an Hfr bacterium.

Initiation codon AUG (sometimes GUG in prokaryotes); codes for the first amino acid in a polypeptide sequence: N-formylmethionine in prokaryotes, and methionine in eukaryotes.

Initiation complex A complex of a ribosome with an mRNA and the initiating Met-tRNA^{Met} or fMet-tRNA^{fMet}, ready for the elongation steps.

Initiation factor Protein that promotes the proper association of ribosomes with messenger RNA and is required for the initiation of protein synthesis.

Initiation of transcription The assembly upstream of a gene of the complex of proteins that will subsequently copy the gene into RNA.

Initiation region A region of eukaryotic chromosomal DNA within which replication initiates at positions that are not clearly defined.

Initiation signal The AUG codon that specifies the incorporation of N-formylmethionine at the 5' end of a new protein chain.

Initiator (Inr) sequence A component of the RNA polymerase II core promoter.

Initiator tRNA Special tRNA that initiates translation. It always carries the amino acid methionine.

Innate defenses Also known as Innate immune response.

Innate immune response or Innate defense Immune response (of both vertebrates and invertebrates) to a pathogen that involves the pre-existing defense of the body-the innate immune system-such as barriers formed by skin and mucosa, antimicrobial molecules and phagocytes. Such a response is not specific for the pathogen.

Innate immunity The early phases of the host response to infection depend on **innate immunity** in which a variety of innate resistance mechanisms recognize and respond to the presence of a pathogen. Innate immunity is present in all individuals at all times, does not increase with repeated exposure to a given pathogen, and discriminates between a group of related pathogens.

Innate resistance Resistance of an individual to diseases that affect other species and other individuals of the same species.

Inner membrane The innermost of two membranes surrounding an organelle. In the mitochondrion, it encloses the matrix and contains the respiratory electron transport chains.

Inner nuclear membrane The innermost of the two nuclear membranes. It contains binding sites for chromatin and the nuclear lamina on its internal face.

Inoculate To treat with microorganisms for the purpose of creating a favorable response. For example, treatment of legume seeds with rhizobia to stimulate N₂ fixation.

Inoculating loop or needle An instrument used to transfer bacteria from one culture medium to another.

Inoculation Placing of an explant in or on a nutrient medium.

Inoculum Material used to introduce a microorganism into a suitable situation for growth.

Inorganic compound A compound that lacks the element carbon.

Inorganic pyrophosphatase An enzyme that hydrolyzes a molecule of inorganic pyrophosphate to yield two molecules of (ortho) phosphate; also known as pyrophosphatase.

Inosine A modified version of adenosine, sometimes found at the wobble position of an anticodon.

Inositol Cyclic polyalcohol, (CHOH)₆, that forms the headgroup of the phospholipid phosphatidylinositol. Phosphorylation of inositol yields inositol trisphosphate.

Inositol phospholipids (Phosphoinositides) One of a family of lipids containing phosphorylated inositol derivatives. Although minor components of the plasma membrane, they are important in signal transduction in eukaryotic cells.

Inositol trisphosphate (IP₃, InsP₃) Small phosphorylated cyclic polyalcohol that is released into the cytosol by the action of phospholipase C on the membrane lipid phosphatidylinositol bisphosphate and that acts to cause release of calcium ions from the endoplasmic reticulum.

Inositol trisphosphate-gated calcium channel Channel found in the endoplasmic reticulum of many cells. The channel opens when inositol trisphosphate binds to its cytoplasmic aspect. It allows only calcium ions to pass.

Insect An arthropod with three body regions, three pairs of legs, and highly specialized mouthparts.

Insectivore An organism that feeds chiefly on insects.

Insert DNA A desired DNA in the rDNA.

Insertion mutation A mutation caused by insertion of one or more extra bases, or a mutagen, between two successive bases in DNA.

Insertion of sets An event which represents the simultaneous happening of both the events A and B.

Insertion sequence Specific base sequences at either end of a transposable segment of DNA.

Insertion site A unique restriction site in a vector, DNA molecule into which foreign DNA can be inserted. It is also used to describe the position of integration of a transposon or insertion site element.

Insertion vector A γ vector constructed by deleting a segment of nonessential DNA.

Insertion A chromosome abnormality in which a piece of DNA is incorporated into a gene and thereby disrupts the gene's normal function.

Insertional editing A less extensive form of pan-editing that occurs during processing of some viral RNAs.

Insertional inactivation A cloning strategy whereby insertion of a new piece of DNA into a vector inactivates a gene carried by the vector.

Insertional mutagenesis Insertion of additional nucleotides into a stretch of DNA.

Insertions They are an additional stretch of base pairs in DNA.

InsP₃(inositol trisphosphate, IP₃) Small phosphorylated cyclic polyalcohol that is released into the cytosol by the action of phospholipase C on the membrane lipid phosphatidylinositol bisphosphate and that acts to cause release of calcium ions from the endoplasmic reticulum.

Instability element A sequence present in yeast mRNAs that affects degradation.

Insulator A segment of DNA that acts as the boundary point between two functional domains.

Insulator element DNA sequence that prevents a gene regulatory protein bound to DNA in the control region of one gene from influencing the transcription of adjacent genes.

Insulin Hormone produced by the 'β' endocrine cells in the pancreas. It activates its own receptor tyrosine kinase, which in turn acts mainly through activation of PI-3-kinase and hence protein kinase B.

Insulin Polypeptide hormone that is secreted by β-cells in the pancreas and helps regulate glucose metabolism in animals.

Insulin receptor Receptor tyrosine kinase specific for insulin, which acts mainly through activation of PI-3-kinase and hence protein kinase B.

Insulin receptor substrate number 1 (IRS-1) Protein phosphorylated on tyrosine by the insulin receptor. Once phosphorylated, it recruits PI-3-kinase, which can then be phosphorylated and hence activated.

Insulin resistance The decreased ability of cells to respond to insulin by increasing their glucose uptake.

Insulin-dependent diabetes mellitus, IDDM In **insulin-dependent diabetes mellitus (IDDM)**, the β cells of the pancreatic islets of Langerhans are destroyed so that no insulin is produced. The disease is believed to result from an autoimmune attack on the P cells.

Insulinotherapy Treatment of diabetic by injecting insulin.

Integral membrane protein Protein that is held tightly in a membrane and can only be removed by treatments that disrupt the lipid bilayer.

Integrase A Type I topoisomerase that catalyzes insertion of the λ genome into Escherichia coli DNA.

Integrating vector A vector that is designed to integrate cloned DNA into host cell chromosomal DNA.

Integration The insertion of the genome of a DNA virus, or of a DNA copy of the genome of an RNA virus, into the genome of a host cell. Such an insertion permits the virus to remain dormant (latent) in the host cell for long periods of time. It also permits transmission of the virus to daughter cells without the appearance of viral proteins or fully assembled viruses that might trigger the host's immune defenses. Much evidence indicates that integration may be a prerequisite for transformation of cells by oncogenic viruses.

Integrins, β Integrins are heterodimeric cell-surface proteins involved in cell-cell and cell-matrix interactions. They are important in adhesive interactions between lymphocytes and antigen-presenting cells and in lymphocyte and leukocyte migration into tissues. The **β₁-integrins**, or very late antigens (VLA), are a family of integrins with shared β₁ chains and different α chains that mediate adhesion to other cells and to extracellular matrix proteins.

Integron A set of genes and other DNA sequences that enable plasmids to capture genes from bacteriophages and other plasmids.

Integument Exoskeletal covering in some animals.

Intein An internal segment of a polypeptide that is removed by a splicing process after translation.

Intellectual property rights Patents, copyrights, and trademarks.

Inter Simple Sequence Repeat (ISSR) A molecular marker technique that targets variation in the DNA between two microsatellite loci.

Interactome network A map showing the interactions between all or some of the proteins in a proteome.

Interbreeding species concept A philosophy and set of methods that define species almost entirely on the ability of species to exchange genes naturally or artificially, as assessed by artificial crossing programs, studies of mechanisms to facilitate gene flow, and biological isolating mechanisms.

Intercalary regeneration Type of regeneration that fills in the missing tissues when two mismatched parts of a structure are grafted together.

Intercalating agent A chemical, usually containing aromatic rings, that can sandwich in-between adjacent base pairs in a DNA duplex. The intercalation leads to an adjustment in the DNA secondary structure, as adjacent base pairs are usually close-packed.

Intercalating mutagen A mutagen that inserts itself between two successive bases in a nucleic acid, causing a frame-shift mutation.

Intercalation With respect to DNA, refers to the fitting (intercalation) of a small molecule between adjacent bases in a DNA helix.

Intercellular Space Space present between two adjacent cells.

Interconvertible enzyme A protein that undergoes phosphorylation and dephosphorylation so as to modulate the activity.

Interdigitating reticular cells Also known as dendritic cells.

Interfacial activation The increase in activity when a lipid specific enzyme contacts the lipid-water interface.

Interference One crossover event inhibits the chances of another crossover event. Also known as positive interference. Negative interference increases the chance of a second crossover.

Interferons, Interferon- α , IFN- α , interteron- β , IFN- β , interferon- γ , IFN- γ Interferons are cytokines that can induce cells to resist viral replication. **Interferon- α (IFN- α)** and **interteron- β (IFN- β)** are produced by leukocytes and fibroblasts, respectively, as well as by other cells, whereas **interferon- γ (IFN- γ)** is a product of CD4 T_H1 cells, CD8 T cells, and NK cells. IFN- γ has as its primary action the activation of macrophages.

Interferon- γ (IFN- γ) Cytokine secreted by certain types of T cells after activation, and which enhances the anti-viral response and macrophage activation.

Intergeneric Hybridization Hybridization between plants belonging to two different genera.

Intergenic regions DNA sequences located between genes. They comprise a large percentage of a genome with no known function.

Interleukin, IL Interleukin, abbreviated IL, is a generic term for cytokines produced by leukocytes. The term interleukin is used in the naming of specific cytokines such as IL-2

Interleukin-2, IL-2 Interleukin-2 (IL-2) is the cytokine that is most central to the development of an adaptive immune response.

Intermediary metabolism All the reactions in an organism that are concerned with storing and generating metabolic energy and with the biosynthesis of low-molecular-weight compounds and energy storage compounds. It does not include nucleic acid and protein synthesis.

Intermediate density lipoprotein or IDL Also known as lipoprotein.

Intermediate filament Fibrous protein filament (about 10nm in diameter) that forms ropelike networks in animal cells. One of the three most prominent types of cytoskeletal filaments.

Intermediate host An organism that harbors the larval or asexual stage of a helminth or protozoan.

Intermediate-day Plant Plants characterized by two critical photo periods. This means the plant will not flower during too short or too long days.

Intermembrane space In organelles such as mitochondria, chloroplasts, and nuclei that are bound by two membranes, the intermembrane space is the aqueous space between the inner and outer membranes. The intermembrane space of nuclei is contiguous with the lumen of the ER. The intermembrane space of mitochondria has the ionic composition of cytosol because porin in the outer mitochondrial membrane allows solutes of $M_r < 10,000$ to pass.

Internal conversion A mode of decay of an excited molecule, in which electronic energy is converted to heat (the kinetic energy or molecular motion).

Internal energy (E) The energy contained in a system. For the purposes of biochemistry, the term encompasses all the types of energy that might be changed by chemical or nonnuclear physical processes, including the kinetic energy of motion and vibration of atoms and molecules and the energy stored in bonds and non-covalent interactions.

Internal membrane Eucaryotic cell membrane other than the plasma membrane. The membranes of the endoplasmic reticulum and the Golgi apparatus are examples.

Internal node A branch point within a phylogenetic tree, representing an organism or DNA sequence that is ancestral to those being studied.

Internal resolution site The sequence at which site-specific recombination occurs during transposition.

Internal ribosome entry site (IRES) A nucleotide sequence that enables the ribosome to assemble at an internal position in some eukaryotic mRNAs.

Internal Transcribed Spacer (ITS) A sequence of nuclear ribosomal DNA commonly examined for phylogenetic analysis consisting of two spacer regions intercalated between the 18S, 5.8S, and 26S genes.

Internode Region between two nodes in plants.

Interphase Phase of cell cycle which is not of cell division but encompasses phases such as G1, S, G2. Here, the cell prepares for cell division.

Interphase chromosome A chromosome, present in a cell during the period between cell divisions, which adopts a relatively uncondensed chromatin structure.

Inter-retrotransposon Amplified Polymorphism (IRAP) A molecular marker technique that targets variation in retrotransposon insertion sites.

Interspecies hydrogen transfer The process in which organic matter is degraded anaerobically by the interaction of several groups of microorganisms in which hydrogen production and hydrogen consumption are closely coupled among species.

Interspecific Also known as Intrageneric. Hybridization between plants belonging to two different species of the same genus.

Interspecific relations Interactions between different species—are numerous, and usually described according to their beneficial, detrimental or neutral effect (for example, mutualism (relation ++) or competition (relation --)). The most significant relation is the relation of predation (to eat or to be eaten), which leads to the essential concepts in ecology of food chains (for example, the grass is consumed by the herbivore, itself consumed by a carnivore, itself consumed by a carnivore of larger size). A high predator to prey ratio can have a negative influence on both the predator and prey biocenoses in that low availability of food and high death rate prior to sexual maturity can decrease (or prevent the increase of) populations of each, respectively. Selective hunting of species by humans which leads to population decline is one example of a high predator to prey ratio in action. Other interspecific relations include parasitism, infectious disease and competition for limiting resources, which can occur when two species share the same ecological niche.

Interspersed repeat element PCR (IRE-PCR) A clone fingerprinting technique that uses PCR to detect the relative positions of genome-wide repeats in cloned DNA fragments.

Interstitial Skin The skin found between the scales of a snake.

Intervarietal Hybridization between plants belonging to two varieties in the same species.

Intervening sequence Also known as intron.

Intestinal anthrax Infection by *Bacillus anthracis* that appears in the intestine. If bacteria enter the bloodstream, causing septicemia, this leads to meningitis.

Intoxication Poisoning.

Intracellular cytokine staining Staining for cytokines in cells that produce them can be achieved by permeabilizing the cell and reacting it with a labelled fluorescent anticytokine antibody. This procedure is called **intracellular cytokine staining**.

Intracellular Domains Domain families that are most prevalent in proteins within the cytoplasm.

Intracellular messenger Cytosolic solute that changes in concentration in response to external stimuli or internal events, and which acts on intracellular targets to change their behavior. Calcium ions, cyclic AMP and cyclic GMP are the three common intracellular messengers.

Intracellular receptors Receptors that are not on the plasma membrane but that lie within the cell and bind transmitters that diffuse through the plasma membrane.

Intracellular signaling protein Protein that relays a signal as part of an intracellular signaling pathway. It may either activate the next protein in the pathway or generate a small intracellular mediator.

Intracutaneous, subcutaneous, intramuscular, intranasal, intravenous Injections can be administered by a number of routes: intracutaneous (intradermal)-entering the skin or dermis; subcutaneous - entering below the skin or dermis; intramuscular - entering the muscle; intranasal - by way of the nose; and intravenous - entering a vein.

Intramolecular base pairing Base pairing that occurs between two parts of the same DNA or RNA polynucleotide.

Intraspecific Refers populations within a species.

Intraspecific relations Relations which are established between individuals of the same species, forming a population. They are relations of co-operation or competition, with division of the territory, and sometimes organization in hierarchical societies.

Intrathymic dendritic cells Also known as dendritic cells.

Intrinsic Protein Protein deeply integrated into the membrane, which cannot be discarded from the membrane easily.

Intrinsic terminator A position in bacterial DNA where termination of transcription occurs without the involvement of Rho.

Introduced Species Organism that would not normally occur but have been introduced in the habitat.

Introgressive hybridization Back crossing in which characters of one parent infiltrate into another parent. As per example Rye to Wheat.

Intron (intervening sequence) A segment of the nascent transcript that is removed by splicing. Also refers to the corresponding region in the DNA. Synonymous with intervening sequence.

Intron homing The conversion of a gene lacking an intron into one that contains an intron, catalyzed by a protein coded by that intron.

Intron In a eukaryotic gene, introns are those parts that are spliced out before the RNA leaves the nucleus. In contrast exons are those parts that after RNA processing leave the nucleus.

Introns early The hypothesis that introns evolved relatively early and are gradually being lost from eukaryotic genomes.

Introns late The hypothesis that introns evolved relatively late and are gradually accumulating in eukaryotic genomes.

Invariant chain The major histocompatibility complex (MHC) class II proteins are assembled in the endoplasmic reticulum with the invariant chain (Ii), which is involved in shielding the MHC class II molecules from binding peptides and in delivering them to cellular vesicles. There Ii is degraded, leaving the MHC class II molecules able to bind peptide fragments of antigen

Invariant residue A residue in a protein that is the same in all evolutionarily related proteins. The opposite of an invariant residue is a hypervariable residue.

Invasive stage or invasive phase Disease spreads into body from site of entry causing symptoms to appear.

Invasiveness The ability of microorganisms to establish residence in a host.

Inversion Type of mutation in which a segment of chromosome is inverted.

Invertebrate Pertaining to organisms (animals) without a backbone.

Inverted repeat A chromosome segment that is identical to another segment on the same chromosome except that it is oriented in the opposite direction.

Iododeoxyuridine (IUDR) A nucleoside analog, much like bromodeoxyuridine. It is used as an antiviral agent and for the induction of latent viruses in cultured cells.

Iodophor A complex of iodine and a detergent.

Ion An atom that has either gained or lost electrons to acquire a charge, for example Na^+ and Cl^- .

Ion channel Transmembrane protein complex that forms a water-filled channel across the lipid bilayer through which specific inorganic ions can diffuse down their electrochemical gradients.

Ion exchange chromatography A fractionation procedure in which charged molecules are selectively retained by a matrix bearing oppositely charged groups.

Ion pair An electrostatic interaction between two ionic groups of opposite charge. In proteins, it is also called a salt bridge.

Ion pore A pore in a cellular membrane through which ions can diffuse. It is formed by a transmembrane protein and can discriminate among ions to some degree on the basis of size and charge. Many ion pores are gated (i.e. they can open and close in response to signals).

Ion product of water (K_w) The product of the concentrations of H^+ and OH^- in pure water: $K_w = [\text{H}^+][\text{OH}^-] = 1 \times 10^{-14}$ at 25 °C.

Ion-exchange resin A polymeric resinous substance, usually in bead form, that contains fixed groups with positive or negative charge. An anion exchange resin has positively-charged groups and is therefore useful in exchanging the anionic groups in a test sample; a cation exchange resin is itself negatively charged, and has the opposite application. The resin is usually used in a column chromatographic procedure.

Ionic bond Cohesion between two atoms, one with a positive charge, the other with a negative charge. One type of noncovalent bond.

Ionic strength (I) A quantity that reflects the total concentration of ions in a solution and the stoichiometric change (charge per atom or molecule) of each ion.

Ionization Dissociation of a molecule into groups of atoms with electrical charges.

Ionizing radiation A type of radiation, such as x rays, γ -rays that causes loss of electrons from some organic molecules, thus making them more reactive.

Ionophore A compound that binds one or more metal ions and is capable of diffusing across a membrane, carrying the bound ion.

Ionotropic cell surface receptors Channels that open when a specific chemical binds to the extracellular face of the channel protein.

Ions Atoms, groups of atoms, or compounds, that are electrically charged as a result of the loss of electrons (cations) or the gain of electrons (anions).

IP3 (inositol trisphosphate, InsP3) Small phosphorylated cyclic polyalcohol that is released into the cytosol by the action of phospholipase C on the membrane lipid phosphatidylinositol bisphosphate and that acts to cause release of calcium ions from the endoplasmic reticulum.

Iris diaphragm Adjustable device in a microscope that controls the amount of light passing through the specimen.

Iron-sulfur center or Iron-sulfur protein A prosthetic group of certain redox proteins involved in electron transfers; Fe^{2+} or Fe^{3+} is bound to inorganic sulfur and to Cys groups in the protein.

Iron-sulfur center Electron-transporting group consisting of either two or four iron atoms bound to an equal number of sulfur atoms, found in a class of electron-transport proteins.

Irradiation breeding Crop improvement by introducing mutations in plant materials by X- or Y- ray irradiation.

Irradiation Exposure of materials or organisms to ionizing radiations.

IRS-1 Protein phosphorylated on tyrosine by the insulin receptor. Once phosphorylated, it recruits PI-3-kinase, which can then be phosphorylated and hence activated.

ISCOMs, immune stimulatory complexes ISCOMs are immune stimulatory complexes of antigen held within a lipid matrix that acts as an adjuvant and enables the antigen to be taken up into the cytoplasm after fusion of the lipid with the plasma membrane.

Isoaccepting tRNAs Two or more tRNAs that are charged with the same amino acid.

Isochore A segment of genomic DNA that has a uniform base composition which differs from that of the adjacent segments.

Isochromosome Chromosome formed by the joining of two identical chromosome arms.

Isoelectric focusing Also known as IEF. A version of gel electrophoresis that allows ampholytes to be separated almost purely on the basis of their isoelectric points. The ampholytes are added to a gel that contains a pH gradient and are subjected to an electric field. Each ampholyte migrates until it reaches the pH that represents its isoelectric point, at which point it ceases to have a net electric charge and therefore comes to a halt and accumulates.

Isoelectric pH (isoelectric point) The pH at which a solute has no net electric charge and thus does not move in an electric field.

Isoelectric point (pI) The pH at which a charged molecule in solution has no net electric charge and therefore does not move in an electric field.

Isoelectric point pH at which a protein or other molecule has no net charge.

Isoenzymes or Isozymes Enzymes that catalyze the same chemical reaction, but which have different kinetic properties (such as ability to bind substrates, maximum velocity of reaction, and so forth) and generally a different but similar amino acid composition. Families of isoenzymes generally have characteristic distribution patterns in tissues at different stages in their embryologic and later development. Isoenzymes may have evolved to meet differing needs for a particular chemical reaction in various tissues or to protect the cell from mutational loss of crucial enzyme. E.g. like these of LDH in different tissues.

Isoforms Related proteins that are the products of different genes or of differential splicing of mRNAs from one gene.

Isogamy Sexual reproduction taking place between gametes that are similar in size. Seen in certain fungi and algae.

Isograft Tissue graft between identical twins.

Isolated system A thermodynamic system that cannot exchange matter or energy with its surroundings.

Isolating Mechanism Prevention of breeding between species due to behavior, morphology, genetics or a geographical barrier.

Isolation Any procedure in which an organism present in a particular sample or environment, is obtained in pure culture.

Isomerase An enzyme that catalyzes an intramolecular rearrangement.

Isoomerization Rearrangement of atomic groups within the same molecule without any loss or gain of atoms.

Isomers Any two molecules with the same molecular formula but a different arrangement of molecular groups.

Isoomorphous replacement The replacement of one atom in a macromolecule with a heavy metal atom in such a way that the structure of the macromolecule does not change. It used in the determination of molecular structure by x-ray crystal diffraction.

Isomorphous substitution Substitution in a crystalline clay sheet of one atom by a similarly sized atom of lower valence.

Isoniazid (INH) A bacteriostatic agent used to treat tuberculosis.

Isopeptide bond An amide linkage between an α -carboxylate group of an amino acid and the ϵ -amino group of Lys, or between the α -amino group of an amino acid and the β - or γ -carboxylate group of Asp or Glu.

Isophosphamide An alkylating agent used in the treatment of tumors.

Isoprene The hydrocarbon 2-methyl-1,3-butadiene, a recurring structural unit of the terpenoid biomolecules.

Isoprenoid (polyisoprenoid) Member of a large family of lipid molecules with a carbon skeleton based on multiple five-carbon isoprene units. Examples include retinoic acid and dolichol.

Isoschizomers Two restriction endonucleases that cleave at the same nucleotide sequence.

Isothermal Occurring at constant temperature.

Isotonic solution A solution in which, after immersion of a cell, osmotic pressure is equal across the cell's membrane.

Isotope coded affinity tag (ICAT) Markers, containing normal hydrogen and deuterium atoms, used to label individual proteomes.

Isotopes Stable or radioactive forms of an element that differ in atomic weight but are otherwise chemically identical to the naturally abundant form of the element; used as tracers.

Isotype switching The first antibodies produced in a humoral immune response are IgM, but activated B cells subsequently undergo isotype switching or class switching to secrete antibodies of different isotypes: IgG, IgA, and IgE. Isotype switching does not affect antibody specificity significantly, but alters the effector functions that an antibody can engage.

Isotypes Immunoglobulins are made in several distinct isotypes or classes- IgM, IgG, IgD, IgA, and IgE-each of which has a distinct heavy-chain C region encoded by a distinct C-region gene. The isotype of an antibody determines the effector mechanisms that it can engage on binding antigen. The different heavy-chain C regions are encoded in exons 3' to the V(D)J rearrangement site. This allows the same antibody heavy-chain V region to link up with different heavy-chain C-region isotypes as a result of somatic recombination.

Isotypic exclusion Isotypic exclusion describes the use of one or other of the light chain isotypes, κ or λ , by a given B cell or antibody.

Janus kinase (JAK): JAK are crucial components of diverse signal transduction pathways that govern cellular survival, proliferation, differentiation and apoptosis. It is a family of intracellular, nonreceptor tyrosine kinases that plays an intermediary role in some types of signal transduction by transducing cytokine-mediated signals via the JAK-STAT pathway.

Jaundice A yellowing of the skin and whites of the eyes as a result of the deposition of the heme degradation product bilirubin in these tissues. It is a symptom of liver dysfunction, bile-duct obstruction, or a high rate of red cell destruction.

Joule (J) i) A unit for energy or work, defined as the work done by a force of 1 newton when its point of application moves 1 meter in the direction of the force. It is the unit of energy used in the Systeme Internationale (SI) ii) Standard unit of energy in the meter-kilogram system. One joule is the energy delivered in one second by a one-watt power source. Approximately equal to 0.24 calories.

Junk DNA: junk DNA" or noncoding DNA describes components of an organism's DNA sequences that do not encode for protein sequences. Much of this DNA has no known biological function and is sometimes referred to as **junk DNA**. Also known as selfish DNA

K⁺ leak channel A K⁺-transporting ion channel in the plasma membrane of animal cells that remains open even in a "resting" cell. The well-known role of background K⁺ currents is to stabilize the negative resting membrane potential and counterbalance depolarization. Leak" K⁺ channels are so termed because of the apparent lack of gating control

k₂ The rate constant for the second step of a simple enzyme-catalyzed reaction that follows Michaelis-Menten kinetics. that is. the conversion of the ES complex to E + P

Kala azar A chronic and potentially fatal parasitic disease of the viscera (the internal organs, particularly the liver, spleen, bone marrow and lymph nodes) due to infection by the parasite called *Leishmania donovani*

Kaposi's (KS) It is a tumor caused by Human herpesvirus 8 (HHV8), also known as Kaposi's sarcoma-associated herpesvirus (KSHV). This sarcoma is a cancer that causes patches of abnormal tissue to grow under the skin, in the lining of the mouth, nose, and throat or in other organs This type of malignancy often found in AIDS patients in which blood vessels grow into tangled masses that are filled with blood and easily ruptured

Karyogamy It is the process of fusion of two gametic nuclei during fertilization by which nuclei fuse to produce a diploid cell. The term comes from the Greek *karuo-* (from *karuon*) meaning *nut* and *-gamos* meaning *marriage*. (Species that use this mode of reproduction can cause diseases like ringworm)

Karyogram: a diagram or photograph of the chromosomes of a cell Used especially for the display prepared from photographs, arranged in homologous pairs and in a numbered sequence in terms of its appearance at metaphase

Karyopherin: a group of proteins, classified as importins and exportins, involved in transporting molecules through the pores of the nuclear envelope. karyopherin-mediated transport occurs through the nuclear pore, which acts as a gateway into and out of the nucleus. Most proteins cannot traverse through the nuclear pore by themselves, but require karyopherins

Karyotype A karyotype is a picture of all the chromosomes from an individual's cell arranged with respect to size, shape, and number. It is used to look for abnormal numbers or structures of chromosomes.

kb. Kilo base pair; 1 kb = 1000 base pairs (bp).

Keratin i) A waterproofing fibrous structural proteins found in epidermal cells ii) Member of family of proteins that form keratin intermediate filaments, mainly in epithelial cells. Specialized keratins are found in hair, nails, and feathers.

Keratitis An inflammation of the cornea often marked by moderate to intense pain and usually involves impaired eyesight.

Keratoconjunctivitis It is an inflammation of the eye that involves both the cornea and conjunctiva in which vesicles appear in the cornea and eyelids.. It occurs due to abrasion trauma, infection, and underlying diseases.

Ketogenesis. When carbohydrate stores are exhausted, cells turn to fat cells for fuel. These fat cells break down and release energy, and ketones are the by-product of that breakdown. Ketogenesis is the release of ketones into the body when fat is broken down for energy. **Ketogenic amino acid.** An amino acid whose degradation in animals yields compounds that can be converted to fatty acids or ketone bodies in contact with glucogenic amino acid.

Ketone bodies The substances acetoacetate, β -hydroxybutyrate, and acetone, which are produced from excess acetyl-CoA in the liver when the rate of fatty acid β -oxidation in liver mitochondria exceeds the rate at which acetyl-CoA is used for energy generation or fatty acid synthesis.

Ketone Organic molecule containing a carbonyl group linked to two alkyl group

Ketose A monosaccharide(sugar) in which the carbonyl group occurs within the chain and hence represents a ketone group.

Ketosis. A potentially pathological condition in which abnormal accumulation of ketones occur in the body as a result of excessive breakdown of fats caused by a deficiency or inadequate use of carbohydrates

Kidney The kidneys are a pair of organs that are found on either side of the spine, just below the rib cage in the back. regulate blood pressure and the levels of water, salts, and minerals in the body, remove waste products from the blood and produce urine

Kilocalorie (kcal) Unit of heat energy equal to 1000 calories. Often used to express the energy content of food or molecules: bond strengths, for example, are measured in kcal/mole, An alternative unit in wide use is the kilojoules, equal to 0.24 kcal

Kilojoule Standard unit of energy equal to 1000 joules, or 0.24 kilocalories

Kinase . An enzyme that transfers a phosphoryl group between ATP and another molecule in a process referred to as *phosphorylation*.

Kinesin It is the founding member of a superfamily of microtubule-based ATPase motors .It uses the energy of ATP hydrolysis to move along a microtubule.

Kinetochores : a specialized structure on the centromere to which the microtubular spindle fibers attach during mitosis and meiosis, the chromatids are held together to form an X shape;

Kinetochores It is the protein structure on chromatids where the spindle fibers attach during cell division to pull sister chromatids apart ; thus essential for accurate chromosome segregation. The kinetochores form on the part of the chromosome known as the centromere.

Kinetochores microtubule, a microtubule with one end attached to the kinetochores on a chromosome in a mitotic or meiotic spindle

Klenow polymerase : A DNA polymerase enzyme, obtained by chemical modification of *Escherichia coli* DNA polymerase I, used primarily in chain termination DNA sequencing. It retains both the 5'-3' polymerase and the 3' exonuclease activities, but not the 5' exonuclease activity. Used to synthesize

DNA complementary to single-stranded DNA template by adding nucleotides to the free 3'-hydroxyl end of an annealed DNA primer.

k_M Boltzmann constant ($1.3807 \times 10^{23} \text{ J} \cdot \text{K}^{-1}$); it is equivalent to R/N , where R is the gas constant and N is Avogadro's number.

K_M Michaelis constant a constant that is a measure of the kinetics of an enzyme reaction and that is equivalent to the concentration of substrate at which the reaction takes place at one half its maximum rate

Knockout Mouse : A knockout mouse is a genetically engineered mouse in which one or more genes have been turned off through a targeted mutation. It is created by gene targeting—targeted gene disruption—in which a specific gene is deleted or inactivated by homologous recombination, to study the effects of its absence.

Koch's postulates Four postulates formulated by Robert Koch in the 19th century; used to prove that a particular organism causes a particular disease

Kornberg polymerase :The DNA polymerase I enzyme of *Escherichia coli*

"Kozak consensus : Kozak consensus sequence plays a major role in the initiation of the translation process occurs on eukaryotic mRNA and has the consensus (gcc)gccRccAUGG, where R is a purine (adenine or guanine) three bases upstream of the start codon (AUG), which is followed by another 'G'.

, Krebs's cycle It produces high-energy phosphate compounds through a series of enzymatic reactions in aerobic organisms involving oxidative metabolism of acetyl units and producing high-energy phosphate compounds, which serve as the main source of cellular energy

Kupffer cells specialized form of phagocytic immune cells that exist only within the liver. They are one of several kinds of macrophages, a type of white blood cells, that help the body maintain health by destroying bacteria, old blood cells and other foreign substances that occur in the blood stream because of illness, injury or body malfunction or simply through natural aging of the various body cells.

Kuru Transmissible spongiform encephalopathy disease of the human brain, caused by prions, associated with cannibalism and tissue/organ transplant

K_w The ionization constant of water: equal to 10^{-14}

α .keratins A class of keratins that are the major proteins of hair. They consist of long α -helical polypeptides, which are wound around each other to form triplet helices.

Lipid storage disease A defect in a lipid degrading enzyme that causes the substrate for the enzyme to accumulate in lysosomes.

Lysozyme : An enzyme used to destabilize the bacterial cell wall prior to DNA purification, functioning as an antibacterial agent by catalyzing the hydrolysis of specific glycosidic linkages in peptidoglycans and chitin and thereby acting as a mild antiseptic.

L- Prefix- describing a stereoisomer; the amino acids found in proteins are always the L-isomers.

L linking number. - a property of a long biopolymer (such as duplex DNA) equal to the number of twists (related to the frequency of turns around the central axis of the helix) plus the writhing number.

Leading strand : the strand that is made in the 5' to 3' direction by continuous polymerization at the 3' growing tip. it is copied in a continuous fashion during genome replication.

Label Chemical group, radioactive atom or fluorescent dye added to a molecule in order to follow its path/progress through a biochemical reaction or to locate it spatially. Also, as a verb, to add such a group or atom to a cell or molecule ..

Lacrimal gland Tear –producing gland of the eye

Lactic acid fermentation- is a biological process by which sugars are converted into cellular energy and the metabolite lactate. It is an anaerobic fermentation reaction that occurs in some bacteria and animal cells, when pyruvate molecules are broken down to make energy when there is not enough oxygen.

Lactobacilli Type of regular, nonsporing, Gram- positive rods found in many foods; used in production of cheeses, yogurt, sourdough and other fermented foods

Lactose intolerance. The inability to digest the disaccharide lactose due to a deficiency of the enzyme β -galactosidase (lactase).

Lactose operon : The **lac operon** is an operon required for the transport and metabolism of lactose in *Escherichia coli* and some other enteric bacteria. It consists of three adjacent structural genes, lacZ, lacY and lacA. The *lac* operon is regulated by several factors including the availability of glucose and of lactose. Gene regulation of the *lac* operon was the first complex genetic regulatory mechanism to be elucidated and is one of the foremost examples of prokaryotic gene regulation.

Lactose repressor : The regulatory protein that controls transcription of the lactose operon in response to the presence or absence of lactose in the environment.

Lag phase First of four major phases of the bacterial growth curve, in which organisms grow in size but do not increase in number. it is the time interval in a bacterial growth curve during which there is no growth. the period of time between the introduction of a microorganism into a culture medium and the time it begins to increase exponentially

Lagging strand The new daughter strand of DNA segments during DNA replication. It is copied in a discontinuous fashion during genome replication that are later joined covalently, The DNA strand that is replicated ,discontinuously from the 5' to the 3' direction.

Lambda bacteriophage (A bacteriophage) Virus that infects *E. coli*. Widely used as a DNA cloning vector accommodating fragments of DNA up to 15 kilobase pairs long. It shows a lytic cycle and a lysogenic cycle and studies on the control of these alternative cycles have been very important for our understanding of the regulation of gene transcription.

Lamellipodium (plural **lamellipodia**) Flattened, sheetlike protrusion supported by a meshwork of actin filaments, which is extended at the leading edge of a crawling animal cell.

Laminin Extracellular matrix protein found in basal laminae, where it forms a sheet like network., a glycoprotein that is a component of connective tissue basement membrane and that promotes cell

adhesion. It facilitates linkage with collagen and other basement membrane components and is involved in neurite regeneration.

Lampbrush chromosome Paired chromosome in meiosis in immature amphibian eggs, in which the chromatin forms large stiff loops extending out from the linear axis of the chromosome, a greatly enlarged diplotene chromosome that has apparently filamentous granular loops extending from the chromomeres and is characteristic of some animal oocytes

Lariat : Refers to the lariat-shaped intron RNA that results from splicing a GU-AG intron.

Larva -Sexually immature stage of a helminth or arthropod.

Laryngeal papilloma Benign growth caused by herpes virus that can be dangerous if such papillomas block the airway; infants are often infected during birth by mothers having genital warts

Laryngitis An infection of the larynx often with loss of voice

Larynx the voice box

Lassa fever Hemorrhagic fever, caused by arenaviruses that begins with pharyngeal lesions and proceeds to severe liver damage

Latency The ability of a virus to remain in host cells for long periods of time while retaining the ability to replicate

Latent disease A disease characterized by periods of inactivity either before symptoms appear or between attacks, The disease that is present and capable of emerging or developing but not now visible, obvious, active, or symptomatic, it is characterized by a period of no symptoms when the pathogen is inactive

Latent infection A condition in which a pathogen remains in the host for long periods without producing disease but can still be passed on to others.

Latent period : The period between injection of a phage genome into a bacterial cell and the time when cell lysis occurs.

Latent viral infection An infection typical of herpesviruses in which an infection in childhood that is brought under control later in life is reactivated

Lateral diffusion. The movement of a lipid within one leaflet of a bilayer.

Lateral gene transfer : Transfer of a gene from one species to another. Genes pass from one organism to another within the same generation

LD₅₀ -The lethal dose for 50% of the inoculated hosts within a given period.

LDL. refers to a class and range of lipoprotein particles which carry cholesterol in the blood and around the body, for use by cells. LDL cholesterol is therefore considered the "bad" cholesterol.

.Lead compound. A drug molecule that serves as the starting point for the development of more effective drug: molecule;

Leader peptide A small gene within the attenuator control region of repressible amino acid operons. Translation of a specific leader peptide tests for the concentration of a specific amino acid or set of amino acids in the cell. If the concentration is high transcription is terminated in the attenuator, if low continued leading to the production of enzymes for amino acid synthesis and hence more amino acid.

Leader segment : The untranslated region of an mRNA upstream of the initiation codon.

Leader sequence (also called signal sequence) For an mRNA, the nontranslated sequence at the 5' end of the molecule that precedes the initiation codon. For a protein, a short N-terminal hydrophobic sequence that causes the protein to be translocated into or through a cellular membrane. (1) A nucleotide sequence that precedes the coding region of an mRNA. (2) A signal sequence.

Leading strand One of the two newly synthesized strands of DNA found at a replication fork. The new daughter strand of DNA formed as a continuous strand during DNA replication. The leading strand is made by continuous synthesis in the 5'-to-3' direction.

Leaky mutation :A mutation that results in partial loss of a characteristic, If is also possible that some function may remain, but not at the level of the wild type allele.

Leavening agent An agent such as yeast, that produces gas to make dough rise

Lectin Protein that binds tightly to a specific sugar. Abundant lectins from plant seeds are often used as affinity reagents to purify glycoproteins or to detect them on the surface of cells, A protein that binds to a specific saccharide

Leproma An enlarged, disfiguring skin lesion that occurs in the lepromatous form of Hansen's disease

Lepromatous Referring to the nodular form of Hansen's disease in which a granulomatous response causes enlarged disfiguring skin disease called lepromas

Lepromin skin test test used to detect Hansen's disease :similar to the tuberculin test

Lepromin test -A skin test to determine the presence of antibodies to *Mycobacterium leprae*.

Leprosy Hansen's disease

Leptospirosis A zoonosis caused by the spirochete *Leptospira interrogans* which enters the body through mucous membranes or skin abrasions

Leptotene The first phase of division I of meiosis, in which the paired duplicated homologous chromosomes condense and become visible in the light microscope, The early stage of prophase in meiosis in which the replicated chromosomes contract and become visible as long filaments well separated from one another.

Lesch-Nyhan syndrome. A genetic disease caused by the deficiency of hypoxanthine-guanine phosphoribosyltransferase (HGPRT), an enzyme required for purine salvage reaction. Affected individuals produce excessive uric acid and exhibit neurological abnormalities.

Lethal mutation A mutation that causes the death of the cell or the organism that contains it. it prevents the organism (or embryo) from performing vital functions

Leucine zipper Structural motif seen in many DNA-binding proteins in which two α helices from separate proteins are joined together in a coiled-coil (rather like a zipper). forming a protein dimer. , A dimerization domain commonly found in DNA-binding proteins. This motif has a Leu at nearly every seventh residue, mediates the association of many types of DNA-binding proteins

Leucocyte white blood cell; a colorless blood corpuscle whose chief function is to protect the body against microorganisms causing disease by engulfing and digesting bacteria and fungi;

Leukemia Cancer of white blood cells. unrestrained proliferation of white blood cells occurs, usually accompanied by anemia, impaired blood clotting, and enlargement of the lymph nodes, liver, and spleen, characterized by abnormally large numbers of leukocytes

Leukocidin An exotoxin produced by many bacteria including the streptococci and staphylococci that kills phagocytes, neutrophils and macrophages

Leukocyte-endogenous mediator(LEM) A substance that helps raise the body temperature while decreasing iron absorption(increasing iron storage), LEM, a low-molecular-weight peptide synthesized by monocytic cells during phagocytosis, has been implicated as the host's initiator of the protein metabolic response to infection and inflammation.

Leukocytosis An increase in the number of white blood cells circulating in the blood. The increased number of leukocytes can occur abnormally as a result of an infection, cancer, or drug intake; however, leukocytosis can occur normally after eating a large meal or experiencing stress.

Leukopenia Leukopenia or leucopenia or leukocytopenia is a decrease in the white blood cells (WBC) or leukocytes present in the blood that places individuals at greater infection risks. Usually, less than 3,500 WBC/mL of blood is regarded as a low WBC count

Leukostatin An exotoxin that interferes with the ability of leukocytes to engulf microorganisms that release the toxin

Leukotriene A reaction mediator released from mast cells after degranulation that causes prolonged airway constriction, dilation and increased permeability of capillaries, increased thick mucous secretion and stimulation of nerve ending that cause pain and itching, function as local hormones, primarily to promote inflammatory and allergic reactions (such as the bronchial constriction' of asthma).

Levorotatory . Rotating the plane of polarized light counter-clockwise from the point of view of the observer: the opposite of dextrorotatory.

LHC A complex of protein molecules found in the thylakoid membrane of chloroplasts that captures and transfers light energy to the photochemical reaction center. Light-harvesting complexes are found in a wide variety among the different photosynthetic species., A pigment-containing membrane protein that collects light energy and transfers it to a photosynthetic reaction center.

Library With respect to molecular genetics, a large collection of random cloned DNA fragments from a given organism, sometimes representing the entire nuclear genome.

Lichen -A phyto organism in a symbiosis co-existence between a fungus and an alga or a cyanobacterium

Ligand any molecule that binds to a specific site on a protein or other molecule In general, a small molecule that binds specifically to a larger one-for example, a hormone that binds to a receptor. The

term can also be used to mean a chemical species that forms a coordination complex with a central atom, which is usually a metal atom, - Carbohydrate-specific binding proteins projecting from prokaryotic cells; used for adherence

Ligand-gated channel. a protein channel that opens and closes in response to signals, such as binding of a ligand (*ligand-gated c.*) or changes in the electric potential across the cell membrane (*voltage-gated c.*) .

. **Ligase** Enzyme that joins together (ligates) two molecules in an energy-dependent process. DNA ligase, for example, joins two DNA molecules together end to end through phosphodiester bonds, An enzyme that catalyzes bond formation coupled with the hydrolysis of ATP.

Ligation. The joining together of two molecules such as two DNA segments.

Light chain smaller of the two identical pairs of chains constituting immunoglobulin molecules One of the smaller polypeptides of a multi subunit protein such as myosin or immunoglobulin.

Light chain Light dependent reaction the part of photosynthesis in which light energy is used to excite electrons from chlorophyll which are then used to generate ATP and NADPH

LIGHT MICROSCOPY the use of any type of microscope that uses visible light to make specimens observable

Light reaction – The series of biochemical reactions in photosynthesis that require light energy that is captured by light-absorbing pigments (such as chlorophyll) to be converted into chemical energy in the form of ATP by photophosphorylation and the reduction of NADP⁺ to NADPH via the oxidation of water **Light reactions** The photosynthetic subprocesses that depend *directly* on light energy; specifically, the synthesis of ATP..

Light repair (also called photoreactivation) Repair of DNA dimers by a light-activated enzyme

Limited proteolysis. A technique in which a polypeptide is incompletely digested by proteases

Limnetic zone - The surface zone of an inland body of water away from the shore.

Limulus amoebocyte lysate (LAL) assay- A test to detect the presence of bacterial endotoxins.

LINE (long interspersed nuclear element) : A type of genome-wide repeat, often with transposable activity, A copy of a functional gene which has no promoter, no introns and which, consequently, is not itself transcribed. LINEs are cDNA copies of functional genes present in the same genome

Lineage analysis Tracing the ancestry of individual cells in a developing embryo.

Lineweaver-Burk plot A plot that allows one to derive the rate constant k_{cat} and the Michaelis constant K_M for an enzyme-catalyzed reaction. It is constructed by measuring the initial reaction rate V_{at} various substrate concentrations $[S]$ and plotting the values on a graph of $1/V$ versus $1/[S]$.

Lineweaver-Burk plot. A graph of a rearrangement of the Michaelis-Menten equation to a linear form that permits the determination of K_m and V_{max} . Also called a double-reciprocal plot.

Linkage The physical association between two genes that are on the same chromosome, (1) mutual effect of the binding of one ligand on the binding of another that is a central feature of the behavior of allosteric proteins. (2) Co-inheritance of two genetic loci that lie near each other on the same

chromosome. The closer together the two loci, that is, the greater the linkage, the lower the frequency of recombination between them.

Linkage analysis :The procedure used to assign map positions to genes by genetic crosses.

Linkage map A map showing the arrangement of genes on a chromosome; it is constructed by measuring the frequency of recombination between pairs of genes.

Linker DNA : The DNA that links nucleosomes: the "string" in the "beads-on-a-string" model for chromatin structure. The ~55-bps segment of DNA that links nucleosome core particles in chromatin

Linker histone : A histone, such as H1, that is located outside of the nucleosome core octamer.

Linking number (L) The total number of times the two strands of an covalently closed, circular DNA helix cross each other by means of either twist or writhe; this equals the number of times the two strands are interlinked. It reflects both the winding of the native DNA helix and the presence of any supercoiling; it cannot be changed without breaking covalent bond

Linking number (L). The number of times that one strand of a covalently closed circular double-stranded DNA winds around the other: it cannot be changed without breaking covalent bond

Lipase An exoenzyme that catalyzes the cleavage of fatty acids from the glycerol moiety of a triglyceride.

Lipid i) A molecule composed of glycerol and fatty acids. ii) Organic molecule that is insoluble in water but tends to dissolve in nonpolar organic solvents. A special class, the phospholipids, forms the structural basis of biological membranes, one of a group of complex, water insoluble compounds, Any member of a broad class of biological molecules that are largely or wholly hydrophobic and therefore tend to be insoluble in water but soluble in organic solvents such

Lipid -

Lipid A toxic substance found in the cell wall of a Gram-negative bacteria

Lipid bilayer A membrane structure that can be formed by amphipathic molecules in an aqueous environment; it consists of two back-to-back layers of molecules, in each of which the polar head groups face the water and the nonpolar tails face the center of the membrane. The fabric of cellular membranes are lipid bilayers.

Lipid raft . A small semicrystalline region of the plasma membrane enriched in sphingolipids and cholesterol.

Lipid-linked protein. A protein that is anchored to a biological membrane via a covalently attached lipid such as a farnesyl, Geranylgeranyl, palmitoyl or glycosylphosphatidylinositol group.

Lipopolysaccharide (LPS)- i)Any of a class of conjugated polysaccharides consisting of a polysaccharide combined with a lipid consisting of a lipid and a polysaccharide, forming the outer layer of gram-negative cell walls ii) Lipopolysaccharide is commonly found as major constituent of the cell walls of certain bacteria, particularly the gram-negative strains, whose function is to help stabilize the overall membrane structure and to protect it from certain chemicals. It is highly immunogenic and is a potent activator of macrophages.

Lipoprotein Any lipid-protein conjugate. Specifically refers to lipid protein association that transport lipids in the circulation. Lipoproteins which transport lipids between tissues via the blood stream are classified by their density as high, low, intermediate and very low density lipoproteins. Different kinds of lipoproteins play different roles in lipid transport

Liposome- A fatty globule that may be used to administer chemotherapeutic agents. It is a synthetic vesicle bounded by a single lipid bilayer

Lipoalysyl arm an extended structure consisting of lipoic acid linked to a lysine side chain that delivers intermediates between active sites in multienzyme complexes such as the pyruvate dehydrogenase complex

Listeriosis is an illness caused by the bacterium *Listeria monocytogenes* that is acquired by eating contaminated food. The organism can spread to the blood stream and central nervous system. During pregnancy, listeriosis often causes miscarriage or stillbirth.

Lithotroph – cell or organism that depends upon inorganic compounds as electron donors for energy production. It consumes reduced compounds (rich in electrons).

Littoral zone- The region along the shore of an inland body of water where there is considerable vegetation and where light penetrates to the bottom.

L-forms Irregularly shaped naturally occurring bacteria with defective cell walls

Liquid chromatography: An analytical method used to separate a mixture of substances based on the differential distribution of the substances between a stationary phase and a liquid mobile phase. A very effective technique to separate substances that are nearly identical

Loiasis Tropical eye disease caused by the filarial worm *Loa loa*

Lobar pneumonia Type of pneumonia that affects one or more of the five major lobes of the lungs

Local infection An infection confined to a specific area of the body where pathogens are limited to a small area of the body.

Local mediator Secretes a signal molecule that acts as a short range on adjacent cells.

Localized anaphylaxis An immediate (Type 1) hypersensitivity restricted to only some tissues/organs resulting in, e.g., reddening of the skin, watery eyes, fever, asthma, hives etc

Locus The location of a gene on a chromosome. Different alleles of the same gene all occupy the same locus.

Locus control region (LCR): A DNA sequence that maintains a functional domain in an open active configuration

Lod score: A statistical measure of linkage as revealed by pedigree analysis

Log phase Second of four major phases of the bacterial growth curve, in which cells divide at an exponential or logarithmic rate

Logarithm (log) -Power to which a base number is raised to produce a given number.

Long patch repair : A nucleotide excision repair process of Escherichia coli that results in excision and resynthesis of upto 2kb of DNA

Long terminal repeats (LTRs) A pair of direct repeats several hundred base pairs long that are found at either end of a retroviral genome. They are involved in integration into the host genome and in viral gene expression.

Long-term potentiation Long-lasting increase (days to weeks) in the sensitivity of certain synapses in the hippocampus. Induced by a short burst of repetitive firing in the presynaptic neurons.

Lophotrichous Having two or more flagella at one or both ends of a bacterial cell

Loss-of-function mutation : A Mutation that reduces or abolishes a protein activity.

Low barrier hydrogen bond an unusually short and strong hydrogen bond that forms when the donor and acceptor groups have nearly equal p^k value so that the hydrogen is equally shared between them

Low temperature long time(LTLT) pasteurization (also called holding method) procedure in which milk is heated to 62.9°C for at least 30 minutes

Low-angle neutron scattering A set of techniques that can be used to find the size of a particle in solution or to find the size or spacing of internal regions that can be distinguished by different neutron scattering power, such as the protein and nucleic acid components of a nucleoprotein particle or labeled proteins within a multisubunit complex.

Low-density lipoprotein (LDL) A type of lipoprotein particle composed of a single protein molecule and many esterified cholesterol molecules together with other lipids. Its functions mainly to distribute cholesterol from the liver to other tissues..

LTR element : A type of genome-wide repeat typified by the presence of long terminal repeats (LTRs).

Luciferase -An enzyme that accepts electrons from flavoproteins and emits a photon of light.

Lumen Cavity enclosed by an epithelial sheet (in a tissue) or by a membrane (in a cell).

Luminescence process in which absorbed light rays are emitted at longer wavelength

Lung surfactant. A protein and lipid mixture that prevents collapse of the lung alveoli on the expiration of air

Lyase. An enzyme that catalyses the elimination of a group to form a double bond.

Lymphoid organ Organs involved in the production or function of lymphocytes, such as thymus, spleen, lymph nodes, and tonsils.

Lymph Colorless fluid derived from blood by filtration through capillary walls. Carries lymphocytes in a special system of ducts and vessels-the lymphatic vessels.

Lymph node an encapsulated globular structure located along the routes of the lymphatic vessels that helps clear the lymph of microorganism

Lymphangitis symptom of septicemia in which red streaks due to inflamed lymphatic appear beneath the skin, - Inflammation of lymph vessels.

Lymphatic system body system closely associated with the cardiovascular system that transports lymph in lymphatic vessels through body tissue and organs, performs important function in host defenses and specific immunity

Lymphatic vessel vessels that returns lymph to the blood circulation system

Lymphilization the drying of a material from the frozen state: freeze drying

Lymphocyte i) A white blood cell involved in specific immune responses ii) a leukocyte responsible for the specificity of adaptive immune responses. There are two main types: B cells, which produce antibody, and T cells, which interact directly with other effector cells of the immune system and with infected cells. T cells develop in the thymus and are responsible for cell-mediated immunity. B cells develop in the bone marrow in mammals and are responsible for the production of circulating antibodies iii) Types of white blood cells that involved in specific immune responses. .Mammalian B lymphocytes develop in the bone marrow and T lymphocytes in the thymus.

Lymphogranuloma nodule a small ,unencapsulated aggregation of lymphatic tissues that develops in many tissues, especially the digestive, respiratory and urogenital tracts, collectively called gut-associated lymphatic tissue(GALT); they are the body's main sites of antibody production

Lymphoid stem cell a cell in the bone marrow from which lymphocytes develop

Lymphokine Any of various substances released by T cells that have been activated by antigens. They function in the immune response through a variety of actions, including stimulating the production of nonsensitized lymphocytes and activating macrophages.

Lymphoma- Any of various usually malignant tumors that arise in the lymph nodes or in other lymphoid tissue.

Lymphophilization the creation of a stable preparation of a biological substance by rapid freezing and dehydration of the frozen product under high vacuum, a means of preservation of cultures

Lysis Disruption of the cell's plasma membrane, leading to the release of cytoplasm and the death of the cell

Lysogen the combination of a bacterium and a temperate phage, a bacterial cell whose chromosome contains integrated viral DNA

Lysogenic pertaining to a bacterial cell in the state of lysogen

Lysogenic conversion the ability of a prophage to prevent additional infections of the same cell by the same type of phage; also the conversion of a non-toxin-producing bacterium into a toxin-producing one by a temperate phage.

Lysogenic infection cycle : The type of bacteriophage infection that involves integration of the phage genome into the host DNA molecule.

Lysogeny A latent state that can be achieved by some bacteriophages, in which the phage genome is integrated into the host bacterial chromosome without lysis and few if any viral genes are expressed. The virus can subsequently be activated to replicate and lyse the cell.

Lysophospholipid. A glycerophospholipid derivative lacking a fatty acyl group at position C2 that acts as a detergent to disrupt cell membranes.

Lysosome Membrane-bounded organelle in eukaryotic cells containing digestive enzymes, which are typically most active at the acid pH found in the lumen of lysosomes, functions to digest ingested material and to recycle cell components

Lysozyme Enzyme that catalyzes the cutting of polysaccharide chains in the cell walls of bacteria, capable of lysing bacterial cell walls.

Lytic cycle the sequence of events in which a bacteriophage infects a bacterial cell, replicates and eventually causes lysis of the host cell\

Lytic infection cycle:The type of bacteriophage infection that involves lysis of the host cell immediately after the initial infection, with no integration of the phage DNA molecule into the host genome.

Lytic phage Any phage that causes host cells to lyse. Lytic phages take over the machinery of the cell to make phage components. They then destroy, or lyse, the cell, releasing new phage particles.

2 micron plasmid A naturally occurring, double stranded, circular DNA plasmid found in the yeast. Many yeast plasmid vectors are derived from the 2 μ m plasmid. Also called 2 μ m circle.

7 methyl guanosine cap A modified guanosine found at the 5' terminus of eukaryotic mRNA. A guanosine is attached to the mRNA by a 5'-5'-phosphodiester link and is subsequently methylated on atom number 7 of the guanine.

M cells Antigens and pathogens enter the body from the intestines through cells called microfold or M cells, which are specialized for this function. They are found over the gut-associated lymphoid tissue, or GALT. They may provide a route of infection for HIV.

M phase kinase (MPF) It was originally called the maturation promoting factor (or M phase-promoting factor). It is a dimeric kinase, containing the p34 catalytic subunit and a cyclin regulatory subunit, whose activation triggers the onset of mitosis.

M phase Period of the eukaryotic cell cycle during which the nucleus and cytoplasm divide; consists of mitosis and cytokinesis.

M protein A heat- and acid-resistant protein of Streptococcal cell walls and fibrils.

M13 strand The single-stranded DNA molecule that is present in the infective form of bacteriophage M13. It is used as a vector for DNA sequencing.

Mac-1 It is another name for the leukocyte integrin CD11b:CD18 [or complement receptor 2 (CR2)].

Macerate To disintegrate tissues to obtain cell dissociation by cutting, soaking or enzymatic actions.

Macrochromosome One of the larger gene-deficient chromosomes seen in the nuclei of chickens and various other species.

Macroconidium (pl. macroconidia) The larger, multicelled conidium in those fungi with smaller conidia (microconidia) or conidia of two sizes. Example: Fusarium.

Macroglobulin describes plasma proteins that are globulins of high molecular weight, including immunoglobulin M (IgM) and α 2-macroglobulin.

Macrolides Large ringed antibiotics that inhibit protein synthesis in bacteria; for example, erythromycin.

Macromolecule (macroG = large + molculusL = a little mass) A large molecule formed from the connection of a number of small molecules, having a molecular weight in the range of a few thousand to many millions; refers specifically to polysaccharides, proteins, enzymes, lipids, and nucleic acids.

Macronucleus Large, kidney bean-shaped nucleus in *Balantidium coli* (shape is not always steady).

Macronutrients (Gr. *makros*, large + L. *nutrire*, to nourish) Essential element required by plants in relatively large quantities (>0.5 millimole/l or 1000mg/kg of dry matter). These include carbon, hydrogen, sulfur, nitrogen, phosphorus, potassium, calcium, magnesium, and oxygen.

Macroparasites Relatively large parasite species, such as arthropods and worms.

Macrophage A type of white blood cell that ingests dead tissue and cells and is involved in producing Interleukin 1. Macrophages have basically the same functions as monocytes, but they carry these out in the tissues i.e., they engulf and kill microorganisms, present antigen to the lymphocytes, kill certain tumor cells, and their secretions regulate inflammation. Macrophages utilize nitric oxide (which they synthesize) to kill the microorganisms they engulf (via oxidation), and the nitric oxide also helps to regulate the immune system. In the spleen, macrophages engulf and destroy old red blood cells. When they reside in the bone marrow, they store iron and then transfer it to red blood cells. In the lungs and GI tract, they are scavengers and keep tissues clean. They also serve as a reservoir for the AIDS virus. Macrophages display chemotaxis (i.e., the sensing of, and movement toward or away from a specific chemical).

Macrophage activation factor Increases macrophages efficiency for destroying ingested cells.

Macrophage activation Resting macrophages will not destroy certain intracellular bacteria unless the macrophage is activated by a T cell. Macrophage activation is important in controlling infection and also causes damage to neighboring tissues.

Macrophage chemotactic factor Attracts macrophages to infection site.

Macrophage colony stimulating factor (M-CSF) A colony stimulating factor (CSF) that stimulates production of macrophages in the body.

Macrophage mannose receptor The macrophage mannose receptor is highly specific for certain carbohydrates that occur on the surface of some pathogens but not on host cells.

Macrophage migration inhibiting factor Prevents macrophages from leaving infection site.

Macrophyte A rooted aquatic plant. Example: water hyacinths or duckweed.

Macropinocytosis A process in which large amounts of extracellular fluid are taken up in single vesicles. This is one means of antigen uptake and is carried out by dendritic cells.

Macroprojectile It is a macroscopic object that can be accelerated to high velocity, which in turn accelerates the desired microprojectiles placed on its surface.

Macropropagation Production of plant clones from growing parts.

Macrorestriction map Map depicting the order of and distance between sites at which restriction enzymes cleave chromosomes.

Macular Pertaining to lesions which are flat and which are often only detected because of a change in color or texture of the lesion from surrounding, normal tissue.

Mad cow disease Transmissible spongiform encephalopathy disease of the brain of cattle, caused by prions.

MadCAM-1 is the mucosal cell adhesion molecule-1 or mucosal addressin that is recognized by the lymphocyte surface proteins L-selectin and VLA-4, allowing specific homing of lymphocytes to mucosal tissues.

MADS box A DNA-binding domain found in several transcription factors involved in plant development.

Madura foot Also called as maduromycosis. It is a tropical disease caused by a variety of soil organisms (fungi and actinomycetes) that often enter the skin through bare feet.

Magainins These are antimicrobial, amphipathic peptides that lyse (burst) certain cells upon contact. Magainins are selective against bacteria, fungi, and protozoa cells. The word magainin comes from the Hebrew word for “shield” and was discovered within frog skin tissues by Michael Zasloff in 1987.

Magic bullet First coined by Paul Ehrlich in 1905, it initially referred only to antibodies (e.g., because antibodies seek their own target, without damaging other nearby tissues). Now this term is also applied to immunotoxins and other immunoconjugates (i.e., toxic or pharmacological molecules which are “attached” to an antibody that “steers/guides” the toxic or pharmacological molecule to the intended “target” in the body such as a tumor).

Magnetic activated cell sorting (MACS) It is a trademark name for a method for separation of various cell populations depending on their surface antigens (CD molecules). The MACS method allows cells to be separated by incubating with magnetic nanoparticles coated with antibodies against a particular surface antigen. This causes the cells expressing this antigen to attach to the magnetic nanoparticles. Afterwards the cell solution is transferred on a column placed in a strong magnetic field. In this step, the cells attached to the nanoparticles (expressing the antigen) stay on the column, while other cells (not expressing the antigen) flow through. With this method, the cells can be separated positively or negatively with respect to the particular antigen(s).

Magnetic particles Refers to various tiny pieces of naturally magnetic materials, that are bonded (attached) to antibodies (e.g., monoclonal antibodies that are specific to a particular type of cell). These can then be mixed with a large population of many cell types (crude tissue samples, cells grown in a vat/reactor, etc.), where the magnetic antibodies will attach themselves to only the desired cells, then the desired cells are separated out using a magnetic field (and the magnetic particles/antibodies are subsequently removed from those cells).

Magnetic resonance imaging (MRI), nuclear magnetic resonance imaging (NMRI), or magnetic resonance tomography (MRT) is a medical imaging technique used in radiology to visualize internal structures of the body in detail. MRI makes use of the property of nuclear magnetic resonance (NMR) to image nuclei of atoms inside the body. An MRI (magnetic resonance imaging) scan is a imaging test that uses powerful magnets and radio waves to create pictures of the body. It does not use radiation (x-rays).

Magnetosome Small membraneous vesicles where magnetite (Fe_3O_4) is stored in magnetotactic bacteria. They are nearly constant in size and exhibit magnetotaxis.

Magnetotactic bacteria Bacteria that can orient themselves in the earth's magnetic field due to the presence of magnetosomes.

Magnetotaxis Movement toward the magnetic poles due to the presence of magnetosomes.

Maintainer line Line used for maintaining a cytoplasmic male sterile line in plants. It has the same nuclear genotype as the male sterile line.

Maintenance approach One of three approaches for making fertilizer recommendations which sets soil test level goals for specific nutrients and then recommends fertilizer to build the soil to those

nutrient goals. The maintenance approach emphasizes maintaining the soil fertility level at or above the point of the economic maximum yield.

Maintenance methylase Adds a methyl group to a target site that is already hemimethylated.

Maintenance methylation Addition of methyl groups to positions on newly synthesized DNA strands that correspond with the positions of methylation on the parent strand.

Major basic protein Eosinophils can be triggered to release their major basic protein, which can then act on mast cells to cause their degranulation.

Major groove (of DNA) Larger of the two grooves along the surface of B-form of the DNA double helix which is 22 Å wide.

Major histocompatibility complex (MHC) A cluster of genes (approximately 3,000 Kb) on human chromosome 6 or mouse chromosome 17, coding for three classes of cell surface proteins important in antigen presentation to T cells. It allows the immune system to distinguish foreign or "non-self" from "self". A better term is histoglobulin. These are the antigens that must be matched between donors and recipients during organ and tissue transplants to prevent rejection. MHC I proteins (located on the surface of nearly all cells) present foreign epitopes (i.e., fragments of antigens that have been ingested; peptides) to cytotoxic T cells (killer T cells). MHC II proteins (located on the surface of immune system cells and phagocytes) present foreign epitopes to helper T cells, and MHC III proteins are components of the complement cascade.

Malabsorptive diarrhea An increase in the total number or volume of stools due to a decrease in the absorption of nutrients (especially fats) in the small intestine.

Malaria (mal' arialt, for mala aria = bad air) Potentially fatal human disease caused by the protozoan parasite *Plasmodium*, which is transmitted by the bite of an infected female mosquito (Anopheles Mosquito).

Malarial pigment: Composed of heme and excess protein left over from the metabolism of hemoglobin; will appear as a brownish pigment after Giemsa staining (*Plasmodium* spp.).

Malate-aspartate shuttle A metabolic circuit that uses the malate and aspartate transporters and the interconversion of malate, oxaloacetate, and aspartate to ferry reducing equivalents into the mitochondrion.

MALDI-TOF-MS Matrix-Associated Laser Desorption Ionization Time of Flight Mass Spectrometry. A mass spectrometry methodology/technology that can establish, in seconds, the identity, purity, etc. of a sample of proteins, oligonucleotide, or (poly) peptides. Also the identification of gram-positive microorganisms, or characterization of genetic materials (DNA, RNA, etc.) on hybridization surfaces. MALDI-TOF utilizes measurement of the time for particles (e.g., proteins) to transit a specific distance after being "dislodged" from ("adhered") surface by specific amount of energy to precisely determine the molecular weight (of proteins, etc.).

Male sterility Absence of functional male gametes (pollen grains in plants, sperm in animals).

Malic acid A C-4 acid that is oxidized by the reduction of NAD⁺ to NADH in the eighth step of the Krebs cycle.

Malignant (malignus = of an evil nature) Describes tumors and tumor cells that are invasive and/or able to undergo metastasis. A malignant tumor is a cancer.

Malignant tertian malaria Malaria caused by *Plasmodium falciparum*.

Malolactic fermentation Conversion of malic acid to lactic acid by lactic acid bacteria.

Malonylation Conjugation of a glucose conjugate of xenobiotic phenolic glucosides to malonyl in the presence of malonyl-CoA and malonyl-CoA-transferase; considered a Phase III reaction or secondary conjugation. Occurs mainly in *Arabidopsis* and tobacco.

Malt extract A mixture of organic compounds from malt, used as a culture medium adjunct.

Malt Germinated barley grains containing maltose and amylase.

Maltase An enzyme which hydrolyzes maltose to glucose. In mammals, it is produced in the crypt of Lieberkuhn in the small intestine and is present in the succus entericus. Maltase is also present in many seeds.

Malted Referring to cereal grains that are partially germinated to increase the concentration of starch digesting enzymes.

Malting Germination of starchy grains resulting in glucose and maltose production. It is a process of generating starch-degrading enzymes in grain by allowing it to germinate in a humid atmosphere.

Maltose (C₁₂H₂₂O₁₁) A hard, crystalline, soluble, reducing sugar, made up of two molecules of glucose; less sweet than cane sugar; formed in malt by the action of the enzyme diastase on starch; also known as maltobiose or malt sugar.

Mammal Any animal of the class Mammalia, a group often regarded as the most highly evolved animals; characterized by the presence of hair, a diaphragm used in aerial respiration, a four-chambered heart, a well-developed cerebral cortex, the ability to maintain a constant body temperature, a permanent set of teeth and mammary glands in females.

Mammalian artificial chromosome An artificial chromosome assembled through the juxtaposition of three kinds of DNA elements: a centromere, several DNA of replication origins, and two telomeric repeats; the resulting structure can carry and express one or more selected genes (transgenes), introduced for specific purposes; the minimal length is unknown, but may be of several Mb.

Mammalian cell culture Technology to artificially cultivate cells, of mammal origin, in a laboratory or production-scale device (i.e., in vitro). Can be either a batch or continuous process device. The first mammalian cell culture was performed by a neurobiologist named R. G. Harrison in 1907 to grow nerve cells from this spinal cord tissue.

Management of farm animal genetic resources The sum total of technical, policy and logistical operations involved in understanding (characterization), using and developing (utilization), maintaining (conservation), accessing, and sharing the benefits of animal genetic resources.

Mannan A polysaccharide component of yeast cell walls.

Mannan binding lectin (MBL) Also called mannan-binding protein, it binds to mannanose residues. It can opsonize pathogens bearing mannanose on their surfaces and can activate the complement system via the mannan-binding lectin pathway (MB-lectin pathway) an important part of innate immunity.

Mannan-binding lectin pathway, MB-lectin pathway In this pathway, mannanose-binding lectin binds to mannanose, glucose or other sugars with 3- and 4-OH groups placed in the equatorial plane, in terminal positions on carbohydrate or glycoprotein components of microorganisms including bacteria such as *Salmonella*, *Listeria*, and *Neisseria* strains. Fungal pathogens such as *Candida albicans* and *Cryptococcus neoformans* as well as some viruses such as HIV-1 and Respiratory syncytial virus (RSV) are bound by MBL

Mannan oligosaccharides (MOS) A family of oligosaccharides that can be produced by man in commercial quantities via certain yeast cells. When consumed (e.g., by humans or monogastric livestock such as

swine or poultry), mannose sugars in the MOS stimulate the liver to secrete the mannose-binding protein. Mannose-binding protein enters the digestive system and binds to the (mannose-containing) capsule (surface membrane) of pathogenic bacteria. That binding to pathogens triggers the immune system's complement cascade to combat those pathogenic bacteria. Consumption of mannanoligosaccharides by mammals also causes macrophages to move toward the gastrointestinal tract (in body's tissues), where those macrophages eliminate some pathogens (i.e., growing/reproducing in the gastrointestinal tract).

Mannitol ($C_6H_{14}O_6$; f.w. 182.17) A sugar alcohol widely distributed in plants. Mannitol is commonly used as a nutrient and osmoticum in suspension medium for plant protoplasts.

Mannose ($C_6H_{12}O_6$; f.w. 180.16) A hexose component of many polysaccharides and mannitol. Mannose is occasionally used as a carbohydrate source in plant tissue culture media.

Mannose-6-phosphate (M6P) Mannose that is phosphorylated on carbon number 6. It acts as a signal that identifies lysosomal proteins.

Mantel test A test that computes the linear correlation between two proximity matrices (dissimilarity or similarity), used in phenetics to test whether results from different analyses of the same taxa are similar or different.

Mantle zone The follicular mantle zone is a rim of B lymphocytes that surrounds lymphoid follicles. The precise nature and role of mantle zone lymphocytes have not yet been determined.

Mantoux test A tuberculin skin test.

Map A diagram showing the ordered arrangement of genes or molecular markers in a genome, indicating the relative positions and distance between the markers and loci. Most maps are genetic maps based on the percentage recombination. Some maps are cytological maps based on the arrangement of chromosomal regions, while others are physical maps based on the amount of DNA between markers and loci. Physical mapping is usually performed by the use of *in situ* hybridization of cloned DNA fragments to metaphase chromosomes.

Map based cloning It is a method for gene isolation. It permits the isolation of any allele which can be genetically mapped. This excludes quantitative trait loci (QTLs). The strategy is to genetically map an allele of a target gene near previously isolated DNA fragments, typically RFLP markers. Then the region of the genome containing the gene is isolated and sub-fragments are used to complement the mutation.

Map distance (map unit) The standard measure of distance between loci, expressed in centiMorgans (cM). It is proportional to the frequency of recombination between two genes. One map unit (1cM) corresponds to a recombination frequency of 1%. For small recombination fractions, map distance equals the percentage of recombination (recombination frequency) between two genes. $1\% \text{ recombination} = 1 \text{ cM}$.

Mapped markers Molecular markers with known chromosomal locations.

Mapping function A mathematical expression relating observed recombination fraction to map distance expressed in centiMorgans. Two common mapping functions are those developed by Haldane and Kosambi. In both functions, the relationship between recombination fraction and map distance is approximately linear for recombination fractions less than 10%; as recombination fraction increases above 10% (up to its maximum of 50%), map distance is increasingly greater than recombination fraction.

Mapping population The group of related organisms used in constructing a genetic map.

Mapping reagent A collection of DNA fragments spanning a chromosome or the entire genome and used in sequence tagged site mapping.

Marek's disease An infectious lymphoma of chickens caused by a *herpesvirus* known as Marek's disease virus. Some evidence suggests that a type C RNA virus may also be involved. The disease can be prevented by vaccination with a turkey herpes virus that is immunologically similar to Marek's disease virus but not pathogenic in either species.

Marginal value theorem A conceptual optimal foraging model proposing that an animal should stay in a food patch until the rate of energy gain in that patch has declined to the average rate for the habitat, then depart for another patch.

Marginal zone The marginal zone of the lymphoid tissue of the spleen lies at the border of the white pulp. It contains a unique population of B cells, the marginal zone B cells, which do not circulate and are distinguished by a distinct set of surface proteins.

Margination The process by which phagocytes stick to the lining of blood vessels.

Mark recapture An approach to estimating population size in which a subset of the individuals in a population are captured, marked, and released; after a suitable period of time, individuals are then captured again, and the proportion of marked individuals found in the second capture is used to estimate the population size.

Marker (DNA marker) A DNA fragment of known size used to calibrate an electrophoretic gel.

Marker (DNA sequence) A specific sequence of DNA that is virtually always associated with a specified trait, because of "linkage" between that DNA sequence (the "marker") and the gene(s) that cause that particular trait. Such markers have been utilized to aid/speed up the process of plant (e.g., crop) breeding since the mid-1970s, via Marker Assisted Selection.

Marker (genetic marker) A trait that can be observed to occur or not to occur in an organism such as, e.g., bacteria or plant(s). Genetic markers include such traits as: expression of luciferase-catalyzed bioluminescence in leaf cells (causing leaves to glow when illuminated by certain light sources); resistance to specific antibiotics; the nature of the cell wall and capsule characteristics; requirements for a particular growth factor; and carbohydrate utilization, to mention a few. For example, if a culture of dividing (growing) bacteria that is not resistant to a particular antibiotic (i.e., lacks the trait of antibiotic resistance) is exposed to only the DNA isolated from bacteria that are resistant to the antibiotic, then a fraction of the cells exposed will directly incorporate this trait (some DNA) into their genome, hence acquiring the trait.

Marker A "landmark" that can be localized to a specific region of the genome. An identifiable DNA sequence that facilitates the study of inheritance of a trait or a gene. Such markers are used in mapping the order of genes along chromosomes and in following the inheritance of particular genes. Genes closely linked to the marker will generally be inherited with it. Markers must be readily identifiable in the phenotype, for instance by controlling an easily observable feature (such as eye colour) or by being readily detectable by molecular means, e.g., microsatellite markers.

Marker assisted introgression The use of DNA markers to increase the speed and efficiency of introgression of a new gene or genes into a population. The markers will be closely linked to the gene(s) in question.

Marker assisted selection (MAS) Use of genetic markers (especially biochemical or DNA markers) to increase the response to selection in a population, for selection of a linked characteristic, trait, or

disease associated gene. MAS have been utilized in many plant (e.g., crop) breeding and animal breeding programs.

Marker gene A gene of known function or known location, used for marking marker-assisted selection or genetic studies. Two main classes of marker genes have been used in the genetic modification of plants: selectable and screenable marker genes. A gene for a trait such as antibiotic resistance that enables technicians to identify cells that have been successfully transformed.

Marker index A way to assess the comparative degree of information provided by different molecular marker systems, as assessed by the product of heterozygosity and multiplex ratio.

Marker peptide A portion of fusion protein that facilitates its identification or purification.

Marrow The soft tissue that fills the cavities of most bones and is the source of red blood cells.

Mash Malted grain that is crushed and mixed with hot water.

MASP-1, MASP-2 The components of the MB-lectin pathway of complement activation include two serine proteases, MASP-1 and MASP-2, that bind to mannan-binding lectin and play the same role in cleaving C4 and C2 to form C4b2a, a C3 convertase.

Mass extinction An event in which a large proportion of Earth's species are driven to extinction worldwide in a relatively short time. Example: dinosaur

Mass flow Process by which a dissolved or suspended molecule is moved with movement of the solvent.

Mass In chemistry, the total number of protons and neutrons in the nucleus of an atom approximately equal to the atomic weight.

Mass selection As practised in plant and animal breeding, the choosing of individuals on the basis of individual phenotypes. Their seed is composited to raise the next generation.

Mass spectrometry An analytical technique for determining the molecular mass from the velocity of motion of ions in a vacuum. The method is used for identifying molecules by measuring the mass-to-charge ratios of molecular ions in the gas phase. It can be used to determine the molecular weights (mass) of proteins and nucleic acids, the sequence of (composition and order of amino acids comprising) protein molecules, the chemical composition of virtually any material, and the rapid identification of intact gram-negative and gram-positive microorganisms (the latter, using matrix assisted laser desorption ionization time of flight mass spectrometry).

Massive parallel sequencing is a term used to describe several revolutionary approaches to DNA sequencing, the so-called next-generation sequencing (NGS) technologies or second generation sequencing. They use miniaturized and parallelized platforms that allow to simultaneously sequence one million to several hundred millions of typically short segments (50-400 bases) from amplified DNA clones.

Mast cell A type of connective tissue cell adjoining blood vessels throughout the body. They are present most abundantly in the submucosal tissues and the dermis. It secretes histamine, heparin, and other biologically active products and participates in immediate type hypersensitivity reactions and in the inflammatory response. When two IgE molecules of the same antibody "dock" at adjacent receptor sites on a mast cell, then the two IgE molecules capture an allergen (e.g., a particle of pollen) between them, a chemical-energetic signal is sent to the interior (inside mast cell) portion of receptor molecules, which causes that interior portion of molecule to change (i.e., transduction). That signal transduction causes a protein named "syk" to set off a chemical chain reaction inside the mast cell; thereby causing that mast cell to release leukotrienes, histamine, serotonin, bradykinin,

and "slow reacting substance." Release of these chemicals into the body causes the blood vessels to become more permeable (leaky) and causes the nose to run, and itchy and watery eyes. These chemicals also cause smooth muscle contraction, causing sneezing, breath constriction, coughing, wheezing, etc. Mastocytosis indicates an overproduction of mast cells.

Mastigophoran A flagellate protozoan such as *Giardia*.

Maternal effect An effect attributable to some aspect of the mother of the individual being evaluated. For example A *Drosophila* gene that is expressed in the parent and whose mRNA is subsequently injected into the egg, after which it influences development of the embryo.

Maternal gene is expressed by the mother during oogenesis. A maternal somatic gene is expressed in a somatic cell of the mother, whereas a maternal germline gene is expressed in the germline (e.g. the oocyte).

Maternal inheritance Inheritance controlled by extrachromosomal (cytoplasmic) factors that are transmitted through the egg.

Mating system Scheme according to which individuals or lines are mated to produce sexual progeny.

Mating type is a property of haploid yeast that makes it able to fuse to form a diploid only with a cell of the opposite mating type. The equivalent of male and female for a eukaryotic microorganism.

Mating type locus (MAT locus) In budding yeast chromosome, the locus that determines the mating type (α or a) of the haploid yeast cell.

Mating type switching The ability of yeast cells to change from a α to α mating type, or vice versa, by gene conversion.

Matrix potential A water potential component, always of negative value, resulting from capillary, imbibitional and adsorptive forces. The energy associated with attractive forces on the surfaces of large molecules inside cells or on the surfaces of soil particles.

Matrix (1) The aqueous contents of a cell or organelle (for example the mitochondria) with dissolved solutes. (2) A two-dimensional (or more) table used for storing data.

Matrix assisted laser desorption ionization (MALDI) is a soft ionization technique used in mass spectrometry, allowing the analysis of biomolecules (biopolymers such as DNA, proteins, peptides and sugars) and large organic molecules (such as polymers, dendrimers and other macromolecules), which tend to be fragile and fragment when ionized by more conventional ionization methods. It is similar in character to electrospray ionization both in relative softness and the ions produced (although it causes many fewer multiply charged ions). MALDI techniques typically employ the use of UV lasers such as nitrogen lasers (337 nm) and frequency-tripled and quadrupled Nd:YAG lasers (355 nm and 266 nm respectively). The term matrix-assisted laser desorption ionization (MALDI) was coined in 1985 by Franz Hillenkamp, Michael Karas and their colleagues. Koichi Tanaka of Shimadzu Corp was able to ionize biomolecules as large as the 34,472 Da protein carboxypeptidase-A. Tanaka received one-quarter of the 2002 Nobel Prize in Chemistry for demonstrating that, with the proper combination of laser wavelength and matrix, a protein can be ionized.

Matrix assisted laser desorption ionization time-of-flight (MALDI-TOF) A type of mass spectrometry used in proteomics. MALDI-TOF instrument or reflectron is equipped with an "ion mirror" that reflects ions using an electric field, thereby doubling the ion flight path and increasing the resolution.

Matrix associated region (MAR) An AT-rich segment of a eukaryotic genome that acts as an attachment point to the nuclear matrix. It is also known as a scaffold attachment site (SAR).

Matrix metalloproteinases (MMP) A family of enzymes that contain the zinc metal ion (Zn^{2+}) at their active sites. Among this family are the collagenases.

Matrix space (1) Central subcompartment of a mitochondrion, bounded by the inner mitochondrial membrane. (2) The corresponding compartment in a chloroplast which is more commonly known as the stroma.

Maturase A protein, coded by a gene in an intron, thought to be involved in splicing.

Maturation (1) The formation of gametes or spores. (2) The process by which complete virions are assembled from newly synthesized components in the replication process.

Mature B cells B cells that have acquired surface IgM and IgD and have become able to respond to antigen.

Maurer's dots or clefts Irregular dots occur infrequently in red blood cells infected with *Plasmodium falciparum* (dots tend to be more blue after Giemsa staining than are the Schuffner's dots).

Maximal velocity (V_{max}) In an enzyme-catalyzed reaction it is the limiting value of the initial velocity of a reaction as the substrate concentration is increased at constant enzyme concentration. Occurs when the enzyme is saturated with substrate.

Maximum contaminant limit (MCL) The highest level of a contaminant that is allowed in drinking water.

Maximum growth temperature The highest temperature at which a species can grow.

Maximum likelihood A set of methods used to construct cladograms based on certain evolutionary models of character state changes.

Maximum parsimony method A method for construction of phylogenetic trees.

Maximum residue level (MRL) Term used for an officially established upper allowable limit of a given compound (e.g., a synthetic hormone) in a particular product, such as meat.

Mckusick number A numerical value used to indicate the dominant, recessive or sex-linked nature of a gene.

Mcm proteins Proteins in the eucaryotic cell that bind to origin recognition complexes in DNA in early G1 and are involved in forming the pre-replicative complex.

M-cyclin Type of cyclin found in all eucaryotic cells that promotes the events of mitosis.

MEA Acronym for Multilateral Environmental Agreement; an agreement (treaty) between a number of nations intended to protect/benefit the environment.

Mean deviation In a set of observations of a series it is the arithmetic mean of all the deviations, without their algebraic signs, taken from its central value.

Mean In statistics, the arithmetic average of a set of observations; the sum of all measurements or values in a sample divided by the sample size.

Mean residence time The amount of time an average molecule of an element spends in a pool, such as a plant or the soil, before leaving it.

Meander A simple topology of a beta-sheet where any two consecutive strands are adjacent and antiparallel.

Mebendazole An anthelmintic agent that blocks glucose uptake by parasitic roundworms.

Mechanical analysis The laboratory procedure used to identify soil separates.

Mechanical stage Attachment to a microscope stage that holds the slide and allows precise control in moving the slide.

Mechanical transmission The process by which arthropods transmit infections by carrying pathogens on their feet and other body parts.

Mechanical weathering The physical breakdown of rocks into progressively smaller particles without a chemical change.

Mechanism based inhibitor An enzyme inhibitor whose action depends on the enzyme's catalytic mechanism. Typically it is a substrate analog that irreversibly modifies the enzyme at a particular step in the catalytic cycle. The molecule chemically inactivates an enzyme only after undergoing part or all of its normal catalytic reaction. Also called a suicide substrate.

Mechanosensitive channel An ion channel whose opening and closing is controlled by stimuli such as touch, sound, and changes in osmotic pressure.

Mediated transport The transmembrane movement of a substance through the action of a specific carrier protein.

Mediator is a large protein complex associated with yeast bacterial RNA polymerase II. It contains factors that are necessary for transcription from many or most promoters. It forms a contact between various activators and the C-terminal domain of the largest subunit of RNA polymerase II.

Medium (pl: media) (1) In plant tissue culture, a term for the liquid or solidified formulation upon which plant cells, tissues or organs develop. (2) A mixture of nutritional substances on or in which microorganisms grow. There are different types of media according to the purposes: basal medium, defined medium, complex medium, differential medium, selective medium, enriched medium, enrichment medium, etc. It may be liquid (e.g., broth) or solid (e.g., agar). Medium formulation is the particular formula for the culture medium. It commonly contains macro-elements and micro-elements (high and low salt), some vitamins (B vitamins, inositol), plant growth regulators (auxin, cytokinin and sometimes gibberellin), a carbohydrate source (usually sucrose or glucose) and often other substances, such as amino acids or complex growth factors. Some formulations are very specific in the kind of explant or plant species that can be maintained; some are very general.

Medulla (Latin, for marrow) The medulla is generally the central or collecting point of an organ. The thymic medulla is the central area of each thymic lobe, rich in bone marrow-derived antigen-presenting cells and the cells of a distinctive medullary epithelium. The medulla of the lymph node is a site of macrophage and plasma cell concentration through which the lymph flows on its way to the efferent lymphatics. Also refers to the part of the brain that controls breathing and other involuntary functions, located at the top end of the spinal cord; also called medulla oblongata.

Medulla (of a lichen thallus) Lichen body consisting of algae (or cyanobacteria) and fungi.

Megabase (Mb) (From Greek *megas*, huge, powerful) A length of DNA consisting of 10^6 base pairs (if double-stranded) or 10^6 bases (if single-stranded). $1 \text{ Mb} = 10^3 \text{ kb} = 10^6 \text{ bp}$. Thus 1Mb is 1 million base pairs of DNA and roughly equal to 1 cm.

Megabase cloning The cloning of very large DNA fragments.

Megacolon Dilation of the colon (Chagas' disease).

Megadalton (MDa) One megadalton is equal to 10^6 daltons.

Megaesophagus Dilation of the esophagus (Chagas' disease).

Megagametogenesis Production of the female gametophyte (embryosac) from megaspore (through mitosis).

Megakaryocyte Large myeloid cell with a multilobed nucleus that remains in the bone marrow when mature. It gives rise to platelets.

Megakaryocyte stimulating factor (MSF) A colony stimulating factor (protein) involved in the regulation of platelet production, white blood cell production, and red blood cell production from stem cells in bone marrow.

Megapascal (MPa) A unit of pressure; one million (10^6) pascals; 1 MPa = 10 atmospheres of pressure; a car tyre is typically inflated to about 0.2 MPa, whereas the water pressure in home plumbing is 0.2 – 0.3 MPa.

Megaspore; macropore A haploid (n) spore developing into a female gametophyte in heterosporous plants.

Megasporogenesis Production of the female spore (megaspore) from megaspore mother cell (through meiosis).

Mega-Yeast Artificial Chromosomes (mega YAC) A large (greater than 500 base pairs in length) piece of DNA that has been cloned (made) inside a living yeast cell. While most bacterial vectors cannot carry DNA pieces that are larger than 50 base pairs, and “standard” YACs typically cannot carry DNA pieces that are larger than 500 base pairs, mega YACs can carry DNA pieces (chromosomes) as large as one million base pairs in length.

Meiosis (Gr. *meioun*, to make smaller) Discovered by Edouard Van Beneden in the 1870s, it is a special cell division process by which the chromosome number of a reproductive cell is reduced to half (n) the diploid (2n) or somatic number. Two consecutive divisions occur. In the first division, homologous chromosomes became paired and may exchange genetic material (via crossing over) before moving away from each other into separate daughter nuclei (reduction division). These new nuclei divide by mitosis to produce four haploid nuclei. Meiosis results in the formation of gametes in animals or of spores in plants. It is an important source of variability through recombination.

Meiosis I and II first and second meiotic divisions.

Meiotic analysis A technique used to analyse chromosome-pairing relationships.

Meiotic drive Any mechanism that causes alleles to be recovered unequally in the gametes of a heterozygote.

Meiotic product(s) they are the gametes.

Meiotic spindle bipolar, microtubule-based structure on which chromosome segregation occurs during meiosis I and II.

Melanin A dark-brown or black pigment, as typically produced by specialised epidermal cells called melanocytes.

Melanism A condition in which excess dark pigment produces dark colour or blackness in scales, skin or plumage.

Melanocytes Cells that produce the pigment melanin which is responsible for the pigmentation of skin and hair; has a protective or camouflage function; also called melanophores.

Melanoma A type of cancer that begins in the melanocytes (the skin cells that produce pigments). It can spread to other areas of the body if not detected and treated early.

Melatonin (from mela [nin] + [sero] tonin) A hormone secreted by the pineal gland, whose removal causes the ovaries to undergo hypertrophy.

Melena Excretion of black, tarry stools containing blood that has been altered by intestinal substances.

Meleney's ulcer A chronic undermining ulcerative lesion of the subcutaneous tissue, usually caused by streptococcal infection.

Melting (of DNA) Melting DNA means to heat-denature it. When this happens, the hydrogen bonds holding the DNA molecule together in the normal way are disrupted, allowing a more random polymer structure to exist.

Melting (of substance other than DNA) To change from a solid to a nonsolid (e.g., liquid) state by the addition of heat (to the solid substance).

Melting temperature (T_m) The midpoint of the temperature range over which a double-stranded DNA or RNA molecule denatures into separate single strands. The T_m is characteristic of each DNA species and gives an indication of its base composition. DNAs rich in G:C base pairs are more resistant to thermal denaturation than A:T rich DNA since three hydrogen bonds are formed between G and C, but only two between A and T.

Membrane A barrier or a boundary layer around a cell or around a structure within a cell, made up of a double layer of phospholipids.

Membrane attack complex (MAC) Complement system proteins (5 to 9), which together make lesions in cell membranes of invading bacteria that lead to cell death.

Membrane bioreactors Bioreactors where cells grow on or behind a permeable membrane, which passes the nutrients for the cell through but retains the cells themselves.

Membrane bound ribosome Ribosome attached to the cytosolic face of the endoplasmic reticulum. The site of synthesis of proteins that enter the endoplasmic reticulum.

Membrane channel Transmembrane protein complex that allows inorganic ions or other small molecules to diffuse passively across the lipid bilayer.

Membrane cofactor of proteolysis (MOP or CD46) is a host-cell membrane protein that acts in conjunction with factor I to cleave C3b to its inactive derivative iC3b and thus prevent convertase formation.

Membrane filter A screen like material with pores small enough to retain microorganisms.

Membrane filter method Method of testing for coliform bacteria in water in which bacteria are filtered through a membrane and then incubated on the membrane surface in growth medium.

Membrane immunoglobulin B cells carry on their surfaces many molecules of membrane immunoglobulin (mlg) of a single specificity, which acts as the receptor for antigen.

Membrane potential ($\Delta\psi$) Voltage difference across a membrane due to a slight excess of positive ions on one side and of negative ions on the other. A typical membrane potential for an animal cell plasma membrane is -60 mV (inside negative relative to the surrounding fluid).

Membrane protein A protein that is associated with a membrane, rather than found free in the cell. A membrane protein may be integral (embedded or buried) in the membrane, or peripheral (attached more loosely, by interactions with either lipid or intergral membrane proteins).

Membrane skeleton The protein network that lies beneath a membrane and helps determine the cell's shape.

Membrane transport Movement of a polar solute across a membrane via a specific membrane protein (a transporter).

Membrane transporter protein A class of transmembrane proteins (i.e., protein molecules embedded in a cell's membrane, extending through both sides of the membrane) that function to transport certain molecules through the cell's membrane. Such molecules which are thus "transported" include: sugar molecules (utilized by the cell as "fuel"); inorganic ions (which catalyze certain cellular processes); polypeptides [e.g., "manufactured" in the cell's ribosome(s) and then secreted from the cell to perform some function elsewhere in the body of the organism]; anticancer drugs; antibiotics.

Membranes (of a cell) Refers to the thin "skin-like" structures that surround the exterior of a cell (i.e., plasma membrane), and also surround various specialized bodies (nucleus, mitochondria, etc.) within the cell itself (e.g., the membrane that surrounds the cell's nucleus is called the "nuclear envelope"). Membranes are lipoidal, i.e., made of fat-like material, in which proteins and protein complexes are embedded. For example, protein molecules known as receptors are embedded in the plasma membrane (i.e., the outermost membrane of the cell) and in the nuclear envelope.

Memory B cell It is a B cell that can recognize its corresponding antigen and rapidly proliferate to produce specific antibodies weeks to years after this antigen was first encountered.

Memory cells Long-lived B and T cells that mediate rapid secondary immune responses to a previously encountered antigen.

Memory response A rapid rise in antibody titer following exposure to an antigen after the primary response to that antigen.

MEMS (nanotechnology) Acronym utilized by Americans to refer to "micro-electromechanical systems" (which Europeans tend to refer to as "microsystems technology" — MST).

Menaquinones Vitamins K. 2-Methyl-3-all-tans-polyprenol-1-4-naphthoquinones possessing side chains of varying length from C5–C65. Menaquinones function as electron carriers.

Mendelian inheritance Mode of inheritance of the genetic traits expected if the gene is located in the nuclear DNA; are passed from parents to offspring. Named after Gregor Mendel, who first studied and recognized the existence of genes and this method of inheritance by breeding experiments with different varieties of peas. There are three modes of Mendelian inheritance: autosomal dominant, autosomal recessive and X-linked inheritance.

Mendelian population A natural, interbreeding unit of sexually reproducing plants or animals sharing a common gene pool.

Mendelism The theory of heredity that forms the basis of classical genetics, proposed by Gregor Mendel in 1866 and formulated in two laws.

Mendel's Laws Two laws summarizing Gregor Mendel's theory of inheritance. The Law of Segregation states that each hereditary characteristic is controlled by two 'factors' (now called alleles), which segregate and pass into separate germ cells. The Law of Independent Assortment states that pairs of 'factors' segregate independently of each other when germ cells are formed.

Meninges Thin, tough tissue surrounding the brain and spinal cord.

Meningitis Inflammation of the meninges, the membranes that cover the brain and spinal cord (e.g., bacterial meningitis).

Meningoencephalitis: Inflammation of the brain and its surrounding membranes (trypanosomiasis, malaria, Naegleria and Angiostrongylus cantonensis infections).

mEPSPS The “m” variant (of the many forms of) the enzyme 5-enolpyruvyl-shikimate-3- phosphate synthase. mEPSPS is unaffected by glyphosate- or sulfosate-containing herbicides, so introduction of the gene (coding for mEPSPS) into crop plants (e.g., corn/maize) makes those crop plants essentially impervious to glyphosate- or sulfosate-containing herbicides.

Mercaptan A compound containing an $-SH$ group.

Mericlinal Refers to a chimera with tissue of one genotype partly surrounded by that of another genotype.

Mericloning A propagation method using shoot tips in culture to proliferate multiple buds, which can then be separated, rooted and planted out.

Meristele The vascular cylinder tissue in the stem. *See* stele.

Meristem (Gr. *meristos*, divisible) A localized region of actively dividing cells in a living plant that has the capacity to produce new shoots; made up of embryonic cells capable of dividing and forming new plant parts. The principal meristems in the flowering plants occur at the tips of the stems and roots (root apical meristem and shoot apical meristem), between xylem and phloem of vascular bundles (cambium) in the cortex (cork cambium), in young leaves and, in many grasses, at the bases of internodes (intercalary meristems).

Meristem culture A tissue culture containing meristematic dome tissue without adjacent leaf primordia or stem tissue. The term may also imply the culture of meristemoid regions of plants, or meristematic growth in culture. The use of meristem tip culture is for virus elimination or axillary shoot proliferation purposes, but less commonly for callus production.

Meristem tip An explant comprising the meristem (meristematic dome) measuring less than 0.1mm in length and usually one pair of leaf primordia. Also refers to explants originating from apical meristem tip or lateral or axillary meristem tip.

Meristemoid A localized group of cells in callus tissue, characterized by an accumulation of starch, RNA and protein, and giving rise to adventitious shoots or roots.

Merodiploid An organism that is diploid for some but not all of its genes.

Merosporangium (pl. merosporangia) A cylindrical small sporangium containing a few spores in a row.

Merozoite A trophozoite of *Plasmodium* found in infected red blood cells or liver cells.

Merozygote Partial zygote produced by a process of partial genetic exchange, such as transformation in bacteria.

Meselson–Stahl experiment The experiment which showed that cellular DNA replication occurs by the semiconservative process.

Mesenchyme Immature, unspecialized form of connective tissue in animals, consisting of cells embedded in thin extracellular matrix.

Mesenteric adenitis Inflammation of mesenteric lymph nodes.

Mesentery A fold of the peritoneum that connects the intestine with the posterior abdominal wall.

Mesoderm The middle germ layer that forms in the early animal embryo and is the precursor to muscle, connective tissue, skeleton etc.

Mesodermal Adult Stem Cells Certain stem cells present within (adult) bodies of organisms, that can be differentiated (via chemical signals) to give rise to bone, muscle, and/or fat cells.

Mesophile An organism that can grow in the temperature range of 25°C (77°F) to 40°C (104°F).

Mesophilic Growing best at a moderate temperature range (25-40°C).

Mesophilic spoilage Spoilage due to improper canning procedures or because the seal has been broken.

Mesophyll (mesosG = middle + phyllonG = leaf) The photosynthetic parenchyma of a leaf, located within the epidermis. The vascular strands (veins) run through the mesophyll.

Mesosome An irregular fold in the plasma membrane of a prokaryotic cell.

Mesothelioma A malignant tumor arising in the mesothelial cells that line joints and the body cavities.

Mesotrophic Having a nutrient status that is intermediate between oligotrophic and eutrophic, usually used in reference to lakes.

Messenger RNA (mRNA) Messenger ribonucleic acid. A class of RNA molecules, each of which is complementary to one strand of DNA and which passes from the nucleus to the cytoplasm; carries the genetic message of genes from the chromosomes to the ribosomes in the cytoplasm, where the message is translated into the amino acid sequence of a polypeptide. The order of bases on mRNA specifies the amino acid sequence of a polypeptide chain.

Metabolic engineering The selective, deliberate alteration of an organism's metabolic pathway(s) via genetic engineering of the genes that define/control the organism's metabolism. Some reasons to do metabolic engineering of an organism include: • Altering cell "behavior" and organism metabolic patterns to induce production of proteins/polypeptides and/or metabolites that are desired by mankind (e.g., "golden rice"). • Altering cell "behavior" and organism metabolic patterns to induce a given organism to consume or accumulate toxic wastes or valuable materials (e.g., gold) that are present at a site in low concentration or highly dispersed. • Altering cell "behavior" and organism metabolic patterns to cure disease.

Metabolic fuel A molecule that can be oxidized to provide free energy for an organism.

Metabolic load It represents the changes in metabolic and cellular functions of the host cell due to the presence of cloned DNA.

Metabolic pathway Refers to a particular pathway [i.e., series of chemical reactions, each of which is dependent on previous one(s)] within the overall process of metabolism in an organism.

Metabolic rate The rate at which an organism carries out metabolism, and which is closely linked to temperature. The relationship between metabolic rate and temperature can be expressed in terms of a value called Q₁₀. The rate of O₂ consumption is an indicator of metabolic rate.

Metabolic turnover A measure of the rate at which already existing molecules of the given species are replaced by newly-synthesized molecules of the same type. Usually isotopic labeling is required to measure turnover.

Metabolic waste Any waste substance that is produced during the metabolism of an organism, such as nitrogen in the form of urea.

Metabolic water Water formed by a type of metabolism called catabolism in which complex molecules are broken down to release their stored energy, with water as a by-product. In certain insects and desert mammals, which feed primarily on dry seeds, the water conservation mechanisms are so efficient that metabolic water alone is sufficient to replace the normal water loss; 'free' water is not required in the diet.

Metabolism (Gr. *metabolos*, to change) The sum of all the chemical reactions (both anabolic and catabolic) that occur in a living cell. Conversion of food and water into nutrients that can be used by the body's cells, and the use of those nutrients by those cells (to sustain life, grow, etc.).

Metabolite A low-molecular-weight intermediate biological compound that is usually synthesized by an enzyme and is essential for a metabolic process. Primary metabolite is essential for normal growth, development, and reproduction. A secondary metabolite is not essential for normal growth, development and reproduction, but usually has important ecological functions. Examples include antibiotics and pigments.

Metabolome The quantitative complement of all the low molecular weight molecules (such as metabolic intermediates, hormones and other signaling molecules, and secondary metabolites) present in cells in a particular physiological or developmental state.

Metabolomics The use of genome sequence analysis for determining the capability of a cell/tissue/organisms to synthesize metabolites. Metabolomics deals with simple cell systems.

Metabonomics It deals with integrated, multicellular and biological systems, including communicating extracellular environments.

Metacentric chromosome A chromosome with the centromere near the middle and, consequently, two arms of about equal length.

Metacercaria The encysted stage of a fluke in its final intermediate host.

Metachromasia Property of exhibiting a variety of colours when stained with a simple stain.

Metachromatic granule Also called volutin. A polyphosphate granule stored by some bacteria, that exhibits metachromasia.

Metal activated enzyme An enzyme that loosely binds a metal ion, typically Na^+ , K^+ , Mg^+ or Ca^+ .

Metalloenzyme An enzyme having a metal ion as its prosthetic group such as Fe^{2+} , Zn^{2+} or Mn^{2+} .

Metalloprotein : A protein having a metal ion (zinc, iron, copper, etc.) as its prosthetic group. Those that contain a zinc atom (Zn^{2+}) are generally enzymes (thus called metalloenzymes), because that metal acts as a catalyst.

Metallothionein A protective protein that binds heavy metals such as cadmium and lead.

Metamerism Division of the body into segments; in insects, for example.

Metamodel (Methods of Bioinformatics) these refer to methods utilized to integrate data that has been independently generated/ created (and generally stored in separate database models) via independent genomics research projects, combinatorial chemistry projects, high-throughput screening projects (e.g., via biochip use), etc. Metamodel methods sometimes reveal important interrelationships that were not apparent in the individual models (i.e., created solely for the genomics project data, or created solely for the combinatorial chemistry project data etc.).

Metamorphosis An abrupt transition in form from the larval to the juvenile life cycle stage that is sometimes accompanied by a change in habitat.

Metaphase (Gr. *meta*, after + *phasis*, appearance) Stage of mitosis during which the chromosomes, or at least the kinetochores, lie in the central equatorial plane of the spindle. It is the stage following prophase and preceding anaphase.

Metaphase chromosome A chromosome at the metaphase stage of cell division, when the chromatin takes on its most condensed structure and features such as the banding pattern can be visualized.

Metaphase plate Imaginary plane at right angles to the mitotic spindle and midway between the spindle poles: the plane in which chromosomes are positioned at metaphase.

Metaphyseal Relating to the conical portion of long bones that lies between the epiphysis and diaphysis.

Metaplasia The transformation of a tissue to another form.

Metaplasia The lifeless constituents of protoplasm. Metastasis, plural metastases (Greek, for to place in another way), Spread of cancer cells from their site of origin to other sites in the body, forming new tumours there.

Metapopulation A set of spatially isolated populations linked to one another by dispersal.

Metastability For a system, the condition of being in a state that does not represent thermodynamic equilibrium but is nearly stable at the time scale of interest because progress toward equilibrium is slow.

Metastasis Spread of cancer cells from their site of origin to other sites or unaffected organs in the body.

Metaxenia Effect of pollen grains on maternal tissues of fruits.

Methanogen A methane-producing prokaryote; member of the Archaea.

Methanogenesis The biological production of methane.

Methanogenic Producing Methane.

Methanotroph An organism capable of oxidizing methane.

Methionine (met) An essential amino acid; furnishes (to organism) both labile methyl groups and sulfur necessary for normal metabolism. Found in cereal, whole grains, sesame and sunflower seeds, and yeast.

Methotrexate Also known as amethopterin. An *antimetabolite* that is a structural analog of *folic acid*. It inhibits the enzyme folic acid reductase [DHFR (dihydrofolate reductase)], and thus interferes with the synthesis of DNA and RNA.

Methyl CpG-binding protein (MeCP) A protein that binds to methylated CpG islands and may influence acetylation of nearby histones.

Methyl jasmonate (MeJA) The volatile chemical compound that results when methyl groups (CH₃) are chemically added to a molecule of jasmonic acid. Plants produce jasmonic acid and methyl jasmonate in response to many biotic and abiotic stresses (in particular, herbivory and wounding), which build up in the damaged parts of the plant. The methyl jasmonate can be used to signal the original plant's defense systems or it can be spread by physical contact or through the air to produce a defensive reaction in unharmed plants. The unharmed plants absorb the airborne MeJA through either the stomata or diffusion through the leaf cell cytoplasm. An herbivorous attack on a plant causes it to produce MeJA both for internal defense and for a signaling compound to other plants.

Methyl salicylate The volatile chemical compound that results when methyl (CH₃) are added to a molecule of salicylic acid. During 1997, Ilya Raskin showed that methyl salicylate emitted by one tobacco plant (e.g., under 'attack' by insects, fungi, bacteria, or viruses) could cause other nearby tobacco plants to "turn on" their self-defense mechanism (systemic acquired resistance).

Methylated Refers to a DNA molecule that is saturated with methyl groups (i.e., methyl submolecule groups, -CH₃, have attached themselves to the DNA molecule at all possible locations). Generally, when a DNA molecule is methylated, the genes comprising that DNA molecule are "turned off" (inactivated).

Methylation The addition of a methyl group (-CH₃) to a macromolecule, such as the addition of a methyl group to specific cytosine and, occasionally, adenine residues in DNA.

Methyloolithroph An organism capable of oxidizing organic compounds which do not contain carbon-carbon bonds; if able to oxidize methane, also a methanolithroph.

Methyltransferase (methylase) is an enzyme that adds a methyl group to a substrate, which can be a small molecule, a protein, or a nucleic acid.

MGMT (O6-methylguanine-DNA methyltransferase) An enzyme involved in the direct repair of alkylation mutations.

MHC Class I Protein The antigen-presenting molecule found on all nucleated vertebrate cells. The protein mostly presents, to CD8+ T cells, peptides that are produced by proteolytic degradation in the cytosol.

MHC class IB The MHC class IB molecules encoded within the MHC are not highly polymorphic like the MHC class I and MHC class II molecules, and present a restricted set of antigens.

MHC class II compartment, MIIC The MHC class II compartment (MIIC) is a site in the cell where MHC class II molecules accumulate, encounter HLA-DM, and bind antigenic peptides, before migrating to the surface of the cell.

MHC Class II Protein The antigen-presenting molecule found primarily on macrophages and B lymphocytes. This class of protein mostly presents, to CD4+ T cells, peptides that are produced by proteolytic degradation in the endocytic pathway.

MHC class II transactivator, CIITA The protein that activates the transcription of MHC class II genes, the MHC class II transactivator (CIITA), is one of several defective genes in the disease bare lymphocyte syndrome, in which MHC class II molecules are lacking on all cells.

MHC congenic Various specialized strains of mice are used to explore the role of MHC polymorphism in vivo. Such mice are called MHC congenic. These mice differ only at the MHC complex

MHC haplotype MHC genes are inherited in most cases as an MHC haplotype, the set of genes in a haploid genome inherited from one parent. Thus, if the parents are designated as ab and cd, then the offspring are most likely to be ac, ad, bc, or bd.

MHC molecule One of a large family of ubiquitous cell- surface glycoprotein encoded by genes of the major histocompatibility complex (MHC). They bind peptide fragments of foreign antigens and present them to T cells to induct, an immune response. They are also known as histocompatibility antigens.

MHC restricted antigen recognition, or MHC restriction, refers to the fact that a given T cell will recognize a peptide antigen only when it is bound to a particular MHC molecule. Normally, as T cells are stimulated only in the presence of self MHC molecules, antigen is recognized only as peptides bound to self MHC molecules.

MHC:peptide tetramers The development of MHC:peptide tetramers held together by fluorescent streptavidin, which has four binding sites for the biotin attached to the tail of the MHC molecule, has made it possible to stain specific T cells in any species.

MIC molecules are MHC class I-like molecules that are expressed in the gut under conditions of stress and are encoded within the class I region of the human MHC. They are not found in mice.

Micelle An aggregate of amphipathic molecules like lipids in water, in which the polar head groups (polar portion) face outward and the hydrophobic tails (nonpolar portion) face inward; no solvent is

trapped in the center. These droplets self-associate to create an “oil droplet” microenvironment. Micelles may be used to solubilize nonwater (oil) soluble or sparingly water soluble molecules in water. They may be formed by ionic or nonionic surfactants.

Michaelis-Menten kinetics A kinetic pattern in which the initial rate of an enzyme-catalyzed reaction exhibits a hyperbolic dependence on substrate concentration. **Michaelis–Menten equation** is an equation that gives the rate of an enzyme catalysed reaction in terms of the concentration of substrate and enzyme as well as two constants that are specific for a particular combination of enzyme and substrate: a rate constant, K_{cat} , for the catalytic production of product when the enzyme is saturated, and the Michaelis constant, K_M . Thus it defines the effect of substrate concentration $[S]$ on the initial velocity of an enzyme-catalyzed reaction: $V_0 = V_{max} [S] / (K_M + [S])$ where V_{max} is the limiting initial velocity obtained as the substrate concentration approaches infinity, $[S]$ is the substrate concentration, and K_M is equal to the substrate concentration at which one measures an initial velocity that is half as fast as the maximal velocity. The substrate concentration (moles/litre) at which an enzyme-catalyzed reaction proceeds at one-half of the maximum velocity (V_m) is known as **Michaelis constant (K_m)** where $K_M = (K_{-1} + K_2) / K_1$.

Micro Immunofluorescence (Micro-IF) is multiple Indirect Fluorescent Antibody (IFA). Several different substrates are arranged in specific locations on a single microscope slide well allowing a rapid, simultaneous IFA on each substrate.

Microaerobic Requiring a partial pressure of oxygen less than that of atmospheric oxygen for growth. New term for "microaerophilic."

Microaerophile An organism that grows best in an environment with less oxygen (O_2) than is normally found in air.

Microaerotolerant anaerobe An organism that grows in an anaerobic system and a microaerophilic environment (5% oxygen) but does not grow in a CO_2 incubator (15% oxygen) or in air (about 21% oxygen).

Microalgal culture Culture in bioreactors of microalgae; microalgae include seaweeds.

Microangiopathic hemolytic anemia: The destruction or breakdown of red blood cells as a result of diseases or disorders of the capillaries.

Microarray A large set of cloned array of DNA molecules on a solid matrix like piece of glass, plastic, or silicon onto which has been placed a large number of biosensors; used for parallel hybridization analysis, gene expression analysis, screen for proteins or other chemical compounds that act against a disease. Also known as the DNA Chip.

Microbe A microscopic organism; applied particularly to bacteria. The word “microbe” was coined by Monsieur Sedillot, a colleague of Louis Pasteur.

Microbial antagonism The ability of normal microbiota to compete with pathogenic organisms and in some instances to effectively combat their growth.

Microbial genetics The study of genes and gene function in bacteria, archaea, and other microorganisms. Often used in research in the fields of bioremediation, alternative energy, and disease prevention.

Microbial genetics The study of genetics in microorganisms.

Microbial mats (biofilms) Layered groups or communities of microbial populations.

Microbial physiology The cell structure, growth factors, metabolism, and genetics of microorganisms.

Microbial source tracking (MST) The process of systematically determining the original source (in a specific environment) of a microbe (e.g., the one that has caused a given disease outbreak). Some of the technologies utilized in MST include genetic fingerprinting, polymerase chain reaction (PCR), serotyping, etc.

Microbicide Any chemical that will kill microorganisms. Used synonymously with the terms biocide and bactericide.

Microbiology The science dealing with the structure, classification, physiology, and distribution of microorganisms, and with their technical and medical significance. The term microorganism is applied to the simple unicellular and structurally similar representatives of the plant and animal kingdoms. With few exceptions, the unicellular organisms are invisible to the naked eye and generally have dimensions of between a fraction of a micron and 200 microns.

Microbody (Gr. *mikros*, small + body) A cellular organelle always bound by a single membrane, frequently spherical, from 20 to 60 nm in diameter, containing a variety of enzymes mainly peroxide-forming and peroxide-destroying enzymes; generally derived from endoplasmic reticulum; includes lysosomes, peroxisomes and glyoxysomes. .

Microcalorimetry Study of microcalories, a measure of heat production.

Microcarriers Small particles used as a support material for cells (particularly mammalian cells) which are too fragile to be pumped and stirred in a large-scale culture reactor.

Microcell A cell fragment, containing one to a few chromosomes, which is formed by the enucleation or disruption of a micronucleated cell.

Microcentre Area within a centre of origin that shows a great diversity for a plant or animal species than the remaining centre of origin.

Microchromosome Human artificial chromosome

Micrococcal nuclease is an endonuclease that cleaves DNA; in chromatin, DNA is cleaved preferentially between nucleosomes.

Microconidium (pl. microconidia) The smaller of two types of conidia in a fungus that produces both large and small conidia; usually single celled and round, ovoid, pear shaped, or club shaped.

Microdroplet array; multiple drop array (MDA); hanging droplet technique Introduced by Kao and Konstabel (1970), this technique is used to evaluate large numbers of media modifications, employing small quantities of medium into which are placed small numbers of cells. Droplets of liquid are arranged on the lid of a Petri dish, inverted over the bottom half of the dish containing a solution with a lower osmotic pressure, and the dish is sealed. The cells or protoplasts form a monolayer at the droplet meniscus and can easily be examined.

Microelectrode, micropipette Piece of fine glass tubing pulled to an even finer tip. Used to penetrate a cell to study its physiology or to inject electric current or molecules.

Microelement An element required in very small quantities.

Microencapsulation A process of enclosing a substance in very small sealed capsules from which material is released by heat, solution or other means.

Microenvironment (Gr. *mikros*, small + O.F. *environ*, about) The environment close enough to the surface of a living or non-living object to be influenced by it.

- Microfibers** A method used to transform tissue culture cells using tiny fibers coated with DNA. These fibers are combined in solution with the cells and shaken vigorously causing the fibers to stab the plant cells delivering the DNA to them.
- Microfibrils** (Gr. *mikros*, small + *fibrils*, diminutive of fibre) Microfibrils are exceedingly small fibres visible only at the high magnification of the electron microscope. In guard cells, microfibrils are made of cellulose and are oriented transversely to the long axis of the cell resulting in cell expansion in the direction of its long axis because the cellulose reinforcement offers the least resistance at right angles to its orientation.
- Microfilament** One of the major filaments (70 Å diameter) of the cytoskeleton found in the cytoplasm of cells; also known as actin filament or F-actin; synonymous with the thin filament of striated muscle. It serves in structure and movement.
- Microfilaria** Embryos produced by filarial worms and found in the blood or tissue of individuals with filariasis.
- Microfiltration** Removes particles, such as microorganisms and macro-molecules, from solution by passing it through a micro-filter.
- Microfluidics** Refers to the science and properties of fluids when flowing through very small passages (e.g., micron or nanometer dimensions) and/or in very small amounts (e.g., femtogram quantities).
- Microgametogenesis** Production of the male gametophyte from microspore (through mitosis).
- Micrograph** Photograph of an image seen through a microscope. May be either a light micrograph or an electron micrograph depending on the type of microscope employed.
- Microheterogeneity** The variability in carbohydrate composition in glycoproteins.
- Microinjection** A technique for introducing a solution of DNA into the nucleus of an oocyte, embryo, or other cell by using a fine microscopic needle, penetrating the cell membrane in such a way that the cells are not killed.
- Microisolating system** Mechanical separation of single cells or protoplasts thus allowing them to proliferate individually.
- Micromachining** Refers to the technology and tools or methods utilized to create the very small parts, grooves (in chips/arrays), etc. in NEMS (nanoelectromechanical systems), biochips, microarrays, and other devices of the field of nanotechnology.
- Micron** Also called micrometer. A unit of length convenient for describing cellular dimensions; the Greek letter μ is used as its symbol. A micron is equal to 10^{-6} m, 10^{-3} mm (millimeter), or 10^4 Å (Angstroms) or 0.00003937 inch.
- Micronucleated cell** A cell which has been mitotically arrested and in which small groups of chromosomes function as foci for the reassembly of the nuclear membrane thus forming micronuclei. The maximum number of micronuclei will be equal to the total number of chromosomes.
- Micronucleus** Small, dotlike nucleus found in *Balantidium coli*; often very difficult to see, even in stained preparations.
- Micronutrient** (Gr. *mikros*, small + L. *nutrire*, to nourish) A chemical element that is essential for plant life, but which is required in much smaller amounts (< 0.5 millimole/litre or < 100mg/kg of dry matter) than the macronutrients. Micronutrients also called trace elements, include zinc, iron, chlorine, copper, manganese, boron, nickel and molybdenum.

Microorganism Any organism of microscopic size (i.e., requires a microscope to be seen by man), unicellular except for some fungi, that include bacteria, yeasts and other fungi, and protozoa, all of which can cause human disease. First viewed by Antoni van Leeuwenhoek in 1676. Some microorganisms are pathogenic (disease-causing) and some are not.

Microparasites Parasite species too small to be seen with the naked eye, such as bacteria, protozoans, and fungi.

Microparticle Enzyme Immunoassay (MEIA) is a technique in which the solid-phase support consists of very small microparticles in liquid suspension. Specific reagent antibodies are covalently bound to the microparticles. Antigen, if present, is then "sandwiched" between bound antibodies and antigen-specific, enzyme-labeled antibodies. Antigen-antibody complexes are detected and quantitated by analysis of fluorescence from the enzyme-substrate interaction.

Microplasmodesmata Fine pores occurring in the septa of certain filamentous prokaryotes, such as actinomycetes and cyanobacterial trichomes. These pores are used for communication (exchange of metabolites) between two adjacent cells which are separated by septa.

Microplasts Vesicles produced by subdivision and fragmentation of protoplasts or thin-walled cells.

Microprojectile bombardment A procedure for modifying cells by shooting DNA-coated metal (tungsten or gold) particles into them. Also known as biolistics, gene gun method and particle gun method.

Microprojectile It can be defined as a small coherent particle capable of being accelerated, such that it penetrates cells and tissues. It should be non-lethal and capable of carrying DNA on its surface or in its interior. They are usually made up of high density metals like tungsten or gold, are more or less spherical and are 0.4-2.0 micron in diameter.

Micropropagation *in vitro* multiplication and/or regeneration of plant material asexually under aseptic and controlled environmental conditions on specially prepared media that contain all the substances necessary for growth. It is used for three general types of tissue: excised embryos (= embryo culture); shoot-tips (= meristem culture or mericloning); and pieces of tissue that range from bits of stems to roots. Four stages of plant tissue culture have been defined by Murashige: Stage I. Establishment of an aseptic culture. Stage II. The multiplication of propagules. Stage III. Preparation of propagules for successful transfer to soil (rooting and hardening). Stage IV. Establishment in soil.

Micropyle A small opening on the surface of a plant ovule through which the pollen tube passes prior to fertilization.

MicroRNA (miRNA) Small RNA molecules only about 20-25 nucleotides long that bind to the 3' untranslated or rarely to the 5' untranslated ends of messenger RNA to block or to activate (rarely) translation of the mRNA into protein. It is thought to regulate the expression of other genes.

Microsatellite A type of simple sequence length polymorphism comprising tandem copies of, usually, di-, tri- or tetranucleotide repeat units. Also called a simple tandem repeat (STR). At any one site (locus), there are usually several different "alleles," each identifiable according to the number of repeat units. These alleles can be detected by PCR using primers designed from the unique sequence that is located on either side of the microsatellite. Microsatellites have been the standard DNA marker as they are easily detectable by PCR, and they tend to be evenly located throughout the genome.

Microshoot The small shoots that are produced by micropropagation.

Microsomal mixed-function oxidases A family of enzymes, found primarily in microsomes, that oxidize a wide variety of molecules foreign to the cell for detoxification. Oxidation makes the molecules more

polar, and thus more soluble, and provides a point of attachment for sugars and other molecule that help solubilize the foreign chemical so that it can be excreted.

Microsome Small closed vesicle that is derived from fragmented endoplasmic reticulum produced when eukaryotic cells are homogenized. It comprises about 15 to 20 percent of the total mass of the cell. They have a high content of lipids and of various enzymes. They are active, among other things, in the biosynthesis of phosphatides, glucuronides, and ascorbic acid: at certain point in metabolism of 6-carbon sugars; in steroid biosynthesis; at certain points in the synthesis of glycerides, phospholipids, and glycolipids: and in the detoxification of foreign chemicals.

Microspore An immature pollen grain. In seed plants, microspores give rise to the pollen grain, the male gametophyte.

Microsporogenesis Production of the pollen grains (microspores) from microspore mother cell (through meiosis).

Microtuber Cultured tissue capable of growing into tuberous plant.

Microtubular molecular motor protein that moves vesicles along microtubules; examples are cytoplasmic dynein and kinesin.

Microtubule associated protein (MAPs) Any protein that binds to microtubules and modifies their properties. Many different kinds have been found, including structural proteins, such as MAP-2 and motor proteins, such as dynein.

Microtubule Long hollow cylindrical structure composed of the protein tubulin arranged helically (240 Å diameter). It is one of the three major classes of filaments of the cytoskeleton. It serves as a track for the movement of chromosomes during cell division and for the movements of vesicles and organelles in non dividing cells. It is also a dynamic component of cilia and flagella.

Microtubule organizing center (MTOC) is a region from which microtubules emanate. The major MTOCs in a mitotic cell are the centrosomes or a basal body, from which microtubules grow.

Microvillus (plural microvilli) Thin cylindrical membrane-covered projection on the surface of all animal cell containing a core bundle of actin filaments. Present in especially large numbers on the absorptive surface of intestinal epithelial cells.

Microwave An electromagnetic wave with wavelength between 10^{-1} m to 10^{-3} m.

Microwave hypothermia The application of microwave energy in the therapy of *tumors*. Limited experimental evidence suggests not only that microwave energy can kill tumors, but also that it can potentiate the action of conventional radiation.

Mid Oleic Sunflowers Refers to sunflower (crop) plant varieties which have been bred so their seeds contain 50–75% oleic acid within the oil in those seeds; vs. historical average of 20% oleic acid in the oil of traditional sunflower (crop) plant varieties.

Mid Oleic Vegetable Oils Refers to any vegetable oils (other than sunflower oil) that contain 50–70% oleic acid. The range of oleic acid content is slightly different for mid-oleic sunflower oil definition.

Mid parent value In quantitative genetics, the average of the phenotypes of two mates.

Mid value The value just at the middle of a class. Also known as mid-point or central value.

Midbody is the last connection between two cells as they separate at the end of cytokinesis. A parallel array of microtubules derived from the mitotic spindle enters the midbody from each cell, and the two arrays interdigitate across its whole width.

Middle genes are phage genes that are regulated by the proteins coded by early genes. Some proteins coded by middle genes catalyze replication of the phage DNA; others regulate the expression of a later set of genes.

Middle lamella (L. *lamella*, a thin plate or scale). Original thin membrane separating two adjacent protoplasts and remaining as a distinct cementing layer between adjacent cell walls.

Middlebinders Anti-carbohydrate antibodies can bind either the ends or the middles of polysaccharide chains; the latter antibodies are called middlebinders.

Midvein Runs down the center of the leaf blade; is part of the framework of the leaf and gives support.

Mieration inhibition factor (MIF) An unidentified substance, released by T Lymphocytes after they react with *antigens* to which they have been sensitized. MIF immobilizes *macrophages* at the site of an injury, infection, or tumor. Immobilized macrophages may destroy foreign or injured cells.

Miliary Of the size of a millet seed (0.5 to 1.0mm); characterized by the formation of numerous lesions of the above size distributed rather uniformly throughout one or more organs.

Milk (1) A whitish, highly nutritive fluid secreted by the mammary glands in mammals which serves to nourish the young. (2) Any white fluid, such as coconut milk.

Millet A small grain used for food often mixed with other grain.

MIM number (also MIM#, OMIM number, or McKusick Code) - The unique six-digit number assigned to each entry listed in the catalog of human genes and genetic disorders, Online Mendelian Inheritance in Man (OMIM). The first digit of a MIM number describes a gene's mode of inheritance.

Mimicry (mimosG = mime) The resemblance in form, colour, or behaviour of certain organisms (mimics) to other more powerful (and hence less subject to predation) or more protected ones (models), which results in the mimics being protected in some way. For example harmless flies that have the same colouration as bees and wasps. Because predators know that wasps sting they tend to avoid anything that looks like them.

Mineralization The conversion of an element from an organic form to an inorganic state as a result of microbial activity.

Mineralocorticoid A steroid hormone that regulates the excretion of salt and water by kidneys. Example: Aldosterone

Minicell is an anucleate bacterial (*E. coli*) cell produced by a division that generates a cytoplasm without a nucleus. It contains plasmids and the apparatus to carry out transcription and translation for a limited amount of time.

Minichromosome One of the smaller, gene-rich chromosomes seen in the nuclei of chickens and various other species. Minichromosome of SV40 or polyoma is the nucleosomal form of the viral circular DNA.

Minigene The name given to the pair of exons carried by a cloning vector used in the exon-trapping procedure.

Minimal bactericidal concentration (MBC) The lowest concentration of a chemotherapeutic agent that will kill test microorganisms, as indicated by absence of growth following subculturing in the dilution method.

Minimal inhibitory concentration (MIC) The lowest concentration of a chemotherapeutic agent that will prevent growth of the test microorganisms. It is a method of determining antibiotic sensitivity.

Minimal medium A medium that provides only the minimum nutritional requirements for growth of a microorganism.

Minimal tillage practices Practices that allow farmers to reduce the tilling of the land to conserve topsoil and its nutrients.

Minimized proteins The domain/active site of a (former) native protein after all or most of its extraneous (unnecessary) portions (peptides) have been removed. In 1995, Brian Cunningham and James A. Wells reduced the 28-residue (peptide) protein (hormone) Atrial Natriuretic Factor to 15-residues (peptides) size without reducing its potency (biological activity). Minimized proteins that retain their potency hold the potential for medicines possessing a greater serum lifetime (when injected into a patient's body), and as "models" for the creation of organic chemical- synthesized mimetic drugs possessing the same therapeutic effect as the native protein.

Minimum effective cell density The inoculum density below which the culture fails to give reproducible cell growth. The minimum density is a function of the tissue (species, explant, cell line) and the culture phase of the inoculum suspension. Minimum density decreases inversely to the aggregate size and division rate of the stock culture.

Minimum growth temperature The lowest temperature at which a species will grow.

Minimum inoculum size The critical volume of inoculum required to initiate culture growth, due to the diffusive loss of cell materials into the medium. The subsequent culture growth cycle is dependent on the inoculum size, which is determined by the volume of medium and size of the culture vessel.

Miniprep A small-scale (mini-) preparation of plasmid or phage DNA. Used to analyse DNA in a cloning vector after a cloning experiment.

Miniprotoplasts The sub-protoplasts containing nucleus, and are capable of regeneration into plants.

Minisatellite A form of variable number tandem repeats (VNTR) in which the repeat units typically range from 10 to 100 bases. They are usually detected by Southern hybridization, using a probe comprising a clone of the repeat unit. The first DNA fingerprints were minisatellites detected in this way. Minisatellites tend to be located at the ends of chromosomes and in regions with a high frequency of recombination.

Minitubers Small tubers (5-15 mm in diameter) formed on shoot cultures or cuttings of tuber-forming crops, such as potato.

Minor groove The smaller of the two grooves of the DNA double helix onto which the glycosidic bonds of a base pair form an angle of $<180^\circ$.

Minor histocompatibility antigens (minor H antigens) are peptides of polymorphic cellular proteins bound to MHC molecules that can lead to graft rejection when they are recognized by T cells.

Minus (negative) strand DNA It is the single-stranded DNA sequence that is complementary to the viral RNA genome of a plus strand virus. It serves as mRNA.

Minus end The end of a microtubule or actin filament at which the addition of monomers occurs least readily; the "slow-growing" end of the microtubule or actin filament. The minus end of an actin filament is also known as the pointed end.

Miracidium Free-living, ciliated larva released from a trematode egg and infective for the snail as intermediate host.

Mis antigens, minor lymphocyte stimulatory (MIs) loci Mis antigens are non-MHC antigens that provoke strong primary mixed lymphocyte responses. They are encoded by minor lymphocyte stimulatory

(MIs) loci, which are endogenous mammary tumor viruses integrated in the mouse genome. MIs antigens are encoded in the 3' long terminal repeat of the integrated virus and act as superantigens. They stimulate a large number of T lymphocytes by binding to the V β domain of all T-cell receptors bearing the V β for which the superantigen is specific.

Miscarriage The expulsion of a foetus before it is viable outside the womb.

Miscible Two solvents that is able to dissolve into each other when mixed.

Mismatch A position in a double-stranded DNA molecule where the usual base-pairing (G-C or A-T) does not occur because the nucleotides are not complementary; in particular, a non-base-paired position resulting from an error in replication or by mutation of a base.

Mismatch repair (MMR) DNA repair process that corrects mismatched nucleotides inserted during DNA replication. A short stretch of newly synthesized DNA including the mismatched nucleotide is removed and replaced with the correct sequence with reference to the template strand. The mechanism preferentially corrects the sequence of the daughter strand, by distinguishing the daughter strand and parental strand on the basis of their states of methylation.

Missense mutation A mutation that alters a DNA codon so as to cause one amino acid in a protein to be replaced by a different amino acid.

Missense suppressor codes for a tRNA that has been mutated so as to recognize a different codon. By inserting a different amino acid at a mutant codon, the tRNA suppresses the effect of the original mutation.

Mist propagation Application of fine droplets of water to leafy cuttings in the rooting stage to reduce transpiration.

Mites Free-living and parasitic animals belonging to the order Acarina, class Arachnida (with spiders). Mites may infest plant crops, reducing their harvest. They may also infest plant tissue culture work areas and incubation facilities in search of sugars, and so contaminate culture vessels and spread bacteria and fungi.

Mithramycin An antitumor *antibiotic*. It is thought to act by binding to cellular DNA, thereby inhibiting the synthesis of RNA.

Mitigation Correction of a problem, often due to the presence of a pollutant.

Mitochondrial genome The genome present in the mitochondria of a eukaryotic cell. Mitochondrial DNA (mtDNA) is a circular ring of DNA found in mitochondria. In mammals, mtDNA makes up less than 1% of the total cellular DNA, but in plants the amount is variable. It codes for ribosomal RNA and transfer RNA, but only some mitochondrial proteins (up to 30 proteins in animals), the nuclear DNA being required for encoding most of these. Mitochondria are passed on from one generation to the next in the cytoplasm of the egg, so they are inherited from the mother and little change occurs in the mtDNA from generation to generation.

Mitochondrial inner membrane inner membrane of mitochondria that is elaborated into cristae. The electron transport chain and ATP synthase, are integral membrane proteins of the mitochondrial inner membrane.

Mitochondrial matrix aqueous space inside the mitochondrial inner membrane, where the enzymes of the Krebs cycle are located.

Mitochondrial outer membrane outer membrane of mitochondria, permeable to solutes of Mr <10,000 because of the presence of the channel porin.

Mitochondrial precursor protein mitochondrial protein encoded by a nuclear gene, synthesized in the cytosol, and subsequently transported into mitochondria

Mitochondrion plural mitochondria (mitosG = thread + chondrionG = small grain) A granular or rod-shaped cell organelles found in eukaryotic cells, separated from the cytoplasm by two membranes, that is by a double membrane, and thought to have originated as a symbiotic bacterium in the host eukaryotic cell. It contains its own genome and unique ribosomes to carry out protein synthesis of only a fraction of the proteins located in this organelle. It contains the enzymes required for the citric acid cycle, fatty acid oxidation, electron transfer, and oxidative phosphorylation; acts as chemical furnaces of the cell and produces most of the ATP via oxidative phosphorylation in eukaryotic cells; also called chondriosome or in common parlance as 'powerhouse' of the cell.

Mitogen It is an extracellular substance (growth factor, hormone, etc.) that initiates cell division within the body. For example, most Angiogenic Growth Factors (e.g., fibroblast growth factor and platelet-derived growth factor) stimulate cell division of the endothelial cells which line blood vessel walls.

Mitogen associated protein kinase (MAPkinase, MAPK) is a signal transduction pathway enzyme that phosphorylates numerous targets, including transcription factors that trigger transcription of the cyclin-D gene. Turned on by a wide range of proliferation- or differentiation-inducing signals and performs a crucial step in relaying signals from the plasma membrane to the nucleus. It is a Ser/Thr protein kinase named for its original identification as a mitogen-activated kinase. There is a large group of cytosolic Thr/Ser protein kinases that form several signaling pathways. The name reflects their original isolation as mitogen-activated protein kinases. **Mitogen associated protein kinase kinase (MAPKK, MAPkinase kinase)** Enzyme that phosphorylates and activates MAP kinase, itself being phosphorylated and hence activated by MAPKK kinase. **Mitogen associated protein kinase kinase kinase (MAPKKK, MAPkinase kinase kinase)** enzyme that phosphorylates and activates MAPK kinase. The most important isoform of MAPKKK is also called Raf. Raf is activated by the G protein Ras.

Mitomycin C An antitumor antibiotic isolated from *Streptomyces caespitosus*. It is thought to act by binding to DNA to inhibit its replication.

Mitosis (Gr. *mitos*, a thread; adj: mitotic; pl: mitoses) Disjunction of replicated chromosomes and division of the cytoplasm to produce two genetically identical daughter cells. The division involves the appearance of chromosomes, their longitudinal duplication, and equal distribution of newly formed parts to daughter nuclei. It is separated into five stages: interphase, prophase, metaphase, anaphase and telophase. Mitosis results in two daughter cells that are genetically identical to each other and to the original cell.

Mitotic cyclin (G2 cyclin) is a regulatory subunit that partners a kinase subunit to form the M phase inducer.

Mitotic chromosome Highly condensed duplicated chromosome with the two new chromosomes still held together at the centromere as sister chromatids.

Mitotic spindle Array of microtubules and associated molecules that forms between the opposite poles of a eukaryotic cell during mitosis and serves to move the duplicated chromosomes apart.

Mitral regurgitation Any condition of the mitral valve between the left atrium and left ventricle that allows blood to flow back into the atrium when the ventricle contracts; normally, the valve shuts

tightly, allowing no backflow of blood into the atrium; often heard as a heart murmur during auscultation.

Mitral valve prolapse A defect in the valve between the left atrium and ventricle caused by a weakening of the tough connective tissue of the valve leaflets, which allows the valve to project back into the left atrium; during normal function, the valve closes tightly during ventricular contraction.

Mixed bud A bud containing both rudimentary leaves and flowers.

Mixed infection An infection caused by several species of organisms/ pathogens present at the same time.

Mixed inhibition A form of enzyme inhibition in which an inhibitor binds to both the enzyme and the enzyme substrate complex and thereby differently affect K_M and V_{MAX} . It is also called non competitive inhibition.

Mixed lymphocyte reaction When lymphocytes from two unrelated individuals are cultured together, the T cells proliferate in response to the allogeneic MHC molecules on the cells of the other donor. This mixed lymphocyte reaction is used in testing for histocompatibility.

Mixed-function oxidase (oxygenase) An oxygenase enzyme that catalyzes a reaction in which two different substrates are oxidized, one by the addition of an oxygen atom from O_2 and the other by supplying two hydrogen atoms to reduce the remaining oxygen atom to H_2O . Example flavoproteins use molecular oxygen (O_2) to simultaneously oxidize a substrate and a cosubstrate (commonly NADH or NADPH).

Mixoploid Cells with variable (euploid, aneuploid) chromosome numbers. Mosaics or chimeras differ in chromosome number as a result of a variety of mitotic irregularities.

Mixotroph An organism able to assimilate organic compounds as carbon sources while using inorganic compounds as electron donors.

Mixture Two or more substances combined in any proportion and not chemically bound.

MMR vaccine Attenuated measles, mumps, rubella viruses.

Mobile genetic element. A segment of the genome that can move as a unit from one location to another on the genome.

Mobilization (1) The transfer between bacteria of a non-conjugative plasmid by a conjugative plasmid. (2) The transfer between bacteria of chromosomal genes by a conjugative plasmid.

Mobilizing functions The genes on a plasmid that give it the ability to facilitate the transfer of either a non-conjugative or a conjugative plasmid from one bacterium to another.

Modal class In a frequency distribution, the class having the greatest frequency.

Mode It is the value at the point around which the items tend to be most heavily concentrated or the values which occur most in the series.

Model A mathematical description of a biological phenomenon.

Model organism An organism which is relatively easy to study and hence can be used to obtain information that is relevant to the biology of a second organism that is more difficult to study. Example *Drosophila melanogaster* or *Escherichia coli* and roundworm *C. elegans*

Modeling The use of statistical analysis, computer analysis, or model organisms to predict outcomes of research.

Moderately repetitive DNA Segments of hundreds to thousands of base pairs that are present at $<10^6$ copies per haploid genome.

Modification (1) Enzymatic methylation of a restriction enzyme DNA recognition site. (2) Specific nucleotide changes in DNA or RNA molecules.

Modification assay A range of techniques used for locating bound proteins on DNA molecules.

Modification interference A technique used to identify nucleotides involved in interactions with a DNA-binding protein.

Modification methylase A bacterial enzyme that methylates a specific sequence of DNA as part of a restriction-modification system.

Modification of DNA or RNA includes all changes made to the nucleotides after their initial incorporation into the polynucleotide chain.

Modified bases are all those except the usual four from which DNA (T, C, A, G) or RNA (U, C, A, G) are synthesized; they result from post synthetic changes in the nucleic acid. Example: Hypoxanthine, xanthine, 5-methylcytosine etc.

Modifying genes Genes that have no phenotypic effect of their own but change the expression of some oligogenes. They have small, cumulative effect producing a continuous range of phenotypes.

Modulator A metabolite that, when bound to the allosteric site of an enzyme, alters its kinetic characteristics. It can be a positive or negative modulator.

Module In proteins or nucleic acids, a unit of structure or function that is found in a variety of different contexts in different molecules.

Moiety Referring to a part or portion of a molecule, generally complex, having a characteristic chemical or pharmacological property.

Molality (m) The number of moles of solute per kilogram of water (mol/kg). It expresses osmotic relationships somewhat more accurately than molarity.

Molar absorptivity (ϵ) A constant that is related to the absorbance of a solution at a concentration of the solute at a given wavelength. Also called as molar extinction coefficient.

Molar Describes a solution with a concentration of 1 mole of a substance dissolved in 1 liter of solution (abbreviated as 1 M).

Molar solution One mole of solute dissolved in water to give a total volume of 1,000 mL.

Molarity (M) The number of moles of a solute per liter of final solution. See mole.

Molasses A brownish, syrupy by-product which is produced during the sugar refining procedure, i.e., crystallization of sucrose from sugar-cane or sugar beet. Molasses primarily consists of sucrose, water and inorganic components. Because of its cheap price, it is commercially used as a substrate for producing other microbial products in fermentation industries.

Mold A filamentous fungus composed of filaments that generally form a colony that may be fuzzy, powdery, wooly, velvety, or relatively smooth.

Mole (M) (moles, L = mass). Amount of substance that has a weight in grams numerically equal to the sum of the atomic weight of the substance. Also called gram molecular weight. A mole contains 6.023×10^{23} molecules or atoms of a substance (An Avogadro's number).

Molecular beacon Term that is used to refer to specific oligonucleotides possessing a “hairpin loop” and bearing a fluorescent dye. A “quencher dye” located on a nearby portion of the hairpin loop prevents fluorescence until the hairpin loop is opened up. Molecular beacons (sometimes called fluorogenic probes) are utilized to detect the presence of a desired “target” molecule. When the “target” (i.e., a molecule possessing the desired functional group or desired property) is present within a given sample being evaluated, the “hairpin loop” opens up because a portion of it forms a stronger bond to the “target,” than to the rest of the loop thereby allowing the fluorescent dye to emit light.

Molecular biology A term coined by Vannevar Bush during the 1940s deals with the study of the structure, function, and makeup of biologically important molecules like nucleic acids and proteins. Molecular biology as a distinct scientific discipline originated largely as a result of a decision to provide “support for the application of new physical and chemical techniques to biology” during the 1930s by Warren Weaver, director of the biology (funding) program at America’s Rockefeller Foundation (a philanthropic organization).

Molecular breeding The plant breeding methods that are coupled with use of DNA based markers for indirect selection and genetic engineering techniques.

Molecular chaperone A protein that helps other unfolded or misfolded proteins to fold by binding to them, thus promoting normal folding and the formation of native quaternary structure. Also known as a heat shock protein (Hsp).

Molecular clock A device based on the inferred mutation rate that enables times to be assigned to the branch points in a gene tree.

Molecular cloning The biological amplification of a specific DNA sequence through mitotic division of a host cell into which it has been transformed or transfected.

Molecular combing A technique for preparing restricted DNA molecules for optical mapping.

Molecular diversity Sometimes referred to as “irrational drug design,” this refers to the drug design technique of generating large numbers of diverse candidate molecules (e.g., pieces of DNA, RNA, proteins, or other organic moieties) at random (via a variety of methods). These diverse candidate molecules are then tested to see which is best at working against a disease/condition (e.g., fitting a cell receptor, or category of receptors relevant to the disease in question). Molecular candidates that show promise (e.g., via a “pretty good fit” to receptor) are then produced in larger quantities (e.g., via Polymerase Chain Reaction techniques) along with additional molecules that are similar though slightly different in structure (e.g., via site-directed mutagenesis) in an attempt to create a molecule that is a “perfect fit” (e.g., to receptor).

Molecular evolution The gradual changes that occur in genomes over time as a result of the accumulation of mutations and structural rearrangements resulting from recombination and transposition.

Molecular farming The use of genetically modified plants and animals as bioreactors to produce molecules that they do not normally produce. When the molecule has pharmaceutical value, the process is called molecular pharming.

Molecular genetic map A representation of the molecular markers/ genes on a chromosome arrayed in a linear order with distances between loci expressed as percent recombination (map units).

Molecular genetics The science dealing with the study of the nature and biochemistry of the genetic material, especially with DNA, RNA and protein molecules.

- Molecular hybridization** A technique for determining if identical or similar sequences of nucleic acids (homologies) exist between two specimens of DNA or one specimen of DNA and one of RNA.
- Molecular lifesciences** The area of research comprising molecular biology, biochemistry and cell biology, as well as some aspects of genetics and physiology.
- Molecular machines** Refers to nanometer dimension “machines” capable of doing various tasks.
- Molecular marker** An identifiable DNA sequence on a chromosome. A marker can be a gene, part of a gene, or a sequence in a non-gene region. SSR, RFLP, RAPD, and AFLP are acronyms for commonly used marker techniques.
- Molecular medicine** The treatment of injury or disease at the molecular level. Examples include the use of DNA-based diagnostic tests or medicine derived from DNA sequence information.
- Molecular oxygen** A biradical molecule containing two oxygen atoms. The molecule has two unpaired electrons which exist in two states: a ground state and a singlet state. The singlet state is much more reactive than the ground state and has electrons that spin in opposite directions. In the ground state both electrons have the same spin.
- Molecular Pharming™** A trademark of the Groupe Limagrain Company, it refers to the production of pharmaceuticals and certain other chemicals (e.g., intermediates utilized to manufacture pharmaceuticals) in agronomic plants (which have been genetically engineered).
- Molecular phylogenetics** A set of techniques that enable the evolutionary relationships between DNA sequences to be inferred by making comparisons between those sequences.
- Molecular physical map** A representation of the molecular markers/ genes depicting their physical location on chromosomes; shows how much DNA separates two markers/ genes; distance is measured in base pairs, as opposed to genetic recombination units (cM) in the genetic map.
- Molecular probe** A group of atoms or molecules attached to other molecules or cellular structures and used in studying the properties of these molecules or structures; radioactive DNA or RNA sequences are used in molecular genetics to detect the presence of a complementary sequence by molecular hybridization.
- Molecular weight** (Mol. wt. or MW) Numerically, the same as the relative molecular mass of a molecule, expressed in daltons ; alternatively, the sum of the atomic weights of the constituent atoms in a molecule. For example, a protein of relative molecular mass 20,000 has a molecular weight of 20,000.
- Molecularity** The number of molecules that participate in a specific reaction step.
- Molecule** (moleculuL = a small mass) A particle made up of two or more atoms chemically bonded to each other. If one or more of such chemical bonds are broken, the nature and properties of the molecule are changed.
- Molluscicide** A chemical substance used for the destruction of snails and other molluscs.
- MON810** A genetically modified corn line with inherent resistance to the European Corn Borer. This line has already been commercialized, and is currently being planted in several countries.
- Monellin** a protein found in the fruits of an African plant *Discorephyllum cumminsii* which is about 100.000 times sweeter than sucrose.
- Monera** The kingdom to which all prokaryotic organisms belong.

Monitoring Activities conducted to measure levels, concentrations or quantities of material and the use of these measurement results to evaluate potential exposures and doses, and to determine existing environmental conditions, pollutant levels (rates) and effects on species in the environment.

Monoamine An amine containing one amino group especially one that functions as a neurotransmitter. Acetylcholine and norepinephrine are monoamines.

Monocarpellary, monocarpous Having only one carpel. Example: avocado, most legumes etc.

Monocarpellate A single seed is produced per carpel.

Monochromatic light Light consisting of vibrations of the same or nearly the same frequency.

Monocistronic mRNA The RNA transcript of a single gene that codes for one protein.

Monoclonal antibodies (MAb) Discovered and developed in the 1970s by Cesar Milstein and Georges Kohler, monoclonal antibodies are the name for antibodies derived from a single source or clone of cells that recognize only one kind of antigen. Made by fusing myeloma cancer cells (which multiply very fast) with antibody-producing cells, then spreading the resulting conjugate colony so thin that each cell can be grown into a whole, separate colony (i.e., cloning). In this way, one gets whole batches of the same (monoclonal) antibody, which are all specific to the same antigen. Monoclonal antibodies are used in diagnostic kits, used in drugs (e.g., to shrink tumors), imaging agents, and in purification processes.

Monocotyledon (Gr. *monos*, solitary + *kotyledon*, a cup-shaped hollow) A class of flowering plants characterized by having one cotyledon in their embryo, leaves with parallel venation and flower parts often in threes. Examples are cereal grains (corn, wheat, rice), asparagus, grasses and lily.

Monocotyledonae A Subclass, in the Class Angiospermae, containing all those plants characterized by having only a single seedling cotyledon or leaf, and adult leaves with parallel, unbranched, veins. In the final analysis, the distinction between dicots and monocots is best made now on the basis of DNA sequences. Liliopsida is an alternate name for Monocotyledonae.

Monocular Refers to a light microscope having one eyepiece (ocular).

Monoculture The agricultural practice of cultivating a single crop on a whole farm or area.

Monocyte A type of *leukocyte* in which the nucleus is large and kidney-shaped and the *cytoplasm* contains fine granules. Monocytes are formed in the *bone marrow* and by organs of the *reticuloendothelial system*. They are generally considered to be immature *macrophages* which migrate from the bloodstream and mature into macrophages at the site of injury or infection. These cells are often the first to encounter a foreign substance or pathogen or normal cell debris in the body. They engulf and kill microorganisms, present antigen to the lymphocytes, kill certain tumor cells, and are involved in the regulation of inflammation.

Monocytosis Increase in the number of monocytes in the peripheral blood; may be found in both helminth and protozoan infections.

Monoecious (monosG = one + eikosG = house, dwelling) A category of plants that possess both male and female reproductive structures on the same plant. Thus, such plants are capable of self pollination. e.g., maize, soybean. In animals they are called hermaphrodites. E.g., trematodes, cestodes

Monogastric animals Animals with simple stomachs that do not ruminate.

Monogenic Controlled by or associated with alleles at a single genetic locus (gene).

Monogenic disorder A disorder caused by mutation of a single gene.

Monohybrid (Gr. *monos*, solitary + L. *hybrida*, a mongrel) The offspring of two homozygous parents that differ from one another for only one trait or in which only one trait is being considered.

Monohybrid cross A sexual cross in which the inheritance of one pair of alleles is followed.

Monolayer A monolayer describes the growth of eukaryotic cells in culture as a layer only one cell deep.

Monomer (1) The basic molecular subunit from which, by repetition of a single reaction, polymers are made. For example, DNA is formed of nucleotide monomers, amino acids (monomers) link together via condensation reactions to yield polypeptides or proteins (polymers). (2) A single subunit or promoter of a multisubunit protein. Thus By analogy, the word is sometimes used to describe proteins that act as a single unit to distinguish them from related proteins that act as larger units, so myoglobin is said to be monomeric by comparison with hemoglobin, which has four subunits. GTPases such as Ran, Arf, and Ras are sometimes called "monomeric G proteins" to distinguish them from trimeric G proteins such as Gq and Gs.

Mononuclear phagocytic system A system of fixed macrophages located in the spleen, liver, lymph nodes, and bone marrow.

Monophyletic A taxonomic unit that includes an ancestral species and all of its descendants.

Monoploid A cell or individual with the basic chromosome number (x), i.e., with one genome and is the lowest number of chromosomes of a polyploidy species. For example, barley has $n = x = 7$, *Triticum aestivum* has $x = 7$ and $n = 21$.

Monopolar Develop or move toward one direction.

Monoprotic acid An acid that can donate only one proton.

Monosaccharides (monosL = one + sakcharonG = sugar) A carbohydrate consisting of a single saccharide (sugar) with the general formula $(CH_2O)_n$, where $n = 3$ to 8 . They are classified by the number of carbon atoms in the (monosaccharide) molecule. For example, pentoses have five and hexoses have six carbon atoms. They normally form ring structures. Monosaccharides are usually white, crystalline solids with a sweet taste and are generally soluble in water.

Monosodium glutamate (MSG) A white soluble crystalline substance; used to intensify the flavour of foods; also called sodium hydrogen glutamate or 'taste powder'.

Monosomic (n : monosomy) **Possessing** only one copy of a particular chromosome instead of the normal two copies ($2n - 1$). In humans, this would result in a total of 45 chromosomes. An example of monosomy is Turner syndrome.

Monospecificity An individual lymphocyte carries antigen receptors of a single antigen specificity and thus has the property of monospecificity in response to antigen.

Monoterpenes A compound that consists of two isoprene units linked together; menthol is an example of monoterpene. These primary alcohols are found in plants, which play a role in the reduction of cholesterol and in stimulating apoptosis. Monoterpenes also increase the levels of liver enzymes involved in detoxifying carcinogens. This in turn appears to have anti-tumour and anticarcinogenic effects.

Monotremata Primitive egg-laying mammals such as the Australian duck-billed platypus and Echidna, the spiny anteater.

Monotrichous A bacterial cell having a single polar flagellum

Monounsaturated fats Fat molecules possessing one less than the maximum possible number of hydrogen atoms (on that given fat molecule). Diets that are high in monounsaturated fat content have been shown to reduce low-density lipoproteins ("bad" cholesterol) blood content, while leaving blood levels of high-density lipoproteins ("good" cholesterol) essentially unchanged.

Monounsaturated fatty acids (MUFA) Refers to the category of those fatty acids (e.g., oleic acid) that possess one less than the maximum possible number of hydrogen atoms (e.g., possible to be attached to the molecular structure of oleic acid). Enzymes (e.g., $\Delta 12$ desaturase) present in some oilseed plants (soybean, corn/maize, canola, etc.) convert some MUFAs to polyunsaturated fatty acids (PUFAs) within their developing seeds. Diets that are high in monounsaturated fatty acid content have been shown to reduce low-density lipoproteins ("bad" cholesterol) blood content while simultaneously leaving blood levels of high density lipoproteins ("good" cholesterol) essentially unchanged. Soybean oil has historically averaged approximately 24.5% monounsaturated fatty acid content by weight.

Monounsaturated Molecules, such as fats, with only one double bond in their chemical structure. Some plant oils and margarines, avocados, olives, nuts and seeds contain mostly mono-unsaturated fats.

Monozygotic twins Identical twins derived from the splitting of a single fertilized ovum.

Monster particles of bacteriophages form as the result of an assembly defect in which the capsid proteins form a head that is much longer than usual.

Montenegro test Delayed hypersensitivity skin test; injection of leishmanial antigen; reading after 72h; positive reaction in cured individuals, negative in early cases (visceral and mucocutaneous leishmaniasis).

Morbid map A diagram showing the chromosomal location of genes associated with disease.

Morbidity (1) The incidence of a specific disease. (2) A condition of being diseased.

Morbidity rate An incidence rate used to include all clinically ill persons during the period of time stated. The person may belong to a specific gender or age group, or to those with certain characteristics.

Morbilloform rash Rash which resembles the flat to slightly raised (maculopapular) lesions seen in measles.

Mordant A substance added to a staining solution to make it stain more intensely by adhering to the cell or cell surface.

Morphine ($C_{17}H_{19}O_3N$) A white, crystalline, narcotic alkaloid drug obtained from unripe seed pods of the opium poppy (*Papaver somniferum*). It was first isolated from opium in 1803 by the German pharmacist F. W. A. Sertürner, who named it after Morpheus, the god of dreams. Given intravenously, it is still considered the most effective drug for the relief of pain.

Morphogen A substance whose distribution and concentration in an embryo directs or stimulates the development pattern in an organism.

Morphogenesis (morpho = form + genesis = origin) Differentiation and growth of the structure of cells and tissues during development of an organism (or a part of an organism).

Morphogenetic An adjective referring to formation and differentiation of tissues and organs in an organism.

Morphogenic response The effect on the developmental history of a plant or its parts exposed to a given set of growth conditions or to a change in the environment.

Morphological species concept A philosophy and set of methods that define species entirely on morphological or anatomical characters.

Morphology (Gr. *morphe*, form + *logos*, discourse) (1) The science of studying form and its development. (2) General: Shape, form, external structure or arrangement.

Morphotype A term used in reference to a specific morphological appearance; can be used in reference to colony appearance (colony morphotype) or Gram stain appearance (cellular morphotype). A given organism (e.g. *Fusobacterium nucleatum*) could have more than one colony morphotype.

Morphs Discrete phenotypes with few or no intermediate forms.

Mortality rate A rate calculated in the same way as an incidence rate by dividing the number of deaths occurring in the population during the stated period of time, usually a year, by the number of persons at risk of dying during the period. A total or crude mortality rate utilizes deaths from all causes, usually expressed as deaths per 1,000. A disease-specific mortality rate covers deaths due to only one disease and is often reported on the basis of 100,000 persons. The population base may be defined by gender, age or other characteristics. The mortality rate must not be confused with case-fatality rate (q.v.) (Synonym: death rate).

Mortality The deaths from a specific notifiable disease.

Mosaic A composite of heterogeneous elements. In genetics, an organism made of a mixture of cells with different genotypes. For example, as a result of mitotic nondisjunction during embryonic development

Mosaicism The presence of two or more cell that have a different genetic or chromosomal makeup in a single individual or tissue.

Most limiting nutrient Justus von Liebig formulated the law of the minimum: plant growth is limited by the most deficient nutrient, even if the other elements are abundant.

Most probable number (MPN) method A statistical determination of the number of coliforms per 100 ml of water or 100g of food.

Mother cell Also called as a parent cell. A cell that has approximately doubled in size and is about to divide into two daughter cells.

Motif Recognizable conserved sequence of bases (in DNA) or amino acids (in a polypeptide). A motif in DNA may bind one transcription factor, e.g., 5'AGAACA3' binds the glucocorticoid receptor. A motif in a polypeptide may, fold in a particular way (e.g., a helix-turn-helix motif), or bind to a target.

Motility The ability of an organism to move by itself.

Motoneuron Nerve cell that carries action potentials from the spine to the muscles. It releases the transmitter acetylcholine onto the muscle cells, causing them to depolarize and hence contract.

Motor protein An intracellular protein that uses free energy (ATP) derived from nucleoside triphosphate hydrolysis to molecular movement relative to another movement of the motor protein.

MOTT Mycobacteria other than *Mycobacterium tuberculosis*.

Mouse leukemia viruses A family of type C RNA viruses that cause leukemias and certain sarcomas in mice: they include the Gross, Moloney, Friend, and Rauscher strains. They have generally been isolated from inbred mice having a high incidence of spontaneous lymphoid leukemia.

Mouse mammary tumor virus (MMTV) is a retrovirus that encodes a viral super antigen; also known as the Bittner virus, causes breast tumor in mice with a certain genetic and hormonal constitution.

M-phase Cdk (M-Cdk) Complex formed in vertebrate cells by an M-cyclin and the corresponding cyclin-dependent kinase (Cdk).

M-phase promoting factor (MPF) Complex of CDK1 and cyclin B that regulates the G₂/M phase transition of the cell division cycle.

M_r Relative molecular mass. A dimensionless quantity that is defined as the ratio of the mass of a particle to 1/12th the mass of a ¹²C atom. Also known as molecular weight and abbreviated Mr or RMM. It is numerically equal to the grams/mole of a compound.

mRNA surveillance A RNA degradation process in eukaryotes.

MS Medium A popular plant tissue culture medium developed by T. Murashige and F. Skoog.

MSAIDs Nonsteroidal antiinflammatory drugs.

MST (nanotechnology) Acronym utilized by Europeans to refer to “microsystems technology” (i.e., their common term for “microelectromechanical systems” — MEMS).

Mucilage A gum like material covering some bacteria (e.g. cyanobacteria) to prevent the water loss during the dryness.

Mucins are highly glycosylated cell-surface proteins. Mucinlike molecules are bound by L-selectin in lymphocyte homing.

Mucociliary escalator Mechanism involving ciliated cells that allows materials in the bronchi, trapped in mucus, to be lifted to the pharynx and spit out or swallowed.

Mucocutaneous Involving the skin and mucous membranes.

Mucopolysaccharide An older name for a glycosaminoglycan.

Mucoprotein A complex of protein with polysaccharide.

Mucopurulent Term used to describe material containing both mucus and pus (e.g. mucopurulent sputum).

Mucosa Any epithelium that secretes mucus, such as the mucous membrane lining the alimentary canal.

Mucosal associated lymphoid tissue (MALT) it comprises all lymphoid cells in epithelia and in the lamina propria lying below the body's mucosal surfaces. The main sites of mucosal-associated lymphoid tissues are the gut-associated lymphoid tissues (GALT), and the bronchial-associated lymphoid tissues (BALT).

Mucosal epithelia All of the body's internal epithelial organs are lined with epithelium that is coated with mucus, and are therefore called mucosal epithelia. This system is the site of entry for virtually all antigens, and is protected by a unique set of lymphoid organs.

Mucous membrane The lining of the gut system and the urinogenital system of animals, consisting largely of moist epithelium overlying connective tissue. It is so called because of the presence in the epithelium of goblet cells that secrete mucus.

Mucus (mucusL = snivel) Jellylike viscous, slimy substance secreted by mucous membranes.

Multi drug resistance protein (MDR protein) Type of ABC transporter protein that can pump hydrophobic drugs (such as some anticancer drugs) out of the cytoplasm of eukaryotic cells.

Multi locus probe A probe that hybridizes to a number of different sites in the genome of an organism.

Multicatalytic proteinase complex (MPC) A massive complex of proteolytic enzymes that is found in the cytosol of many eukaryotic cells and seems to function in the programmed destruction of cellular proteins.

Multicellular tumor spheroids (MCTS) In vitro cellular three dimensional proliferating models for the study of tumor cells.

Multicopy control A plasmid is said to be under multicopy control when the control system allows the plasmid to exist in more than one copy per individual bacterial cell.

Multicopy plasmids Plasmids present inside bacteria in quantities greater than one plasmid per (host) cell. e.g., pBR322 is a multi-copy plasmid, there are usually 50 pBR322 molecules (or copies) per *E. coli* genome.

Multicysteine zinc finger A type of DNA-binding domain in proteins that is characterized by the coordination of one or more zinc ions and cysteine residues in order to stabilize the protein fold.

Multidrug resistance is a condition enabling a disease-causing organism to resist distinct drugs or chemicals of a wide variety of structure and function targeted at eradicating the organism.

Multidrug resistance protein multidrug-resistance proteins are plasma-membrane proteins that actively extrude anticancer agents from the cell interior, decreasing drug accumulation and thus, allowing the multidrug-resistant cells to survive in the presence of toxic levels of chemotherapeutic agents. Example: P-glycoprotein.

Multienzyme complex A group of noncovalently associated enzymes that catalyze two or more sequential steps in a metabolic (chemical reaction) pathway.

Multifactorial Describes a trait that is determined by the interaction of multiple genetic and environmental factors.

Multiforked chromosome (in bacterium) has more than one replication fork, because a second initiation has occurred before the first cycle of replication has been completed.

Multigene family A group of genes that are similar in nucleotide sequence or that produce polypeptides with similar amino acid sequences.

Multigenic Controlled by several genes, as opposed to monogenic. Example: Milk yield, Complex diseases etc.

Multiline varieties Mixtures of several similar purelines having different genes for disease resistance.

Multilocular cyst Cyst containing many cavities (*Echinococcus multilocularis*).

Multipass transmembrane protein Membrane protein in which the polypeptide chain crosses the lipid bilayer more than once.

Multiple aleurone layer (MAL) gene A gene in corn (maize) that (when present in the DNA of a given plant) causes that plant to produce seed that contains higher-than normal levels of calcium, magnesium, iron, zinc, and manganese. These higher mineral levels are particularly useful for feeding of swine, since traditional yellow (dent) corn does not contain enough for optimal animal growth.

Multiple alignment An alignment of three or more nucleotide sequences.

Multiple alleles More than two alternative forms of a single gene. Each allele may cause a different phenotype.

Multiple Arbitrary Amplicon Profiling (MAAP) A collective term for techniques using single arbitrary primers, such as AP-PCR, DAF, and RAPD.

Multiple hit or multiple substitution The situation that occurs when a single nucleotide in a DNA sequence undergoes two mutational changes, giving rise to two new alleles, both of which differ from each other and from the parent at that nucleotide position.

Multiple myeloma A malignant tumor of plasma cells. It is characterized by greatly increased numbers of abnormal plasma cells and the destruction of healthy bone tissue, and is usually associated with anemia, an abnormal immunoglobulin in the blood, and Bence-Jones protein in the urine. The cancerous B cell proliferates and produces massive quantities of a single antibody known as myeloma protein.

Multiple ovulation and embryo transfer (MOET) A technology by which a single female that usually produces only one or two offspring can produce a litter of offspring. Involves stimulation of a female to shed large numbers of ova; natural mating or artificial insemination; collection of fertilized ova (either surgically, or non-surgically through the cervix); and transfer (usually non-surgical, through the cervix) of these fertilized ova to recipient females.

Multiple sclerosis A disease in which the human body's immune cells attack myelin (the "insulation" that surrounds nerve fibers in the spinal cord and brain) and the body's acetyl choline receptors. That leads to recurrent muscle weakness, loss of muscle control, and (potentially) eventual paralysis. It is caused by an autoimmune response to various antigens found in the myelin sheath.

Multiple sequence alignment An alignment of three or more sequences with gaps inserted in the sequences such that residues with common structural positions and/or ancestral residues are aligned in the same column. Clustal W is one of the most widely used multiple sequence alignment programs.

Multiple tube fermentation test A method of detecting the presence of coliforms.

Multiplex ratio A measure of the number of bands simultaneously analyzed per DNA marker assay (experiment), that is, the number of bands resolved on a particular gel.

Multiplexing A laboratory approach that performs multiple sets of reactions in parallel (simultaneously); greatly increasing speed and precision.

Multipoint cross A genetic cross in which the inheritance of three or more markers is followed.

Multipotent The potential to make a few cell types in the body. Certain stem cells present within (adult) bodies of organisms, that can be differentiated (via chemical signals) to give rise to a variety of different cell/tissue types (bone, cartilage, fat, muscle, red blood cells, B cells, T cells, etc.).

Multiregional evolution A hypothesis that holds that modern humans in the Old World have descended from *Homo erectus* populations that left Africa over 1 million years ago.

Multisubunit protein A protein made up of more than one peptide chain. Also called as multimer or multimeric protein. Example: Hemoglobin, Insulin etc.

Multivalent Structure formed by the association of more than two homologous chromosomes as a consequence of synapsis during meiosis.

Multivalent vaccine A single vaccine that is designed to elicit an immune response either to more than one infectious agent or to several different epitopes of a molecule.

Murein The cross-linked mucopeptides that form the rigid framework of bacterial cell walls.

- Muriform** A multicelled, transverse and longitudinal septate conidium.
- Murmur** Abnormal sounds heard on auscultation of the heart, lungs, or vessels; this is a physical finding that has a variety of causes.
- Muscarinic acetylcholine receptor** A class of integral membrane protein that use G proteins as their signalling mechanism and binds acetylcholine. It then becomes a GEF for the trimeric G protein G_q, hence leading to the activation of phospholipase C β which in turn leads to release of calcium ions from the endoplasmic reticulum. Synapses that have these receptors may be either excitatory or inhibitory. Example secretion from salivary glands and stomach, smooth muscle contraction etc.
- Muscle** (musculusL = mouse) The tissue in the body of humans and animals, made up of highly contractile cells, that can be contracted and relaxed to make the body move. Mesodermal in origin it is of three types, skeletal, smooth and cardiac type.
- Muscular dystrophy** (MD) A genetic disease characterized by the progressive wasting of muscles and eventual death. It is caused by a defect in the X chromosome (resulting in nonexpression of the Duchenne Muscular Dystrophy gene); first recognized by G. A. B. Duchenne in 1858. The disease affects males almost exclusively because males have only one X chromosome, whereas females inherit two copies of the X chromosome and have a "backup" in case one X chromosome is damaged (as is the case for MD victims). The disease first shows itself between 1 and 6 years, progressing until the patient is confined to a wheelchair by the early teens, with death resulting by the late teens in most affected individuals. Other forms of MD are controlled by autosomal genes (both dominant and recessive) and hence they are equally frequent in boys and girls.
- Mushroom** A filamentous fungus belonging to the class basidiomycetes, that produces large, sometimes edible structure, called fruiting body. e.g., *Agaricus bisporus* (button mushroom).
- Mutable genes** Genes with an unusually high mutation rate.
- Mutagen** (mutareL = to change) A chemical substance or a physical one capable of producing a genetic mutation (change), by causing changes in the DNA of living organisms, such as UV light. According to the World Health Organization (WHO), 60–80% of all known mutagens are also carcinogens (cancer-causing). A mutation can occur in either germ cells or somatic cells, but only a change in a germ cell will be transmitted to future generations by sexual reproduction
- Mutagenesis** Change(s) in the genetic constitution of a cell through alterations to its DNA with the aid of mutagens.
- Mutagenicity** The capacity of a chemical or physical agent to cause permanent genetic alterations.
- Mutant** (mutareL= to change) An altered cell or organism resulting from mutation (an alteration) of the original wild (normal) type which has resulted due to a change in its gene or chromosomes. A change from the normal to the unique or abnormal. A mutant organism may carry mutated gene(s) (= gene mutation); mutated chromosome(s) (= chromosome mutation); or mutated genome(s) (= genome mutation).
- Mutarotation** The change in optical rotation of a sugar that is observed immediately after it is dissolved in aqueous solution, as the result of the slow approach of equilibrium of a pyranose or a furanose in its alpha and beta forms.
- Mutase(s)** An enzyme catalyzing transposition of a functional group in the substrate (substance acted upon by the enzyme). Intramolecular transfer of a chemical group from one position (i.e., carbon atom) to another within the same molecule. An example of a mutase is phosphoglucomutase. It has

a molecular weight of about 60,000 Daltons with about 600 amino acid residues (monomers). The mutase can interchange (move) a phosphate unit between the #1 and #6 position.

Mutasome A protein complex that is constructed during the SOS response (distress signal) of *Escherichia coli*. The complex includes Rec A, UmuC-UmuD' and pol III/pol V proteins.

Mutation (L. *mutare*, to change) A sudden, heritable change in the DNA sequence appearing in an individual as the result of a change in the structure of a gene (= gene mutation); changes in the structure of chromosomes (= chromosome mutation); or in the number of chromosomes (= genome mutation). A mutation can arise in a germ cell and be passed on to an individual's children, who will then carry it in every cell of their body. A mutation can also arise in one cell in the body, such as a skin or heart cell. Mutations like these can lead to cancer if they interrupt the cell cycle. **Mutation breeding** refers to several techniques, involving induced mutations with ionizing radiation or chemical mutagens, to introduce desirable genes into the plants. For example, gene(s) to confer resistance to plant diseases, increased yield etc.

Mutation frequency is the frequency at which a particular mutant is found in the population.

Mutation pressure A constant mutation rate that adds mutant genes to a population; repeated occurrences of mutations in a population.

Mutation rate is the rate at which a particular mutation occurs, usually given as the number of events per gene per generation.

Mutation screening A set of techniques for determining if a DNA molecule contains a specific mutation.

Mutator gene A gene that increases the mutation rate of other genes in the same organism i.e., increase in the basal level of mutation of the genome. Such genes often code for proteins that are involved in repairing damaged DNA.

Muteins The second generation recombinant therapeutic proteins are collectively referred as muteins.

Mutual recognition agreements (MRAs) Legal agreements (treaties) between two or more nations, to recognize and respect each other's approval process for new crops/ animals derived via biotechnology.

Mutualism A symbiosis between two organisms of two different species.

Mutually exclusive Two or more cases are said to be mutually exclusive if the happening of any one of them excludes the happening of all others in a single experiment.

Myalgia Soreness or aching of muscles.

Myasthenia gravis An autoimmune disease specific to skeletal muscle, especially muscles of the limbs, eye movement, speech and swallowing; in which autoantibodies against the acetylcholine receptor on skeletal muscle cells cause a block in neuromuscular junctions, leading to progressive weakness and eventually death.

Mycelia Sterilia An order of the Fungi Imperfecti consisting of fungi that do not produce conidia or spores.

Mycelium (pl: mycelia) A mass of long filaments of cells that branch and interwine, forming the vegetative (somatic) portion. Example molds.

Mycetoma A localized, chronic cutaneous or subcutaneous infection caused by certain fungi and *Nocardia*, classically characterized by draining sinuses, granules, and swelling.

Mycobacteria Slender, acid fast rods, often filamentous; include organisms that cause TB, leprosy and chronic infections.

Mycobacterium tuberculosis The pathogen that causes tuberculosis, a human disease in which the lungs are destroyed as this bacteria grows (within lung tissue). Some of the bacterial strains are sensitive to antituberculosis drugs like rifampicin and streptomycin. In 1998, scientists completed sequencing of the genome of *Mycobacterium tuberculosis*.

Mycology The study of fungi and their biology.

Mycoplasma A group of bacteria without a cell wall. They are grouped together with gram-positive bacteria not because they are stained positive but because they are phylogenetically close to the clostridia. The other important feature of mycoplasma is that they are very small, probably the smallest organisms capable of autonomous growth.

Mycoprotein Fungal protein. Example the edible protein of mushrooms

Mycorrhiza (Gr. *mykos*, fungus + *riza*, root) A soil fungus that form an association with or have a symbiotic relationship with roots of more developed vascular plants. Plural, mycorrhizae; adj., mycorrhizal. They are named after their presence in the plant's rhizosphere (root system). Example vesicular-arbuscular mycorrhizas (VAM) in wheat.

Mycosis (pl. mycoses) A disease caused by a fungus in animals and humans. Example athlete's foot.

Mycotoxins Toxins produced by fungi. More than 350 different mycotoxins are known to man, but the first ones to be isolated and scientifically characterized (i.e., described) were the aflatoxins, in 1961. The second group of mycotoxins to be isolated and characterized were the ochratoxins, in 1965. Almost all mycotoxins possess the capacity to harmfully alter the immune systems of animals. Consumption by animals (including humans) of certain mycotoxins (via eating infected corn/maize, wheat, certain tree nuts, peanuts, cottonseed products, etc.) can result in liver toxicity, gastrointestinal lesions, cancer, muscle necrosis, etc.

Myelin It is a dielectric (electrically insulating) fatty substance that is wrapped around nerve cell axons. The production of the myelin sheath is called myelination. It is produced by oligodendrocytes in the central nervous system and by Schwann cells in the peripheral nervous system. Myelin was discovered in 1854 by Rudolf Virchow and it is a characteristic feature of vertebrates.

Myeloblast A large, mononuclear, nongranular cell of the bone marrow that is a precursor of myelocytes, which in turn are precursors of granulocytes.

Myeloid cell Any white blood cell other than lymphocytes.

Myeloid dendritic cells Dendritic cells can arise from myeloid cells, in which case they are called myeloid dendritic cells, or from lymphoid tissues, in which case they are called lymphoid dendritic cells.

Myeloid progenitors are cells in bone marrow that give rise to the granulocytes and macrophages of the immune system.

Myeloma A tumor cell line derived from a lymphocyte. It usually produces a single type of immunoglobulin.

Myeloma cells These cells produce a monoclonal immunoglobulin, called myeloma protein, which is detectable in the patient's plasma.

Myeloma proteins These are immunoglobulins secreted by myeloma tumors and are found in the patient's plasma.

Myelopoiesis is the production of monocytes and polymorphonuclear leukocytes in bone marrow.

Myiasis Infestation with maggots (fly larvae).

Myoblast Mononucleated, undifferentiated muscle precursor cell. Skeletal muscle cell is formed by the fusion of multiple myoblasts.

Myocardial infraction The death of heart tissue caused by the loss of the blood supply (a heart attack).

Myocarditis Inflammation of the heart muscle.

Myoelectric signals The nerve signals that are sent by the body in order to control muscle movement.

Myoepithelial cell type of unsriated muscle cell found in epithelia, e.g.in the iris of the eye and in glandular tissue.

Myofibril Long, highly organized bundle of actin, myosin, and other proteins of muscle cells that contract by sliding filament mechanism.

Myoglobin A relatively small (MW = 16,700), oxygen-binding, globular protein consisting of 153 amino acid residues in a polypeptide chain and one heme group; has molecular dimensions $45 \times 35 \times 25 \text{ \AA}$; found in the muscles of vertebrates and some invertebrates (giving the muscles a deep red-brown colour due to the presence of iron-porphyrin or heme group); has a high affinity for oxygen. It is a oxygen storing pigment as compared to hemoglobin which is a oxygen transporting pigment.

Myosin (myosG = muscle + inG = belonging to) The main protein of the thick filaments in a muscle myofibril. It is composed of two coiled subunits that can aggregate to form a thick filament, which is globular at one end.

Myosin II A class of myosin that forms the large filaments seen in striated muscle but that is also found in other cell types. It is responsible for producing muscle contraction in muscle cells.

Myosin V A class of myosin that carries vesicles and organelles along actin filaments. Its size is 36 nm.

Myositis Inflammation of a muscle, sometimes caused by infection as in pyomyositis, an infection caused by *Staphylococcus aureus* that leads to small abscesses within the muscle substance.

Myristoylation The covalent attachment of a myristoyl group (derived from myristic acid) via an amide bond to the alpha-amino group of an N-terminal amino acid of a nascent polypeptide. It is more common on glycine residues but can also occur on other amino acids. Such transformation of proteins in cells can cause cancer. In plants it plays a critical role in signal transduction in response to environmental stress.

Myxosarcoma A malignant tumor arising in connective tissue.

Myxedema (myxaG = slime + oidemaG = swelling) A hypothyroidal disease, characterized by an abnormally low basal metabolic rate (BMR), deposition of a semifluid material under the skin, an increase in subcutaneous fat and mental and physical sluggishness; also spelt as myxoedema.

Myxoma A benign tumor arising in embryonic connective tissue

Myxomatosis A disease of rabbits caused by the myxoma virus.

Myxoviruses A family of RNA viruses that includes influenza viruses, hemagglutinating viruses, and the subgroup of paramyxoviruses. The RNA genome of myxoviruses has a mass of about $2 \text{ to } 8 \times 10^6$, is encapsulated in a lipoprotein envelope. Myxoviruses have been shown to cause tumors in many species.

β -mercaptapurine An antimetabolite that is a structural analog of hypoxanthine. It is converted by intracellular enzymes to a nucleotide, thioinosine monophosphate that interferes with the production of adenosine monophosphate and guanosine monophosphate. It thus inhibits the synthesis of DNA.

N-acetyl muramic acid : An acetylated amino sugar bearing a lactyl group. Together with N-acetylglucosamine, it forms the polysaccharide backbone of murein, the rigid, cross-linked polymer that forms the rigid portion of a eubacterial cell wall.

N-Acetylglucosamine (N-acetyl-D-glucosamine, or GlcNAc, or NAG) is a monosaccharide derivative of glucose. It is an amide between glucosamine and acetic acid. It has a molecular formula of $C_8H_{15}NO_6$, a molar mass of 221.21 g/mol, and it is significant in several biological systems.

It is part of a biopolymer in the bacterial cell wall, built from alternating units of GlcNAc and N-acetylmuramic acid (MurNAc), cross-linked with oligopeptides at the lactic acid residue of MurNAc. This layered structure is called peptidoglycan (formerly called murein).

NAD (nicotinamide adenine dinucleotide, nicotinamide adenine dinucleotide phosphate) : Nicotinamide-containing coenzymes functioning as carriers of hydrogen atoms and electrons in some oxidation-reduction reactions.

Nagler test : A test once widely used to presumptively identify *Clostridium perfringens*. It is used less often in today's laboratories because it is not specific for *C. Perfringens*. The Nagler test employs an antitoxin that will neutralize the lecithinase produced by *C perfringens* (and three additional *Clostridium* spp.)

Naive lymphocyte : A mature T- or B-cell which has not yet been activated by encounter with antigen.

Nanophytus salmincola : A digenetic trematode (acquired by ingestion of raw, undercooked, or smoked salmon) human infections have now been reported from North America. Symptoms include gastrointestinal complaints or unexplained eosinophilia. Eggs were also recovered from the stool specimens.

Nanoplankton : Planktonic organisms that are 2-20 micrometers in size.

nanopore - Soil pore having dimensions measured in nanometers. Materials encased in nanopores are beyond the reach of microorganisms and enzymes.

napkin (diaper) candidiasis : Typically found in infants whose diapers are not changed frequently and are therefore not kept dry. Caused by *Candida* species of fungi

NAPL : Non-aqueous phase liquid. This can be lighter than water (LNAPL), or more dense than water (DNAPL).

Narrow-spectrum drugs : Chemotherapeutic agents that are effective only against a limited variety of microorganisms.

Nasopharyngeal : Pertaining to the part of the pharynx above the level of the soft plate.

Native conformation : The biologically active conformation of a macromolecule.

NATIVE GEL - An electrophoresis gel run under conditions which do not denature proteins (i.e., in the absence of SDS, urea, 2-mercaptoethanol, etc.).

Natural attenuation. The decrease in the level of an environmental contaminant that results from natural chemical, physical, and biological processes.

Natural catastrophe : An extreme environmental event such a flood, severe windstorm, or outbreak of disease that can eliminate or drastically reduce the sizes of populations (10)

Natural classification : A classification system that arranges organisms into groups whose members share many characteristics and reflect as much as possible the biological nature of organisms.

Natural Farming : Masanobu Fukuoka's method for letting roots till the soil instead of machine. Decrease cultivation and you decrease weeds. Leguminous cover crops and mulching instead of fertilizer. Fukuoka practices what he calls the "no-plowing, no-fertilizer, no-weeding, no-pesticides. Do-nothing method of natural farming," To him the idea that people can grow crops is egocentric, for it is nature that grows crops. His rice yields have been impressive. (He reads like kind of a nut: lots of "man in his arrogance" soliloquizing reminiscent of Roger Payne in the seventies.)

Natural Gas : Hydrocarbon gasses that accumulate in coaks of marine sediment. Roughly 80% methane.

Natural killer (NK) cell : A non-T, non-B lymphocyte present in nonimmunized individuals that exhibits MHC-independent cytolytic activity against tumor cells. A specialized lymphocyte that recognizes and destroys foreign cells or infected host cells in a nonspecific manner.

Natural Selection : Nature's selections of viable strengths through environmental pressure that for an organism to adapt. The bat that hears better than the rest stands a better chance of living enough to pass on that kind of hearing. In this way certain favorable genes-favorable to adapting environment pressures-gradually become more numerous in a given population. Discovered by Charles Darwin.

Natural Systems Agriculture : An approach developed by Wes Jackson and the The Land Institute that emphasizes mimicking natural ecosystems by growing perennial polycultures or mixtures of perennial grains, as prairies do.

Naturally acquired active immunity : The type of active immunity that develops when an individual's immunologic system comes into contact with an appropriate antigenic stimulus during the course of normal activities; it usually arises as the result of recovering from an infection and lasts a long time.

naturally acquired passive immunity : The type of temporary immunity that involves the transfer of antibodies from one individual to another.

Nausea **Nausea** is a sensation of unease and discomfort in the upper stomach with an involuntary urge to vomit. It often, but not always, precedes vomiting. A person can suffer nausea without vomiting

NB : Northern Blot (RNA hybridization) The **northern blot** is a technique used in molecular biology research to study gene expression by detection of RNA (or isolated mRNA) in a sample. With northern blotting it is possible to observe cellular control over structure and function by determining the particular gene expression levels during differentiation, morphogenesis, as well as abnormal or diseased conditions. Northern blotting involves the use of electrophoresis to separate RNA samples by size and detection with a hybridization probe complementary to part of or the entire target sequence.

Necrosis - Damage of living tissues because of infection or injury. Localized death of cells or tissues.

Necrotic : Dead

Necrotizing fasciitis : A very serious, painful infection involving the fascia (membranous covering) of one or more muscles; may spread widely in short periods of time since there is no anatomic barrier to spread in this type of infection.

necrotroph : An organism that kills part or all of another organism before deriving nutrients from it (usually applied to plant pathogens). 2. An organism that derives nutrients from dead plant or animal tissues, whether or not it is responsible for the death of those tissues.

Necrotrophic - Nutritional mechanism by which an organism produces a battery of hydrolytic enzymes to kill and break down host cells and then absorb nutritional compounds from the dead organic matter.

Negative cooperativity : A phenomenon of some multisubunit enzymes or proteins in which binding of a ligand or substrate to one subunit impairs binding to another subunit.

Negative feedback : Regulation of a biochemical pathway achieved when a reaction product inhibits an earliest step in the pathway.

Negative selection : Deletion by apoptosis in the thymus of T-cells which recognize self peptides presented by self MHC molecules, thus preventing the development of autoimmune B-cells. Negative selection of developing B-cells also occurs if they encounter high levels of self antigen in the bone marrow.

Negative staining : A staining procedure in which a dye is used to make the background dark while the specimen is unstained eg ??

Negri bodies (na_gre) Masses of virous or unassembled viral subunits found within the brain neurons of rabies-infected animals. Characteristic virally-induced inclusions present in rabies-infected brain cells.

Nekton : Organisms with swimming abilities that permit them to move actively through the water column and to move against currents eg ??

nematicide : A chemical compound or physical agent that kills nematodes.

Nematode : More or less elongate, spindle-shaped, worm-like animals ranging in size from less than a millimeter to several meters in length, living as saprophytes in soil or water or as parasites of plant or animals.

Neonatal : First 4 weeks after birth.

Neoteny : Retention of juvenile characteristics in an adult, as in the axolotl salamander near Mexico City; under certain environmental conditions it never fully matures.

Neotype : A specimen selected as the type subsequent to the original description in cases in which the primary types are definitely known to have been destroyed.

Nephelometry (NEPH) : is used to quantitate antigen by analyzing increases in turbidity, as measured by increasing scatter of laser light. The interaction of specific antibodies in the reagent with the antigen from the sample results in the formation of antigen-antibody complexes which are rendered insoluble by the presence of precipitating reagents. Most modern nephelometers compare the rate of formation of antigen-antibody complexes (determined by computer analysis of laser light scatter data) to that of known antigenic standards in order to measure precisely the protein antigens (some of which are actually immunoglobulins) present in moderate concentrations.

Nephrosis : Degeneration of renal tubular epithelium.

Nepovirus : (Siglum of nematode polyhedral virus). Member of a group of multicomponent plant viruses with two isometric particles containing two species of linear RNA, transmitted mechanically and by soil-inhabiting nematodes.

Neritic : The **neritic zone**, also called **coastal waters**, the **coastal ocean** or the **sublittoral zone** is the part of the ocean extending from the low tide mark to the edge of the continental shelf, with a relatively shallow depth extending to about 200 meters (110 fathoms or 667 feet). The neritic zone has generally well-oxygenated water, low water pressure, and relatively stable temperature and salinity levels. These, combined with presence of light and the resulting photosynthetic life, such as phytoplankton and floating sargassum, make the neritic zone the location of the majority of sea life.

Nested PCR - A very sensitive method for amplification of DNA, which takes part of the product of a single PCR reaction (after 30-35 cycles), and subjects it to a new round of PCR using a different set of PCR primers which are nested within the region flanked by the original primer pair.

Net ecosystem production : The combined ecosystem fluxes of CO_2 , including net primary production and heterotrophic respiration.

Net primary production (NPP) : The amount of energy (per unit time) that autotrophs capture by photosynthesis and chemosynthesis, minus the amount used in cellular respiration.

Net primary productivity : Total primary production, minus the amount consumed in respiration.

Net reproductive rate (R_0) The mean number of offspring produced by an individual in a population during its lifetime.

Net secondary production : The balance between energy gain through ingestion, and energy losses by cellular respiration and egestion in heterotrophs.

Neuritis : inflammation of one or more nerves. The characteristic symptoms of neuritis include pain and tenderness; impaired sensation, strength, and reflexes; and abnormal circulation and decreased ability to sweat in the distribution of the inflamed nerve or nerves. Neuritis frequently results from an injury that causes pressure on a nerve just underneath the skin. The condition may also result from a tumour or from infected or scarred connective tissue that compresses the nerve.

Neuron : A nerve cell that transmits electrochemical impulses. Neurons were thought to work somewhat like electric switches; When triggered at the dendrite end by an incoming nerve pulse, they generate a pulse down the axon (with help from the Nodes of Ranvier, which work like signal boosters) to the terminal button, where the pulse triggers the release of neurotransmitter chemicals into the synapse, the space between one neuron and another. These chemicals then trigger a pulse (or inhibit one) in other neurons. As it turns out, however, each neuron is more like a microchip than a simple switch. At any moment only about 5-10% of the human brains neurons are sparking, but eventually they all do, a fact that contradicts the common but inaccurate idea that people use only a small portion of their brains. The adult brain contains about 10 billion neurons, with the brain as a whole drawing 20-40 watts of power, and with an ultimate storage capacity of (very roughly) 100 terabytes; about the same as every book ever written, digitized. It's hard to estimate because each dendrite contacts about 10,000 other neurons in extraordinarily complicated neural nets.

Neuropathy : Diseases or disorders affecting the cranial nerves or the peripheral nerves.

Neurotoxin : A toxin that is poisonous to or destroys nerve tissue; especially the toxins secreted by *C tetani*, *Corynebacterium diphtheriae*, and *Shigella dysenteriae* a poison that disrupts nerve function. Some venoms are neurotoxins that paralyze the prey.

Neurotransmitter : A low molecular weight compound (usually containing nitrogen) secreted from the terminal of a neuron and bound by a specific receptor in the next neuron; serves to transmit a nerve impulse (as in a chemical synapse)

Neurotrophic : Having a selective affinity for nerve tissue, Rabies is caused by a neurotrophic virus.

Neuston : Planktonic organisms associated with the air-water interface.

Neustonic : The microorganisms that live at the atmospheric interface of a water body.

Neutralization (NT) : is similar to complement fixation but is applicable only in certain pathogenic situations where the antibody being measured is directed against a hemolysin (a bacterial toxin capable of directly lysing erythrocytes). In these situations, the hemolysin and reagent erythrocytes

are added, and if the antibody to the hemocytin is present, the lysis of RBC's will not occur. As in Complement Fixation (CF), crude quantitation is afforded by serial dilution which may be quantitatively compared to established standard material dilutions.

Neutron : A chargeless particle in the nucleus of an atom. Neutrons and protons make up most of the atom's mass.

Neutropenia : Abnormally low numbers of neutrophils in the circulating blood. It is a granulocyte disorder characterized by an abnormally low number of neutrophils. Neutrophils usually make up 50-70% of circulating white blood cells and serve as the primary defense against infections by destroying bacteria in the blood. Hence, patients with neutropenia are more susceptible to bacterial infections and, without prompt medical attention, the condition may become life-threatening (neutropenic sepsis).

Neutrophil : The major circulating phagocytic polymorphonuclear granulocyte. Enters tissues early in an inflammatory response and is also able to mediate antibody-dependent cellular cytotoxicity (ADCC). A mature white blood cell in the granulocyte lineage formed in bone marrow. It has a nucleus with three to five lobes and is very phagocytic.

neutrophile Microorganisms that grow best at around a neutral pH range between pH 5.5 and 8.0

Newborn Screening : Newborn screening is testing performed on newborn babies to detect a wide variety of disorders. Typically, testing is performed on a blood sample obtained from a heel prick when the baby is two or three days old. In the United States, newborn screening is mandatory for several different genetic disorders, though the exact set of required tests differs from state to state.

NFB : Glucose nonfermenting gram-negative bacteria.

NGU : Nongonococcal urethritis. **Nongonococcal urethritis (NGU)** is an inflammation of the urethra that is not caused by gonorrheal infection. The symptoms of urethritis can include pain or a burning sensation upon urination (dysuria), a white/cloudy discharge and a feeling that one needs to pass urine frequently. For men, the signs and symptoms are discharge from the penis, burning or pain when urinating, itching, irritation, or tenderness, and underwear stain. In women, the signs and symptoms are discharge from vagina, burning or pain when urinating, anal or oral infections, abdominal pain, or abnormal vaginal bleeding, which may be an indication that the infection has progressed to Pelvic Inflammatory Disease. However, men are frequently, and women are occasionally, asymptomatic. Mainly caused by *Ureaplasma urealyticum* and *Mycoplasma genitalium*

Niche - Functional role of a given organism within its habitat. A general term referring to the range of environmental space occupied by a species.

Niche Difference : Those that keep organisms from competing for resources (like plants that draw nutrients from different depths).

Niche Model : A predictive tool that models the ecological niche occupied by a species based on the conditions at localities the species is known to occupy.

Niche overlap : An overlap in resource requirements by two species

NICK - In duplex DNA. this refers to the absence of a phosphodiester bond between two adjacent nucleotides on one strand.

Nick Translation - A method for introducing labeled nucleotides into a double-stranded DNA molecule which involves making small nicks in one strand with DNase, and then repairing with DNA polymerase 1.

Nick translation : Use of enzymes to break DNA and repolymerize small sections of the molecule usually for purposes of labeling the DNA with a radioactive nucleotide. A procedure for making a DNA probe in which a DNA fragment is treated with DNASE to produce single-stranded nicks, followed by incorporation of radioactive nucleotides from the nicked sites by DNA polymerase I.

Nickpoint : Elevation drop along a stream. Falls occur at nick points.

Nicotinamide adenine dinucleotide phosphate (NADP) : An important coenzyme, functioning as a hydrogen carrier in a wide range of redox reactions; the H is carried on the nicotinamide residue. The oxidized form of the coenzyme is written NADP⁺, the reduced form as NADPH. Many oxidoreductases are specific for either NAD or NADP, although some can function with either. As a broad generalization, NADP is more commonly associated with biosynthetic reactions, NAD with catabolic and energy-yielding reactions.

Nicotinic acid (niacin) : A white crystalline acid that is a component of the vitamin B complex.

Ninhydrin reaction : A color reaction given by amino acids and peptides on heating with ninhydrin; widely used for their detection and estimation.

Nitrate reduction (biological) - Process whereby nitrate is reduced by plants and microorganisms to ammonium for cell synthesis (nitrate assimilation, assimilatory nitrate reduction) or to various lower oxidation states (N_2 , N_2O , NO_2) by bacteria using nitrate as the terminal electron acceptor in anaerobic respiration.

Nitrate test : Any test that detects an organism's ability to reduce nitrate to nitrite.

Nitrification : A process by which certain heterotrophic bacteria, known as nitrifying bacteria, convert ammonia (NH_3) and ammonium (NH_4) to nitrate (NO_3) under aerobic conditions (21)

Nitrifying bacteria : Chemolithotrophic, gram-negative bacteria that are members of the family Nitrobacteriaceae and convert ammonia to nitrate and nitrite to nitrate. Chemolithotrophs capable of carrying out the transformations from NH_3 to NO_2 , or NO_2 to NO_3 .

Nitrogen Cycle (or Nitrification) : Cycling of nitrogen from the air and soil to plants, animals, and then back to the environment. Bacteria, legumes, and algae convert atmospheric nitrogen into nitrates that enter plant roots before turning into protoplasm that decomposers eventually break down again.

Nitrogen fixation : The process of taking up nitrogen gas (N_2) and converting it into chemical forms that are more chemically available to organisms.

Nitrogen Oxygen demand (NOD) : The demand for oxygen in sewage treatment, caused by nitrifying microorganisms.

Nitrogen saturation point : The point at which mineral nitrogen, when added to an ecosystem, can no longer be incorporated into organic matter through biological processes.

Nitrogenase : The enzyme that catalyzes biological nitrogen fixation. A nitrogen-fixing enzyme found only in certain bacteria.

Nitrogenase complex : A system of enzymes capable of reducing atmospheric nitrogen to ammonia in the presence of ATP.

Nivation : The process of erosion by frost or snow.

NK (natural Killer) Cell : Large granular lymphocyte which does not rearrange nor express either immunoglobulin or T-cell receptor genes but is able to recognize and destroy certain tumor and virally infected cells in an MHC and antibody -independent manner.

NKT cell : NKT 1 + lymphoid cells with a morphology and granule content intermediate between T-cells and NK cells. They express low levels of α B TCR with an invariant α chain and very restricted B chain specificity, recognize lipid and glycolipid antigens presented by the nonclassical MHC-like molecule (CD1d), and are potent producers of IL - 4 and IFN γ .

NMR : Nuclear magnetic resonance is a physical phenomenon in which nuclei in a magnetic field absorb and re-emit electromagnetic radiation. This energy is at a specific resonance frequency which depends on the strength of the magnetic field and the magnetic properties of the isotope of the atoms; in practical applications, the frequency is similar to VHF and UHF television broadcasts (60–1000 MHz). NMR allows the observation of specific quantum mechanical magnetic properties of the atomic nucleus.

N-nucleotides : Nontemplated nucleotides added to the junctions between antibody (and T-cell receptor) variable (V), diversity (D) and joining (J) gene segments during gene rearrangement.

Nocturnal : Pertaining to the dark portion of a 24th day; active at night (filariasis)

Nod like receptor : A family of cytoplasmic pattern recognition receptors involved in sensing the presence of pathogens.

Node : The point on a stem from where new stem or leaves grow. The nonmyelinated point on an axon where the action potential originates.

Nodular Body : One or more closely intertwined hyphae forming a rounded ball-like form.

Nodule : A small, hard nodule that can be felt by touch (onchocerciasis, coenurosis, cysticercosis, myiasis).

Nodule bacteria : Nitrogen fixing bacteria, mostly involved in root nodule formation during nitrogen fixation. Eg. Rhizobium

Nodulins - A small, hard nodule that can be felt by touch (onchocerciasis, coenurosis, cysticercosis, myiasis)

Nodulin Proteins - Unique proteins produced in root nodules in response to rhizobial infection.

Nomenclature (no-men-klatur) The branch of taxonomy concerned with the assignment of names to taxonomic groups in agreement with published rules.

Noncardioforms : Bacteria that resemble members of the genus Nocardia; they develop a substrate mycelium that readily breaks up into rods and coccoid elements (a quality sometimes called fugacity).

Noncircular transmission : Virus transmission characterized by a very short period of acquisition of the virus by a vector (e.g. an aphid), no latent period before the vector can transmit the virus, and a short period of retention by the vector after acquisition. (Also termed nonpersistent transmission).

Noncompetitive inhibition : A type of enzyme inhibition not reversed by increasing the substrate concentration.

Nonconservative substitution : A mutation which results in the substitution of one amino acid within a polypeptide chain with an amino acid belonging to a different polarity/charge group.

Noncyclic electron flow : The light-induced flow of electrons from water to NADP in oxygen-evolving photosynthesis; it involves both photosystems I and II.

Noncyclic photophosphorylation : The process in which light energy is used to make (ATP) when electrons are moved from water to NADPI during photosynthesis; both photosystem I and photosystem II are involved.

Nondegradable Pollutants; those that do not decompose. Examples include lead, mercury, arsenic plastics, and synthetics.

Non-Directiveness : Non-directiveness refers to the nature of the genetic counseling process. According to the principle of non-directiveness, the genetic counselor has the responsibility to provide the client with accurate information about a test or outcome but should remain neutral and not try to influence the decisions made by the client.

Nonequilibrium theory : A proposed explanation for the coexistence of species in a community that relief on fluctuating conditions that maintain their coexistence by keeping dominant species from monopolizing resources.

Nonessential amino acids : Amino acids that can be made by humans and other vertebrates from simple precursors, and are thus not required in the diet.

Nonheme iron proteins : Proteins, usually acting in oxidation-reduction reactions, containing iron but no porphyrin groups.

Nonphotochromogens : Slow-growing, nonpigmented mycobacteria.

Nonpoint Source (NPS) : Diffuse pollution whose source is difficult to determine (like polluted runoff).

Nonpolar : Possessing hydrophobic (water repelling) characteristics and not easily dissolved in water.

Nonpresumptive identification : Any of the methods pertaining to valid identification regardless of methods used to obtain identification. May include conventional biochemical testing gas-liquid-chromotography, or various molecular biology techniques.

Nonrenewable Resource : One that can be used up, like coal

Nonselective media : Also known as enrichment media, it contains all of the necessary nutrients for the growth of all organisms. No inhibitory factors are contained in these media.

Nonsense codon : A codon that does not specify an amino acid, but signals the termination of a polypeptide chain.

Nonsense mutation - A change in the sequence of a nucleic acid that causes a nonsense (stop or termination) codon to replace a codon representing an amino acid.

Nonsense suppressor : A mutation, usually in the gene for a TRNA, that causes an amino acid to be inserted into a polypeptide in response to a termination codon.

Nonseptate : Lacking cross-walls. Lacking septas (coenocytic).

Nonsporulating : Does not produce spores.

Nonsterile sites : An anatomic site usually inhabited by (colonized with) members of the indigenous microflora (e.g. the skin, oral cavity, distal urethra, vagina, and gastrointestinal tract). (Improperly collected specimens from non sterile sites are unsuitable for anaerobic bacteriology).

Non-sulfur purple bacteria : A group of phototrophic prokaryotes containing bacteriochlorophylls a or b which grow best as photoheterotrophs and have a relatively low tolerance for hydrogen sulfide (H₂S)

Non-suppurative sequelae : Complications caused by a previous attack of a disease, that do not contain or drain pus.

Nonsymbiotic Mutualism : A relationship of relative independence, yet necessary for both species. a with bees and apple trees.

Nontranslated RNA (NTR) - The segments located at the 5' and 3' ends of a mRNA molecule which do not encode any part of the polyprotein; may contain important translational control elements.

Normotensive : Normal blood pressure; the usual readings in adults are seen between 90/50 and 150/90Hg.

North Blot (NB) : Uses techniques similar to the Southern blot described above. Messenger-RNA from the specimen is separated by electrophoresis and blotted to a specifically modified paper support to result in covalent fixing of the mRNA in the electrophoretic positions. Radiolabeled single-stranded DNA fragments complementary to the specific mRNA being sought are then hybridized to the bound mRNA. If the specific mRNA is present, the radioactivity is detected by autoradiography. The derivation of this technique from the Southern blot used for the DNA detection has led to the common usage of the term "Northern blot" for the detection of specific mRNA.

Nosocomial : Pertaining to or originating in hospital, as nosocomial infection.

Nosocomial infection : An infection occurring in a patient in a hospital or other healthcare facility in whom it was not present or incubating at the time of admission; or the residual of an infection acquired during a previous admission. Includes infections acquired in the hospital but appearing after discharge and also such infections among the staff of the facility (Synonym hospital-acquired infection).

No-take Reserves. Geographic areas where by law no one is allowed to fish or collect biological specimens. Rules could apply to one or all species.

Nuchal rigidity: Stiffness of the neck, often associated with meningeal infection.

Nuclear Power: Energy released by the fission (splitting) or fusion of atomic nuclei: on effect rending the very fabric of matter. The resulting heat drives electric generators. Although the average nuclear plant creates 20-30 tons of highly toxic byproducts and wastes a year, no one has thought up a safe way to deal with it (plutonium has a half-life of 24,400 years).

Nucleases: Enzymes that hydrolyze the internucleotide (phosphodiester) linkages of nucleic acids.

Nucleic acid hybridization : Process by which the single-stranded probe unites with complementary DNA in an unknown sample.

Nucleic acid probe: Piece of labeled single-stranded NA used to detect complementary DNA in clinical material or a culture and thus to specifically identify the presence in these materials of an organism identical to that used to make the probe.

Nucleic acids: Polymer of nucleotides, like DNA and RNA . A very long molecule made up of nucleotide chains carrying genetic information built from carbon, hydrogen, nitrogen, oxygen, and phosphorus.

Nucleocapsid : Name of viral particle that includes virus nucleic acid core enclosed in the protein capsid coat.

Nucleoid : In bacteria, the nuclear zone that contains the chromosome but has no surrounding membrane. The aggregated mass of DNA that makes up the chromosome of prokaryotic cells.

Nucleolus: A densely staining structure in the nucleus of eukaryotic cells; involved in RNA synthesis and ribosome formation.

Nucleophile: An electron-rich group with a strong tendency to donate electrons to an electron-deficient nucleus (electrophile); the entering reactant in a bimolecular substitution reaction.

Nucleophilic compound: Chemical that attracts or is drawn to electron-deficient regions in other chemicals; reducing agents act as nucleophilic compounds.

Nucleoplasm: The portion of a cell's contents enclosed by the nuclear membrane; also called the nuclear matrix.

Nucleoprotein : A compound of nucleic acid and protein.

Nucleoside : **Nucleosides** are glycosylamines consisting of a nucleobase (often referred to as simply *base*) bound to arbose or deoxyribose sugar via a beta-glycosidic linkage. Examples of nucleosides include cytidine, uridine, adenosine, guanosine, thymidine and inosine.

Nucleoside diphosphate kinase: An enzyme that catalyzes the transfer of the terminal phosphate of a nucleoside synthesis 5'-triphosphate to a nucleoside 5' - diphosphate.

Nucleoside diphosphate sugar: A coenzymelike carrier of a sugar molecule, functioning in the enzymatic synthesis of polysaccharides and sugar derivatives.

Nucleoside monophosphate kinase: An enzyme that catalyzes the transfer of the terminal phosphate of ATP to a nucleoside 5' -monophosphate.

Nucleosome (nu -kle-0-soom²) A complex of histones and DNA found in eucaryotic chromatin; the DNA is wrapped around the surface of the beadlike histone complex.

Nucleosome : Structural unit for packaging chromatin; consists of a DNA strand wound around a histone core.

Nucleotide: **Nucleotides** are biological molecules that form the building blocks of nucleic acids (DNA and RNA) and serve to carry packets of energy within the cell (ATP). In the form of the nucleoside triphosphates (ATP, GTP, CTP and UTP), nucleotides play central roles in metabolism.^[1] In addition, nucleotides participate in cell signaling (cGMP and cAMP), and are incorporated into important cofactors of enzymatic reactions (e.g. coenzyme A, FAD, FMN, NAD, and NADP⁺). **Nucleus:** Membrane-enclosed structure containing the genetic material (DNA) organized in chromosomes. A cellular inclusion composed of chromatin; morphology often used to help identify intestinal protozoa (*Entamoeba* and *Dientamoeba* spp).

nude mouse: Mouse which is T-cell deficient due to a homozygous gene defect (*nu/nu*) resulting in the absence of a thymus (and also lack of body hair).

Nuisance bloom : A rapid increase of one or only a few species of phytoplankton, resulting in densities high enough to cause discoloration of the surface water, possible increase of toxins, and degradation of water quality aspects such as dissolved oxygen.

Null Model : A statistical model or computer simulation used to analyze something in a community or its environment.

Numerical taxonomy : The grouping by numerical methods of taxonomic units into taxa based on their character states.

Nuranone : is a sex pheromone produced by female Japanese beetles to attract males are not available for mating.

nurse plant: An adult plant that provides shade or other protection allowing plants of its own or other species to germinate and survive.

nutrient : Substance taken by a cell from its environment and used in catabolic or anabolic reactions.

Nutrient agar : The solid version of nutrient broth supplemented with agar.

Nutrient broth : A general-purpose liquid basal medium composed of, e.g. beef extract and peptone, which allows many types of microorganism to grow. A liquid basal medium.

Nutrient cycling : The cyclic movement of nutrient between organisms and the physical environment the cycling of nutrient through the environment and its inhabitants from soil to plants to animal and back to soil.

Nutrient Density : Nutrient content of a food expressed in relation to energy content (e.g. Mg per 1000 kcal).

nystatin (nis_tah-tin) : A polyene antibiotic from *Sterptomyces noursei* that is used in the treatment of Candida infections of the skin, vagina and alimentary tract.

O antigen : A polysaccharide antigen extending from the outer membrane of some gram-negative bacterial cell walls; it is part of the lipopolysaccharide.

obligate aerobe: An organism growing only in an anaerobic environment, not in a microaerophilic environment, a CO₂ incubator, or air. Microorganisms that cannot tolerate the presence of oxygen and die when exposed to it.

Obligate aerobe: An organism which growing only in the presence of oxygen (O₂).

Obligate aerobes: Organism that grow only in the presence of oxygen.

Obligate Parasite: A parasite that is able to extract nutrient only from a living host. It cannot extract nutrients from non-living material.

obligate: (i) Adjective referring to an environment factor (for example, oxygen) that is always required for growth. (ii) Organism that can grow and reproduce only by obtaining carbon and other nutrients from a living host, such as obligate symbiont. Restricted to a particular set of environmental conditions, without which an organism cannot survive. (e.g., an obligate parasite can survive only by parasitizing another organism.)

oblong : (Of spores) longer than broad (about twice as long or somewhat less,) with sides nearly parallel and with ends more or less flattened.

obovate : Egg-shaped, with the wide end outward.

obovoid : Egg-shaped, with the narrow end outward.

obtuse: (Of pileus, cystidia, spores) rounded or blunt.

Occult blood: Blood present in very small amount; usually detectable by chemical means; specimen is most often stool; may or may not be related to parasitic infection.

Octal numbers : Numbers employed in computer data bases to identify biochemical profiles of organisms and thus their identification.

odontopathogens : Dental pathogens.

oedema: Intumescence or blister formation because of an increase in intercellular water.

O-F: Oxidation-fermentation medium. Eg. The Oxidation-fermentation dextrose media is used to determine the oxidative or fermentative metabolism or non-utilization of dextrose by gram negative rods. Dextrose can be degraded either by a fermentative (anaerobic) or an oxidative (aerobic) process with the formation of pyruvic acid as the key intermediate in both metabolic pathways. In fermentation, pyruvic acid transfers its electrons to organic compounds with the formation of a large amount of mixed acids, whereas in oxidation pyruvic acid further enters the Krebs cycle where it transfers its electrons to oxygen to form water. Citric acid produced in the Krebs cycle is a weak

acid compared with the mixed acids produced by fermentation. Two tubes of O-F dextrose are inoculated, one of which is overlaid with mineral oil to create an anaerobic environment and the other is exposed to atmospheric oxygen.

Oidium : This is the generic name given to the conidial stage of all powdery mildews, the Erysiphales. The conidia are consistently similar throughout this family, being unbranched and producing chains of hyaline, oval conidia.

Oil immersion microscopy : Use the immersion oil to fill the space between the slide being studied and the special objective of the microscope; this keeps the light rays from dispersing and provides good resolution at high magnification (total magnification of 1000x).

Oil insecticides: A thin film of mineral oil (e.g. kerosene) on water will kill mosquito larvae by depriving them of oxygen. This is an example of a stable insecticide which is beyond the capacity or micro-evolutionary change of the parasite. However their use is rarely environmentally acceptable.

Oil seed crops : Any crop that is cultivated specifically for its seed, which has a high vegetable oil content. Temperate oil seeds include canola, sunflower, and linseed. Tropical oil seeds include oil palm, sesame, and coconut. Oil is also extracted, on an industrial basis, from other seeds, such as maize, soybean, peanut, and cotton. which are not cultivated specifically for their oil. Oil is also extracted from the tissues of olives, avocado and oil palm.

oilgoctanal : A few different clones, or the product of a few different clones.

Oilgocyclic parasite : A parasite that has several, but not many, life cycles in each crop cycle, or season.

OILGODEXYRIBONUCLEOTIDE: A short, single-stranded DNA molecule, generally 1550 *nucleotides* in length, which may be used as a *primer* or a *hybridization probe*. Oilgodeoxyribonucleotides are synthesized chemically under automated conditions.

Okazaki fragments : **Okazaki fragments** are short, newly synthesized DNA fragments that are formed on the lagging template strand during DNA replication. They are complementary to the lagging template strand, together forming short double-stranded DNA sections. Okazaki fragments are between 1,000 to 2,000 nucleotides long in *Escherichia coli* and are between 100 to 200 nucleotides long in eukaryotes. They are separated by ~10-nucleotide RNA primers and are unligated until RNA primers are removed, followed by enzyme ligase connecting (ligating) the two Okazaki fragments into one continuous newly synthesized complementary strand.

Oligomer : A short polymer, usually of amino acids, sugars, or nucleotides; the definition of "short" is somewhat arbitrary, but usually less than 50 subunits.

Oligomeric protein : A multisubunit protein having two or more identical polypeptide chains.

Oligonucleotide : Short nucleic acid chain, either obtained from an organism or synthesized chemically.

Oligopeptide : A few amino acids joined by peptide bonds.

Oligosaccharide : Several monosaccharide groups joined by glycosidic bonds.

Oligotroph : Microorganism specifically adapted to grow under low nutrient supply. Thought to subsist on the more resistant soil organic matter and be little affected by the addition of fresh organic material. sometimes a synonym for autochthonous.

OLIGOTROPHIC : Lake have low nutrient status and relatively low primary productivity

Oligotrophic environment An environment containing low levels of nutrients. particularly nutrients that support microbial growth

Omnivora : A consumer of foods of both animal and plant origin. Humans are omnivores. Our teeth also indicate our fundamental omnivorous nature. See

Onchiostylet : In nematodes : A stylet developed from a special cell in the anterior part of the esophagus from which it moves into place during each molt.

onchoecercoma : Nodule containing adult worms (onchocerciasis).

Oncofetal antigen : Antigen whose expression is normally restricted to the fetus but which may be expressed during malignancy in adults.

Oncogene : One of a number of genes believed to be associated with the malignant transformation of cells; originally identified in certain oncogenic retroviruses (v-onc) but also present in cells (c-onc). A gene whose activity is associated with the conversion of normal cells to cancer cells.

Oncogenic : Possessing the potential to cause normal cells to become malignant; causing cancer;

Oncosphere : Spherical, six-hooked tapeworm larva within the egg shell (Taenia and Hymenolepis spp.)

One-pathotype technique : A technique for ensuring that all vertical resistance is matched during the process of screening for horizontal resistance. The technique requires the designation of a single vertical pathotype of the parasite in question. All the original parents of the breeding population must be susceptible to (i.e. matched by) the designated pathotype. Which is then used in all screening for resistance to that parasite, during the entire breeding program. The designated pathotype is usually cultured on the matching designated host. See also Saturation technique.

One-step growth experiment : An experiment used to study the reproduction of lytic phages in which one round of phage reproduction occurs and ends with the lysis of the host bacterial population.

Onobrychis viciifolia Sainfoin : This is fodder legume that was often used in place of alfalfa, but which is now in decline from competition with improved strains of clovers and alfalfa. It may be of local limited interest to amateur breeders.

On-site selection Because the epidemiological competence of parasites varies from one agro-ecosystem of another, the requirement for horizontal resistance to each of these parasites, also varies. If a cultivar is to be fully adapted to its agro-ecosystem, its selection during breeding must be conducted within that agro-ecosystem.

ontogeny : Development of the individual

Onychomycosis : A fungal infection of the nail plate producing nails that are opaque, white, thickened, friable, and brittle. Also called ringworm of the nails and tinea unguium. Caused by Trichophyton and other fungi such as C. albicans.

Oocyst : Cyst formed around a zygote of malaria and related protozoa.

Oocyte : Female germ cell.

Oogamy : A type of heterogamy in which plasmogamy takes place between a large nonmotile egg and a small motile gamete or cytoplasm from an antheridium.

Oogonia : Mitotically dividing female structures that produce primary oocytes and gametes.

Oogonium : A female gametangium that contains one or more discrete gametes.

Oogonium : Specialized sexual structure formed as a female gametangium by funguslike organisms in the phylum Oomycota.

oomy : A collective name for members of the division Oomycota; also known as the water molds. A class of aquatic and terrestrial fungi (subdivision Mastigomycotina) that typically produce oogonia and zoosporangia in which form zoospores having one anteriorly-directed tinsel flagellum and one posteriorly-directed whiplash flagellum.

Open Reading Frame : A region within a reading frame of an mRNA molecule that potentially encodes a polypeptide; and which does not contain a translational stop codon .

Open system : A system that exchanges matter and energy with its surrounding.

Open-pollinated crops : This term is synonymous with cross-pollination. Open-pollinated crops can be divided into those that are obligately crosspollinated, and those that have an optional selfpollination.

Operator - The site on DNA at which a repressor protein binds to prevent transcription from initiating at the adjacent promoter.

Operculate : Of an ascus or sporangium, opening by a subcircular apical lid to discharge spores, as in basic of the Pezizales.

Operculated ova : Ova possessing a cap or lid (trap door) at one end through which the larva escapes diphyllbothrium, Clonorchis, Paragonimus spp.

Operculum : A lidlike structure on one end of the egg shell through which the larval form escape Diphyllbothrium, Clonorchis, and Paragonimus spp.).

Operon - A complete unit of bacterial gene expression and regulation, including the structural gene or genes, regulator gene(s), and control elements in DNA recognized by regulator gene product(s).

Ophthalmia neonatorum : A gonorrheal eye infection in a newborn, which may lead to blindness. Also called conjunctivitis of the newborn.

Opisthodelphic, In nematodes; Having the uterus (or uteri) directed posteriorly.

Opisthotonic : Spastic state in which the head and heels are bent backward and the torso extends outward.

Opportunistic infection : An infection caused by an organism capable of causing disease only in individuals whose resistance to infection is lowered.

Opportunistic microorganism or pathogen : A microorganism that is usually free-living or a part of the host's normal microbiota, but which may become pathogenic under certain circumstances, such as when the immune system is compromised.

Opportunistic Pathogens : Microorganisms that under ordinary circumstances, cause no human but can cause disease under certain conditions (e.g. after immunosuppressive therapy or when host is suffering from some immuno deficiency diseases.

Opsonic : Pertaining to an agent (typically an antibody) that, when bound to an antigen such as bacterial proteins, enhances the ingestion of the antigen by white blood cells.

Opsonin : Substance, e.g. antibody or C3b, which enhances phagocytosis by promoting adhesion of the antigen to the phagocyte.

Opsonization : The action of opsonins in making bacteria and other cells more readily phagocytosed. Antibodies, complement (especially C3b), and fibronectin are potent opsonins.

Opsonize : To facilitate destruction of pathogens by phagocytic ingestion or lysis by complement through the action of adherent antibodies.

Optical activity : The capacity of a substance to rotate the plane of plane-polarized light.

Optical microscope : The light microscope, as opposed to an electron microscope.

Optical tweezer : The use of a focused laser beam to drag and isolate a specific microorganism from a complex microbial mixture.

Optimum pH : The characteristic pH at which an enzyme has maximal catalytic activity.

OPV : Oral polio vaccine.

Orchitis : Inflammation of a testis ; may be accompanied by swelling, fever (filariasis).

Order A level in the taxonomic hierarchy. An order is a group of closely related families.

Organ Any significant, macroscopic component of an organism.

Organelles : The internal, microscopic organs of a single cell.

Organic agriculture is an example of a complex system that aims to maximize the biodiversity of insects and microbial life, in order to allow the local ecology to operate as a self-organizing system. This system both minimizes the impact of pests and disease, and maximizes the nutritional content of organic food.

Organic chemicals Originally, chemical substances that had been produced by living organisms were called organic chemicals, as opposed to the inorganic chemicals such as rocks and water, which had not been produced by living organisms.

Organic farming : In simplest terms, organic farming is a form of agriculture that avoids any use of synthetic chemicals or GMOs.

Organic fertilizers : Any manure that has been produced by a living organism. The term includes farmyard manure, night soil, guano, sewage solids, bone meal, dried blood, and green manure.

Organic Food Food that has been produced on an organic farm without any use of synthetic chemicals or GMOs. Recent studies have proved conclusively that organic foods are higher in nutrient content than conventional foods, as well as being free of pesticide residues, additives and preservatives.

Organism : Any living individual; the word is derived from organised.

Organomegaly : Abnormal enlargement of the organs; visceromegaly.

Organotroph: In reference to energy source (electron donor) An organism which obtains energy by the metabolism of organic substrates (as electron donors) There are two types of organotrophs; chemoorganotroph and photoorganotroph. Compare with autotrophy, lithotrophy, heterotrophy, phototrophy.

Origin : The nucleotide sequence or site in DNA where DNA replication is initiated.

Original parents : In a program of recurrent mass selection. the parents of the first polycross.

Ornamentals : Horticultural crops grown for a decorative function. Ornamentals are usually cut flowers but the term also includes decorative foliage, dried flowers, etc.

Oropharyngeal : Pertaining to the oral and pharyngeal cavities.

Orthostatic hypotension : Decreased blood pressure caused by standing erect; often seen in patients who are dehydrated.

Orthotropic branches : In a plant with dimorphic branching, the orthotropic branch is the vertical stem that carries the apical meristem. This is the branch that must be used for cutting in crops such as coffee, cotton, and black pepper.

Osmophilic microorganisms : Microorganisms that grow best in or on media of high solute concentration.

Osmosis : The passage of a solvent, such as water, through a semi-permeable membrane, such as cell membrane, from a less concentrated solution into a more concentrated solution. This process produces osmotic pressure, and is responsible for the turgidity of plant cells.

Osmotic potential : Portion of total soil water potential due to the presence of solutes in soil water.

Osmotic pressure : Pressure generated by the osmotic flow of water through a semipermeable membrane into an aqueous compartment containing solute at a higher concentration.

Osmotolerant : Organisms that grow over a fairly wide range of water activity or solute concentration.

Osteomyelitis : Inflammation of the bone and the marrow.

Ostiole : A mouth or opening.

Ostiole . A neck-like structure in an ascocarp, lined with paraphyses, and terminating in a pore. The opening of a pycnidium.

Otitis : Inflammation of the ear from a variety of causes; including bacterial infection; otitis media; inflammation of the middle ear.

Ototoxic : Refers to a substance that has a toxic effect on the ear; some antibiotics, for example have this property.

Outbreak : The sudden, unexpected occurrence of a disease in a given population. The occurrence of a large number of cases of a disease in a short period of time.

Outbreeder : A species of plant that is allogamous (i.e. cross-pollinating).

Outbreeding cereals : The outbreeding cereals are maize, sorghum, millets, and rye.

Outbreeding legume : Most cultivated legumes are inbreeders. The outbreeding grain legumes are pigeon pea (*Cajanus cajan*), broad bean (*Vicia faba*), and cowpea (*Vigna unguiculata*). The outbreeding fodder legumes are : alfalfa (*medicago sativa*) and various clovers (*Trifolium* spp.)

Out-cross : The progeny of a cross-pollination

Outer membrane : A special membrane located outside the peptidoglycan layer in the cell walls of gram-negative bacteria.

Ovarian aspiration : Removal of oocytes through a needle inserted into a follicle of the ovary with suction applied to the needle.

Ovary : Female sexual gland in which the ova, or eggs, are formed. The **ovary** is an ovum-producing reproductive organ, often found in pairs as part of the vertebrate female reproductive system. Ovaries in female individuals are analogous to testes in male individuals, in that they are both gonads and endocrine glands.

Oven-dry soil : Soil that has been dried at 105⁰ C until it reaches constant mass.

Overdominance : Mode of inheritance for which the heterozygote is favoured by selection, hence is most fit.

Overhang : A terminus of a duplex DNA molecule which has one or more unpaired nucleotides in one of the two strands (hence either a 3' or 5' overhang). Cleavage of DNA with many restriction endonucleases leaves such overhangs.

Overwintering : The method that an organism uses for surviving a winter.

Oviduct : In vertebrates, the passageway from the ovaries to the outside of the body is known as the **oviduct**. The eggs travel along the oviduct. These eggs will either be fertilized by sperm to become a zygote, or will degenerate in the body. Normally, these are paired structures, but in birds, crocodilians, and some cartilaginous fishes, one or the other side fails to develop (together with the corresponding ovary), and only one functional oviduct is found..

Oviparous : Producing eggs that hatch after expulsion from the body in birds & many other lower vertebrates.

Ovoid : Egg-shaped.

Ovoviviparous : Producing eggs that hatch within the body.

Ovule : The female cell of a plant which, when fertilized by a pollen cell, develops into an embryo.

Oxic - Containing oxygen; aerobic. Usually used in reference to a microbial habitat.

Oxidase Test : Determine the organism's ability to produce cytochrome oxidase.

oxidation : Process by which a compound gives up electrons, acting as an electron donor, and becomes oxidized. This type of reaction occurs in air.

Oxidation state : Number of electrons to be added (or subtracted) from an atom in a combined state to convert it to the elemental form.

Oxidation-reduction (redox) reaction : Coupled pair of reactions, in which one compound becomes oxidized while another becomes reduced and takes up the electrons released in the oxidation reaction.

Oxidation-reduction potential : Electromotive force exerted by a nonreacting electrode in a solution containing the oxidized and reduced forms of a chemical, relative to a standard hydrogen electrode; the more negative the value, the more anaerobic conditions are.

oxidation-reduction reaction : A reaction in which electrons are transferred from a donor to an acceptor molecule; also called a redox reaction.

Oxidative phosphorylation : Synthesis of ATP involving a membrane-associated electron-transport chain and the creation of a proton-motive force. Also called electron-transport chain phosphorylation.

Oxidizing agent (oxidant) : The acceptor of electrons in an oxidation-reduction reaction.

Oxygen debt : The extra oxygen (above the normal resting level) consumed in the recovery period after strenuous physical exertion.

Oxygenases : An **oxygenase** is any enzyme that oxidizes a substrate by transferring the oxygen from molecular oxygen O₂ (as in air) to it. The oxygenases form a class of oxidoreductases; their EC number is EC 1.13 or EC 1.14.

Oxygenic : Able to produce oxygen. (Contrast with anoxygenic)

Oxygenic photosynthesis : Use of light energy to synthesize ATP and NADPH by noncyclic photophosphorylation with the production of oxygen from water.

Oz : Ounce. : is a unit of mass with several definitions, the most commonly used of which is equal to approximately 28 grams. The ounce is used in a number of different systems, including those of

mass that form part of the United States customary, and imperial, systems. The size of an ounce varies between systems. The most commonly used ounces today are the international avoirdupois ounce and the international troy ounce.

Posphere : A large, naked, nonmotile usually spherical, female gamete. Thick-walled spore formed within an oogonium by fungus-like organisms in the phylum Oomycota. Develops from an oosphere through plasmogamy or parthenogenesis.

Q₁₀ Relative increase in a reaction rate with temperature. It is expressed as the increase over a 10°C interval.

Quadriallel analysis Analysis based on double crosses obtained by crossing n homozygous lines in a diallel fashion, and then crossing the F_1 's so generated according to the diallel scheme with the restriction that in any double cross a homozygous line must not occur more than once as a parent.

Quadrivalent Structure produced by pairing among four homologous chromosomes during meiosis.

Qualitative character Character showing distinct classes and little or no effect of the environment; governed by oligone(s).

Quantitative character Character showing continuous variation and considerable effect of the environment.

Quantitative PCR A PCR method that enables the number of DNA molecules in a sample estimated.

Quantitative Trait: These traits are controlled by various genes and environmental factors. They are measured on a continuous scale.

Quantum efficiency (Q) With respect to photosynthesis, the ratio of oxygen molecules released to photons absorbed.

Quarantine Isolation of an organism for observation on weeds, diseases and pest and for preventing their spread.

Quartile deviation Quartile deviation is the measure of dispersion, which is defined as half of the difference between 3rd quartile and 1st quartile.

Quaternary ammonium compound (quat) A cationic detergent with four organic groups attached to a central nitrogen atom; used as a disinfectant.

Quaternary structure - the interconnection and arrangement of polypeptide chains within a protein. Only proteins with more than one polypeptide chain can have quaternary structure. For a protein, the level of structure that results when separate, folded polypeptide chains (subunits) associate in a specific way to produce a complete protein. Compare *primary structure*, *secondary structure*, *tertiary structure*.

Quaternary structure The structure resulting from the association of two or more polypeptides.

Quelling reaction Apparent swelling of a bacterial capsule in the presence of a specific antibody.

Query The input sequence (in FASTA format or as bare sequence data) or sequence identifier with which all the sequences in a database are compared during a BLAST search.

Quiescence: Every plant requires some specific environmental conditions for its proper functioning and rapid growth. The growth or germination of the seeds or plants are hampered if these environmental conditions are not satisfied. This is termed as 'quiescence'.

Quiescent At rest. Nondividing cells are often said to be quiescent.

Quiescent Center: Quiescent center is the portion of the root situated at the apex of the plant tissue i.e. meristem in which cell division does not occur.

Quinine An antimalarial drug derived from the cinchona tree and effective against schizogony stage in red blood cells.

R loop A triple-stranded structure in which RNA displaces a DNA strand by DNA-RNA hybrid formation in a region of the DNA.

Rab family: family of GTPases that mediate fusion of vesicles with other membranes.

Rhabdomyosarcoma It is a type of cancer, specifically a sarcoma (cancer of connective tissues), in which the cancer cells are thought to arise from skeletal muscle progenitors.

RAC Recombinant DNA Advisory Committee, a supervisory group that oversees the Recombinant DNA experiments.

RACE (rapid amplification of cDNA ends) A PCR-based technique for mapping the end of an RNA molecule.

Rachis Rachis is the extension of the axis of petiole or leafstalk in the compound leaf. All leaflets are attached to the rachis.

Radiation Evolution of multiple species from a single ancestry, but these species have morphological differences, however, they coexist in the same habitat or spread to different habitats or they have a change of ecological role.

Radiation hybrid A collection of rodent lines that contain different fragments of a second genome, constructed by a technique involving irradiation and used for mapping, for example in studies of the human genome.

Radicule Extension of the axis of petiole or leafstalk in the compound leaf. All leaflets are attached to the rachis.

Radioactive labeling The labeling of probes or primers with radioactive tags in order to enable detection of variation in DNA fragments.

Radioactive marker A radioactive atom incorporated into a molecule and whose radioactive emissions are subsequently used to detect and follow that molecule during a biochemical reaction.

Radioautography A technique in which an item containing radioactively labeled elements (for example, a tissue slice or a chromatography gel) is laid against a photographic film; the radioactivity exposes the film to form an image of the labeled elements. Also called autoradiography.

Radioimmunoassay (RIA) Also known as competitive binding assay or saturation analysis. A very sensitive technique for measuring small concentrations of a substance in biological fluids. In the assay, radioactive-labeled *antigens* compete with antigens in the fluid for binding sites on specially prepared antibodies.

Radioisotope An isotope of an element that undergoes spontaneous decay with the release of radioactive particles/rays.

Radiolabelling The technique for attaching a radioactive atom to a molecule.

Radula A rough and raspy tongue normally seen in mollusks, used to grate food.

Raf Isoform of MAPKKK, the enzyme at the top of the mitogen-associated protein kinase cascade.

Ramachandran plot A plot that constitutes a map of all possible backbone configurations for an amino acid in a polypeptide. The axes of the plot consist of the rotation angles of the two backbone bonds that are free to rotate (ϕ and ψ , respectively); each point ϕ and ψ on the plot thus represents a conceivable amino acid backbone configuration.

Random Amplified Polymorphic DNA (RAPD) A molecular marker technique that uses primers of random sequence to amplify DNA fragments by PCR.

Random An event whose occurrence is determined solely by chance and there is no discrimination.

Random coil Refers to a linear polymer that has no secondary or tertiary structure but instead is wholly flexible with a randomly varying geometry. This is the state of a denatured protein or nucleic acid.

Random genetic drift The process that leads to alleles gradually changing their frequency in a population.

Random sampling A random sample is one in which unit of population has an equal chance of being included in it.

Range (i) Range is a measure of dispersion, which is defined as the difference between maximum value and minimum value. (ii) A particular geographical area in which particular species of organisms are found.

Rapid amplification of cDNA ends (RACE) A technique that employs reverse transcription and PCR for the rapid amplification of cDNA ends.

Rapid plasma reagin A serologic test for syphilis.

Rapid-start complex The complex that RNA polymerase forms at the promoter site just before initiation.

Rare A species of an organism found in very small numbers and hence, found with lot of effort only for a short duration.

Ras GTPase that activates the MAP kinase pathway and hence promotes cell division. Ras is activated by SOS (son of sevenless protein), its GTP exchange factor (GEF), which is in turn recruited to the plasma membrane via receptor tyrosine kinases and the adaptor protein Grb2. It is a protein involved in signal transduction.

Rate constant With respect to chemical reactions, a constant that relates the reaction rate for a particular reaction to substrate concentrations.

- Rate equation** An equation, such as the Michaelis-Menten equation that relates velocity of an enzyme-catalyzed reaction to measurable parameters.
- Rattle** Shed skin, which is often seen on tail of a rattlesnake, used to make a rattling sound in order to deter predators.
- Ray** Series of parenchyma cells that are radially arranged along the vascular region of the xylem and the phloem. These parenchyma cells transport food, water and other materials laterally in the roots and stems of woody plants.
- RB** protein that binds to the transcription factor E2F-1 and therefore prevents transcription of proteins required for DNA synthesis. Phosphorylation of RB by CDK4 causes it to release E2F-1, allowing entry to S phase. Mutations in RB lead to the formation of the eye cancer called retinoblastoma.
- RD-114** An endogenous xenotropic virus of cats. It was thought to be a human cancer virus.
- R-determinant** Genes for antibiotic resistance carried on R factors of R plasmids of bacteria.
- Reactants** Substances that react to form products in a chemical reaction.
- Reaction center** In photosynthesis a specific pair of chlorophyll molecules in a photo system that collect light energy absorbed by other chlorophyll molecules and pass it to an electron acceptor, normally the first compound of an electron transport chain.
- Reaction Wood** Is formed when a woody plant encounters mechanical stress, as caused by wind exposure, soil movement and excess snow fall.
- Reactive oxygen species (ROS)** Oxygen species intermediate in oxidation level between O_2 and H_2O , which are more reactive than O_2 ; ROS include superoxide, peroxide, peroxynitrite, and hydroxyl radical.
- Reactivity (Cross-reactivity)** It is the reaction between an antibody and an antigen that differs from the immunogen. It is sometimes also referred to as crossimmunity or cross-protective immunity. A few examples of cross-reactivity have been confirmed in humans, one of which involves influenza virus-specific CD8+ T cell and hepatitis C virus antigens.
- Reading frame** Reading of the genetic code in blocks of three bases—there are three possible reading frames for each mRNA only one of which will produce the correct protein.
- Readthrough mutation** A mutation that changes a termination codon into a codon specifying an amino acid, and hence results in readthrough of the termination codon.
- Reagin Reagin** Antibody of a specialized immunoglobulin class (IgE) which attaches to tissue cells of the same species from which it is derived, and which interacts with its antigen to induce the release of histamine and other vasoactive amines. A form of cytotoxic antibody, it is present in the serum of naturally hypersensitive individuals and can confer specific immediate (type I) hypersensitivity in nonreactive individuals. For e.g. IgE antibodies made in response to a treponemal infection characterized by their ability to combine with lipids.
- Reannealing-** Process where two complementary single strands of DNA automatically hybridize back into, double-stranded molecule upon cooling.
- RecA** An *Escherichia coli* protein involved in homologous recombination.

Recalcitrant xenobiotics The xenobiotics that do not easily undergo biodegradation, and therefore persist in the environment for a long period. The recalcitrant xenobiotic compounds can be grouped into various groups like halocarbons, polychlorinated biphenyls, oil mixtures, synthetic polymers, alkyl benzyl sulphonates, etc.

RecBCD enzyme An enzyme complex involved in homologous recombination in *Eschericia coli*

Recessive The allele that is not expressed in a heterozygote.

Recurrent selection In cross-pollinated populations schemes of selection (on the basis of phenotype or progeny test), followed by intermitting (in all combinations) of the selected plants or their selfed progeny to produce the population for the next cycle of selection practiced.

Receptacle: Expanded portion of the peduncle, wherein various parts of the flower are attached.

Receptor Protein that specifically binds a particular extracellular molecule (ligand). Receptors can be transmembrane, cytosolic, or nuclear proteins. Particular receptor proteins perform additional functions (ion channel, enzyme, activator of endocytosis, transcription factor) that are activated by the binding of the solute.

Receptor tyrosine kinase Integral membrane protein with a binding site for transmitter on the extracellular domain and tyrosine kinase catalytic ability on the cytosolic domain. Binding of transmitter causes self-phosphorylation on tyrosine and hence recruitment of proteins with SH2 domains such as Grb2, phospholipase C γ , and phosphoinositide 3-kinase, which may then themselves be phosphorylated. The PDGF receptor, the FGF receptor, the Trk family of receptors, and the insulin receptor are all receptor tyrosine kinases.

Receptor-mediated endocytosis Process in which ligands bind to specific receptors in the plasma membrane and trigger clathrin-mediated vesicle budding. After the binding of a ligand to plasma membrane-spanning receptors, a signal is sent through the membrane, leading to membrane coating, and formation of a membrane invagination. The receptor and its ligand are then opsonized (the rendering of bacteria and other foreign substance subject to phagocytosis) in clathrin-coated vesicles. Once opsonized, the clathrin-coated vesicle uncoats (a pre-requisite for the vesicle to fuse with other membranes) and individual vesicles fuse to form the early endosome. Since the receptor is internalized with the ligand, the system is saturable and uptake will decline until receptors are recycled to the surface.

Recessive Gene is recessive if its effects are hidden when the organism possesses a second, dominant, version. Recessive genes usually code for nonfunctional proteins, so that if the individual can make the protein using the other, working gene, no effects are seen.

Recessive Trait It is the trait that reflects in the phenotype only when the dominant gene is absent. E.g. color blindness.

Recipient cell A cell that receives DNA from a donor cell in recombination.

Reciprocal cross Cross in which the line previously used as male is used as female, while that previously used as female is now used as male. In one cross, a male expressing the trait of interest will be crossed with a female not expressing the trait. In the other, a female expressing the trait of interest will be crossed with a male not expressing the trait of interest.

Reciprocal strand exchange The exchange of DNA between two double stranded molecules, occurring as a result of recombination, such as that the end of one molecule is exchanged for the other molecule.

Reciprocal translocation Translocation in which small chromosome segments are exchanged

Recognition factor A protein (alphaglobulin) that combines with certain types of foreign matter to mark it for destruction by *macrophages*.

Recognition helix In a helix-turn-helix DNA binding motif the α -3 helix which fits deep in the major groove and is responsible for the sequence specificity of binding.

Recombinant A progeny member that possesses neither of the combinations of alleles displayed by the parents.

Recombinant DNA A fragment of DNA containing the DNA from two different species spliced together in the laboratory. A plant cell naturally infected with *Agrobacterium* also contains recombinant DNA.

Recombinant DNA technology The techniques involved in the construction, study and use of recombinant DNA molecules.

Recombinant plasmid Plasmid into which a foreign DNA sequence has been inserted.

Recombinant protein Protein expressed from the foreign DNA inserted into a recombinant plasmid or other cloning vector. Recombinant proteins are often expressed in bacteria, yeast, insect, or mammalian cells.

Recombinant vaccine A vaccine made recombinant DNA technique. It is a strategy to produce recombinant DNA vaccines by using genetic engineering techniques. Paoletti and his colleague, Virologist Dennis Panicali, set out to do was to alter the DNA of cowpox virus by inserting a gene from another virus (namely herpes, hepatitis B or influenza). These efforts resulted, amongst others in the development of a commercial Hepatitis B vaccine which is now widely used. HPV vaccine is another notable recombinant DNA vaccine.

Recombinase A diverse family of enzyme that catalyses site-specific recombination events.

Recombination A process in an organism in which two parent DNA molecules give rise to daughter DNA that combines segments from both parent molecules. It may involve the integration of one DNA molecule into another, the substitution of a DNA segment for a homologous segment on another DNA molecule, or the exchange of homologous segments between two DNA molecules.

Recombination frequency The proportion of recombinant progeny arising from a genetic cross.

Recombination hotspot A region of a chromosome where crossovers occur at a higher frequency than the average for the chromosome as a whole.

Recombination repair A DNA repair process that mends double-stranded breaks.

Recovery stroke Part of the beat cycle of a cilium in which the cilium is moved back into a position where it can push again; used in contrast to the effective stroke that generates the force as in ciliary motion in *Paramecium multimicronucleatum*.

Rectrices The stiff and main feather of a bird that is used to navigate, when the bird is in flight.

Red Tide Marine phenomenon in which a reddish tint is formed on the water due to the sudden growth of cells in certain protozoa or red algae.

Redia Trematode larval stage that reproduces asexually to produce cercariae.

Redox couple An electron donor and its corresponding oxidized form.

Redox potential (E) The relative tendency of a pair of molecules to release or accept an electron. The standard redox potential (E^{\ominus}) is the redox potential of a solution containing the oxidant and reductant of the couple at standard concentrations.

Reducing equivalent (power) Electrons stored in reduced electron carriers such as NADH, NADPH and $FADH_2$.

Reducing equivalent An amount of a reducing compound that donates the equivalent of 1 mole of electrons in an oxidation-reduction reaction. The electrons may be expressed in the form of hydrogen atoms.

Reducing medium A culture medium containing ingredients that will remove dissolved oxygen from the medium to allow the growth of anaerobes.

Reduction Addition of electrons to a compound, e.g., by the addition of hydrogen atoms or the removal of oxygen atoms.

Reduction potential Inherent tendency of a compound to act as an electron donor or an electron acceptor. Measured in millivolts.

Reductive dechlorination Removal of Cl as Cl^- from an organic compound by reducing the carbon atom from C-Cl to C-H.

Redundancy Refers to identical or near identical items. In germplasm analyses it refers to (near) duplicate germplasm accessions. **Genetic redundancy** is a term typically used to describe situations where given biochemical function is redundantly encoded by two or more genes. The main source of genetic redundancy is the process of gene duplication which generates multiplicity in gene copy number

Refractive index. In optics the **refractive index** (or **index of refraction**) n of a substance (optical medium) is a number that describes how light, or any other radiation, propagates through that medium. n is defined as the factor by which the wavelength and the velocity of the radiation are reduced with respect to their vacuum values: The speed of light in a medium is $v = c/n$, where c is the speed in vacuum. Similarly, for a given vacuum wavelength λ_0 , the wavelength in the medium is $\lambda = \lambda_0/n$. This implies that vacuum has a refractive index of 1. Refractive index of materials varies with the wavelength.

Regeneration It is the process of renewal, restoration, and growth that makes genomes, cells, organs, organisms, and ecosystems resilient to natural fluctuations or events that cause disturbance or damage. Every species is capable of regeneration, from bacteria to humans

Registered seed Progeny of foundation seed; not used in India.

Regulated secretion Secretion that only occurs in response to a signal, such as a rise in the cytosolic concentration of calcium ions.

Regulatory control Control over bacterial gene expression that depends on the influence of regulatory proteins.

Regulatory enzyme. An enzyme in which the active site is subject to regulation by factors other than the enzyme substrate. The enzyme frequently contains a nonoverlapping site for binding the regulatory factor that affects the activity of the active site.

Regulatory gene. A gene whose principal product is a protein designed to regulate the synthesis of other genes.

Regulatory mutant A mutant that has a defect in a promoter or other regulatory sequence.

Regulon A group of unlinked (nonadjacent) genes that are all regulated by a common mechanism.

Relative frequency curve Relative frequency is the proportion of all observations determined by dividing the number of observations in a category by the total number of all observations.

Relative Molecular Mass Mass of one mole of a substance compared to the mass of one mole of hydrogen. It is abbreviated Mr or RMM and is sometimes called "molecular weight." It is dimensionless but is sometimes expressed in Daltons.

Release factors Independent protein factors that are necessary participants in the release of a finished polypeptide chain from a ribosome.

REMAP A molecular marker technique that targets variation in retrotransposon insertion site.

Remiges Flight feather of a bird used to control direction during flying, their function is similar to that of the rectrices to a certain extent.

Remission A period of good health occurring after the onset of cancer and associated with a reduction in the size of the tumor. Remission may occur spontaneously or be induced by therapy, but it should not be confused with cure as it more often represents only a temporary quiescence of the malignancy.

Renaturation The process of returning a denatured structure to its original native structure, as when two single strands of DNA are reunited to form a regular duplex, or an unfolded polypeptide chain is returned to its normal folded three-dimensional structure.

Rennin Rennin, also called Chymosin, is a proteolytic enzyme that curdles milk by transforming caseinogen into insoluble casein; it is found only in the fourth stomach of cud-chewing animals, such as cows. Its action extends the period in which milk is retained in the stomach of the young animal. An enzyme from a calf's stomach forms curd from milk.

Repair synthesis DNA synthesis following excision (cutting out) of damaged DNA.

Repetitive DNA A DNA sequence that is repeated two or more times in a DNA molecule or genome.

Repetitive DNA fingerprinting A clone fingerprinting technique that involves determining the positions of genome-wide repeats in cloned DNA fragments.

Repetitive DNA PCR A clone fingerprinting technique that uses PCR to detect the relative positions of genome-wide repeats in cloned DNA fragments.

Repetitive DNA. A DNA sequence that is present in many copies per genome.

Replacement vector A λ vector designed so that insertion of new DNA is by replacement of part of the nonessential region of λ DNA molecule.

Replica plating A technique in which an impression of a culture is taken from a master plate and transferred to a fresh plate. The impression can be of bacterial clones or phage plaques.

Replication Conversion of one double-stranded DNA molecule into two identical double-stranded DNA molecules.

Replication factor C (RFC) A multisubunit accessory protein involved in eukaryotic genome replication.

Replication factory Various microscopic techniques have shown that the active processes of replication occur within discreet nuclear foci, known as replication factories.

Replication fork The region of a double-stranded DNA molecule that is being opened up to enable DNA replication to occur.

Replication licensing factors (RLFs) A set of proteins that regulate genome replication, in particular by ensuring that only one round of genome replication occurs per cell cycle.

Replication mediator protein (RMP) A protein responsible for detachment of single-strand binding proteins during genome replication.

Replication protein A (RPA) The main single-strand binding protein involved in replication of eukaryotic DNA.

Replication slippage An error in replication that leads to an increase or decrease in the number of repeat units in a tandem repeat such as a microsatellite.

Replicative form A double stranded RNA molecule produced during the multiplication of certain RNA viruses who have single stranded RNA as genetic material.

Replicon A unit in the genome that consists of an origin of replication and all the DNA that is replicated from that origin.

Replisome A complex of protein involved in genome replication.

Reporter gene A gene whose phenotype can be assayed and which can therefore be used to determine the function of a regulatory DNA sequence.

Repressible operon Operon whose transcription is repressed in the presence of a particular substance; often the final product of the metabolic pathway.

Repression Process by which the synthesis of an enzyme is inhibited by the presence of an external substance (the repressor).

Repressor A regulatory protein that inhibits transcription from one or more genes. It can combine with an inducer (resulting in specific enzyme induction) or with an operator element (resulting in repression).

Reproduction It is the birth of a new organism born either by sexual or asexual means.

Reptilia Reptiles or vertebrates, who possess a dry scaly skin and reproduce amniotic eggs. Snakes, lizards and alligators belong to this category. They are poikilothermic i.e. cold blooded animals.

Repulsion phase Linkage between the dominant allele of one gene with the recessive allele of another.

RER (rough endoplasmic reticulum): portion of the endoplasmic reticulum associated with ribosomes and concerned with the synthesis of secreted proteins. Proteins destined to remain within the majority of single-membrane-bound organelles (Golgi, lysosomes,) are also made on the rough ER, as are integral proteins of these organelles and of the plasma membrane.

Reticuloendothelioma A malignant tumor arising in cells of the reticuloendothelial system (reticuloendothelial system - a widely distributed system consisting of all the cells able to ingest bacteria or colloidal particles etc, except for certain white blood cells).

Reservoir of infection A continual source of infection.

Resident: A non-migratory species of birds, which stays in a given geographical area throughout its life.

Residue Residue (chemistry), material remaining after a distillation or an evaporation, or portion of a larger molecule. Or when a molecule is built into a larger molecule with the loss of some part, the part that remains and forms part of the larger molecule is called a residue. For example, an amino acid that has been built into a polypeptide, with the loss of the elements of water, is said to be an amino acid residue.

Resin Canal Tubular duct present in coniferous trees and seeds, which is lined with resin secreting cells.

Resistance (R) factor A bacterial plasmid carrying genes that determine resistance to antibiotics.

Resistance breaking biotype The biotype of an insect pest, which has developed the ability or adaptation to infest a resistant variety of the host.

Resistance Gene Homologue Polymorphism (RGHP): A group of molecular marker techniques that target groups of resistance genes by PCR using primers aimed at conserved domains of resistance genes.

Resistance The ability to ward off diseases through nonspecific and specific defenses.

Resistance transfer factor group of genes for replication and conjugation on the R factor.

Resolution (1) Separation of a pair of recombining double-stranded DNA molecules. (2)The ability to distinguish fine detail with a magnifying instrument.

Resolving power Measure that defines the smallest object that can be distinguished using a microscope.

Resonance hybrid. A molecular structure that is a hybrid of two structures that differ in the locations of some of the electrons. For example, the benzene ring can be drawn in two ways, with double bonds in different positions. The actual structure of benzene is in-between these two equivalent structures.

Respiration With respect to energy metabolism, the process in which cellular energy is generated through the oxidation of nutrient molecules with O_2 as the ultimate electron acceptor. This type of respiration is also called *cellular respiration* to distinguish it from respiration in the sense of breathing.

Respiratory chain The electron transport chain that is employed during cellular respiration and has O_2 as the ultimate electron acceptor.

Response module A sequence motif found upstream of various genes that enables transcription initiation by RNA polymerase II to respond to general signals from outside of the cell.

Resting potential The voltage difference that exists across the membrane of an excitable cell such as a nerve cell, except in places where an action potential is in progress. It is a consequence of the ion gradients that are maintained across the membrane.

Resting voltage Voltage across the plasma membrane of an unstimulated cell, typically -70 to -90 mV inside with respect to outside.

Restriction endonuclease (restriction enzyme) Enzyme that recognizes and cleaves specific DNA sequence, generating either blunt or single-stranded (sticky) ends.

Restriction Enzyme Also called restriction endonuclease, this enzyme is capable of recognizing specific sequences in DNA at a specific site (restriction site), and then severing it.

Restriction fragment length polymorphism (RFLP) Method to identify differences between similar genes from different organisms. Digestion of genes with restriction endonucleases followed by separation of the resulting fragments by gel electrophoresis yields banding patterns that are characteristic of the individual gene.

Restriction mapping Determination of the positions of restriction sites in a DNA molecule by analyzing the sizes of restriction fragments.

Restriction-modification system. A pair of enzymes found in most bacteria (but not eukaryotic cells). The restriction enzyme recognizes a certain sequence in duplex DNA and makes one cut in each unmodified DNA strand at or near the recognition sequence. The modification enzyme methylates (or modifies) the same sequence, thus protecting it from the action of the restriction enzyme.

Restrictive conditions For some mutations to be expressed, the individual needs to be placed in a specific environment. This is called the restrictive condition. But if the individual grows in any other environment (permissive condition), the wild type phenotype is expressed. These are called conditional mutations. Mutations that only expressed at a specific temperature (temperature sensitive mutants), usually elevated, can be considered to be conditional mutations.

Re-synthesized/Recreated In studies of hybrid origins of species, investigators may attempt to "re-synthesize" a hybrid by crossing its putative parents and compare the natural to the putative hybrid by morphological or molecular markers.

Reticulate Venation Reticulate venation is a thin, flat, laminar like structure of a leaf, featuring a net-like pattern of the veins, structured for the purpose of photosynthesis e.g. coriander, rose, maple, and oak.

Reticulated Species whose veins or nerves are like threads of a net, arranged in a network.

Reticuloendothelial system A network monocytes and macrophages distributed throughout the body in the blood, spleen, liver, lymph nodes, connective tissues, and bone marrow. The cells of this system are involved in the phagocytosis of tissues debris and bacteria, storage of fatty materials, scavenging of worn-out red blood cells, and the metabolism of iron and pigments.

Reticuloendotheliosis Hyperplasia of cells of the reticuloendothelial system or in other words an abnormal condition characterized by increased growth and proliferation of the cells of the reticuloendothelial system.

Retinoblastoma Cancer of the eye, usually caused by a mutation in the *RB* gene.

Retinoids Substances that are derived from retinoic acid (a form of vitamin A) and act as intercellular mediators; they are particularly important in regulating development of epithelial cell growth. Retinoids have many important and diverse functions throughout the body including roles in vision, regulation of cell proliferation and differentiation, growth of bone tissue, immune function, and activation of tumor suppressor genes

Retroelement A genetic element that transposes via an RNA intermediate.

Retrogene A gene duplicate that arises by insertion of a pseudogene adjacent to the promoter of an existing gene.

Retrograde Backward movement; when applied to axonal transport it means toward the cell body.

Retrohoming A process during which an excised intron, comprising single-stranded RNA, inserts directly into an organelle genome prior to being copied into double-stranded DNA.

Retrotranspos A genome-wide repeat with a sequence similar to an integrated retroviral genome and possibly with retrotransposition activity.

Retrotransposition Transposition via an RNA intermediate. The retrotransposons' replicative mode of transposition through an RNA intermediate increases the copy numbers of elements rapidly and thereby can increase genome size. Like DNA transposable elements (class II transposons), retrotransposons can induce mutations by inserting near or within genes.

Retrotransposon-Based Insertional Polymorphism (RBIP) A molecular marker technique that targets variation in retrotransposon insertion sites.

Retroviral-like element (RTVL) A truncated retroviral genome integrated into a host chromosome.

Retrovirus Common type of plant virus whose genetic material is single-stranded RNA. It is a family of RNA viruses that possess reverse transcriptase. After the virus infects a cell, this enzyme transcribes the RNA genome into a double-strand DNA version, which integrates into a host chromosome. Human immunodeficiency virus (HIV) is a retrovirus.

Reverse engineering The synthesis, in the laboratory, of an artificial gene or a strand of DNA matching the amino acid sequence of a known protein.

Reverse genetics research that begins with a gene of known sequence but unknown effect and works toward deducing its effects and therefore function.

Reverse Migration Phenomenon wherein the migrating organism migrates in the opposite direction, normal to other migrating species. Although some large birds such as swans learn migration routes from their parents, in most small species, such as passerines, the route is genetically programmed,

and young birds can innately navigate to their wintering area. Sometimes this programming goes wrong, and the young bird, in its first autumn, migrates on a route 180° from the correct route. If a bird sets off in the opposite direction, shown by the orange arrow, it will end up in Western Europe instead of South East Asia. This is a mechanism that leads to birds such as Pallas's Warbler turning up thousands of kilometres from where they should be. suggested^[1] that birds from east of Lake Baikal in Siberia could not occur in western Europe because the migration routes were too north-south.

Reverse transcriptase PCR (RT-PCR) PCR in which the first step is carried out by reverse transcriptase, so RNA can be used as the starting material.

Reverse transcriptase RNA-dependent DNA polymerase; an enzyme that synthesizes a complementary DNA from an RNA template. Reverse transcription is the process whereby RNA is copied into DNA.

Reversible reaction A chemical reaction in which the end products can readily revert to the original molecules.

Rgroup. Shorthand for the side chain of an amino acid.

Rh factor Classification of red blood cells based on the presence or absence of Rh antigens.

Rhabdomyoma A benign tumor arising in striated muscle.

Rhabdomyosarcoma A combined sarcoma and *rhabdomyoma*.

Rheology The ability of a solution to modify its flow characteristics.

Rhizine A root like hypha that anchors a fungus to a surface.

Rhizobacteria Bacteria that aggressively colonize roots. The dominant species found in the rhizosphere is a microbe from the genus *Azospirillum*.

Rhizobia Bacteria capable of living symbiotically in roots of leguminous plants, from which they receive energy and often fix nitrogen. Common examples are *Rhizobium leguminosarum*, *Bradyrhizobium*, *Burkholderia*.

Rhizoid Delicate root like filament that functions as a root in mosses and ferns. It provides support or performs the absorption function in them.

Rhizome Horizontally oriented, underground root-like stem that has nodes and internodes. Examples of plants that are propagated this way include hops, asparagus, ginger, irises, Cannas, sympodial orchids ginger, turmeric, galangal, and fingerroot.

Rhizomorph Mass of fungal hyphae organized into long, thick strands usually with a darkly pigmented outer rind and containing specialized tissues for absorption and water transport.

Rhizoplane Plant root surfaces and usually strongly adhering soil particles.

Rhizosphere competence Ability of an organism to colonize the rhizosphere.

Rhizosphere Zone of soil immediately adjacent to plant roots in which the kinds, numbers, or activities of microorganisms differ from that of the bulk soil.

Rho factor. A protein involved in the termination of transcription of some messenger RNAs.

Rho-dependent terminator A position in bacterial DNA where termination of transcription occurs with the involvement of Rho.

Ribbon-helix-helix motif A type of DNA binding domain. The ribbon-helix-helix (RHH) superfamily of transcription factors uses a conserved three-dimensional structural motif to bind to DNA in a sequence-specific manner. This functionally diverse protein superfamily regulates the transcription of genes that are involved in the uptake of metals, amino-acid biosynthesis, cell division, the control of plasmid copy number, the lytic cycle of bacteriophages and, perhaps, many other cellular processes. In this Analysis, the structures of different RHH transcription factors are compared in order to evaluate the sequence motifs that are required for RHH-domain folding and DNA binding, as well as to identify conserved protein-DNA interactions in this superfamily.

Riboflavin Vitamin B2 that functions as a flavoprotein.

Ribonuclease An enzyme that degrades RNA.

Ribonuclease H: enzyme that cleaves phosphodiester links in an RNA molecule that is joined to a DNA molecule by complementary base pairing.

Ribonuclease MRP An enzyme involved in processing eukaryotic pre-rRNA.

Ribonuclease P An enzyme involved in processing pre-tRNA in bacteria.

Ribonucleic Acid (RNA) Type of molecule containing large amount of nucleotide units, wherein each nucleotide contains three elements- nitrogenous base, a ribose sugar, and a phosphate. Each nucleotide in RNA contains a ribose sugar, with carbons numbered 1' through 5'. A base is attached to the 1' position, in general, adenine (A), cytosine (C), guanine (G), or uracil (U). It is involved in protein synthesis.

Ribonucleic acid polymerase Enzyme that synthesizes RNA.

Ribonucleic acid primer Short length of RNA, complementary in sequence to a DNA strand, that allows DNA polymerase III to attach and begin DNA synthesis.

Ribonucleoprotein (RNP) domain A common type of RNA binding domain.

Ribonucleoside monophosphate Nitrogenous base attached to the sugar ribose that has one phosphate group on its 5' carbon atom; also known as a ribonucleotide.

Ribose Ribose is an organic compound with the formula $C_5H_{10}O_5$; specifically, a monosaccharide (simple sugar) with linear form $H-(C=O)-(CHOH)_4-H$, which has all the hydroxyl groups on the same side in the Fischer projection. Ribose constitutes the backbone of RNA, a biopolymer that is the basis of genetic transcription.

Ribosomal protein One of the protein components of a ribosome.

Ribosomal RNA (rRNA) Types of RNA found in the ribosome; some participate actively in the process of protein synthesis.

Ribosome binding site The nucleotide sequence that acts as the attachment site for the small subunit of the ribosome during initiation of translation in bacteria.

Ribosome Cell organelle composed of proteins and ribonucleic acid (RNA), which is responsible for protein synthesis.

Ribosome recycling factor (RRF) A protein responsible for disassembly of the ribosome at the end of protein synthesis in bacteria.

Ribosome-inactivating proteins (RIPs) The antifungal /antimicrobial proteins secreted by plants that inhibit protein biosynthesis.

Ribozyme RNA having property of catalytic enzyme.

Ricin A toxic protein from castor oil beans.

Rictal Bristles: A stiff bristle like feather, which grows at the base of a bird's bill.

Rifampicin A derivative of rifamycin SV that is used to treat tuberculosis and that may be a potential antitumor agent. Rifamycin SV is an antibiotic isolated from *Streptomyces mediterranei*. It is the progenitor of a family of compounds that have shown potential both as antiviral agents and as antitumor agents. They are thought to act by inhibiting DNA polymerases.

Ribonuclease D An enzyme involved in processing pre-tRNA in bacteria.

River Dolphins A species of dolphins, which dwell in major rivers like the Amazon in Brazil, Yangtze in China and the Ganges in India.

RNA editing A process by which nucleotides not coded by a gene are introduced at specific positions in an RNA molecule after transcription.

RNA induced silencing complex (RISC) A complex of proteins which cleaves and hence silences an mRNA as part of the RNA interference pathway.

RNA interference (RNAi) An RNA degradation process in eukaryotes.

RNA polymerase An enzyme that synthesizes RNA on a DNA or RNA template.

RNA polymerase I The eukaryotic RNA polymerase that transcribes ribosomal RNA genes.

RNA polymerase II The eukaryotic RNA polymerase that transcribes protein-coding and snRNA genes.

RNA polymerase III The eukaryotic RNA polymerase that transcribes tRNA and other short genes.

RNA polymerase. An enzyme that catalyzes the formation of RNA from ribonucleotide triphosphates, using DNA as a template.

RNA primer During DNA replication, the short stretch of RNA nucleotides that is laid down at the beginning of each Okazaki fragment; it provides a 3' -OH end from which DNA polymerase can extend the fragment. It is later replaced with DNA.

RNA splicing Removal of introns from an RNA molecule and the joining together of exons to form the final RNA product.

RNA transcript An RNA copy of a gene.

RNA world The early period of evolution when all biological reactions were centered on RNA.

RNA-directed DNA polymerase Also known as reverse transcriptase. An enzyme that mediates the synthesis of DNA, using an RNA template found primarily in oncornairuses or in cells infected by them.

RNA primer Short length of RNA, complementary in sequence to a DNA strand that allows DNA polymerase III to attach and begin DNA synthesis.

Robertsonian translocation A special type of translocation in which the long arms of two acrocentric chromosomes form a metacentric chromosome; also called centric fusion.

Roguing Removal of off-type plants of the same species.

Roll tube Anaerobic culturing technique in which bacteria grow in agar medium that solidified on the interior wall of a test tube.

Rolling circle replication A replication process that involves continual synthesis of a polynucleotide which is "rolled off" of a circular template molecule.

Root Cap Thimble-shaped mass of cells that cover and protect the growing tip of the root.

Root Hair Hairlike outgrowth arising through the epidermal cell of the root. Located just behind the tip of the root, this root hair helps absorb water and nutrients from the soil.

Root nodule Specialized structure occurring on roots, especially of leguminous plants, in which bacteria fix nitrogen and make it available for the plant.

Root Organ of the plant situated below the ground and absorbs water and mineral salts. Buds, leaves or nodes are absent in root.

Rooted Refers to a phylogenetic tree that provides information on the past evolutionary events that have led to the organisms or DNA sequences being studied.

Rostral Scale Is a scale present on the tip of the upper jaw of a snout, usually seen in snakes.

Rostrum An anatomical structure, present in a species in the form of a snout, which projects out from the head of the animal.

Rotating biological contactor (RBC) A device for the biological treatment of sewage.

Rough endoplasmic reticulum (RER) Portion of the endoplasmic reticulum associated with ribosomes and concerned with the synthesis of secreted proteins. Proteins destined to remain within the majority of single-membrane-bound organelles (Golgi, lysosomes) are also made on the rough ER, as are integral proteins of these organelles and of the plasma membrane.

Roundworms Animals belonging to the phylum Aschelminthes, e.g. *Ascaris lumbricoides*

Rous sarcoma virus A type of C RNA virus. The Rous sarcoma virus was one of the first viruses shown to cause tumors in animals, its primary host is chickens, but it has also been shown to cause tumors in hamsters rabbits and monkeys. Subsequent work has shown that at least some strains of it are defective; these can replicate or produce a tumor only in the presence of a "helper" virus the Rous associated virus, that supplies the outer coat of the viral particle.

R-selected species A species that produces a large number of off-spring, each of which receives little care (quantity rather than quality). R-selected species are better suited for variable or unpredictable environments.

r-strategy Ecological strategy where organisms rely on high reproductive rates for continued survival within the community. Populations of r-strategists are subject to extreme fluctuations.

Rubidazone An antitumor antibiotic that is synthetically prepared analog of daunorubicin. It is believed to act by binding to cellular DNA to block the production of RNA.

Rubisco (ribulose biphosphate carboxylase-oxygenase) The enzyme that accomplishes carbon fixation in photosynthesis by adding CO₂ to ribulose-1,5-biphosphate. It can also add O₂ in place of CO₂, initiating photorespiration.

Ruderal species A plant associated with human dwellings, construction, or agriculture, that usually colonizes disturbed or waste ground. Ruderals are often weeds which have high demands for nutrients and are intolerant of competition.

Runner Slender creeping stem that contains long internodes, growing horizontally along the surface of the ground. e.g. strawberry plant, *Argentina* (silverweed), *Cynodon*, *Fragaria*, and *Pilosella* (Hawkweeds), *Zoysia japonica*, *Ranunculus repens*, *Mentha*.

Ryanodine Ryanodine is a poisonous alkaloid found in the South American plant *Ryania speciosa* (Flacourtiaceae). It was originally used as an insecticide. It binds to the ryanodine receptor, with complex effects on gating of the channel.

Ryanodine receptor calcium channel found in the membrane of the endoplasmic reticulum. In most cells it opens in response to a rise of calcium concentration in the cytosol. In skeletal muscle ryanodine receptors are directly linked to voltage-gated calcium channels in the plasma membrane and open when the latter open.

10 sequence It is the consensus sequence (the calculated order of most frequent residues, either nucleotide or amino acid) centered about 10 bp before the startpoint of a bacterial gene. It is involved in melting DNA during the initiation reaction.

- 16S rRNA** A large polynucleotide (about 1500 bases) which functions as a part of the small subunit of the ribosome of prokaryotes and from whose sequence evolutionary information can be obtained; the eukaryotic counterpart is 18S rRNA.
- 35 sequence** It is the consensus sequence centered about 35 bp before the startpoint of a bacterial gene. It is involved in initial recognition by RNA polymerase.
- S phase** It is a part of the eukaryotic cell cycle during which synthesis of DNA occurs.
- S region** It is an intron sequence involved in immunoglobulin class switching. S regions consist of repetitive sequences at the 5' end of gene segments encoding the heavy chain constant regions.
- S1 nuclease** An enzyme that specifically degrades RNA or single-stranded DNA to 5' mononucleotides. Purified from the filamentous fungus *Aspergillus oryzae*, S1 nuclease is used in assessing the extent of a hybridization reaction by removing unpaired regions. It is also used to remove the sticky ends of restriction fragments. In S1 mapping, the coding region of a gene is detected by performing mRNA-DNA hybridization and removing unpaired DNA with S1 nuclease.
- Sabin vaccine** A preparation containing three attenuated strains of polio virus administered orally.
- Sac fungus** Also called as Ascomycota. A member of a diverse group of fungi that produces sac like asci during sexual reproduction.
- Saccharification** The hydrolysis of polysaccharides by glucoamylase to maltose and glucose.
- Saccharin** ($C_6H_4SO_2CONH$) A white, crystalline, sparingly soluble solid with a melting point of 227°C; about 400 times sweeter than sugar; manufactured from toluene; used as an artificial sweetening agent which is noncalorific, i.e., provides no energy, hence of no food value; may have harmful effects if used in excess; also used in the form of a sodium salt called saccharin sodium, $C_6H_4CO_2NNa \cdot 2H_2O$.
- Saccharomyces** Genus of yeasts that reproduce asexually by budding or sexually by conjugation. Economically important in brewing and baking, they are also widely used in genetic engineering and as simple model organisms in the study of eucaryotic cell biology.
- S-adenosylmethionine (SAM)** An enzymatic cofactor involved in methyl group transfers.
- Salicylic Acid (SA)** SA is a signaling molecule in Systemic Acquired Resistance (SAR) when SAR is triggered in plants via chewing by insects on the leaves of tomato plants, and/or the entry-into-plant of certain pathogenic bacteria/fungi, etc. it is also used by humans as a drug to treat skin infections
- Salinity** The concentration of dissolved salts (such as sodium chloride, magnesium and calcium sulfates, and bicarbonates) in water. Expressed as mg/L or ppm (parts per million).
- Salinization** A process by which high rates of evapotranspiration in arid regions result in a progressive buildup of salts at the soil surface.
- Saliva** A viscous, transparent liquid containing water, salts, mucin and sometimes salivary amylase (previously called ptyalin); secreted by cells of the salivary glands; the quantity of saliva produced depends on the type of food being consumed: dry foods and acidic foods stimulate large quantities of nonviscous saliva while liquid foods such as milk stimulate small quantities of thick saliva.
- Salivary gland** Any gland that secretes saliva; in humans, the salivary glands occur in 3 pairs, one in the cheek and two between the bones of the lower jaw. The salivary glands in mammals are exocrine glands, glands with ducts, that produce saliva. They also secrete amylase, an enzyme that breaks down starch into maltose. In other organisms such as insects, salivary glands are often used to produce biologically important proteins like silk or glues.

Salk vaccine A preparation of a formalin-inactivated polio virus that is injected. It was developed in 1952 by Jonas Salk at the University of Pittsburgh.

Salmonella Bacterial genus characterized by rods, usually motile by peritrichous flagella; can utilize citrate as carbon source; Gram negative; consisting of more than 2,400 serovars (strains/types) classified within two species (*Salmonella enterica* and *Salmonella bongori*). All of these serovars are potentially pathogenic (disease-causing) to poultry and humans (e.g., when undercooked eggs are eaten by humans). *Salmonella enteritidis* and *Salmonella typhimurium* are increasingly causing outbreaks of foodborne illnesses (e.g., when foods are not washed or cooked thoroughly enough prior to consumption by humans).

Salmonellosis A common enteritis characterized by abdominal pain, fever and diarrhoea with blood and mucus; caused by *Salmonella* species.

Salpingitis Inflammation or infection of a tube; usually the fallopian tubes between the ovaries and uterus.

Salt A substance that dissolves in water to cations and anions, neither of which is H^+ or OH^- . It is formed when the hydrogen of an acid has been replaced by a metal; a salt is produced, together with water, when an acid reacts with a base; salts are named according to the acid and the metal from which the salts are derived; for example, sodium chloride is a salt derived from sodium and hydrochloric acid.

Salt bridge (in protein structure) Interaction between a positively charged amino acid residue (such as arginine) and a negatively charged residue (such as aspartate).

Salt tolerance The ability to withstand a higher concentration of sodium (Na^+ ion), or of any other salt, in the soil (or in culture), which is damaging or lethal to other plants. For example, a salt-tolerance gene from *Arabidopsis thaliana* was inserted into a tomato plant (*Lycopersicon esculentum*) thereby making that plant resistant to salt concentrations up to 200 mM (far higher than it could previously survive).

Salting in The increase in solubility of a protein (or other molecule) with decreasing (low) salt concentration. Upon the addition of small amounts of certain salts, such as ammonium sulfate the proteins become globular in shape.

Salting out The decrease in protein solubility (or other molecule) with increasing (high) salt concentration.

Saltatory conduction Jumping of an action potential from node to node down a myelinated axon.

Salvage pathway A metabolic pathway for converting free purines and pyrimidines to their nucleotide forms.

Sam-K Gene A gene naturally present within the *E. coli* bacteriophage T3. If the sam-k gene is inserted via genetic engineering into a (fruit crop) plants genome that causes greatly reduced production of the chemical compound S-adenosylmethionine (SAM) in that plant's fruit. Because the SAM is normally converted (chemically) into l-aminocyclopropane-1-carboxylic acid (ACC) in the fruits of traditional varieties of (fruit crop) plants, such sam-k gene-containing plants produce fruits which ripen/soften far slower than fruit from traditional varieties of those plants; which can reduce spoilage/loss in the harvest and transport of such fruit. That is because ACC is required for fruits to produce ethylene, the plant hormone which triggers (over-) ripening/softening of fruit.

Sampling error Part of the total estimation error of a parameter due to the sampling procedure or due to the small size of the sample.

Sampling The procedure of collecting sample.

- Sampling with replacement** A method of sampling in which each item selected and observed is returned to the population before the next item is selected. The same item may appear several times in the sample.
- Sampling without replacement** A method of sampling in which items are selected from the population once or successively without being returned to the population.
- Sand** The coarsest soil particles (0.05–2 mm). Individual rock or mineral fragments in a soil that range from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but they can be of any mineral composition. Sand is also the textural class name of any soil that contains 85 percent or more sand and no more than 10 percent clay.
- Sandwich ELISA** The technique of sandwich ELISA uses antibody bound to a surface to trap a protein by binding to one of its epitopes. The trapped protein is then detected by an enzyme-linked antibody specific for a different epitope on the protein's surface. This gives the assay a high degree of specificity.
- Sanger sequencing** A widely used method of determining the order of bases in DNA.
- Sanitary and Phytosanitary (SPS) Measures** Technical barriers (i.e., against some imports) that are designed for the protection of human health or the control of animal and plant pests/diseases. In the Sanitary and Phytosanitary (SPS) Agreement to GATT/WTO, the WTO member nations agreed to base their SPS measures only on an assessment of actual risks posed by the particular import in question, and to utilize only scientific methods in assessing those risks.
- Sanitary landfill** Disposal of solid waste in low lying areas, with wastes covered with a layer of soil each day.
- Sanitize** To remove microorganisms or substances that support microbial growth by using sanitizing agents.
- Sap** Fluid content of the xylem and phloem cells of plants. Fluid contents of the cell vacuole are referred to as cell sap.
- Saponification** Alkaline hydrolysis of triacyl glycerols to yield fatty acid salts. The molecules thus produced are known as surfactants (surface active agents), commonly called soap. The process of soapmaking.
- Saponins** A group of phytochemicals (i.e., sugars linked to a triterpene or a steroid molecular subunit) produced by certain plants (the soybean plant, spinach plant, tomatoes, potatoes, ginseng plant, etc.). Evidence suggests that human consumption of saponins (e.g., produced in soybeans) can help to lower a person's blood content of low-density lipoproteins (LDLP) and can help prevent certain types of cancer.
- Sapremia** Blood poisoning caused by putrefactive bacteria.
- Saprophyte** An organism that obtains its nutrients from dead organic matter.
- Sarcina** (1) A group of 8 bacteria that remain in a packet after dividing. (2) When written as a genus, refers to gram-positive, anaerobic cocci.
- Sarcoma** A malignant tumor arising from derivatives of embryonal mesoderm. These include the lining of the body cavity, the circulatory system, certain parts of the excretory system, muscle, bone, teeth (except the enamel), mesenchymal tissues such as cartilage, connective tissues, adipose tissue and tendon and the reproductive organs. Leukemias and lymphomas can thus be considered subgroups

of sarcomas. Sarcomas (not including leukemias and lymphomas) account for about 2% of human malignancies.

Sarcomere Repeating unit of a myofibril in a muscle cell, composed of an array of overlapping thick (myosin) and thin (actin) filaments that slide past each other during muscle contraction.

Sarcoplasmic reticulum Network of internal membranes in the cytoplasm of a muscle cell that is concerned with the regulation of the concentration of calcium ions Ca^{2+} which is released into the cytosol during muscle excitation.

Satellite chromosome A terminal portion of chromosome that is separated from the main body of the chromosome arm by a thin filament or narrow constriction.

Satellite DNA DNA consisting of multiple tandem repeats (identical or related) of very short nucleotide sequences; makes up 10 to 20% of genome of higher eukaryotes; usually identifiable by its unusual nucleotide composition; most often associated with the centromeric region; satellite DNA is not transcribed and has no known function. It can be isolated from the rest of the DNA by CsCl density gradient centrifugation. They may have a structural role in chromosomes.

Satellite RNA (viroids) A small, self-splicing RNA molecule that accompanies several plant viruses, including tobacco ringspot virus.

Saturated Describes a molecule containing carbon-carbon bonds that has only single covalent bonds.

Saturated fat A fat that has only single bonds in the molecule.

Saturated Fatty Acids (SAFA) A fatty acid that does not contain any double bonds in its hydrocarbon chain. Beef fat contains approximately 54% SAFA; sheep fat 58% SAFA; pork fat 45% SAFA and chicken fat 32% SAFA. High levels of dietary SAFA have been related to increased blood cholesterol levels, which tends to lead to coronary heart disease (CHD) in humans. In general, fats possessing the highest levels of saturated fatty acids tend to be solid at room temperature; and those fats possessing the highest levels of unsaturated fatty acids tend to be liquid at room temperature.

Saturates Oils containing saturated fatty acids.

Saturation density The maximum cell number attainable, under specified culture conditions, in culture vessel. The term is usually expressed as the number of cells per cubic centimeter in a suspension culture.

Saturation kinetics are said to occur when the rate of a reaction approaches a maximum, limiting value as the concentration of reactant increases. The rate becomes limited by the availability of binding sites on the catalyst for the reactant.

Saturation mutagenesis Induction and recovery of large numbers of mutations in one region of the genome, or in one function, or identifying all the genes in that area, or affecting that function.

Savanna A type of plant community dominated by grasses with intermixed trees and shrubs.

Saxitoxin A type of neurotoxin produced by some dinoflagellates.

Scabies Highly contagious skin disease caused by the itch mite *Sarcoptes scabiei*.

Scaffold attachment region (SAR) An AT-rich segment of a eukaryotic genome that acts as an attachment point to the nuclear matrix.

Scaffold protein Protein that organizes groups of interacting intracellular signaling proteins into signaling complexes.

- Scaffold** The central core structure of condensed chromosome composed largely of topoisomerase to which the DNA is attached as a loop. The scaffold is composed of non-histone chromosomal proteins.
- Scale** The spatial or temporal dimension at which ecological observations are collected.
- Scale up** Conversion of a process, such as fermentation of a micro-organism, from a small laboratory setup to a large commercial fermentor.
- Scanning** A system used during initiation of eukaryotic translation, in which the pre-initiation complex attaches to the 5'-terminal cap structure of the mRNA and then scans along the molecule until it reaches an initiation codon.
- Scanning electron microscope (SEM)** A type of electron microscope in which the image is formed from electrons that are reflected back from the surface of a specimen as the electron beam scans rapidly back and forth over it. The scanning electron microscope is particularly useful for providing topographical information about the surfaces of cells or tissues.
- Scanning tunneling microscopy (STM)** Also called scanning probe microscope; type of microscope in which electrons tunnel into each other's clouds, can show individual molecules, live specimens and work underwater.
- Scope** A leafless flowering stem arising from the ground.
- Scarce mRNA** (complex mRNA) consists of a large number of individual mRNA species, each present in very few copies per cell. This accounts for most of the sequence complexity in RNA.
- Scarification** The chemical or physical treatment given to some seeds (where the seed coats are very hard or contain germination inhibitors) in order to break or weaken the seed coat sufficiently to permit germination. Example cotton seed
- Scarlet fever** Infection caused by *Streptococcus pyogenes* characterized by sore throat, nausea, vomiting, reddish skin rash etc. Also called as scarlatina.
- Scatchard analysis** is a mathematical analysis of equilibrium binding that allows the affinity and valence of a receptor-ligand interaction to be determined.
- Scatter diagram** A bivariate or multivariate graphic representation of population analysis.
- Scavenger receptors** on macrophages and other cells bind to numerous ligands and remove them from the blood. The Kupffer cells in the liver are particularly rich in scavenger receptors.
- S-Cdk** Complex formed in vertebrate cells by an S-cyclin and the corresponding cyclin-dependent kinase (Cdk).
- Schaeffer-Fulton stain** An endospore stain that uses malachite green to stain the endospores and safranin as a counterstain.
- Schick test** A skin test to detect the presence of antibodies to diphtheria.
- Schiff base** A complex formed by the reversible condensation of a primary amine with an aldehyde or a ketone.
- Schiff's reagent** (named after Hugo Schiff, 1834-1915) A reagent consisting of the dye magenta, which has been decolorized with sulfur dioxide or sulfurous acid; used to test for aldehydes— the aldehydes oxidize the reduced form of the dye back to its original colour.

Schizogamy A type of sexual reproduction common among sporozoan (protozoa) in which nuclear division occurs several times, producing a schizont that then further segments into daughter cells.

Schizogenesis Asexual reproduction by fission.

Schizogony The process of multiple fission, in which organism divide to produce many daughter cells (schizonts). E.g., Sporozoa (*Plasmodium*).

Schizont A cell that by repeated asexual division or schizogony produces numerous small cells (schizonts). E.g., *Plasmodium*.

Schizonts (merozoites) Mobile spores formed by schizogony or multiple asexual fission, e.g., many protozoa.

Schlichter test Also known as the serum bactericidal level test. It is a direct method for determining the antibacterial activity of serum of patients receiving antimicrobial drugs.

Schuffner's dots Tiny, red-staining granules in the cytoplasm of red blood cells infected with either *Plasmodium vivax* or *P. ovale*; using Giemsa stain.

Schwann cell Cells responsible for forming myelin sheaths in the peripheral (outside the brain and spinal cord) nerve fibres in vertebrates.

Scientific method An iterative and self-correcting process by which scientists learn about the natural world, consisting of four steps: (1) observe nature and ask a question about those observations; (2) develop possible answers to that question (hypotheses); (3) evaluate competing hypotheses with experiments, observations, or quantitative models; (4) use the results of those experiments, observations, or models to modify the hypotheses, pose new questions, or draw conclusions.

Scientific name A unique identifier consisting of a genus and a species name (the specific epithet) in Latin, assigned to each recognized and described species of organism. Based on the Linnean system of classification.

Scion The twig or bud to be grafted onto another plant, the root stock, in a budding or grafting operation.

Scion stock interaction The effect of a root stock on a scion (and vice versa) in which a scion performs differently on one kind of rootstock than it would on its own roots or on a different rootstock.

Sclerenchyma (Gr. *skleros*, hard + *echyma*, a suffix denoting tissue) A strengthening tissue in plants, composed of cells with heavily lignified cell walls.

Scleroprotein A class of complex, insoluble fibrous proteins (e.g., keratin, collagen, elastin) that occur in the surface coatings of animals and form the framework binding cells together in animal tissues.

Sclerotia The compact mass of hardened mycelia of the fungus *Claviceps purpurea* that fills infected rye flowers; produces the toxin ergot.

Scolex (pl. Scolices) Head portion of a tapeworm; may attach to the intestinal wall by suckers or hooklets.

Scorable marker A marker gene that is used for confirming the transformed nature of the regenerated plant obtained after transformation.

Scrapie A brain disease of sheep causing extreme itching.

Screenable marker genes Marker genes used for identifying and tracking genetic modification in plants, e.g. glucuronidase, Gus and Luc (Luciferase). They are particularly important when direct selection of the transformed plant is not feasible or effective.

Screening To separate by exclusion or collection on the basis of a set of criteria (biochemical, anatomical, physiological, etc.). Screening is often applied to the process of selection for specific purposes, such as disease resistance or improved agronomic qualities in plants, improved performance in animals, specific enzyme properties in micro-organisms, etc.

scRNPs (scyrps) are small cytoplasmic ribonucleoproteins (scRNAs associated with proteins).

Scurvy (scurbutFr = scurvy) A disease caused by deficiency of vitamin C (ascorbic acid) in the diet. It results in inadequate formation of 4-hydroxyprolyl residues in the collagens, thereby reducing the collagen's stability.

Scutellum The single cotyledon of the grass embryo; the scutellum is specialized for absorbing nutrients from the endosperm as the seed germinates.

Scutulum Cup-shaped crust of hyphae and spores in favus of the skin.

Sebaceous gland Cutaneous glands occurring in the skin; secretes oil or sebum into the hair follicles in mammals; maintains an oily coating to the hair and contributes to its waterproofing protection from any bacteria.

Sebum Oily substance secreted by the sebaceous glands.

Second law of thermodynamics The law states that in any physical or chemical process, the entropy (degree of disorderness) of the universe tends to increase.

Second messenger gated channel is an ion channel whose activity is controlled by small signaling molecules inside the cell.

Second messenger Small molecule that is formed in or released into cytoplasm in response to an extracellular signal (first messenger such as a hormone) and helps to relay the signal to the interior of the cell. For example cyclic AMP, GMP, IP₃ and Ca²⁺.

Second order reaction A reaction in which two reactant molecules must come together for the reaction to occur. The reaction is called second-order because the reaction rate depends on the square of reactant concentration (for two molecules of the same reactant) or on the product of two reactant concentrations (for two different reactants).

Second set rejection When the recipient of a first tissue or organ graft has rejected that graft, a second graft from the same donor is rejected more rapidly and vigorously in what is called a second set rejection.

Second signal The co-stimulatory signal required for lymphocyte activation is often called a second signal, with the first signal coming from the binding of antigen by the antigen receptor. Both signals are required for the activation of most lymphocytes.

Second site mutation (reversion) The second mutation within a mutant gene; in many cases, the second site mutation suppresses the first mutation, so that the mutant has the wild-type phenotype.

Secondary antibody response, secondary immunization It is the antibody response induced by a second or booster injection of antigen—a secondary immunization. The secondary response starts sooner after antigen injection, reaches higher levels, is of higher affinity than the primary response, and is dominated by IgG antibodies. Therefore, the response to each immunization is increasingly intense, so the secondary, tertiary, and subsequent responses are of increasing magnitude.

Secondary antibody The antibody that binds to the primary antibody. The secondary antibody is often conjugated with an enzyme such as alkaline phosphatase. Commonly used in an ELISA or other immunological assays system. Secondary antibodies are produced by one species of animal in

response to the injection of another animal's antibodies, thus a "goat antirabbit" secondary will bind to any primary antibody that has been generated by a rabbit.

Secondary attachment site is a locus on the bacterial chromosome into which phage lambda integrate inefficiently because the site resembles the *att* site.

Secondary cell wall Layers of a plant cell wall formed external to the primary cell wall, with a highly organized microfibrillar structure, which is formed in certain cells after cell elongation has ceased. It gives rigidity to the cells. It is made of cellulose, lignin, suberin etc.

Secondary compound One of a wide variety of chemicals produced by plants and used in functions such as defense against herbivory, protection from harmful radiation, and soil nutrient cycling; secondary compounds are so-named because they are synthesized on side branches of the primary metabolic pathways that produce the carbohydrates, amino acids, lipids, and other compounds common to all organisms.

Secondary data These are data which have already been collected by some other persons and which have passed through the statistical machine at least once.

Secondary embryogenesis The development of embryos from young embryos.

Secondary growth Type of growth characterized by an increase in thickness of stem and root and resulting from formation of secondary vascular tissues by the vascular cambium.

Secondary immune response Adaptive immune response to an antigen that is made on a second or subsequent encounter with a given antigen. It is more rapid in onset, stronger and more specific than the primary immune response. This second exposure is also referred to as a "booster".

Secondary immunodeficiency disease An immunodeficiency disease of known nongenetic causes. Result of damage to T cells or B cells after they have developed normally.

Secondary immunofluorescence microscopy Form of light microscopy in which a fluorescent secondary antibody is used to label a preapplied primary antibody specific for a particular protein or subcellular structure. Also called indirect immunofluorescence microscopy.

Secondary infection An infection caused by an opportunistic pathogen after a primary infection has weakened the host's defenses.

Secondary lymphoid organ An organ in which effector lymphocytes are present. Example spleen, Adenoids, tonsils, Peyer's patches of the gut, and appendix.

Secondary messenger A chemical compound within a cell that is responsible for initiating the response to a signal from a chemical messenger (such as a hormone) that cannot enter the target cell itself.

Secondary metabolism Pathways that lead to the production of specialized products which are not found in every living cell; usually have no known metabolic role in cells. Examples of the products include antibiotics and pigments.

Secondary metabolite A compound that is not necessary for growth or maintenance of cellular functions but is synthesized, generally, for the protection of a cell or micro-organism. Example alkaloids, terpenoids, phenol etc.

Secondary phloem Phloem tissue formed by the vascular cambium during secondary growth in a vascular plant.

- Secondary plant products** Metabolic products not having a known functional or structural use in plant cells. They have been extracted from plant tissue cultures for pharmaceutical and food processing purposes (e.g., essential oils, food additives, flavours).
- Secondary production** Energy in an ecosystem that is derived from the consumption of organic compounds produced by other organisms.
- Secondary sex characters** Features of a male or female animal that develop as a result of hormones secreted by endocrine part in the gonads, for example, the female secondary sex characters are induced by estrogens and the male human secondary sex characters are induced by androgens at puberty.
- Secondary structure** local folding pattern of a linear polymeric molecule usually the result of hydrogen to form a regular repeating structure; for example, the B- and Z-forms of DNA helix and the α helices and β pleated sheets in proteins.
- Secondary succession** Succession that involves the re-establishment of a community in which most, but not all, of the organisms have been destroyed.
- Secondary thickening** Deposition of secondary cell wall materials which result in an increase in thickness in stems and roots.
- Secondary treatment** Biological degradation of the organic matter in waste matter, following primary treatment.
- Secondary vascular tissue** Vascular tissue (xylem and phloem) formed by the vascular cambium during secondary growth in a vascular plant.
- Secondary xylem** Xylem tissue formed by the vascular cambium during secondary growth in a vascular plant.
- Secretin** A peptide hormone of 27 amino acid residues and with molecular weight of 3,056; formed by the upper intestinal mucosa; causes the flow of pancreatic juice; also stimulates the flow of bile and intestinal juices; the first hormone to be identified.
- Secretion** The passage of a molecule from the inside of a cell through a membrane into the periplasmic space, or the extracellular medium.
- Secretion vector** A DNA vector in which the protein product is both expressed and secreted (excreted) from the cell.
- Secretory component** A protein present on intestinal epithelial cells that acts as an IgA receptor and on binding to IgA, protects it against proteolytic attack in the intestine.
- Secretory pathway** The series of steps in which an integral membrane or secretory proteins is recognized by the signal recognition particle as it emerges from the ribosome, is translocated across the endoplasmic reticulum membrane and in some cases is cleaved by a signal peptidase.
- Secretory vesicle** It is a membrane-bounded compartment that contains molecules to be released from cells by regulated exocytosis. It is also called a secretory granule. The vesicles are derived from the Golgi apparatus or the ER.
- Section** Very thin slice of tissue, suitable for viewing under the microscope.
- Sector** A region of tissue whose phenotype is distinctly different from the surrounding tissues.
- Securins** are a class of proteins that prevent the initiation of anaphase by binding to and inhibiting separin, a protease which cleaves the structural component required for holding sister chromatids together.

Inhibition of separin by securin ends when securin is itself proteolyzed as a result of activation of the anaphase promoting complex (APC).

Sedative A drug that reduces nervousness, irritability and excitement by inducing sedation. Example propofol.

Sediment Eroded particles that are no longer part of the soil. These sediments, sand silt, or clay size, are carried by wind or water and deposited to a different area, like surface water bodies. Sedimentation occurs when eroded soil is deposited and/or settles in water. Erosion, itself, is the process of detaching and transporting soil particles.

Sedimentation analysis The centrifugal technique used to measure the sedimentation coefficient of a molecule or structure.

Sedimentation coefficient (*S* value) A physical constant specifying the rate of sedimentation of a particle in a centrifugal field under specified conditions. It depends on the density of the medium, the specific density of the particle, and the size, shape, and mass of the particle.

Sedimentation equilibrium A technique for using centrifugation to measure the mass of a large molecule such as a protein. A solution of the substance is centrifuged at low speed until the tendency of the substance to sediment is balanced by its tendency to diffuse to uniform concentration; the resulting concentration gradient is used to measure the molecular mass.

Sedimentation The process of separating an insoluble solid from a liquid in which it is suspended by allowing it to fall to the bottom of the containing vessel, with or without agitation or centrifuging.

Seed Botanically, A structure that develops from the mature ovule of a seed plant; contains an embryo and stored food enclosed by protective seed coat(s); a reproductive and dispersal unit of plant. Colloquially, a seed is anything which may be sown; i.e., seed potatoes (which are vegetative tubers); seed of corn, sunflower, etc.

Seed alignment Alignment that contains only one of each pair of homologues that are represented in a CLUSTALW-derived phylogenetic tree linked by a branch of length less than a distance of 0.2.

Seed apomixis A type of sexual reproduction in plants in which a sex cell or a somatic cell develops into an embryo without undergoing meiosis and fertilization.

Seed certification It consists of field inspections and seed tests to ensure genetic and physical purity and good germination of seed lots, and issuance of a certificate to that effect.

Seed coat The outer layer of a seed; develops from the integuments of the ovule.

Seed storage proteins Proteins accumulated in large amounts in seeds as a convenient source of amino acid for use when the seed germinates.

Seed test A series of tests on purity, moisture content and germination of a seed sample to determine its quality.

Seedling growth inhibitors Mode of action of a group of herbicides that generally disrupt early growth of plants. Example 2,4-D, trifluralin (Treflan) and alachlor (Lasso).

SEG A program for filtering low complexity regions in amino acid sequences. Residues that have been masked are represented as "X" in an alignment. SEG filtering is performed by default in the blastp subroutine of BLAST 2.0.

Segment polarity genes Developmental genes that provide greater definition to the segmentation pattern of the *Drosophila* embryo established by the action of the pair-rule genes. They are expressed in a

striped pattern with one stripe in every future segment. Each stripe indicates the posterior margin of a segment. Segmentation genes are concerned with controlling the number or polarity of body segments in insects.

Segmentation genes Insect genes especially zygotically expressed genes of *Drosophila* that stimulate the development along the anteroposterior axis after the establishment of anterior and posterior regions of the embryo. Gap genes, pair-rule genes, and segment polarity genes are all segmentation genes.

Segmentation The process of formation of a series of segments arranged along the length of an organism with repetition of the principal organs in each segment, e.g., annelids and arthropods. In vertebrates, the embryo shows segmentation of the muscular, skeletal and nervous system, as the animal develops, specialization and enlargement of organs obliterate the original segmental arrangement. Also known as metameric segmentation.

Segments Morphologically and structurally repetitive body units of *Drosophila* and other arthropods.

Segregant A hybrid resulting from the crossing of two genetically unlike individuals.

Segregating generation The F_2 and the subsequent generations obtained through continued selfing of a F_1 individual.

Segregating population A collection of lines from a cross or population that is undergoing Mendelian or Hardy-Weinberg gene segregation.

Segregation (1) Cytologically, the separation of homologous chromosomes during first meiotic division. Mendel's first principle of inheritance (the Law of Segregation) predicts that heterozygotes will produce equal numbers of gametes containing each allele. (2) Genetically, the formation of two separate phenotypes, corresponding to two alleles of a gene, either in different individuals or in different tissues.

Segregation analysis Monitoring the separation and distribution of alleles of different cells, following meiosis.

Segregation distortion Deviation of the expected segregation ratio from that expected by Mendelian inheritance. Distorted segregation means that either the maternal or paternal allele was transmitted to the progeny at a higher frequency than expected.

Selectable (reporter genes) Having a gene product that, when present, enables a researcher to identify and preferentially propagate a particular organism or cell type.

Selectable marker A gene whose product has an activity, such as antibiotic resistance, such that, under the appropriate conditions, cells harboring the gene can be distinguished from those that lack it. Thus it allows the identification of a specific trait or gene in an organism or cells that have been transformed or transfected with a vector containing the marker gene. The marker allows the transformed cell to survive and grow under conditions that kill or restrict the growth of nontransformed cells. Examples are resistant to kanamycin, neomycin or G418 antibiotics; phosphinothricin, 2,4-D or sulphonylurea herbicide tolerance

Selectin Member of a family of cell-surface carbohydrate-binding proteins that mediate transient, Ca^{2+} -dependent cell-cell adhesion in the blood stream. For example between white blood cells and the endothelium of the blood vessel wall. Also called LEC-CAMs (leukocyte cell adhesion molecules).

Selection (1) Survival of a reproductively fit organism. (2) A system for either isolating or identifying specific organisms in a mixed culture. (3) A technique for plant improvement in which the best seed

from each crop representing a particular trait is saved for planting the next generation or making the next cross.

Selection coefficient (*s*) The proportion of fitness of one genotype in relation to the fitness of a standard genotype, which is usually the genotype with the highest fitness. In general, relative fitness = $1 - s$.

Selection culture A selection based on difference(s) in environmental conditions or in culture medium composition, such that preferred variant cells or cell lines (presumptive or putative mutants) are favored over other variants or the wild-type.

Selection differential (*S*) The ratio between the mean of a population and the mean of the individuals selected, as parents of the next generation.

Selection pressure The intensity of selection acting on a population of organisms or cells in culture. Its effectiveness is measured in terms of differential survival and reproduction, and consequently in change in the frequency of alleles in a population.

Selection response The difference between the mean of the individuals selected to be parents and the mean of their offspring. Predicted response = heritability (narrow-sense) \times selection differential.

Selection unit The minimum number of organisms or cells effective in the screening process.

Selective agent An environmental or chemical agent characterized by its lethal or sub-lethal stress on growing plants, or portion thereof in culture. A selective agent is mainly used when selection of resistant or tolerant individuals is the research aim.

Selective Apoptotic Anti-Neoplastic Drug (SAAND) A category of pharmaceuticals that acts to prevent neoplastic growth (i.e., cancer) by allowing normal cell apoptosis to occur again (e.g., by blocking an enzyme that is hindering normal apoptosis) in abnormal precancerous cells and cancerous cells. Example; sulindac, which blocks phosphodiesterases (enzymes).

Selective breeding A process in which new or improved strains of plants or animals are developed, mainly through controlled mating or crossing and selection of progeny for desired traits.

Selective estrogen receptor modulators (SERM) This term refers to chemical compounds (flavones, flavonols, isoflavones, the pharmaceuticals Evista/raloxifene and tamoxifen, etc.) which impart some beneficial effect on the human body when consumed by humans, without any of the adverse impacts of estrogen (e.g., promotion of the growth of certain tumors by estrogen).

Selective grazing Taking certain plant species, individual plants, or plant parts to the exclusion of others.

Selective medium A medium which allows the growth of certain types of microorganisms in preference to others. For example, an antibiotic-containing medium allows the growth of only those microorganisms which are resistant to this antibiotic. Also called as selection media.

Selective neutrality The state in which genetic variation is influenced only by random processes.

Selective system An experimental technique that increases the recovery of specific genotypes.

Selective toxicity The property of some antimicrobial agents to be toxic for a microorganism and nontoxic for the host.

Selectively Amplified Microsatellite Polymorphic Locus (SAMPL) A variation of the AFLP (Amplified fragment length polymorphism) technique that amplifies microsatellite loci by using a single AFLP primer in combination with a primer complementary to compound microsatellite sequences, which do not require prior cloning and characterization.

Selectively permeable membrane (seligereL = to gather apart + permeareL = to go through) Refers to the ability of a cell membrane to allow passage across the membrane of some solutes, but not others; previously called as semi permeable membrane.

Selectivity Differential effect of an herbicide when applied to a mixed population of plants; sensitive plants die, tolerant plants are unharmed. Implies that different plant species do not respond in the same way to a particular herbicide. Selectivity allows for acceptable weed control without injury to crop plants.

Selectivity filter That part of an ion channel structure that determines which ions it can transport.

Self antigens Antigens present in the body of an individual, they are associated with the normal cells and tissues of the body.

Self assembly The term refers to the spontaneous formation of any biological structure that occurs when molecules collide and bind to each other. This occurs due to the formation of weak chemical bonds between surfaces with complementary shapes. Examples of such large molecular structures include micelles, reverse micelles, ribosomes, peptide nanotubes, and Tobacco Mosaic Virus (TMV).

Self fertility Ability to set seeds on self pollination. Example seed production in rice.

Self fertilization The process by which pollen of a given plant fertilizes the ovules of the same plant. Plants fertilized in this way are said to have been selfed. An analogous process occurs in some animals, such as nematodes and molluscs.

Self incompatibility In plants, the inability of the pollen to fertilize ovules (female gametes) of the same plant; lack of seed set on self pollination. Also called self sterility.

Self pollination Transfer of pollen from the anthers to the stigma of the same flower or to another flower of the same plant

Self renewal The ability of stem cells to continue to divide and replenish themselves indefinitely.

Self replicating elements Extrachromosomal DNA elements that have their own origins of replication for the initiation of their own DNA synthesis. Example Ti plasmid of *E.coli*.

Self replication Refers to the ability of DNA to make exact copies of itself.

Self tolerance The ability of an organism to recognize and not make antibodies against self.

Self tolerance, tolerance Tolerance is the failure to respond to an antigen; when that antigen is borne by self tissues, tolerance is called self tolerance.

Selfish DNA A repetitive nucleotide portion of DNA that appears to have no function and apparently contributes nothing to the cell in which it is found. Also called Junk DNA. Example: transposons are considered to be selfish DNA because they can replicate fast and move copies of themselves to several sites in a genome.

Semelparous (Latin semel= once, and pario=to beget) Reproducing only once in a lifetime.

Semi continuous culture Cells in an actively dividing state are maintained in culture by periodically draining off the medium and replenishing it with fresh medium.

Semi solid Gelled but not firmly so; small amounts of a gelling agent are used to obtain a semi-solid medium; called also semi-liquid.

Semiconservative replication A mode of DNA replication wherein each strand of a parent DNA molecule is a template for the synthesis of its new complementary strand. Thus, one strand of a pre-existing

DNA molecule is conserved during each round of replication. It was proposed by Matthew Meselson and Franklin Stahl in 1958.

Semiconserved (semiinvariant) position is one where comparison of many individual sequences finds the same type of base (pyrimidine or purine) always present.

Semidiscontinuous replication is mode in which one new strand (the leading strand) is synthesized continuously while the other is synthesized as a series of discontinuous fragments (Okazaki fragments) that are later joined (the lagging strand).

Semipermeable membrane A cell or plasma membrane that is partially permeable; certain ions or molecules (water, solvents) can pass through it but others cannot (such as certain solutes).

Semisynthetic catalytic antibody An antibody produced (e.g., via monoclonal antibody techniques) in response to a carefully selected antigen (i.e., one of the molecules involved in the chemical reaction that you are trying to catalyze). Such an antibody is then made to be catalytic by "attaching" a (molecular) group that is known to catalyze the desired chemical reaction. This attaching is done either via chemical modification of the antibody, or via genetic engineering of the cell (DNA) that produces that antibody.

Sendai virus Parainfluenza virus that adheres to the cell surface and facilitates cell fusion.

Senescence The last stage in the post-embryonic development of multicellular organisms, during which loss of functions and degradation of biological components occur. A physiological ageing process in which cells and tissues deteriorate and finally die. It is characterized by an accumulation of metabolic products, an increased respiratory rate, and a loss in dry weight. Also called biological aging.

Senescent cells show visible changes in the appearance of a culture as the result of limitations posed by telomere shortening on the number of chromosomal replications that can occur.

Senile Senescence associated with morbid processes.

Sense organ Any receptor organ that receives a specific external or internal stimuli.

Sense RNA A primary transcript (RNA) that contains a coding region (contiguous sequence of codons) that is translated to produce a polypeptide.

Sense strand The DNA strand complementary to the strand that is transcribed. It has the same base sequence as that of the RNA except for the replacement of U with T. Also called as the coding strand.

Sensible heat flux The transfer of heat through the exchange of energy by conduction or convection.

Sensitization Initial exposure to an antigen, which causes the host to mount an immune response against it.

Sepal Leaf-like structures that enclose the rest of the structures in a flower. The first or lowest whorl in a floral structure, is usually green and part of the calyx; can protect the flower when in bud. Sepals collectively form the calyx.

Separation distance The distance between the border of a genetically modified (GM) crop and the border of another crop that is sexually compatible with the GM crop.

Separins are proteins which play a direct role in initiating anaphase by cleaving and inactivating a component (a cohesin) that holds sister chromatids together.

Sepsis Also known as systemic inflammatory response syndrome, this life-threatening condition (“septic shock”) occurs when the body’s immune system over-responds to infection (e.g., by gram-negative bacteria) in which release of bacterial endotoxin (lipopolysaccharide, or LPS) occurs. Those immune system cells (e.g., macrophages, etc.) overproduce numerous inflammatory agents (e.g., cytokines), which induce fever, shock, and sometimes organ failure.

Septal ring (Z-ring) is a complex of several proteins coded by *fis* genes of *E. coli* that forms at the mid-point of the cell. It gives rise to the septum at cell division. The first of the proteins to be incorporated is FtsZ, which gave rise to the original name of the Z-ring.

Septate hypha A fungal hypha consisting of uninucleate cell-like units.

Septate junction Main type of occluding cell junction in invertebrates; their structure is distinct from that of vertebrate tight junctions.

Septic embolus Clot (blood or other occlusive material) carried by the blood which contains infectious agents; often leads to systemic infection. Its occurrence can be sudden.

Septic High number of neutrophils, due to infection by bacteria.

Septic shock Acute circulatory failure caused by toxins of microorganisms; often leads to sudden drop in blood pressure, multiple organ failure and is associated with a relatively high mortality.

Septic tank A tank built into the ground, in which waste water is treated by anaerobic digestion.

Septum (L. *septum*, fence) (pl. *septa*) A crosswall (partition) dividing a parent cell into two daughter cells during binary fission or occurring between adjacent cells in the hyphae. The same term is used to describe the cell wall that forms between plant cells at the end of mitosis.

Sequela (pl. *sequelae*, Latin *sequi* = “follow”) A condition that occurs as a result of a disease process, injury, or other trauma. For example *sequelae* of traumatic brain injury include headache and dizziness.

Sequenase An enzyme used in chain termination DNA sequencing.

Sequence (of a DNA molecule) The specific nucleic acids that comprise a given segment of a DNA molecule.

Sequence (of a protein molecule) The specific amino acids (and the order in which they are coupled together) that comprise a given segment of a protein molecule.

Sequence assembly A process whereby the order of multiple sequenced DNA fragments is determined.

Sequence Characterized Amplified Region (SCAR) A molecular marker technique that amplifies DNA fragments by 18-25 base PCR using specific primers, designed from nucleotide sequences established from cloned RAPD fragments linked to a trait of interest.

Sequence complexity measure of the total number of different sequences present in a genome.

Sequence contig A contiguous DNA sequence obtained as an intermediate in a genome sequencing project.

Sequence hypothesis Francis Crick’s seminal concept that genetic information exists as a linear DNA code; DNA and protein sequence are collinear.

Sequence is the order of nucleotides along a polynucleotide chain or strand.

Sequence map A pictorial representation of the sequence of amino acids in a protein molecule, the sequence of nucleic acids in a DNA molecule, or the sequence of oligosaccharide components in a glycoprotein/carbohydrate molecule.

Sequence motif A sequence motif is a pattern of nucleotides or amino acids shared by different genes or proteins that often have related functions. Sequence motifs observed in peptides that bind a particular MHC glycoprotein are based on the requirements for particular amino acids to achieve binding to that MHC molecule.

Sequence skimming A method for rapid sequence acquisition in which a few random sequences are obtained from a cloned fragment, the rationale being that if the fragment contains any genes then there is a good chance that at least some of them will be revealed by these random sequences.

Sequence tagged site (STS) Short (200 to 500 base pairs) DNA sequence that has a single occurrence in the genome and whose location and base sequence are known. Detectable by polymerase chain reaction, STSs are useful for localizing and orienting the mapping and sequence data reported from many different laboratories and serve as landmarks on the developing physical map of the human genome. Expressed sequence tags (ESTs) are STSs derived from cDNAs.

Sequence-Related Amplified Polymorphism (SRAP) A molecular marker technique that targets subsets of open reading frames from coding sequences in the genome.

Sequence-Specific Amplified Polymorphism (S-SAP) A dominant, multiplex marker system for the detection of variation in DNA flanking a retrotransposon insertion site

Sequential theory of cooperativity and allosteric regulation A model based on cooperative binding of identical ligands to the oligomeric proteins. Also known as the ligand induced theory.

Sequencing by hybridization A method for determining the order in which nucleotides occur on a strand of DNA; typically used to look for small changes relative to a known DNA sequence; the method is sensitive to even single-base mismatches.

Sequencing Determination of the order of nucleotides (base sequences) in a DNA or RNA molecule or the order of amino acids in a protein. Sequencing of DNA was first done in the mid-1970s by Frederick Sanger.

Sequencing technology The instrumentation and procedures used to determine the order of nucleotides in DNA.

Sequential hemaphroditism A change or changes in the sex of an organism during the course of its life cycle. It is common in fish and jellyfish.

Sequential model of allostereism A model for allosteric behavior in which the subunits of an oligomeric protein change conformation in a step wise manner as the number of bound ligands increase. This was described by Koshland, Nemethy, and Filmer in 1966. Example hemoglobin oxygenation.

Sequential reaction A reaction in which all substrates must combine with the enzyme before a reaction can occur; it can proceed by an ordered or random mechanism.

Sequester To withdraw in seclusion or to move apart and segregate.

Sequestrum A detached or dead piece of bone within a cavity, abscess, wound, or area of osteomyelitis.

Sequon A (potential) site on a protein molecule's "backbone" where a sugar molecule (or a chain of sugar molecules, i.e., an oligosaccharide) may be attached.

- Sereny test** Test for bacterial invasiveness; involves applying a suspension of the organism to the conjunctiva of a small mammal and observing for development of conjunctivitis.
- Serial analysis of gene expression (SAGE)** It is a tool that allows the analysis of overall gene expression patterns with digital analysis .i.e., A method for studying the composition of a transcriptome (the set of all RNA molecules, including mRNA, rRNA, tRNA, and other non-coding RNA produced in one or a population of cells).
- Serial dilution** The process of diluting a sample several times successively from the original sample.
- Serial divisions** Splitting at about monthly intervals of excised shoot-tip material growing on culture medium, in order to induce additional plantlets.
- Serial float culture** A technique of floating anthers on liquid medium developed by Sunderland. Anther dehiscence, pollen release and development occur at intervals of several days, and in different nutrient media.
- Serial nuclear transplantation** Sequential transfer of nuclei from a single transplanted nucleus to enucleated eggs. The perpetuation of a clone of genetically identical twins is raised.
- Serine (ser)** A nonessential amino acid; a biosynthetic precursor of several metabolites, including cysteine, glycine, and choline. In 1999, Solomon H. Snyder, Herman Wolosker, and Seth Blackshaw conducted research that showed that some mammals synthesize (manufacture) D-serine within their brains, and it functions as a neurotransmitter there.
- Serine protease** Type of protease that has a reactive serine in the active site and acts as a nucleophile during catalysis.
- Serine–threonine kinase** enzyme that phosphorylates proteins on serine or threonine residues, by transferring the terminal phosphate of ATP to the amino acid side chain. With a few exceptions, protein kinases are either serine–threonine kinases (which can phosphorylate on serine or on threonine) or tyrosine kinases (which only phosphorylate on tyrosine).
- Seroconversion** The development of antibodies in blood serum (specific to that disease-causing microorganism) in response to vaccination or natural exposure to a disease-causing microorganism. Thus the specific antibody can be identified in serum.
- Serology** The study of the nature and interactions in vitro between an antigen and its antibody. Serology is mainly used to identify and distinguish between antigens, such as those specific to micro-organisms or viruses. It includes the diverse techniques used for the “test tube” measurement of antibody-antigen reactions, including blood typing (e.g., for transfusions). Serology is also employed as an indicator technique to assay plants suspected of being virus-infected.
- Seronegative** Refers to negative results of a serology test.
- Serosanguinous** It is a serum like exudate from a wound or other area of the body that is tinged with blood.
- Serotonin** 5-hydroxytryptamine (5-HT) is a monoamine neurotransmitter. Biochemically derived from tryptophan; it also acts as a vasodilator, increases capillary permeability, and causes contraction of smooth muscle. Serotonin is primarily found in the gastrointestinal (GI) tract, platelets, and in the central nervous system (CNS) of animals including humans. In mice it is found in the mast cells.
- Serotype** The antigenically distinct and separable members of a single species.
- Serotyping** Tests used to identify microorganisms on the basis of presence of specific characteristic antigens.

Serovar Strain; a subspecies category.

Serpentine receptor has 7 transmembrane segments. Typically it activates a trimeric G protein.

Serpins Serpins are a large family of protease inhibitors.

Serum albumin A globular protein obtained from blood and body fluids.

Serum bactericidal level Lowest dilution of a patient's serum that kills a standard inoculum of an organism isolated from that patient; this, of course, is related to antibiotic level achieved in the patient serum and the bactericidal activity of the drug being employed.

Serum dependence describes the need of eukaryotic cells for factors contained in serum in order to grow in culture.

Serum killing power Test used to determine effectiveness of an antimicrobial agent in which a bacterial suspension is added to the serum of a patient who is receiving an antibiotic and incubated.

Serum lifetime The average length of time that a molecule circulates in an organism's bloodstream before it is cleared from the bloodstream.

Serum response element (SRE) is a sequence in a promoter or enhancer that is activated by transcription factor(s) induced by treatment with serum. This activates genes that stimulate cell growth.

Serum sickness A type III hypersensitivity response to the exposure of foreign antigen, as a result of the formation of immune complexes in the blood stream. It occurs approximately 1 to 2 weeks after a foreign serum or protein has been introduced into the body and is characterized by fever, arthralgias, and nephritis.

Serum The clear yellow fluid of blood after cells and the clotting factors have been removed.

Service mutualism A mutualism in which one partner performs an ecological service for the other. Example pollination.

Sessile (1) Without a petiole (leaf) or pedicel (stalk of a flower). (2) Microorganisms that are attached to a (support) substrate directly by their base; not attached via an intervening peduncle (i.e., stalk).

Seven-methyl guanosine cap modified guanosine found at the 5 terminus of eukaryotic mRNA. A guanosine is attached to the mRNA by a 5- 5-phosphodiester link and is subsequently methylated on atom number 7 of the guanine.

Severe acute respiratory syndrome (SARS) It is caused by a virus of the Coronavirus family (a virus that is often a cause of the common cold) and the paramyxovirus family (causes measles and mumps). The syndrome includes fever and coughing or difficulty breathing, and can be fatal.

Severe combined immune deficiency (SCID) It is an primary immunodeficiency disease caused by the failure of stem cells to develop properly, resulting in both B and T-cell deficiencies. The SCID mutation causes severe combined immune deficiency in mice. One such defect is a deficiency of the enzyme adenosine deaminase.

Sewage The liquid waste arising mainly from domestic and industrial sources.

Sewage treatment The treatment of sewage to minimize its biological oxygen demand and to check the pathogenic microorganisms present. Sewage treatment methods vary widely, but all have a biological basis to break down the organic material in sewage and convert it into something that can be safely discharged into the environment (usually rivers or seas).

Sex cells A male or female reproductive cell. They are produced through the cell division process of meiosis. They are also called gametes. The gametes are the sperm (in males) and the egg (in females); or the spermatozoa and ova, respectively.

Sex chromatin An X chromosome randomly selected and inactivated at an early stage of development in the cells of mammalian females; also called a Barr body.

Sex chromosome A special chromosome in eukaryotes that usually differ in number, size and shape and control sex determination. Humans have two kinds of sex chromosomes; X and Y. Normal females possess two X chromosomes and normal males possess one X and one Y. Also called allosome. The sex chromosomes comprise the 23rd chromosome pair in a karyotype.

Sex determination The genetic or environmentally induced mechanism by which the distinction between males and females is established in a species.

Sex factor A bacterial episome (e.g., the F plasmid in *E. coli*) that enables the cell to be a donor of genetic material. It is able to initiate the process of conjugation, by which chromosomal material is transferred from one bacterium to another.

Sex hormones Hormones capable of stimulating the development of the reproductive organs and secondary sex characters in both sexes of mammals; three types of sex hormones are recognized: the estrogens (female hormones), the androgens (male hormones) and the progestogens (corpus luteal hormones); synthesized in mammals by the ovary (or testis), adrenal cortex, corpus luteum, and the placenta.

Sex influenced dominance The tendency for the type of gene action to vary between the sexes within a species. Thus the presence of horns in some breeds of sheep appears to be dominant in males and recessive in females.

Sex limited character A character present in only one sex. e.g., milk production in mammals; egg production in chickens.

Sex linkage The location of a gene on a sex chromosome, typically on the X chromosome.

Sex linked character A character determined by a gene located in the sex chromosomes.

Sex linked genes Genes located on the X chromosome

Sex linked Traits or diseases associated with the X or Y chromosome; generally seen in males.

Sex plasmid is actually an episome;

Sexduction The incorporation of bacterial genes into F factors of donor *E.coli* and their subsequent transfer, by conjugation, to a recipient cell.

Sexed embryos Embryos separated according to sex.

Sexual conjugation An infrequent occurrence in which two adjacent bacteria stretch out portions of their (cell) membranes to touch one another, fuse, and then pass transposons, jumping genes, or plasmids to each other.

Sexual dimorphism The distinctly different appearance of adult male and female organisms.

Sexual reproduction The process where two cells (haploid gametes) from two different individuals fuse to form one fertilized diploid cell or zygote. Individuals produced by sexual reproduction differ from either of their parents and from each other.

Sexual spore Spore formed by the conjugation of gametes or nuclei from individuals of different mating type or sex.

Sexual state The part of the life cycle in which the organism reproduces by the union of two nuclei. Also known as the perfect state.

SH2 domain named originally as the Src homology domain because it was identified in the Src product of the Rous sarcoma virus. It is a region of ~100 amino acids that is bound by the SH2-binding domain of the protein upstream in a signal transduction cascade. It binds a short amino acid sequence containing a phosphotyrosine. Important proteins with SH2 domains are Grb2, PI-3-kinase, and phospholipase C γ .

SH2-binding site is an area on a protein that interacts with the SH2 domain of another protein.

SH3 domain is used by some proteins that contain SH2 domains to enable them to bind to the next component downstream in a signal transduction cascade.

Shadow casting The coating of electron microscopy specimens with a heavy metal, like gold or palladium, to create a 3-D effect.

Shake culture An agitated suspension in culture providing adequate aeration for cells in the liquid medium. Usually an Erlenmeyer flask containing the culture is attached to a horizontal or platform shaker, or agitated with a magnetic stirrer.

Shaker A platform fitted with clips for grasping Erlenmeyer flasks, with set or variable speed control. Shaking speed must be adjusted for gentle and even agitation of suspension cultures.

Shannon index The index most commonly used to describe species diversity quantitatively.

Shattering The opening or disintegration of the seed capsule, fruit, or husk before harvesting, with the consequent loss of seed/grain.

Shear (1) The sliding of one layer across another, with deformation and fracturing in the direction parallel to the movement. This term usually refers to the forces that cells are subjected to in a bioreactor or a mechanical device used for cell breakage. (2) To fragment DNA molecules into smaller pieces by the mechanical force of shaking or stirring. This method is little used now, having been replaced by the use of partial digests with four-base-pair cutters, such as *Sau3A*, as a means of generating random DNA fragments.

Sheath (1) A secreted, tubular structure formed around a chain of cells or around a bundle of filaments; cells within a sheath may or may not subsequently separate from the sheath. (2) A layer of outer membrane covering the bacterial flagella.

Sheet erosion The removal of a relatively uniform thin layer of soil for the land surface by unchanneled runoff, or sheet flow.

Shelf life The time period during which an edible stored product remains useful or suitable for consumption. Example fresh tomatoes, ripe banana etc.

Shikimate pathway Important chemical pathway in plants. It is responsible for producing amino acids and other aromatic products.

Shine-Dalgarno sequence A purine rich conserved sequence (AGGAGG) in prokaryotic mRNAs approx 10 nucleotide upstream from the start codon; that is complementary to a sequence near the 3' terminus of the 16S ribosomal RNA. It directs the binding of the 30S ribosomal subunit during the initiation of protein synthesis. Also known as ribosomal binding site.

- Shoot** A young branch that grows out from the main stock of a tree, or the young main portion of a plant growing above ground that contains one or more meristems.
- Shoot differentiation** The development of growing points, leaf primordia and finally shoots from a shoot tip, axial bud, or even a callus surface.
- Shoot tip culture** A technique for culturing the growing region at the tip of a plant stem in order to induce the formation of multiple microshoots.
- Shoot tip; shoot apex** The terminal bud (0.1 - 1.0 mm) of a plant, which consists of the apical meristem (0.05 - 0.1 mm) and the immediate surrounding leaf primordia and developing leaves and adjacent stem tissue.
- Shoot-tip graft; micrograft.** A shoot tip or meristem tip is grafted onto a prepared seedling or micropropagated rootstock in culture. Meristem tip grafting is mainly used for *in vitro* virus elimination with *Citrus* spp. and other plants.
- Short day plant** Plant that requires a night (or dark period) longer than its critical photoperiod to induce flower formation. The length of the dark period required to induce flowering differs among species and varieties of a species. Examples are Maize, Poinsettia, Chrysanthemum etc.
- Short interfering RNA (siRNA)** An intermediate in the RNA interference pathway. It is of 18-25 nucleotide long that inhibits gene expression through RNA interference.
- Short patch repair** A nucleotide excision repair process of *Escherichia coli* that results in excision and resynthesis of about 10-12 nucleotide pairs of DNA.
- Short tandem repeat (STR)** A type of simple sequence length polymorphism comprising tandem copies of, usually, di-, tri- or tetranucleotide repeat units. Also called a microsatellite. They are useful in DNA profiling.
- Short template** A DNA strand that is synthesized during polymerase chain reaction and has a primer sequence at 5' end and a sequence complementary to the second primer at the 3' end.
- Short term immunity** Immunity that lasts only for a short time because it does not result in the formation of long lasting B and T memory cells. This type of immunity can be conferred by passive immunization and transfer of antibodies from mother to fetus.
- Short term inbred** A line derived by one or a few generations of inbreeding. Such a line is not homozygous or even nearly homozygous.
- Shotgun approach** A genome sequencing strategy in which the molecules to be sequenced are randomly broken into fragments which are then sequenced individually.
- Shotgun rescue** The ability to transfer, identify and possibly isolate genes encoded for traits that are monogenic and dominant either by screening for a loss of function due to gene disruption that can be caused by the insertion of a transposon or T-DNA, or by screening for gain of function by the introduction of genomic DNA from a donor Genome into a cultivar or a species lacking the trait of interest.
- Shotgun sequencing** (Shotgun cloning) Sometimes called Whole genome Shotgun Sequencing. A technology for rapid sequencing of DNA, in which an organism's genome (DNA) is first fragmented ("broken up"), and then randomly selected pieces of the DNA are individually sequenced. Those individual pieces' sequences must subsequently be "bridged" (i.e., "assembled" in an overlapping end-by-end pattern) in order to assemble a complete map (e.g., of an organism's chromosome or genome).

Shrink Swell Potential The susceptibility of a soil to a change in volume due to a loss or gain in moisture, especially those soils with relatively high clay content.

Shrub of life A diagram that represents our current understanding of the early evolution of life.

Shuttle vector; bifunctional vector A plasmid capable of replicating in two different host organisms because it carries two different origins of replication and can therefore be used to 'shuttle' genes from one to the other. The main advantage of these vectors is that these can be manipulated in *E.coli* and then used in a system which is more difficult or slower to use (e.g. yeast, other bacteria). For example, the YE_p, pJDB219, is a shuttle vector able to replicate in *E. coli* from its pMB9 origin and in *Saccaromyces cerevisiae* from its 2 μm-plasmid origin.

SI nuclease An enzyme that specifically degrades single stranded DNA. In molecular biology, it is used in removing single stranded tails from DNA molecules to create blunt ended molecules and opening hairpin loops generated during synthesis of double stranded cDNA. Organisms like *Aspergillus oryzae* and mungbean sprouts contain the SI enonuclease.

Sialic acids N-Acyl derivatives of neuraminic acid, a 9-carbon amino sugar, highly negatively charged. Sialic acids are found widely distributed in animal tissues and to a lesser extent in other species, ranging from plants and fungi to yeasts and bacteria, mostly in glycoproteins and gangliosides.

Sib Individuals having both parents common, but derived from different gametes i.e., they are not identical twins. Half-sibs are individuals having one common parent.

Sib-mating Crossing of siblings. Matings involving two individuals of the same parentage; brother-sister matings.

Sickle-cell anemia A genetic human disease resulting from a hemoglobin mutation; caused by a homozygous allele coding for the β chain of hemoglobin (Glu 6β →Val). The condition is recognized by the sickling of erythrocytes when exposed to low oxygen tension. It produces fragile erythrocytes, causes a reduction in numbers of red blood cells leading to anemia.

Side chain the part of amino acid that differs between different amoniacids, giving the amino acid its unique physical and chemical properties.

Siderophore A low molecular weight substance that binds very tightly to iron. Siderophores are synthesized by a variety of soil micro-organisms to ensure that the organism is able to obtain sufficient amounts of iron from the environment. This characteristic of microbes has been exploited by chemists for extraction of some elements from soil.

Sieve tube A tube within the phloem tissue of a plant, and composed of joined sieve elements.

Sigma (Σ) cascade The sequential expression of different sigma (σ) subunits that bind to the core RNA polymerase. Σ cascade can regulate gene expression by directing different σ subunits of RNA polymerase to different promoters, including those DNA sequences (gene) that encode additional σ subunits.

Sigma factor (σ factor) The sub-unit of prokaryotic RNA polymerases that recognizes the promoter sequence sites on DNA and is responsible for the initiation of transcription at specific initiation sequences.

Sigmoidal curve The S-shaped graphical representation of the cooperative binding of a ligand to a molecule.

Sigmoidoscopy Visual examination of the rectum and sigmoid flexure of the colon by using a lighted tube; often performed for suspect amoebiasis cases (*Entamoeba histolytica*).

- Sign inversion model** describes the mechanism of DNA gyrase. DNA gyrase binds a positive supercoil (inducing a compensatory negative supercoil elsewhere on the closed circular DNA), breaks both strands in one duplex, passes the other duplex through, and reseals the strands.
- Signal end** is produced during recombination of immunoglobulin and T cell receptor genes. The signal ends are at the termini of the cleaved fragment containing the recombination signal sequences. The subsequent joining of the signal ends yields a signal joint.
- Signal gated channel** An ion channel whose opening and closing (gating) is controlled by the binding of an intracellular signaling molecule.
- Signal hypothesis** Proposal that the mRNA sequence of a secretory protein contains signal codons that direct its synthesis on ER-bound as opposed to free ribosomes,
- Signal joint** A signal joint is formed by the precise joining of recognition signal sequences in the process of somatic recombination that generates T-cell receptor and immunoglobulin genes.
- Signal molecule** Extracellular or intracellular molecule that cues the response of a cell to the behavior of other cells or objects in the environment.
- Signal patch** protein sorting signal that consists of a specific three dimensional arrangement of atoms on the folded protein's surface.
- Signal peptidase** An integral membrane protein of the RER that specifically removes the signal sequences from proteins as they are translocated into the lumen of the endoplasmic reticulum. Signal peptidase is one component of a larger protein complex.
- Signal recognition particle (SRP)** It is a ribonucleoprotein complex (complex of six proteins and 7S RNA) found in eukaryotes that binds de novo synthesized peptide as it comes out from the ribosome. It is involved in binding the ribosome to the cytosolic face of the ER, to facilitate protein translocation to the lumen.
- Signal recognition particle (SRP)** Ribonucleoprotein particle that binds an ER signal sequence on a partially synthesized polypeptide chain and directs the polypeptide and its attached ribosome to the endoplasmic reticulum.
- Signal recognition particle receptor** Receptor on the endoplasmic reticulum to which the signal recognition particle binds during the process of polypeptide chain synthesis and import into the endoplasmic reticulum. Also called the "docking protein."
- Signal sequence** A segment of about 15 to 30 amino acids at the N terminus of a protein that enables the protein to pass through a cell membrane. The signal sequence is removed by signal peptidase as the protein is secreted. Also called signal peptide, leader peptide.
- Signal** The end complex formed when a specific sequence of DNA or RNA is detected by autoradiography or other method. Hybridization with a complementary radioactive polynucleotide (Southern or Northern blotting) is commonly used to generate the signal.
- Signal to noise ratio** (often abbreviated SNR or S/N) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise. It is defined as the ratio of signal power to the noise power. A ratio higher than 1:1 indicates more signal than noise. While SNR is commonly quoted for electrical signals, it can be applied to any form of signal (such as isotope levels in an ice core or biochemical signaling between cells).
- Signal transducer and activator of transcription (STAT)** A type of protein that responds to binding of an extracellular signaling compound to a cell surface receptor by activating a transcription factor.

Signal Transduction Pathway The process whereby a receptor initiates one or more sequences of biochemical reactions that connect the stimulus to a cellular response.

Signal transduction Relaying of a signal to a cell through a receptor by conversion from one physical or chemical form to another by means of a series of intermediary linked reactions. For example, G-proteins (which are embedded in the surface membrane of certain cells, but extend through to outside and inside of the membrane) accomplish signal transduction. In lymphocytes, the most important changes are those occurring during infection, that generate antigens that stimulate the cells of the immune system to bring about an adaptive immune response.

Signal translocation The process by which an extracellular signal is transmitted to an intracellular target through the membrane – associated receptor, a transducer, and an effector enzyme.

Signaling molecule A molecule utilized to “signal” (communicate with) cells, or to deliver a signal to other organisms. Such molecules are released from the cell sending the signal, cross over the gap between cells by diffusion, and interact with specific receptors in another cell, triggering a response in that cell by activating a series of enzyme controlled reactions which lead to changes inside the cell. Some examples are Hydrogen sulfide, nitric oxide and carbon monoxide in the human body.

Signaling The “communication” that occurs between and within cells of an organism, e.g., via hormones, nitric acid, etc. Such signaling “tells” certain cells to grow, change, or produce specific proteins at specific times.

Signature sequence Short oligonucleotides of unique sequence found in 16S ribosomal RNA of a particular group of prokaryotes.

Silencer is a short sequence of DNA present some distance from the transcription start site, where a repressor of transcription may bind and can inactivate expression of a gene.

Silencing describes the repression of gene expression in a localized region, usually as the result of a structural change in chromatin.

Silent Mutation A mutation in a gene that causes no detectable change in the biological characteristics of that gene’s product (e.g., a protein). The mutation does not produce any amino acid change in the protein synthesized.

Silent sites in a gene describe those positions at which mutations do not alter the product.

Silicon carbide microfibers transformation It involves agitating a mixture of DNA, silicon carbide microfibers, and tissue of the plant to be transformed. The silicon carbide microfibers apparently act as micro injection needles and facilitate DNA delivery into cells.

Silk (1) A natural, protein polymer with a predominance of alanine and glycine amino acids. The proteins are mainly sericin and fibroin. Silk is produced by silkworms that have fed on mulberry tree leaves. The body of a silkworm can retain proteins (i.e., raw material for silk) amounting to as much as 20% of its body weight. (2) The female inflorescence of the maize plant is also called silk.

Silt A soil inorganic separate in the range of 2 to 50 micrometers (or 0.002 to 0.05 mm.). Silt is smaller than sand but larger than clay.

Simian sarcoma virus A type C RNA virus that produces a leukemia-like disease in monkeys.

Similarity approach A rigorous mathematical approach for alignment of nucleotide sequences.

Simple correlation coefficient A measure of the relationship between two variables.

Simple diffusion The movement of solute molecules across a membrane from a region of higher concentration to a region of lower concentration, unassisted by a protein transporter and energy.

Simple protein A protein that yields only amino acids on hydrolysis (i.e., cleavage of the protein molecule into fragments), and does not have other molecular constituents such as lipids or polysaccharide attachments.

Simple sequence length polymorphism (SSLP) An array of repeat sequences that display length variations.

Simple Sequence Repeat (SSR) Also known as a microsatellite. These DNA markers are based on differences in length of repeated di- and tri-nucleotide sequences. SSRs are usually codominant and a potentially large number can be identified. By identifying the conserved flanking sequences of these SSRs, primers can be designed to selectively amplify them via PCR. Only small amounts of DNA are required, and analyses can be run quickly and relatively inexpensively.

Simple Sequence Repeat (SSR) DNA Marker Technique A “genetic mapping” technique which utilizes the fact that microsatellite sequences “repeat” (appear repeatedly in sequence within the DNA molecule) in a manner enabling them to be used as “markers.”

Simple stain A method of staining microorganisms with a single basic dye.

SINES Short interspersed nuclear elements. Families of short (150 to 300 bp), moderately repetitive nucleotides in eukaryotes, occurring about 100,000 times in a genome. SINES appear to be DNA copies of certain tRNA molecules, created presumably by the unintended action of reverse transcriptase during retroviral infection.

Single bond A covalent bond that shares only one electron pair. Usually, a single bond is a sigma bond. Example H_2 .

Single cell protein (SCP) Protein derived from single-celled organisms with a high protein content. The dried mass of a pure sample of a protein-rich-micro-organism, which may be used either as feed (for animals) or as a food (for humans). Yeast is an example.

Single chain antigen Antibody-binding domains in which the two chains are produced by a gene and linked by a short peptide.

Single chain antigen binding protein Polypeptides based on antibody variable domains (i.e. antigen binding sites) in which the C-terminal of the heavy chain variable region is linked to the N-terminal of the light chain variable region by a peptide that accommodates the three-dimensional structural requirements of the linkage.

Single copy A gene or DNA sequence which occurs only once per (haploid) genome. Most structural genes, those encoding functional proteins, are single-copy genes.

Single copy DNA A region of the genome whose sequence is present only once per haploid complement.

Single copy plasmid replicates under a control system analogous to the bacterial chromosome that allows only one copy to exist in an individual bacterial cell.

Single copy sequence A DNA sequence that is not repeated elsewhere in the genome.

Single cross A cross between two lines, usually inbred lines.

Single displacement reaction A reaction in which a group is transferred from one molecule to another in a concerted fashion (with no intermediates).

Single Domain Antibodies (dAbs) VH “heavy chains” (portion of antibody molecules) produced by genetically engineered Escherichia coli cells that act to bind antigens in a manner similar to

antibodies or monoclonal antibodies (MAbs). Similar to MAbs, dAbs can be produced in large quantities, to be used as human or animal therapeutics (e.g., to combat diseases).

Single gene disorder Hereditary disorder caused by a mutant allele of a single gene (e.g., Duchenne muscular dystrophy, retinoblastoma, sickle cell disease).

Single locus probe Probe used in DNA fingerprinting that identifies a single sequence (locus) in the genome.

Single node culture Culture of separate lateral buds with each carrying a piece of stem tissue.

Single nucleotide polymorphism (SNP) DNA sequence variations that occur when a single nucleotide (A, T, C, or G) in the genome sequence is altered. This is responsible for most of the genetic variation between individuals and can cause a phenotypic difference in hair colour, height or response to a drug, depending on the gene. SNPs usually occur in the same genomic location (e.g., on the organism's DNA) in different individuals. "SNP mapping" is a "genetic mapping" technique that utilizes the fact that individual nucleotides (within a DNA molecule) can exist in different forms (for a particular "site"/location on that DNA molecule), which enables such SNPs to be utilized as "markers."

Single orphan A gene present only in one species or animal group but not in any other. Such genes are referred to as "novel," "orphan" or "taxonomically restricted". Their function and origin are often obscure. A team of scientists led by Thomas Bosch from the Christian-Albrechts-Universität zu Kiel in Germany, used transgenic polyps to uncover the role of "orphan" genes in morphologically-simple animals. They reported that morphological differences between two closely related species of fresh water polyps (Hydra) are due to a secreted protein, encoded by "novel" gene Hym301. This gene controls the pattern in which the tentacles in Hydra develop.

Single pass transmembrane protein membrane protein in which the polypeptide chain crosses the lipid bilayer only once.

Single positive thymocytes During T-cell maturation in the thymus, mature T cells are detected by the expression of either the CD4 or the CD8 co-receptor and are therefore called single-positive thymocytes.

Single Primer Amplification Reaction (SPAR) A technique that uses a single primer containing only the core motif of a microsatellite.

Single seed descent Breeding procedure in which progenies of a segregating population are self-pollinated and advanced to the next generation by a single seed in each progeny line.

Single seed descent method A method of advancing the generations; one seed from each F2 plant of a cross and the subsequent generations is bulked to raise the next generation.

Single strand annealing model (SSA) It is a homologous recombination model that repairs double-strand breaks between two repeat sequences.

Single strand assimilation (single-strand uptake) describes the ability of RecA protein to cause a single strand of DNA to displace its homologous strand in a duplex; that is, the single strand is assimilated into the duplex.

Single strand binding protein (SSB) A tetrameric protein that attach to single-stranded DNA in the region of the replication fork, preventing base pairs forming between the two parent strands before they have been copied. Also known as helix destabilizing protein.

Single strand binding SSB protein of *E. coli*, a protein that binds to single-stranded DNA.

Single Strand Conformation Polymorphism (SSCP) A molecular marker technique that uses PCR and gel electrophoresis of single strand DNA to detect nucleotide sequence variation among amplified DNA fragments.

Single strand exchange is a reaction, in which one of the strands of a duplex of DNA leaves its former partner and instead pairs with the complementary strand in another molecule, is placing its homologue in the second duplex.

Single strand passage is a reaction catalyzed by type I topoisomerase in which one section of single-stranded DNA is passed through another strand.

Single stranded A DNA or RNA molecule that comprises just a single polynucleotide.

Single stranded A term used to describe nucleic acid molecules consisting of only one polynucleotide chain. The genomes of certain phages, e.g., M13, are single-stranded DNA molecules; rRNA, mRNA and tRNA are all single-stranded nucleic acids, but they all contain double-stranded regions formed by the intra-strand base-pairing of self-complementary sequences.

Single X hypothesis describes the inactivation of one X chromosome in female mammals.

Single-cell line; cell strain A culture initiated from a single cell, usually from suspension cultures of single cells or small aggregates plated on solidified medium. The latter may incorporate a selective agent, from which tolerant or resistant individual cell lines or cell clones can be selected.

Single-chain variable fragment (scFv) A single-chain Fv fragments, comprising a V region of a heavy chain linked by a stretch of synthetic peptide to a V region of a light chain, can be made by genetic engineering.

Singlet oxygen The common name used for an electronically excited state of molecular oxygen (O_2). Highly reactive.

Singlet states An orbital to which an electron may move after being excited by a photon. Singlet state orbitals require that the excited electron have a spin opposite to that of the spin on the electron remaining in the ground state.

Sink A characteristic place in a nutrient cycle where the nutrient accumulates.

Sinus A large passageway in tissues, hollows, or cavities near the nose (e.g., frontal and maxillary sinuses) lined with phagocytic cells.

Sinusitis Inflammation of the sinus cavities, often leading to headaches or nasal congestion.

Sires Male animals used for breeding.

Sister chromatid exchange (SCE) A crossing over like event that occurs between sister chromatid at mitosis or meiosis.

Sister chromatids Identical chromatids belonging to the same homologue.

Site directed hydroxyl radical probing A technique for locating the position of a protein in a protein–RNA complex, such as a ribosome, by making use of the ability of Fe (II) ions to generate hydroxyl radicals which cleave nearby RNA phosphodiester bonds.

Site directed mutagenesis The introduction of base changes - mutations - into a piece of DNA at a specific site, using recombinant DNA methods. This technique can be used to make a protein that differs slightly in its structure from the protein normally produced (by an organism or cell). A single mutation (in the cell's DNA) is caused by hybridizing the region in a codon to be mutated with a short, synthetic oligonucleotide. This causes the codon to code for a different specific amino acid in

the protein gene product. Site-directed mutagenesis holds the potential to enable man to create modified (engineered) proteins that have desirable properties not currently available in the proteins produced by existing organisms.

Site of Absorption Site of Absorption is the location where the herbicide is taken up by the plant. This should not be confused with Site of Action which is the biochemical pathway within the plant where the herbicide acts.

Site of action The site of action is the biochemical pathway a particular herbicide acts upon in a plant. Currently there are over 20 sites of action.

Site specific A term used to describe any process or enzyme which acts at a defined sequence within a DNA or RNA molecule. Type II restriction enzymes are site-specific endonucleases and the recombination systems encoded by some transposons are site-specific, such as the integration of phage into the *E. coli* chromosome.

Site specific mutagenesis A technique to change one or more specific nucleotides within a cloned gene in order to create an altered form of a protein with one or more specific amino acid changes. Also known as oligonucleotide-directed mutagenesis.

Site specific recombination (specialized recombination) A type of genetic recombination that occurs between two specific (not necessarily homologous) sequences, as in phage integration/excision or resolution of cointegrate structures during transposition.

Sitostanol A chemical (ester) derived from sitosterol (a sterol present in pine trees), and fibers (e.g., the hull or seed coat) of corn/maize (*Zea mays*) or soybeans (*Glycine max* L.). When sitostanol is consumed by humans in sufficient quantities, it causes their total serum cholesterol and their low density lipoprotein (LDLP) levels to be lowered by approximately 10%, via inhibition (i.e., the sitostanol is preferentially absorbed by the gastrointestinal system instead of cholesterol).

Six base cutter A type II restriction endonuclease that binds (and subsequently cleaves) DNA at sites that contain a sequence of six nucleotide pairs that is uniquely recognized by that enzyme. Because any sequence of six bases occurs less frequently by chance than any sequence of four bases, six-base cutters cleave less frequently than do four-base cutters. Thus, six-base cutters create larger fragments than four-base cutters.

Skeletal muscle cells Large multinucleate muscle cells that are attached to bone. Most cuts of meat are mainly skeletal muscle.

Skin test The intradermal injection of an antigen or antibody to determine susceptibility to an antigen.

Skotomorphogenic From skoto- (dark) + morpho (shape) + genic (producing), it refers to seeds that develop underground for their first season before producing any above-ground green shoots. Germination dependent on stored reserves rather than photosynthesis.

Slant The slant is the upper surface of the medium in a test tube. It is exposed to air in the tube.

SLC The chemokine known as SLC is produced by lymphatic vessels and attracts dendritic cells.

Slide agglutination tests A method of identifying an antigen by combining it with a specific antibody on a slide.

Sliding filament model A mechanism for muscle contraction in which interdigitated thin and thick filaments move past each other so as to shorten the overall length of a sarcomere.

Slime An extracellular (i.e., outside of the cell) material produced by some (micro) organisms and characterized by a slimy consistency. The slime is of varied chemical composition. However, usual components are polysaccharides (polysugars) and specific protein molecules.

Slime layer A thin diffused layer of polysaccharide exterior to the cell wall that protects the cell against drying, helps trap nutrients, and sometimes binds cells together.

Slime mold A nonphototrophic eukaryotic microorganism lacking cell walls, which aggregate to form fruiting structures (cellular slime molds) or simply masses of protoplasm (acellular slime molds).

Slippage The translocation of a ribosome along a short non-coding nucleotide sequence between the termination codon of one gene and the initiation codon of a second gene.

Slow component of a reassociation reaction is the last to reassociate; usually consists of nonrepetitive DNA.

Slow stop mutant It is a type of DNA replication in temperature sensitive mutants of *E. coli* that can finish a round of replication at the unpermissive temperature, but cannot start another.

Slow viral infection A disease process that occurs gradually over a long period.

Sludge digester Large fermentation tank in which sludge is digested by anaerobic bacteria into simple organic molecules like CO₂ and methane gas.

Sludge The semi solid matter obtained during sewage / waste water treatment process.

Small cytoplasmic RNA (scRNA) A type of short eukaryotic RNA molecule with various roles in the cell. Are present in the cytoplasm and (sometimes are also found in the nucleus).

Small G proteins are monomeric G proteins such as Ras that act as intracellular signaling molecules downstream of many transmembrane signaling events. They bind GTP in their active form, and hydrolyze it to GDP to become inactive.

Small nuclear ribonucleoprotein (snRNP) Structures involved in splicing GU-AG and AU-AC introns during post-transcriptional processing of mRNA and in other RNA processing events, comprising one or two snRNA molecules complexed with proteins.

Small nuclear RNA (snRNA) Short RNA transcripts of 100-300 bp that associate with proteins to form small nuclear ribonucleoprotein particles (snRNPs); most snRNAs are components of the spliceosomes that excise introns from pre-mRNAs in RNA processing.

Small nucleolar RNA (snoRNA) A type of short eukaryotic RNA molecule (70-100nt) involved in chemical modification of rRNA like methylation.

Small subunit of the ribosome (30S in bacteria, 40S in eukaryotes) binds the mRNA.

Smallpox is an infectious disease, caused by the virus variola that once killed at least 10% of infected people. It has now been eradicated by vaccination.

Smear A thin film of liquid specimen spread out on a microscopic slide.

Smectite A group of silicate (i.e., rocks or minerals with their primary unit as silicon tetroxide, SiO₄) clay minerals that have shrink-swell property.

Smooth endoplasmic reticulum (SER) portion of the endoplasmic reticulum without attached ribosomes, among its functions are the synthesis of lipids and the storage and stimulated release of calcium ions.

Smooth muscle cell Type of long, spindle-shaped mononucleate muscle cell making up the muscular tissue found in the walls of arteries and of the intestine and other viscera of the vertebrate body. Called "smooth", because it lacks the striated myofibrils of skeletal and cardiac muscle cells.

SNARE receptor A transmembrane protein that mediates fusion of vesicles with other membranes. They are involved in guiding vesicles to their correct destinations. They exist in pairs - a v-SNARE in the vesicle membrane that binds specifically to a complementary t-SNARE in the target membrane.

Snottite Mucus-like strings of bacterial colonies growing on the walls of caves that were created by microbial produced sulfuric acid that dissolves rock. These bacteria eat sulfur and drip sulfuric acid.

SNP MAP A group of known/detailed SNPs (single-nucleotide polymorphisms), superimposed onto the genome map of an organism (e.g., to facilitate genetic/population studies, such as of genetically related disease susceptibility).

Soap A long chain fatty acid and potassium or sodium hydroxide; soaps are important cleansing agents because of their emulsifying action.

Social hierarchy An arrangement within a group of animals, such as rabbits, where some individuals are dominant over others. The more dominant an animal, the more likely it is to have preferred access to mates and sources of food.

Sodium action potential action potential driven by the opening of sodium channels and the resulting sodium influx, as in neurons, skeletal and muscle cells.

Sodium dodecyl sulfate (SDS) Also known as sodium lauryl sulfate (SLS). A surfactant commonly used in biochemical and biotechnological applications for the solubilization of membrane components and hard-to-solubilize (dissolve) molecules. The SDS/PA in water solution helps to separate out contaminants commonly present in samples from plant tissues (polysaccharides, proteins, etc.) because DNA molecules are much more soluble in SDS/PA solution than are those contaminant molecules. Above a critical concentration, SDS forms micelles in water which are thought to be responsible for its solubilizing action. SDS is also used in such items as shampoo.

Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) A technique for separating proteins by their relative molecular mass by dissolving them in the detergent sodium dodecyl sulfate (SDS). This technique is widely used to characterize proteins, especially after labeling and immunoprecipitation. The protein mixture to be separated is run through a gel containing the detergent sodium dodecyl sulfate (SDS) which unfolds the proteins and frees them from association with other molecules.

Sodium gradient energy currency. Sodium ions are more concentrated outside the cell than inside, and this chemical gradient is usually supplemented by a voltage gradient pulling sodium ions in. If sodium ions are allowed to enter down their electrochemical gradient, they release 15,000 J/mol.

Sodium polyanelthol sulfonate An antimicrobial used in the presumptive identification of anaerobic bacteria. Most anaerobic gram-positive cocci are resistant to this antimicrobial; however, *P. anaerobius* is susceptible. *P. micros* may show a small zone of inhibition.

Sodium pump (sodium/potassium ATPase) plasma membrane carrier. For every ATP hydrolyzed, three Na⁺ ions are moved out of the cytosol and two K⁺ ions are moved in.

Sodium/calcium exchanger carrier in the plasma membrane. Three sodium ions move into the cell down their electrochemical gradient and one calcium is moved out up its concentration gradient.

- Soil** A mix of mineral particles, detritus, dissolved organic matter, water containing dissolved minerals and gases (the soil solution), and organisms that develops in terrestrial ecosystems.
- Soil age** Determined by the amount of weathering that has occurred; to what extent the parent material has been converted to distinct horizons or soil layers. Usually described as young, mature or old.
- Soil aggregation/ aggregates** The process of soil particles binding together. The mineral components of soil are clay, silt and sand. Clay particles are too small to be seen with a light microscope, and sand particles can be seen with the naked eye. Silt particles are of intermediate size. Without soil aggregation, soils would not have pores large enough for movement of air and water, and roots would not be able to penetrate the soil.
- Soil air** The soil atmosphere; the gaseous phase of the soil, being that volume not occupied by solid or liquid.
- Soil amelioration** The improvement of poor soils, usually using bacteria or fungi. This contrasts with bioremediation, which is the cleaning up of toxins, usually in soils. Amelioration includes breaking down organic matter; forming humus; by solubilizing them, making minerals - such as phosphates - in the soil available to plants; fixing nitrogen; and sometimes an element of bioremediation as well.
- Soil classification** A specific soil is classified according to the number of horizons in its soil profile and the soil properties of each horizon.
- Soil development / soil forming factors** The variables usually interrelated natural agencies that are active in and responsible for the formation of soil. The factors are usually grouped into five major categories as follows: parent material, climate, organisms, topography, and time
- Soil horizons** A layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics such as color, structure, texture, consistency, kinds and number of organisms present, degree of acidity or alkalinity, etc.
- Soil Organic Matter** The organic fraction of the soil, exclusive of undecayed plant and animal residues.
- Soil Sample** A collection of individual cores from a known area.
- Soil Series** A unit of soil classification determined by studying horizon characteristics, such as: number of horizons, color, thickness, texture, erosion phase, slope, and organic content. All soils given the same soil series name possess the same characteristics across the landscape.
- Soil Structure** The arrangement of soil separates into units called soil aggregates.
- Soil Test Calibration** A means of establishing a relationship between a given soil test value and the yield response from adding a nutrient to soil as fertilizer.
- Soil Test** Chemical analysis of soil samples to assess soil nutrient levels and determine how fertilizer use can be improved.
- Soil Test Correlation** The relationship between the amount of nutrient extracted from soil by a laboratory test and nutrient uptake by plants in the greenhouse or field and/or crop yield.
- Soil Texture** This refers to the relative proportions of sand, silt and clay in a soil.
- Soil** The top layer of the Earth's surface, consisting of four major components: air, water, organic matter and mineral matter. There are three categories of soil particles--sand, silt and clay--which are called "soil separates."

Soil Water Content The water lost from the soil upon drying to a constant mass at 105 degrees C., expressed either as the mass of water per unit mass of dry soil or as the volume of water per unit bulk volume of soil.

Soilless culture; soil-free culture and hydroponics Growing plants in nutrient solution without soil.

Solanine A glycoside neurotoxin naturally present at low levels within potatoes.

Solar radiation Sunlight including the non visible UV and infrared part of the spectrum.

Solenoid structure The supercoiled arrangement of DNA in eukaryotic organisms produced by coiling the continuous string of nucleosomes.

Solid state reactions chemical reaction which proceeds without a solvent (i.e., water)

Solid media Nutrient media that has been solidified, such as by addition of agar.

Solid phase immunosorbent assay (SPIA) ELISA test in which the capture antigen or antibody is attached to the inside of a plastic tube, microwell, or to the outside of a plastic bead, in a filter matrix, or some other solid support. Allows faster interaction between reactants and more concentrated visual end products than ELISA test performed in liquid.

Solid substrate fermentation Fermentation process wherein the growth of the microorganisms is carried out on solid substrates.

Solubility The ability of a solute to dissolve in a solvent.

Soluble A state change when a solid material is put into a solvent. The molecules leave the solid phase and go into the liquid phase of the solvent

Soluble CD4 A synthetic version of the CD4 protein that may interfere with the ability of HIV (i.e., AIDS) viruses to infect human immune system cells with the acquired immune deficiency syndrome (AIDS) virus.

Solute Any molecule that is dissolved in a liquid. The liquid is called a solvent.

Solute potential The effect of dissolved solutes on water potential.

Solution A mixture of molecules, such as sugars, amino acids, and ions, dissolved in water.

Solvation sphere The aggregate of solvent molecules that surrounds an ion or solute.

Solvation The state of a molecule or ion being surrounded by several layers of ordered solvent molecules. Hydration is solvation by water.

Solvent A liquid that is capable of dissolving other molecules called solutes. In biological systems, water is usually the solvent

Somaclonal Variation The epigenetic or genetic variation (i.e., new traits) that results from the growing of entire new plants from plant cells or tissues (e.g., maintained in culture). The variation in new plants is mainly due to chromosomal rearrangements during the period of dedifferentiation or when plants are regenerated (grown) from plant cells that has been altered via genetic engineering.

Somaclone The plants derived from somaclonal variations.

Somatic antigen An antigen associated with some somatic bodies of an organism. Example an antigen located in the cell wall of a gram-positive or gram-negative bacterium.

Somatic backcrossing Production of a somatic hybrid by fusing protoplasts of a somatic hybrid with the protoplasts of one of the species used to produce this somatic hybrid.

- Somatic cell** (somaG = body) Any cell of a plant or animal other than a germ cell or germ-cell precursor.
- Somatic cell embryogenesis** Embryos are produced either from somatic cells of explants (direct embryogenesis) or by induction on callus formed by explants (indirect embryogenesis). Also known as asexual embryogenesis.
- Somatic cell gene therapy** Incorporating new genetic material into cells other than reproductive cells of an individual for therapeutic purposes. The new genetic material cannot be passed to offspring.
- Somatic cell genetic mutation** A change in the genetic structure that is neither inherited nor passed to offspring. Also called acquired mutations.
- Somatic cell genetics** The study of genetic phenomena of somatic cells. The cells under study are most often cells grown in culture.
- Somatic cell nuclear transfer (SCNT)** A cloning technique where the nucleus from an unfertilized egg is removed and replaced with the nucleus from a somatic cell. The resulting egg will carry the full complement of genetic material of the host organism. This is how Dolly the cloned sheep was produced; she was genetically identical to her "mother". This technique can be used both for reproductive cloning and therapeutic cloning.
- Somatic cell variant** A somatic cell with unique characters not present in the other cells, such as might be selected for in a screening trial that following a mutation event.
- Somatic cells** Any cell in a body other than a germ cell. It divides by mitosis.
- Somatic diversification theory** When immunologists discovered that antibodies were variable, they entertained various theories, including the somatic diversification theory that postulated that the genes for immunoglobulin were constant, and that they diversified in somatic cells. This turned out to be partly true, as somatic hypermutation is now well established. However, other theories were needed to explain other features of antibody diversity, including somatic gene rearrangement and isotype switching.
- Somatic embryo (id)** An organized embryonic structure morphologically similar to a zygotic embryo but initiated from somatic (non-zygotic) cells. Under *in vitro* conditions, somatic embryos go through developmental processes similar to embryos of zygotic origin and are capable of developing into normal plantlets. It is an independent bipolar structure and not physically attached to the tissue of origin.
- Somatic embryogenesis** Formation of embryo like structure from asexual cells.
- Somatic hybrid** A hybrid formed asexually by the fusion of two or more protoplasts.
- Somatic hybridization** (1) Asexual fusion of protoplasts from somatic cells of genetically different parents. (2) Hybridization by induced fusion of cells (protoplasts) from two contrasting genotypes for production of hybrids or cybrids which contain various mixtures of nuclear and/or cytoplasmic genomes, respectively. Also known as parasexual hybridization.
- Somatic hypermutation** A high frequency of mutation that occurs in the gene segments encoding the variable regions of antibodies during the differentiation of B lymphocytes into antibody producing plasma cells. It results in the generation of variant immunoglobulins, some of which bind antigen with a higher affinity.
- Somatic mutation** A mutation occurring in a somatic cell, and therefore affecting only its daughter cells; it is not inherited by descendants of the organism. Somatic mutations are generally spontaneous, but

a case of directed mutation occurs in the immune system where more diversity is generated in rearranged immunoglobulin genes by somatic mutation.

Somatic recombination genetic rearrangements that occur only in somatic cells; the changes are not inherited. Somatic recombination describes the process of joining a C gene to a C gene in a lymphocyte to generate an immunoglobulin or T cell receptor.

Somatic reduction Halving of the chromosomal number of somatic cells; a possible method of producing "haploids" from somatic cells and calluses by artificial means.

Somatic Referring to vegetative or non-sexual stages of a life-cycle.

Somatic variants Regenerated plants (i.e., clones) derived (produced) from cells that originally came from the same plant, but are not genetically identical. Such plants (clones) are called "sports" or somatic variants because they vary (genetically) from the "parent" plant. Sometimes such somatic variants are developed by man to become a new plant variety.

Somatomedins A family of peptides that mediates the action of growth hormone on skeletal tissue, and stimulates bone formation.

Somatostatin A 14 amino acid peptide that inhibits the release of growth hormone. Somatostatin is secreted in several locations of the digestive system, brain etc.

Somatotrophic hormone (STH) A anterior pituitary protein hormone with a molecular weight 27,000 and consisting of 190 amino acid residues; acts directly upon various tissues to produce diverse effects; affects the rate of skeletal growth and gain in body weight; stimulates chondrogenesis followed by ossification, in adult animals with closed epiphyses; also called somatotropin or growth hormone (GH).

somite One of a series of paired blocks of mesoderm that form during early development and lie on either side of the notochord in a vertebrate embryo. They give rise to the vertebral column, muscles and associated connective tissue. Each somite produces the musculature of one vertebral segment, plus associated connective tissue.

Sonication Disruption of cells or DNA molecules by high frequency sound waves. Also known as ultrasonication.

Sonication mediated transformation The use of ultra sound to facilitate the uptake of DNA into plant cells, in suspension and intact pieces of plant tissue.

Sorbitol ($\text{CH}_2\text{OH}(\text{CHOH})_4\text{CH}_2\text{OH}$) A white, crystalline, sweet, soluble polyhydric alcohol with a m.p. 110°C (for the dextrorotatory compound); obtained from dextrose; used as a sugar substitute and in the manufacture of synthetic resins.

Sorption The removal of an ion or molecule from solution. Commonly used in regards to phosphorus fixation.

Sorting signal Amino acid sequence that directs the delivery of a protein to a specific location outside the cytosol such as the nucleus or mitochondrion. Sorting signals can be lengths of peptide (targeting sequences), such as the signal sequence that targets a protein to the endoplasmic reticulum, or can be the result of posttranslational modification, e.g., mannose-6-phosphate, which targets a protein to the lysosome.

Sorting vesicle vesicle that carries proteins from one membrane compartment to another.

- SOS response** In *E. coli* it is the coordinate induction of many enzymes, including repair activities ("switching on" of genetic repair machinery) in response to irradiation or other damage to DNA; results from activation of protease activity by RecA to cleave LexA repressor.
- SOS system** A set of DNA repair enzymes and regulatory proteins that regulate their synthesis so that maximum synthesis occurs when the DNA is damaged.
- Source DNA** The DNA from an organism that contains a target gene; this DNA is used as starting material in a cloning experiment.
- Source of infection** The person, animal, object or substance from which an infectious agent passes to a host.
- Source organism** A bacterium, plant or animal from which DNA is purified and used in a cloning experiment.
- Southern blot (SB)** first developed by the Scottish molecular biologist Edward M. Southern. In this technique Specimen DNA is denatured, treated with restriction enzymes to result in DNA fragments and then the single-stranded DNA fragments are separated by electrophoresis. The electrophoretically separated fragments are then blotted to a nitrocellulose membrane, retaining their electrophoretic position, and hybridized with radiolabeled single-stranded DNA fragments (labeled nucleic acid probe) with the sequences complementary to those being sought. The resulting double-stranded DNA bearing the radiolabel is then, if present, detected by autoradiography.
- Southern hybridization** A procedure in which a cloned, labelled segment of DNA is hybridized to DNA restriction fragments on a Southern blot.
- Soy Protein** An edible protein (after heat processing) produced within its beans (seeds) by the soybean plant (*Glycine max* (L.) Merrill). soy protein is composed of approx.2.5% cysteine, 3.4% histidine, 5.2% isoleucine, 8.2% leucine, 6.8% lysine, 1.1% methionine, 5.6% phenylalanine, 4.2% threonine, 1.3% tryptophan, 4.2% tyrosine, 5.4% valine, 4% alanine, 7.7% arginine, 6.9% aspartic acid, 19% glutamic acid, 3.7% lycine, 0.1% 4-hydroxyproline, 5.3% proline, and 5.4% serine. Soy protein (concentrate) is a complete ("ideal") protein (i.e., it provides all essential amino acids) for humans.
- Soybean Oil** is composed of 60.8% polyunsaturated fatty acids (PUFA), 24.5% monounsaturated fatty acids, and 15.1% saturated fatty acids.
- Spacer DNA** DNA found between genes (non coding sequences lodged in between the coding sequences), that separates the repeated copies of the transcription unit, its function is unknown.
- Spadix** Part of the inflorescence of the family Araceae, it is a fleshy spike bearing tiny flowers. The spadix is typically surrounded by a leaf-like curved bract known as a spathe.
- Sparganum** A migrating tapeworm larva that invades the subcutaneous tissues with inflammation and fibrosis (*Diphyllobothrium* and *Spirometra* spp.).
- Sparger** A device that introduces air into a bioreactor in the form of separate fine streams.
- Spatial summation** the process in which simultaneous release of synaptic transmitter by a number of presynaptic nerve cells depolarizes the postsynaptic neuron to threshold.
- Spec protein** Family of ectoderm specific Ca^{2+} -binding proteins similar to that of calmodulin.
- Special pair** The set of two closely spaced chlorophyll groups in a photosynthetic system that undergo photooxidation.

Special potency disks Used to aid in the presumptive identification process. These disks include: kanamycin, vancomycin, colistin, and sodium polyethol sulfonate antibiotic disks. Nearly all gram negative organisms are resistant to vancomycin. Kanamycin and colistin disks help identify gram negative organisms down to the genus level. Sodium polyanethol sulfonate is used for gram-positive cocci.

Specialized Anatomically or physiologically adapted for particular functions or habitats.

Specialized T cell T cell with a specific function; differentiated after exposure to an antigen.

Specialized transduction The process of transferring a specific sequence of bacterial cell DNA adjacent to a prophage into another cell.

Speciation The development of one or more species from an existing species.

Species (*L. species*, appearance, form, kind) A single type (taxonomic group) or organism as determined by the distinguishing characteristics used for the particular group of life forms. Thus a species is "a cluster of genetically similar organisms" having in common one or more distinctive characters and being capable of interbreeding and reproducing their characters in their offspring, thus remaining relatively stable in nature.

Species accumulation curve A graph that plots species richness as a function of the total number of individuals that have accumulated with each additional sample.

Species area relationship The relationship between species richness and area sampled.

Species composition The identity of the species present in a community.

Species diversity A measure that combines both the number of species (species richness) in a community and their relative abundances compared with one another (species evenness).

Species evenness The relative abundances of species in a community compared with one another.

Species richness The abundant number of species in a community.

Species specific Refers to a compound (e.g., a protein) or a disease (e.g., a viral infection) or some other effect that only acts in/on one specific species of organism. For example, the antibiotic penicillin kills bacteria by blocking an enzyme that is critical for growth and repair of the bacterial cell wall (i.e., peptidoglycan layer), but penicillin does not harm other species (e.g., man).

Species tree A phylogenetic tree that shows the evolutionary relationships between a group of species.

Specific activity An enzyme unit defined as the number of moles of substrate converted to product by an enzyme preparation per unit time under specified conditions of pH, substrate concentration, temperature, etc. Specific enzyme activity units may be expressed as: moles of product produced/minute/mg of protein used (or mole of enzyme used if the preparation is pure).

Specific combining ability Deviation in performance of a cross combination from that predicted on the basis of general combining abilities of the parents involved in the cross.

Specific defence A host defense that operates in response to a particular invading pathogen.

Specific epithet The second name of an organism in a scientific binomial system of nomenclature, following that of genus. For example, "coli" is the specific epithet of *Escherichia coli*.

Specific gravity The former term for the ratio of the density of a substance to that of water. As the word specific now has a different usage, the term relative density is now used for this concept.

- Specific heat** The amount of energy (in joules or calories) needed to raise the temperature of 1 g of a pure substance by 1°C.
- Specific immunity** Defense against a particular microbe.
- Specific rotation** The rotation, in degrees, of the plane of plane-polarized light (D-line of sodium) by an optically-active compound at 25°C, with a specified concentration and light path.
- Specificity** (1) The ability of an enzyme or receptor to discriminate among competing substrates or ligands. (2) For diagnostic tests, the ability of a probe to react precisely with a specific target molecule. The specificity of an antibody determines its ability to distinguish the immunogen from other antigens
- Specificity constant** ratio between the catalytic rate constant (k_{cat}) and the Michaelis constant (K_M) for an enzyme. It is a rate constant with dimensions of liters mol⁻¹ s⁻¹ and is used to compare different substrates for the same enzyme or to compare the effectiveness of one enzyme with another.
- Spectral karyotype** A graphic of an organism's chromosomes, each labeled with a different color. Useful for identifying chromosomal abnormalities.
- Spectratyping** One uses spectratyping to define certain types of DNA gene segments that give a repetitive spacing of three nucleotides, or one codon.
- Spectrin** A fibrous protein associated with the cytosolic side of the plasma membrane in red blood cells, forming a rigid network that supports the membrane.
- Spectrophotometer** An instrument that measures the concentration of a compound that has been dissolved in a solvent (water, alcohol etc.). The instrument permits a wavelength of light through the solution, measures the fraction of the light that is absorbed by the solution and calculates the concentration from that absorbance value. Different types of spectrophotometers operate in different wavelength ranges, such as U.V, visible and infrared light.
- Spectrum of action** The range of microorganisms against which an antibiotic is targeted.
- Spemann's Organizer** Specialized tissue at the dorsal lip of the blastopore in an amphibian embryo; a source of signals that help to orchestrate formation of the embryonic body axis.
- Spent medium** After each sub-culture, the medium is discarded because it has been depleted of nutrients, dehydrated or accumulated toxic metabolic products.
- Sperm sexing** The separation of sperm into those bearing an X chromosome and those bearing a Y chromosome, in order to be able to produce animals of a specified sex, via artificial insemination or *in vitro* fertilization.
- Spermatid** One of the four cells formed by the meiotic divisions in spermatogenesis. Spermatids become mature spermatozoa (sperm).
- Spermatocyte** Sperm mother cell. The cell that undergoes two meiotic divisions (spermatogenesis) to form four spermatids; the primary spermatocyte before completion of the first meiotic division; the secondary spermatocyte after completion of the first meiotic division.
- Spermatogonium** (pl: spermatogonia) Primordial male germ cell that may divide by mitosis to produce more spermatogonia. A spermatogonium may enter a growth phase and give rise to a primary spermatocyte.
- Spermatophyta** The taxonomic category encompassing all the true seed plants. The spermatophytes includes the Gymnospermae, Cycads, Gingko, Gnetales, and Angiospermae.

Spermatopsida Newer name for Spermatophyta.

Spharoblast Nodule of wood which can give rise to adventitious shoots with juvenile characteristics.

Spherocytosis A hereditary abnormality in the erythrocytes cytoskeleton that renders the cells rigid and spheroidal and causes hemolytic anemia.

Spheroplast (formerly also sphaeroplast) A microbial or plant cell from which most of the cell wall has been removed, usually by enzymic treatment. Strictly, in a spheroplast, some of the wall remains, while in a protoplast the wall have been completely removed. In practice, the two words are often used interchangeably.

Spherule Large, round, thick-walled structure containing spores.

Sphingolipid An amphipathic lipid with a sphingosine (C₁₈ amino alcohol) backbone to which is attached a long-chain fatty acid and a polar alcohol.

Spicule Accessory reproductive structure in male nematodes; useful in identification to the species level. In sponges the meshing of many spicules serves as the skeleton.

Spike (L. *spica*, an ear of grain) An inflorescence in which the main axis is elongated and the flowers are sessile. (2) A carbohydrate-protein complex that projects from the surface of certain enveloped viruses.

Spikelet (L. *spica*, an ear of grain + diminutive ending -let) The unit of inflorescence in grasses; a small group of grass flowers.

Spin label A substance that has an unpaired electron detectable by electron spin resonance and that is used as a chemical label.

Spinae Hollow conical appendages observable by light microscopy and having cross-strains when viewed by electron microscopy.

Spindle (A.S. *spinel*, a tool for spinning thread by hand) In mitosis and meiosis, refers to the spindle-shaped intracellular structure made up of microtubules, involved in the correct partitioning of chromosomes to daughter cells.

Spindle attachment checkpoint Checkpoint that operates during mitosis to ensure that all chromosomes are properly attached to the spindle before sister chromatid separation starts.

Spine Hard, sharp structure on the surface of a plant; usually a modified leaf.

Spiral hypha Coiled or corkscrew-like turns in a hypha.

Spirillum (plural: spirilli) (1) A helical or corkscrew shaped bacterium which is relatively rigid (i.e. not flexible, compare with spirochaete.. (2) When written as a genus, refers to aerobic, helical bacteria in the genus *Spirillum* with clumps of polar flagella.

Spirochaete A non-rigid, corkscrew-shaped gram-negative bacterium that moves by means of muscular flexions of the cell.

Spleen The spleen is an organ in the upper left side of the peritoneal cavity having the function of forming and storing lymphocytes and storing red corpuscles. These are squeezed out into the blood stream when the blood needs more cells in circulation, as for instance in haemorrhage or shock.

Splenectomy Removal of the spleen.

Splenomegaly Enlargement of the spleen

Splice site Location in the DNA sequence surrounding the exon-intron boundaries where RNA removes the noncoding areas to form a continuous gene transcript for translation into a protein.

Splice Variants Refers to all possible gene transcripts (e.g., arising from alternative splicing).

Spliced leader RNA (SL RNA) is a small RNA that donates an exon in the trans-splicing reaction of trypanosomes and nematodes.

Spliceosome During the maturation of eukaryotic mRNA, the protein-RNA complex involved in splicing GU-AG or AU-AC introns out of pre-mRNA transcripts and converting them into mature mRNA. The process of eliminating intervening intron sequences and covalently joining exon sequences of RNA is known as splicing.

Splicing junctions The sequences (in RNA molecules) of nucleotides immediately surrounding the exon-intron boundaries.

Splicing pathway The series of events that converts a discontinuous pre-mRNA into a functional mRNA.

Splinter hemorrhages Effects of vacuolitis in trichinosis; tiny linear hemorrhages in nail beds (larval migration).

Split genes In eukaryotes, structural genes are typically divided up (split) by a number of non-coding regions called introns.

Spongiform Pertaining to a sponge like appearance; when this is noted in brain tissue, it is indicative of the presence of viral disease.

Spongy parenchyma Parenchyma cells that are chlorophyllous and rounded, loosely arranged together, and located between the lower epidermis and the palisade parenchyma of a leaf.

Spontaneous mutations occur in the absence of any added mutagen to increase the mutation rate, due to errors in replication (or other events involved in the reproduction of DNA) or by environmental damage.

Spontaneous process A thermodynamic process that occurs without the input of free energy from outside the system.

Sporadic cancer Cancer that occurs randomly and is not inherited from parents. Caused by DNA changes in one cell that grows and divides, spreading throughout the body.

Sporadic disease A disease that occurs occasionally in a population

Sporangia Spore-containing structures all plants and fungi.

Sporangiophore A specialized hyphal branch or stalk bearing a sporangium.

Sporangiospore An asexual fungal spore formed within a sporangium.

Spore (1) A reproductive cell that develops into an individual without union with other cells; some spores such as meiospores occur at a critical stage in the sexual cycle, but others are asexual in nature (sporangiospore). (2) A small, protected reproductive form of a micro-organism, often developed when nutrient levels are low.

Sporocyst Larval form of a fluke consisting of an elongated sac without a mouth or other distinct internal or external structure.

Sporocyte A diploid cell that gives rise to four haploid spores by meiosis.

Sporogenesis Production of mega- and micro- spores from mega- and micro-spore mother cells, respectively (through meiosis).

- Sporogony** Stage in the sexual cycle in the malarial parasite that takes place in the mosquito.
- Sporophore** A specialized hypha that develops spores in fungi.
- Sporophyll** A modified leaf that bears a spore or other reproductive cell. Microsporophyll refers to anther.
- Sporophyte** The diploid generation in the life cycle of a plant, and that produces haploid spores by meiosis.
- Sporozoa** Nonmotile parasitic protozoa.
- Sporozoite** Slender, spindle-shaped organism that is the infective stage of the malarial parasite; it is inoculated into humans by an infected mosquito and is the result of the sexual cycle of the malarial parasite in the mosquito.
- Sport** An individual or portion thereof distinguished by a spontaneous mutation. Bud sport is a part of a plant (normally a woody plant, but sometimes in herbs as well) that shows morphological differences from the rest of the plant. Sports may differ by foliage shape or color, flowers, or branch structure. Sports with desirable characteristics are often propagated vegetatively to form new cultivars that retain the characteristics of the new morphology. Such selections are often prone to "reversion", meaning that part or all of the plant reverts to its original form. An example of a bud sport is the nectarine, which developed from a bud sport from a peach.
- Sporulation** is the generation of a spore by a bacterium (by morphological conversion) or by a yeast (as the product of meiosis). Formation from vegetative cells of metabolically inactive cells that can resist extreme environmental conditions.
- Spread plate method** A technique used to prepare cultures by placing a diluted sample of cells on the surface of an agar plate and then spreading the sample evenly over the surface.
- Spirillum** A rigid, spiral-shaped bacterium.
- Sputum** Material discharged from the surface of the lower respiratory tract air passages and expectorated (or swallowed).
- Squalamine** A potent antimicrobial agent (steroid, antibiotic) discovered in the tissues of the dogfish shark in 1992. It has been found to be active against a broad spectrum of bacteria, protozoa, and fungi. Squalamine was chemically synthesized by man in 1993.
- Squalene** A natural organic compound (sterol) originally obtained for commercial purposes primarily from shark liver oil, though plant sources (primarily vegetable oils) are used as well, including amaranth seed, rice bran, wheat germ, and olives.
- Squamous cell carcinoma** Also called epithelioma, a malignant tumor composed of flat cells arising from the epithelium.
- Squamous flat**, A term used of epithelial cells.
- Squelching** The inhibition of the activity of a transcription factor by another transcription factor that competes with it for binding to DNA.
- SR protein** has a variable length of Arg-Ser-rich region and is involved in splice-site selection during splicing of GU-AG introns.
- Src family** Family of cytoplasmic tyrosine kinases (pronounced "sark") that associate with the cytoplasmic domains of some enzyme-linked receptors (for example, the T cell antigen

receptor) that lack intrinsic tyrosine kinase activity. They transmit a signal onwards by phosphorylating the receptor itself and other signaling proteins.

Src-family tyrosine kinases The Src-family tyrosine kinases are receptor-associated protein tyrosine kinases. They have several domains, called Src-homology 1, 2, and 3. The SH1 domain contains the active site of the kinase, the SH2 domain can bind to phosphotyrosine residues, and the SH3 domain is involved in interactions with proline-rich regions in other proteins.

SR-like CTD-associated factor Proteins thought to play regulatory roles during splicing of GU–AG introns.

sRNA is a small bacterial RNA that functions as a regulator of gene expression.

SRP receptor The endoplasmic reticulum protein that serves as a docking point for the signal recognition particle (SRP) during the synthesis of a transmembrane or secretory protein.

Stab cells Immature lymphocytes.

Stab culture Culture in which the inoculation of a tube or solid medium is made by stabbing with a needle to encourage anaerobic growth in the bottom.

Stability analysis An analysis to estimate the adaptability of a genotype; adaptability is the ability of a genotype to produce a relatively narrow range of phenotypes in different environments.

Stability The tendency of a community to remain the same in structure and function.

Stabilizing selection Selection that favors individuals with an intermediate phenotype.

Stable age distribution A population age structure that does not change from one year to the next.

Stable Returning to the original state after some perturbation.

Stachyose A carbohydrate (oligosaccharide) naturally produced in soybeans (and some other plants). Stachyose is relatively insoluble in water, and much less available for digestion by monogastric animals (e.g., swine, poultry).

Stacked genes Refers to the insertion of two or more (synthetic) genes into the genome of an organism. One example would be of a plant into which a gene for insect resistance and a gene for resistance to a specific herbicide have been inserted.

Stacking energy The energy of interaction that favors the face-to-face packing of purine and pyrimidine base pairs.

Stacking interactions The stabilizing van der Waals interactions between successive (stacked) bases and base pairs in a polynucleotide. Stacking interactions result in imparting the helical shape to the nucleic acids.

Stages of culture in invitro propagation It comprises of 4 stages. Stage I is characterized by the establishment of an aseptic tissue culture of a plant. Stage II characterized by the rapid numerical increase of organs or other structures. Stage III by preparation of propagule for successful transfer to soil after rooting, hardening of plants and initiating the change from the heterotrophic to the autotrophic stage. Stage IV involves the establishment of the plants in soil.

Staggered cuts Scissions (cuts) made in duplex DNA when the two strands of DNA that make up the duplex DNA are cleaved at different points near each other by restriction endonucleases. What is produced is a single stranded structure (in which the single strands are a number of nucleotide bases long) with a double-stranded core section.

Stain A discoloration that can be clearly distinguished from the surface, material, or medium it is found upon. Stains and dyes are frequently used in biology and medicine to highlight structures in biological tissues for viewing, often with the aid of different microscopes.

Stalk A nonliving ribbon-like or tubular appendage, excreted by a bacterial cell that mediates attachment to a surface.

Stamen (L. *stamen*, the standing-up things or a tuft of thready things) The stamen is the male part of the flower. It is made up of an anther (pollen-bearing portion) and a stalk or filament.

Staminode A sterile stamen, one not bearing pollen. Often petaloid in appearance and structure.

Standard bacterial growth curves A graph plotting the number of bacteria versus time and showing the phases of bacterial growth.

Standard deviation A statistical measure of variability in a population of individuals or in a set of data; the square root of the variance. i.e., It is the square root of the arithmetic mean of the squares of all the deviations from the arithmetic mean.

Standard error A statistical measure of variation in a population of means, used to indicate how well sample estimates represent population parameters. It is estimated as standard deviation of a sample divided by square root of the number of observations in the sample.

Standard free-energy change (ΔG°) The free energy change for a reaction occurring under a set of standard conditions: temperature 298 K, pressure 1 atm or 101.3 kPa, and all solutes at 1M concentration; ΔG° denotes the standard free-energy change at pH 7.0.

Standard reduction potential (E°) a measure of the relative tendency of the reducing agent to get oxidized and to reduce other substances under biochemical standard state conditions.

Standard state A set of reference conditions for a biochemical reaction. It is defined as a temperature of 298 K (25°C), a pressure of 1 atmosphere, a solute concentration of 1.0 M, and a pH of 7.0.

Staphylococcal enterotoxins cause food poisoning and also stimulate many T cells by binding to MHC class II molecules and the V β domain of certain T-cell receptors; the staphylococcal enterotoxins are thus superantigens.

Staphylococci A grape-like cluster of broad sheet of spherical bacterial cells.

Staple length The length of the individual fibres of cotton. Affects the quality of the fabric that is made from it.

Starch (M.E. *starchen*, to stiffen) A polymer of glucose molecules (i.e., a polysaccharide) stored/used by plants to store energy. Plants produce starch in two different molecular forms, a branched chain component, amylopectin (80-85%) and an unbranched straight-chain component, amylose (15 – 20%). Starch is broken down by enzymes (amylases) to yield glucose, which can be used as an energy source. The analogous polymer used by mammalian systems is called glycogen or animal starch.

StarLink™ An insect-resistant variety of corn that was approved for animal feed only and not for human consumption.

START (restriction point) is the point during G1 at which a cell becomes committed to division.

Start codon; initiator codon The set of three nucleotides in an mRNA molecule with which the ribosome starts the process of translation. The start codon sets the reading frame for translation. The most commonly used start codon is AUG, which is decoded as methionine in eukaryotes and as N-

formylmethionine in prokaryotes. AUG appears to be the only start codon used by eukaryotes, while in bacteria, GUG (valine) may sometimes be employed.

Start signal start signal for protein synthesis is the codon AUG, specifying the incorporation of methionine.

Start transfer signal Short amino acid sequence that enables a polypeptide chain to start being translocated across the endoplasmic reticulum membrane through a protein translocator. Multipass membrane proteins have both n-terminal (signal sequence) and internal start-transfer signals.

Start/Stop Codons Codons used to start and stop translation during protein synthesis. The start codon always codes for methionine in eukaryotes and a modified Met (fMet) in prokaryotes. The most common start codon in RNA is AUG. The stop codons are amber (UAG), ochre (UAA) and opal (UGA).

Starter culture A pure or mixed culture of microorganisms employed to initiate a desired fermentation process; used in the production of food by microbial activity.

Startpoint (startsite) refers to the position on DNA corresponding to the first base incorporated into RNA.

State function Quantities such as energy, enthalpy, entropy and free energy, whose values depend only on the current state of the system, not on how they reached that state.

Static life tables A life table that records the survival and reproduction of individuals of different ages during a single time period.

Stationary culture A culture maintained in the growth chamber with no agitation or movement.

Stationary phase The plateau of the growth curve after log growth, during which cell number remains constant. New cells are produced at the same rate as older cells die.

Stationary trial Trial conducted by a breeder to assess the performance of strains evolved by him as compared to a standard check; usually at one location. Also known as preliminary yield trials (PYTs).

Statistic An estimate based on a sample or samples of a population, providing an indication of the true population parameter.

Statistical test A procedure that determines whether a hypothesis should be rejected or not.

Statistics The science which deals with the collection, analyses and interpretation of numerical data.

Steady state (1) In a continuous fermentation process when the number of cells that are removed with the outflow is balanced by newly produced cells. (2) A state in which the rate of synthesis of a compound is equal to its degradation or breakdown.

Stearate/ Stearic acid (stearG = hard fat) A C-18 saturated fatty acid with no double bonds; i.e., it is fully saturated. Commonly found in animal and plant fats.

Stearoyl-ACP desaturase A "family" of enzymes that is naturally produced in oilseed plants. They play the central role in determining the ratio of saturated to unsaturated fatty acids (in the vegetable oils produced from such plants).

Stele (Gr. *stèle*, a post) The central cylinder, inside the cortex, of roots and stems of vascular plants.

Stem (1) The main body of the above-ground portion of a tree, shrub, herb or other plant; the ascending axis, whether above or below ground, of a plant. (2) The base-paired segment of a hairpin structure in RNA.

Stem Cell A type of living cell that is capable of being developmentally modified to serve any of the specialized functions of the living organism. Also called Pluripotent cells. E.g., Fetal cells that give rise to bone marrow, blood cells, and B and T cells.

Stem cell differentiation The process by which a stem cell can become a specific cell type. Stem cell differentiation begins when they are exposed to certain biochemical cues - whether physiological or experimental. Biochemical cues in different parts of the body stimulate stem cells to grow into the specific cells needed in that location. All stem cells have the capacity to differentiate, but to different degrees. Totipotent stem cells can become any cell in the human body. Pluripotent stem cells can become almost any cell in the human body, but they cannot become placental tissue needed for development in the human uterus. Multipotent stem cells can become only a certain type of cell, such as blood cells.

Stem Cell Growth Factor A growth factor (glycoprotein hormone) that acts upon stem cells in a wide variety of ways to increase growth, proliferation, and maturity (into red blood cells or white blood cells).

Stem loop structure A structure made up of a base-paired stem and non-base-paired loop, which can form in a single-stranded polynucleotide that contains an inverted repeat.

Stenothermous Animals adapted to a very narrow temperature range. Example *Chionoecetes opilio*

Stereochemically The specific 3-dimensional arrangement of atoms around an asymmetric carbon.

Stereocilium A large, rigid microvillus found in "organ pipe" arrays on the apical surface of hair cells in the ear. A stereocilium contains a bundle of actin filaments, rather than microtubules, and is thus not a true cilium. The deflection by sound waves triggers the electronic signaling necessary for the sense of hearing.

Stereoisomers Isomers that are nonsuperimposable mirror images of each other. The compounds have the same molecular formula and the same structure, but differ only in spatial configuration of the atoms in the molecule. Many of the physical and chemical properties of stereoisomers are the same, but there are differences in the crystal structures, in the direction in which they rotate polarized light (which has been passed through a solution of the stereoisomer), and in their use in an enzyme-catalyzed (biological) reaction.

Stereospecificity The potential of an enzyme to recognize and act upon only one stereoisomer of a substrate.

Steric Hindrance Refers to the compression that a group (chemical entity) suffers by being too close to its nonbonded neighbors. If an enzyme and a substrate try to come together in order to react, but the substrate has on it a bulky group that disallows close contact between the two (because the group bumps into the enzyme), then the reaction will not occur because of steric hindrance.

Sterigma (sterigmata) A small pointed hyphal branch or structure which supports a sporangium, a conidium, or basidiospore in a fungus.

Sterile (1) Medium or object with no perceptible or viable micro-organisms. (2) Incapable of fertilizing or being infertile.

Sterile room Operation room for performing inoculations under aseptic conditions; usually now replaced by use of laminar air-flow cabinets, in which filtered air is blown from the inside to the outside.

Sterilization Treatment resulting in death of all living organisms and viruses in a material.

Sterilize (1) The process of elimination of micro-organisms, such as by chemicals, heat, irradiation or filtration. (2) The operation of making an animal incapable of producing offspring.

Steroid (stereosG = solid + oL = from oleum, oil) A chemical compound composed of a series of four carbon rings joined together to form a (molecular) structural unit called cyclopentanoperhydrophenanthrene. Important examples of steroids are cholesterol, and sterol; several hormones are also steroids such as sex hormones and corticosteroid hormones. Even vitamin D is based on the steroid structure. It is an important component of cell membrane.

Steroid hormone receptor transcription factors that, upon binding their appropriate steroid hormone, activate transcription of particular genes.

Steroid hormones Hormones derived from cholesterol; C18 and C19 steroids promote the development of the female and male secondary sex characters, respectively; C21 steroids are concerned with the transport of electrolytes, with the metabolism of carbohydrates, proteins and fats and also with the implantation of the fertilized ovum.

Steroid receptor A protein that binds a steroid hormone after the latter has entered the cell, as an intermediate step in modulation of genome activity.

Sterol Any steroid-based alcohol having a hydrocarbon (aliphatic) side-chain of 8-10 carbons at the 17-beta position and a hydroxyl group (-OH) at the 3-beta position (that's why it's an alcohol). Cholesterol is one type of sterol. Because of its hydrophilic property at the -OH end and hydrophobic at the hydrocarbon side chain, it can be incorporated into the lipid bilayers of the cytoplasmic membrane. However, sterols only exist in the cytoplasmic membranes of eukaryotes while in prokaryotes, virtually all do not have sterol in their membranes except mycoplasmas, a group of bacteria lack cell walls.

Steward bottle Flask developed by Steward for the growth of cells and tissues in a liquid medium, in which they can be periodically submerged during rotation.

Stewardship The preservation of public good by ensuring that the social and the ethical issues related to biotechnology are addressed, and that the federal government has an effective regulatory regime and the science capacity to protect human and animal health and the environment.

Sticky Ends Complementary single strands of DNA (deoxyribonucleic acid) that protrude from opposite ends of a DNA duplex or from ends of different DNA duplex molecules. They can be generated by staggered cuts in DNA by type II restriction enzymes that cut each strand at a separate location. They are called "sticky" because the exposed single strands can bind (stick) to complementary single strands on another DNA molecule. Also known as cohesive ends.

Stigma (*L. stigma*, a prick, a spot, a mark) The female structure at the tip of the pistil to which pollen adheres. This is the receptive organ for pollen germination.

Stigmasterol A phytosterol produced within the seeds of the soybean plant (*Glycine max* L.), among others. Evidence indicates that human consumption of stigmasterol helps reduce levels of total serum cholesterol and low-density lipoproteins (LDLP); thereby lowering risk of coronary heart disease (CHD).

Stimulatory G protein (G_s) G protein that, when activated, activates the enzyme adenylyl cyclase and thus stimulates the production of cyclic AMP.

Stipe A stem like supporting structure of multicellular algae and basidiomycetes.

Stirred tank fermenter A growth vessel in which cells or micro-organisms are mixed by mechanically-driven impellers.

Stochastic processes Processes involving randomness or probability.

Stock culture A reserve culture used to store an isolated organism in pure condition for use in the laboratory.

Stock plant The source plant from which cuttings or explants are made. Stock plants are usually maintained carefully in an optimum state for (sometimes prolonged) explant use. Preferably they are certified-pathogen-free plants.

Stock seed The seed produced by a breeder of a strain, which has been identified but has not yet been released as a variety. It will be known as breeder seed once the strain is released and notified.

Stock solutions Pre-prepared solutions of individual components and used to prepare many different types of media.

Stock The lower portion of a graft.

Stocking Density Animal demand per unit-area (AU/acre) at an instant in time.

Stoichiometry The branch of chemistry that deals with the relative quantities of reactants and products in chemical reactions.

Stolon (L. *stolo*, a shoot) A lateral stem that grows horizontally along the ground surface often bearing rhizoids that penetrate the medium and sporangiophores that ascend into the air.. The runners of white clover, strawberry and bermuda grass are examples of stolons.

Stoma (Gr. *stoma*, mouth; pl: stomata) (1) Any of various small openings or pores in an animal body, especially an opening resembling a mouth in various invertebrates. (2) Botany: A minute pore in the epidermis of the leaf or stem of a plant, forming a slit of variable width between two specialized cells (guard-cells), which allows movement of gases, including water vapour, to and from the intercellular spaces. Also, the whole pore with its associated guard-cells.

Stomatal complex Includes the stoma, together with its guard cells and, when present, the subsidiary cells.

Stomatal index is given as the number of stomata per $\text{mm}^2 \times 100$ / (number of stomata per mm^2 + number of epidermal cells per mm^2). This value has been found useful in comparing leaves of different sizes. Relative humidity and light intensity during leaf development affect the value of stomata index.

Stop codon (termination codon) A set of three nucleotides for which there is no corresponding tRNA molecule to insert an amino acid into the polypeptide chain. Protein synthesis is hence terminated and the completed polypeptide released from the ribosome. Three stop codons are: UAA (ochre), UAG (amber) and UGA (opal). Mutations which generate any of these three codons in a position which normally contains a codon specifying an amino acid are known as nonsense mutations. Stop codons can also be called nonsense codons.

Stop signal signal, to stop protein synthesis, given to the ribosome by a stop codon on mRNA.

Stop transfer signal Hydrophobic amino acid sequence that halts translocation of a polypeptide chain through the endoplasmic reticulum membrane, thus anchoring the protein chain in the membrane.

Strain isolation Isolation of any bacterium, animal or plant from the outside world.

- Strain** The basic taxonomic unit of microbiology. A group of organisms of the same species that possess(es) distinctive genetic characteristics that set it apart from others within the same species, but whose differences are not severe enough for it to be considered a different breed or variety (of that species). Can also be used to designate a population of cells derived from a single cell. Strains are maintained by interbreeding individuals within the same strain. A strain is known as a variety when it is released for commercial cultivation by a variety release committee.
- Strand displacement** is a mode of replication of some viruses in which a new DNA strand grows by displacing the previous (homologous) strand of the duplex.
- Strand invasion** The exchange between two single strands of DNA from two nicked molecules of different sources having homologous nucleotide sequences.
- Stratification** (1) Exposing dormant seeds to a cold temperature (+2° to +4°C) to encourage germination or break seed dormancy. (2) Layering of plant material (herbaceous, shrub, understory, canopy). (3) The layering of water in oceans and lakes due to differences in water density and temperature with depth.
- Stratified epithelium** type of epithelium consisting of several layers, such as in the skin.
- Stratified sampling** A method of sampling when entire heterogenous population is divided into a number of homogenous groups, which differ from one another but each of these groups is homogenous within itself.
- Streak plate method** A method of isolating a culture by spreading microorganisms over the surface of a solid culture medium.
- Streptobacilli** A genus of aerobic, gram-negative facultative anaerobe bacteria, which grow in culture as rods in chains. Example *S. moniliformis*.
- Streptococci** Gram positive Cocci that remain attached in chains after cell division. They are the lactic acid bacteria group like *S. pneumoniae*, *S. pyogenes*, *Enterococcus* etc.
- Streptokinase** A bacterially produced enzyme that digests blood clots.
- Streptolydigin** inhibit the elongation of transcription by bacterial RNA polymerase.
- Streptolysin** Toxin produced by streptococci that kills phagocytes.
- Streptomycetes** Gram positive, filamentous, sporing, soil dwelling actinobacteria, producer of many antibiotics. It includes the important genus *Streptomyces*. This genus was the original source of many antibiotics, namely streptomycin. Streptomycin was the first antibiotic against tuberculosis.
- Streptomycin** An antibiotic produced by *Streptomyces*; effective against several types of diseases, including some against which penicillin is inactive; used in the treatment of tuberculosis.
- Streptozotocin** An antitumor antibiotic isolated from *Streptomyces achromogenes* that is a potential alkylating agent. It is one of the few antitumor agents that do not suppress synthesis of leukocytes in the bone marrow.
- Stress activated protein (SAP) kinase** A stress-activated signal transduction pathway.
- Stress activated protein kinase** kinase that stimulates cell repair but can also trigger apoptosis. p38 and JNK are stress-activated protein kinases.
- Stress** An abiotic factor that results in a decrease in the rate of an important physiological process, thereby lowering the potential for an organism's survival, growth, or reproduction.

Stress fiber bundle of actin filaments commonly seen in cultured, nonmotile animal cells.

Stress proteins Discovered by Italian biologist Ferruccio Ritossa in the 1960s, these molecules are also called heat-shock proteins. Proteins made by many organisms (plant, bacteria, and mammal) cells when those cells are stressed by environmental conditions such as certain chemicals, pathogens, or heat. In 1996, Richard I. Morimoto discovered that two stress proteins known as HSP 90 and HSP 70 help ensure that certain crucial proteins in cells are folded into the configuration/conformation needed by that cell.

Stress tolerant plants Plants that are adapted to conditions of high biotic and abiotic stress.

Striated muscle Muscle composed of transversely striped (striated) myofibrils. Skeletal and heart muscle of vertebrates are the best known examples.

Stringency of hybridization describes the effect of conditions on the degree of complementarity that is required for reaction. At the most stringent conditions, only exact complements can hybridize. As the stringency is lowered, an increasing number of mismatches can be tolerated between the two strands that are hybridizing.

Stringent plasmid A plasmid that only replicates along with the main bacterial chromosome and is present as a single copy, or at most several copies, per cell.

Stringent response It refers to the ability of a bacterium to shut down synthesis of tRNA and ribosomes in a poor-growth medium. It is due to the formation of phosphorylated guanylate compounds elicited by the presence of an uncharged tRNA molecule in the aminoacyl site of a ribosome during protein synthesis in prokaryotes.

Stroma (Greek, for anything spread out) (1) In chloroplasts, the fluid matrix between the grana inside the chloroplast; does not include the contents within the thylakoid membranes; the site of the biochemical (i.e., "dark") reactions of photosynthesis. (2) The connective tissue in which a glandular or other epithelium is embedded.

Stromal cells The development of B lymphocytes and T lymphocytes occurs in association with stromal cells, which provide various soluble and cell-bound signals to the developing lymphocyte.

Stromal lamellae The membranous assemblies that connect grana in a chloroplast.

Stromatolites Laminated microbial mats, typically built from layers of filamentous and other microorganisms associated with warm lagoons or hot springs, which can become fossilized.

Stromelysin A collagenase (enzyme) that "clears a path" through living tissue, ahead of tumor cells, thereby enabling a cancer to spread within the body.

Strong acid An acid that is completely ionized (dissociates) in aqueous solution. Stronger acid has a larger K_a (acid dissociation constant) than a weaker acid. A common example is toluenesulfonic acid.

Strong promoter A promoter that directs a relatively large number of productive initiations per unit time.

Structural distortion is a change in the shape of a molecule.

Structural domain A segment of a polypeptide that folds independently of other segments. Also, a loop of eukaryotic DNA, predominantly in the form of the 30 nm chromatin fiber, attached to the nuclear matrix.

Structural gene A gene or a region of DNA that codes for a protein or RNA molecule and consequently the protein; as distinct from a regulatory gene that regulates gene expression.

Structural genomics Study of, or discovery of, where (gene) sequences are located within the genome, and what (DNA) subunits comprise those sequences.

Structural maintenance of chromosomes describes a group of proteins that include the cohesins, which hold sister chromatids together, and the condensins, which are involved in chromosome condensation.

Structural polysaccharide A polysaccharide that holds cells and organisms together; cellulose is the most abundant structural polysaccharide in plants.

Structural protein A protein that contributes to the structure of cells, cell parts, and membranes. Examples are keratin, actin, collagen etc.

Structure based drug design The synthesis of more effective drug molecules as guided by knowledge of the target molecule's structure and interactions with other drug molecules. Also called rational drug design.

Structure functionalism The scientific tradition that stresses the relationship between a physical structure and its function, e.g., the related disciplines of anatomy and physiology.

STS mapping A physical mapping procedure that locates the positions of sequence tagged sites (STSs) in a genome.

Stuffer fragment The non essential DNA fragment present within a λ vector that can be replaced by the DNA to be cloned.

Style (Gr. *stylos*, a column) Slender column of tissue that arises from the top of the ovary and through which the pollen tube grows.

Sub clone A method in which smaller DNA fragments are cloned from a large insert which has already been cloned in a vector.

Sub culture interval The time between subsequent sub-cultures of cells. Sub-culture interval has no relationship to the term *cell generation time*.

Sub protoplasts The fragments derived from protoplasts that do not contain all the contents of the plant cell.

Sub unit vaccine One or more immunogenic proteins either purified from the disease-causing organism or produced from a cloned gene. A vaccine composed of a purified antigenic determinant that is separated from the virulent organism.

Sub viral pathogen is an infectious agent that is smaller than a virus, such as a viroids.

Subacute disease A disease with symptoms between acute and chronic.

Subcarinal Refers to the area below the ridge that separates the right and left main bronchi at their junction with the trachea.

Subclinical infection An infection that does not cause a noticeable illness.

Subcloning (1) Splicing part of a cloned DNA molecule into a different cloning vector. (2) The process of transferring a cloned DNA fragment from one vector to another.

Subculture Division and transfer of a portion or inoculum from one culture vessel to another containing fresh medium. Sometimes used to denote the adding of fresh liquid to a suspension culture.

Subculture number The number of times cells, etc., have been sub-cultured, i.e., transplanted by inoculation from one culture vessel to another.

Subculturing The process by which cells from an existing culture are transferred to fresh medium in new containers.

Subcutaneous mycosis A fungal infection of tissue beneath the skin.

Suberect Facing outward at an angle from the vertical axis of the pedicel or the plant.

Suberin A waxy waterproof substance that occurs in cork cells and in the cells of underground plant parts; consists of hydroxylated fatty acids that are linked together in a complex array.

Sublimation The conversion of a solid directly into vapour, and subsequent condensation, without melting.

Suborbicular Somewhat circular, almost circular.

Subsessile Almost sessile; having a short, rudimentary stalk.

Subspecies Population(s) of organisms sharing certain characteristics those are not present in other populations of the same species.

Substantial Equivalence A principle inherent in the safety assessment process that compares a genetically modified food with a conventional non-modified food with a long history of safe use. If the modified food has essentially all the characteristics of the non-modified food with respect to food and food value it is said to be substantially equivalent.

Substitution A point mutation in which one base pair in the DNA sequence is replaced by another.

Substitution lines A line in which a pair of chromosomes has been replaced by a pair from another variety of the same species.

Substitution Matrix A substitution matrix containing values proportional to the probability that amino acid *i* mutates into amino acid *j* for all pairs of amino acids. Such matrices are constructed by assembling a large and diverse sample of verified pairwise alignments of amino acids. If the sample is large enough to be statistically significant, the resulting matrices should reflect the true probabilities of mutations occurring through a period of evolution.

Subtractive hybridization A technology that allows for PCR-based amplification of only cDNA fragments that differ between a control and experimental transcriptome; differences in relative abundance of transcripts are also highlighted; the technique relies on the removal of dsDNA formed by hybridization between a control and test sample, thus eliminating cDNAs or gDNAs of similar abundance, and retaining differentially expressed, transcripts or genomic sequences.

Substrain Derived from a strain by isolating a single cell or groups of cells having properties or markers not shared by all cells of the strain.

Substrate (1) The specific compound acted upon by an enzyme molecule, e.g., lactose is a substrate for β -galactosidase. (2) The medium on which an organism (especially a microorganism) can grow.

Substrate Analogs Molecules that differ in structure, at one or more positions, from the endogenous substrate.

Substrate cycle Two opposing metabolic reactions that function together to hydrolyze ATP, but provide a control point for regulating metabolic flux. Also called a futile cycle.

Substrate level phosphorylation Phosphorylation of a nucleoside diphosphate to triphosphate by transfer of a phosphoryl group from a substrate (non nucleotide), results in ATP production; independent of the electron transport system used in oxidative phosphorylation.

- Substrate modulation** A phenomenon of controlling enzyme activity, distinct in the complement system in which a protein cannot be cleaved by a protease until it first binds to another protein.
- Substratum** Solid surface to which a cell adheres.
- Subterminal spore** An endospore located somewhere other than the end of the cell.
- Subunit** Individual polypeptide chains in a protein that combines with other polypeptides to comprise a multisubunit protein.
- Succession** The change in species composition over time as a result of abiotic and biotic agents of change.
- Succinic acid** A C-4 organic acid that is oxidized by the reduction of ubiquinone to ubiquinol in the sixth step of the Krebs cycle; the product of this oxidation is fumaric acid.
- Succinyl CoA** An acetylated C-4 organic acid that is converted to succinic acid by losing its acetyl- CoA group, thereby driving the substrate level phosphorylation of one molecule of ADP to ATP in the fifth step of the Krebs cycle.
- Sucker** A shoot that arises from an underground root or stem and grows at the expense of the parent plant.
- Suckering** Type of vegetative propagation where lateral buds grow out to produce an individual that is a clone of the parent.
- Sucrose** (C₁₂H₂₂O₁₁) A common, nonreducing, disaccharide made up of a molecule of glucose and one of fructose linked by an $\alpha 1 \leftrightarrow \beta 2$ glycosidic bond; obtained from sugarcane and sugar beet; used as a sweetening agent; also called table sugar or saccharose.
- Sucrose density gradient centrifugation** A type of differential centrifugation often used to purify enveloped viruses (with densities 1.1-1.2 g/cm³), ribosomes etc.
- Sugar** Small carbohydrates with a monomer unit of general formula (CH₂O)_n containing 4 to 7 carbon atoms in a chain. Examples are the monosaccharides glucose, fructose and mannose, and the disaccharides like lactose and sucrose.
- Suicide gene** A gene that codes for a protein that kills the cell directly or indirectly.
- Suicide inhibitor** A relatively inert molecule that is transformed by an enzyme, at its active site, into a reactive substance that irreversibly inactivates the enzyme.
- Suicide substrate** A substrate which irreversibly binds to the active site of an enzyme, preventing it to catalyze further reactions.
- Sulfa drugs** Any synthetic chemotherapeutic agent containing sulfur and nitrogen
- Sulfate reducing bacterium** A prokaryote which is able to reduce sulfate (as a terminal electron acceptor) to H₂S (hydrogen sulfide) using electrons donated from organic acids, fatty acids, alcohols or hydrogen (electron donors).
- Sulfhydryl group** A portion of a molecule with the formula -SH; found in the amino acid cysteine and other molecules. Two sulfhydryls can join to produce a disulfide bond which is present in cystine; also called thiol.
- Sulfonamide drugs** A group of organic compounds, containing the sulfonamide group, SO₂NH₂ or its derivative; the group includes sulfanilamide, sulfadiazine, sulfathiazole and many others; some of the sulfonamides are sulfa drugs and act as powerful inhibitors of bacterial activity.
- Sulfonamides** Bacteriostatic compounds that interfere with folic acid synthesis by competitive inhibition.

Sulfonylurea (Herbicide) Tolerant Soybeans These are soybeans that have been bred (via insertion of ALS gene by traditional breeding methods) to resist the (weed killing) effects of sulfonylurea-based herbicides. The ALS gene was discovered by Scott Sebastian in 1986.

Sulfonylureas A herbicide family with similar chemical structure belonging to the amino acid synthesis inhibitors mode of action; these herbicides specifically target the ALS-AHAS enzyme.

Sulforaphane A compound naturally produced within cruciferous plants such as broccoli and cabbage.

Sulfosate An active ingredient in some herbicides, it kills plants (e.g., weeds) by inhibiting the crucial plant enzyme EPSP (5-enolpyruvylshikimate-3-phosphate) synthase. Chemically, sulfosate is a trimethylsulfonium salt of the same organic acid as glyphosate, so sulfosate can be applied over crops (e.g., soybeans) that have been genetically engineered to be tolerant to glyphosate-based herbicides.

Sulfur cycle The cyclic movement of sulfur through an ecosystem.

Sulfur granule Small colony of organisms with surrounding clublike material; yellow-brown; resembles grain of sulfur.

Sulfur oxidation The oxidation of various forms of sulfur to sulfate.

Sulfur reduction The reduction of elemental sulfur to hydrogen sulfide.

Super antigen An antigen that activates many different T cells, thereby eliciting a large immune response. These superantigens, which thus overactivate the organism's immune system, are thought to be responsible for some autoimmune diseases (in which T cells attack and destroy the organism's own, healthy tissues). The staphylococcal enterotoxins are one of the sources of superantigens. It is differentiated from a mitogen by its specificity for T cells bearing these variables.

Super infection (1) Growth of the target pathogen that has developed resistance to the antimicrobial drug being used. (2) Growth of an opportunistic pathogen.

Super repressed is a mutant condition in which a repressible operon cannot be de-repressed, so it is always turned off.

Super secondary structure An interaction of secondary structures that occurs in a number of proteins. Also known as motif. E.g., helix-turn-helix-motif.

Superbug the first genetically engineered organism (bacterial strain of *Pseudomonas*) developed by Dr.A.Chakrabarty that was patented. It combined different hydrocarbon-degrading genes obtained from different plasmids.

Supercoil A DNA molecule that contains extra twists as a result of overwinding (positive supercoils) or underwinding (negative supercoils).

Supercoiled DNA Region of DNA in which the double helix is further twisted on itself.

Supercoiled plasmid The predominant in vivo form of plasmid, in which the plasmid is coiled around histone-like proteins. Supporting proteins are stripped away during extraction from the bacterial cell, causing the plasmid molecule to supercoil around itself in vitro.

Supercoiling Also known as superhelicity. The coiling of a closed duplex DNA (deoxyribonucleic acid molecule) in space so that it crosses over its own axis.

Supercritical Carbon Dioxide A solvent that, when combined with water and an appropriate surfactant (e.g., fluoroethers), forms a solvent system that can effectively dissolve large biological molecules without causing those molecules to lose biological activity. Carbon dioxide is a gas at normal

(atmospheric) pressure and ambient temperature, but in its supercritical state — temperature above 31.3°C (88°F) and pressure greater than 72.9 atmospheres — carbon dioxide becomes a dense (sort of) liquid.

Superfamily is a set of genes, related by presumed descent from a common ancestor, but now showing considerable variation.

Superficial mycosis A fungal infection localized in surface epidermal cells and along hair shafts.

Supergene A group of neighboring genes on a chromosome that tend to be inherited together and sometimes are functionally related.

Supernatant The soluble liquid fraction of a sample after centrifugation or precipitation of insoluble solids.

Supernodulation The ability of legume plants to form significantly higher nodule numbers than the normal. It is found in several legumes like pea and soybean.

Superoxide anion (O_2^-) A harmful derivative of oxygen capable of oxidative destruction of cell components of obligate anaerobes.

Superoxide dismutase (SOD) Enzyme that converts superoxide free radical to molecular oxygen and hydrogen peroxide.

Superphosphoric acid A mixture of polyphosphate and orthophosphate made by dehydrating water from phosphoric acid; used to produce ammonium polyphosphate fertilizers.

Suppressor tRNA molecule A mutant tRNA molecule possessing an altered anticodon that allows it to bind to a termination codon. Such binding incorporates the amino acid carried by tRNA into the growing polypeptide chain.

Suppression Describes the occurrence of changes that eliminate the effects of a mutation without reversing the original change in DNA.

Suppressor (1) A mutation that restores wild-type phenotype without altering the original mutation, usually arising by mutation that occurs at a different site or in another gene. (2) extragenic Suppressor is usually a gene coding a mutant tRNA that reads the mutated codon either in the sense of the original codon or to give an acceptable substitute for the original meaning. (3) intragenic Suppressor is a compensating mutation that restores the original reading frame after a frame shift.

Suppressor gene A gene that can suppress the action of another gene.

Suppressor mutation A mutation that totally or partially restores a function lost by a primary mutation. It is located at a site in the gene different from the site of the primary mutation.

Suppressor sensitive mutant An organism that can grow when a second genetic factor - a suppressor - is present, but not in the absence of this factor.

Suppressor T Cells Those T cells (thymus derived lymphocytes) that are triggered (after other types of T cells and other immune system cells have successfully fought off an infection) to slow down gradually and halt the body's immune response (to the now-conquered pathogen). Discovered by Tomio Tada in 1971, suppressor T cells inhibit B cell activity.

Suppurative lymphadenopathy Enlarged, tender lymph nodes from which pus is draining.

Supramolecular Assembly Refers to a very large molecular structure.

Suprapubic bladder aspiration Obtaining urine by direct needle puncture of the full bladder through the abdominal wall above the pubic bone.

Surface active agent (surfactant) Amphipathic molecules (i.e., molecules that contain both a polar and nonpolar domain) which decreases the tension between molecules lying on the surface of a liquid. A surface-active agent or wetting agent, such as Tween 20™ or Tween 80™, Teepol™, Lissapol FTM, Alconox™, etc. Surfactants are commonly used to solubilize cell membrane components and other hard-to-solubilize molecules.

Surface immunoglobulin The membrane-bound immunoglobulin that acts as the antigen receptor on B cells is often known as surface immunoglobulin (sIg).

Surface labeling A technique in which a lipid-insoluble protein labeling reagent is used to identify the portion of a membrane protein that is exposed to solvent.

Surrogate A person or animal that functions as a substitute for another. In the case of a surrogate mother, a woman or female animal carries an embryo and ultimately gives birth to a baby that was formed from the egg of another female.

Surrogate light chain The surrogate light chain is made up of two molecules called VpreB and $\lambda 5$. Together, this chain can pair with an in-frame heavy chain, move to the cell surface, and signal for pre-B-cell growth.

Surrogate species A species selected as a priority for conservation with the assumption that its conservation will serve to protect many other species with overlapping habitat requirements.

Surveillance Systematic collection, analysis, interpretation and dissemination of data (generated by the laboratory and private and public domain literature) related to the biotechnology field to assist in the planning and implementation of research, evaluation and management of risks and public health interventions and programs (if needed).

Survival factor Extracellular signal required for a cell to survive; in its absence the cell will undergo apoptosis and die.

Survival rate The proportion of individuals of age x that survive to be age $x + 1$ (denoted S_x in a life table).

Survivorship curve A graph that is based on survivorship data (l_x) and that plots the number of individuals from a hypothetical cohort (typically, of 1,000 individuals) that will survive to reach different ages.

Survivorship The proportion of individuals that survive from birth (age 0) to age x (denoted l_x in a life table).

Susceptibility The lack of resistance to a disease, herbicides etc.

Susceptible Sensitive to a stimulus. A person or animal not possessing sufficient resistance against a particular pathogenic agent to prevent contracting infection or disease when exposed to the agent.

Suspension A solid dispersed in another solid, liquid or gas that does not dissolve but remains as a solid in the mixture.

Suspension culture A type of culture in which (single) cells and/or clumps of cells grow and multiply while suspended in a liquid medium.

Suspensor (1) In plant zygotes it is the organ anchoring and supporting a developing embryo. Suspensor connects embryo with the endosperm. (2) They are filamentous structural formations employed by fungi in holding a zygospore between two strains of hyphae.

- Sustainable agriculture** The successful management of the elements and resources of agriculture to satisfy changing human needs while maintaining the natural resources base and avoiding environmental degradation.
- Sustainable development** An approach to development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It seeks to ensure that current development does not alter the environment's ability to recover from any damage sustained, and also makes use of renewable resources.
- Sustainable use of biodiversity** Using components of biological diversity in a way and at a rate that does not lead to the long-term decline of the diversity, thus maintaining its potential to meet the needs and aspirations of present and future generations.
- SV40** Also known as simian vacuolating virus. A DNA virus of the papovirus family that produces seemingly inapparent infections in monkeys, especially rhesus monkeys, and that is a common contaminant of monkey cell cultures. It has been shown to produce tumors in hamsters and to transform cultured monkey cells. Tumors caused by SV40 exhibit a specific antigen associated with the virus and known as T-antigen,
- Svedberg unit (S)** The unit used to express the sedimentation constant ($S = 10^{-13}$ sec). The sedimentation constant S is proportional to the rate of sedimentation of a molecule in a given centrifugal field.
- SW1/SNF** is a chromatin remodeling complex; it uses hydrolysis of ATP to change the organization of nucleosomes.
- Swarmer cell** Spherical, flagellated *Rhizobium* cell that invades the root hairs of leguminous plants, eventually to form nodules.
- Sweat gland** A structure present in the skin of some mammals that secretes sweat containing NaCl as part of the cooling system. A typical human has about 2.5 million sweat glands. Dogs, cats and rabbits are amongst the mammals that do not sweat but use evaporation from the upper respiratory tract to lose excess body heat.
- Swimmer's itch** Dermatitis caused by skin penetration of humans by cercariae of schistosomes (normally infect birds and semiaquatic animals).
- Switch proteins** Refers to certain protein molecules that signal a plant when environmental conditions are so dry (or cold, etc.) that the plant needs to protect itself (via extreme measures) to survive.
- Symbiont hypothesis** Proposal that mitochondria and chloroplasts might have originated as prokaryotic intracellular parasites that established a symbiotic relationship with the eukaryotic cell.
- Symbionts** Two or more organisms that are mutually interdependent; usually living in physical association.
- Symbiosis** (Gr. *syn*, with + *bios*, life) The close association of two different kinds of living organisms where there is benefit to both or where both receive an advantage from the association. An example is the association of the mycelium of mycorrhizal fungi with roots of seed plants.
- Symbiosome** A structure found in nodules of legumes. It encases the symbiotic form of *Rhizobium* and *Bradyrhizobium* called the bacteroid.
- Symbiotic** Refers to the mutually beneficial living together of organisms, in an intimate association or union. For example, lichen are a life form consisting of algae and a fungus growing together as a unit on a solid surface (e.g., a tree trunk or a rock). Each helps the other to survive and grow.
- Symmetric hybrid** Somatic hybrid cell/plant containing the complete somatic complements of both the species involved in fusion.

Sympathetic ophthalmia When one eye is damaged, there is often an autoimmune response that damages the other eye, a syndrome known as sympathetic ophthalmia.

Sympatric speciation The formation of new species by populations that inhabit the same or overlapping geographic regions.

Sympatry Refers to two or more populations that occupy the same geographic areas.

symplast The system of protoplasts in plants, that are interconnected by plasmodesmata.

Symplastic Path Water travels from one cell to the next via plasmodesmata. Symplastic means "living" tissue.

Sympodial A type of plant development in which the terminal bud of the stem stops growing due to either its abortion or its development into a flower or an inflorescence, and the uppermost lateral bud takes over the further axial growth of the stem.

Sympodial growth Conidiogenous structure that continues to increase in length by forming a new growing point just below each new terminal conidium, often resulting in a geniculate (bent) appearance.

Symport A form of cotransport in which a membrane carrier protein transports two solute species across the membrane in the same direction. The two solutes can be transported simultaneously or sequentially.

Symptom A change in body function that is felt by a patient as a result of a disease.

Syn conformation A purine nucleotide conformation in which the ribose and the base are eclipsed.

Syn₀ The parental lines of a synthetic variety.

Syn₁ The population derived by intermating among the Syn₀ lines in all possible combinations

Synapse Communicating cell-cell junction that allows signals to pass from a nerve cell to another cell. In a chemical synapse the signal is carried by a diffusible neurotransmitter; in an electrical synapse a direct connection is made between the cytoplasm of the two cells via gap junctions.

Synapsis (1) In genetic recombination, the initial formation of base pairs between complementary DNA strands in different DNA molecules that occurs at sites of crossing-over between chromosomes. (2) In meiosis, the pairing of the two pairs of sister chromatids (representing homologous chromosomes) that occurs at the start of meiosis; the resulting structure is called a bivalent, more particularly during zygotene stage of Prophase I.

Synaptic signaling Type of cell-cell communication that occurs across chemical synapses in nervous system.

Synaptic vesicle Small neurotransmitter- filled secretory vesicle formed at the axon terminals of nerve cells and whose contents are released into the synaptic cleft by exocytosis when an action potential reaches the axon terminal.

Synaptonemal complex Proteinaceous structure, composed of two lateral arms and a medial element, that forms between pairing homologues during zygonema, the end of the first meiotic prophase.

Synchronization A term used to represent the cells when they are at the same stage of cell division.

Synchronous culture A culture in which the majority of the cells are dividing at the same time or are at a specific phase of the cell cycle.

Syncope Fainting or loss of consciousness due to a temporary deficiency of blood supply to the brain.

Syncytium A single cell structure comprising a mass of cytoplasm and many nuclei; that forms from repeated nuclear division without the formation of new plasma membrane, usually the result of viral infection of the cells..

Syncytium forming virus An RNA virus that causes cells to fuse into large masses. Syncytium-forming viruses contain an RNA-directed DNA polymerase and replicate through a DNA intermediate but they have never been shown to cause tumors.

Syndrome (synG = together + drameinG = to run) Refers to a disease characterized by a group of signs and symptoms; often named after their discoverer, for example Down's syndrome, Klinefelter's syndrome and Turner's syndrome.

Synergids The two nuclei within the embryo sac at the upper end in the ovule of the flower, which, with the third (the egg), constitute the egg apparatus.

Synergism A chemical phenomenon in which the combined activity of two or more compounds is greater than the sum of the individual activities. For example, auxin and cytokinin act synergistically in promoting DNA replication.

Synergist A non-phytotoxic chemical which increases the phytotoxicity of a herbicide, usually by inhibiting metabolism of the herbicide through enzyme inhibition.

Synergy When the actions of two or more processes, structures, or agents are combined to yield a result that is greater than the sum of each individually; for example, antibiotics can be synergistic.

Syngamy The fusion of gametes to form a zygote.

Syngeneic Genetically identical members of the same species.

Syngeneic graft A syngeneic graft is a graft between two genetically identical individuals. It is accepted as self.

Synkaryon A nucleus formed by the fusion of nuclei from two different somatic cells during somatic-cell hybridization.

Synonymous codons Codons that specify the same amino acid. For example Serine has 4 codons viz.,UCU, UCC, UCA, UCG.

Synonymous mutation A mutation that changes a codon into a second codon that specifies the same amino acid.

Synovial fluid A viscous fluid contained within a membrane enclosing moveable joints such as the elbow and knee. The fluid acts as a lubricant.

Synteny The identical arrangement of genes on chromosomes in different organisms.

Synthases Enzymes that catalyze condensation reactions without the involvement of energy i.e ATP.

Synthase An enzyme that catalyzes the linking of two substrates by expenditure of the chemical potential energy of a nucleoside triphosphate (ATP, GTP). They are the members of the enzyme class ligases.

Synthesizing (of DNA molecules) The building (i.e., polymerization manufacture) of a known sequence of nucleotides/ amino acids into a chain called an oligonucleotide/ polynucleotide. Har Gobind Khorana and his colleagues at the University of Wisconsin, Madison, in 1968, invented the process to create genes or gene fragments for use in research. Robert Bruce Merrifield in 1963 developed the solid phase synthesis method in which repetitive coupling of the constituent amino acids is done to a growing polypeptide backbone, which itself is attached to a polymeric support (substrate)..

Synthesizing (of oligosaccharides) Chemical synthesis (manufacture) of a known oligosaccharide (structure). For example, a synthesis of a defined-sequence oligosaccharide (molecular) branch” at a specific site on a glycoprotein in order to “cover up” an antigenic site on that glycoprotein molecule (e.g., so the glycoprotein can be used as a pharmaceutical).

Synthetic (S) phase Specific part of interphase during which DNA synthesis occurs.

Synthetic drug A chemotherapeutic agent that is prepared from chemicals in a laboratory.

Synthetic genomics A discipline involving study of artificial creation of genetic material.

Synthetic medium A growth medium prepared in the laboratory from materials of precise or reasonably well-defined composition.

Synthetic seeds Artificially encapsulated somatic embryos, shoot buds, cell aggregates, or any other tissue that can be used for sowing as a seed and that possesses the ability to convert into a plant under in vitro or ex vitro conditions.

Synthetic variety In cross pollinated species; a variety obtained by mating in all possible combinations a number of lines that combine well with each other.

Syntropy A nutritional situation in which two or more organisms combine their metabolic capabilities to catabolize a substance not capable of being catabolized by only one of the two organisms. For example there are many organisms that feast on faeces or dung. A cow eats a lot of grass, the cellulose of which is transformed into lipids by micro-organisms in the cow's large intestine. These micro-organisms cannot use the lipids because of lack of dioxygen in the intestine, so the cow does not take up all lipids produced. When the processed grass leaves the intestine as dung and comes into open air, many organisms, such as the dung beetle, feast on it.

Syphilis A chronic human disease caused by *Treponema pallidum*. Infection generally occurs by direct contact with lesions of syphilis.

Systematics The scientific study of the kinds and diversity of organisms and any and all relationships among them, it is the scientific classification of living organisms.

Systemic Acquired Resistance (SAR) Discovered in 1992 (applicable to harpin induced SAR) and in 1996 by J.A. Ryals, U.H. Neuenschwander, M.G. Willits, A. Molina, H.-Y. Steiner, and M.D. Hunt, SAR is a sort of “immune (cascade) response” by a plant, against infection (by bacteria, fungus, etc.). One example of this is the production of stress proteins or pathogenesis related proteins when certain plants are attacked by certain pathogens.

Systemic anaphylaxis is the most dangerous form of immediate hypersensitivity reaction. It involves antigen in the bloodstream triggering mast cells all over the body. The activation of these mast cells causes widespread vasodilation, tissue fluid accumulation, epiglottal swelling, and often death.

Systemic Herbicide A herbicide that can move throughout the plant; the activity is not limited to the point of application.

Systemic infection An infection that spreads throughout the body via the circulatory system.

Systemic Involving the entire body. Having the ability to move throughout the plant by either the xylem or phloem.

Systemic lupus erythematosus (SLE) is an autoimmune disease in which autoantibodies against DNA, RNA, and proteins associated with nucleic acids form immune complexes that damage small blood vessels, especially of the kidney.

Systemic mycosis A fungal infection in deep tissues.

Systole Muscular contraction of the heart or of any chamber of it. Commonly it is of two types: atrial and ventricular systole.

β sheet common secondary structure in proteins, in which lengths of fully extended polypeptide run alongside each other, hydrogen bonds forming between the peptide bonds of the adjoining strands.

12D treatment A sterilization process that would result in a decrease of the number of *Clostridium botulinum* endospores by 12 logarithmic cycles.

3' end The end of a nucleic acid that lacks a nucleotide bound at the 3' position of the terminal residue.

6-Thioguanine An antimetabolite that is a structural analog of guanine. It is converted by intracellular enzymes to a nucleotide, 6-thioguanine monophosphate, that interferes with the synthesis of other nucleotides and thus inhibits the synthesis of DNA and RNA.

T antigen An antigen in the nucleus of a tumor cell.

T cell or T lymphocytes (also known as thymus-dependent lymphocytes) A group of lymphocytes that are involved in cell-mediated immunity, rejection of grafts, delayed hypersensitivity reactions, and graft-versus-host reactions. T lymphocyte precursors from the bone marrow and other lymphoid tissues accumulate in the thymus, where they become thymocytes. The thymocytes proliferate from the cortex of the thymus and move inward to the medullary region, where they mature. They then enter the circulating pool of lymphocytes and are called T lymphocytes, they account for 70 to 80 percent of circulating lymphocytes.

T helper (T_H) cell Type of T cell which works together with B cells to produce antibodies.

T or thymine One of the four bases found in DNA; thymine is a pyrimidine.

T state One of two conformations of an allosteric protein; the other is the R state. The T state is usually the catalytically less active state.

T T_H1 cells are a subset of CD4 T cells that are characterized by the cytokines they produce. They are mainly involved in activating macrophages, and are sometimes called inflammatory CD4 T cells.

T T_H2 cells are a subset of CD4 T cells that are characterized by the cytokines they produce. They are mainly involved in stimulating B cells to produce antibody, and are often called helper CD4 T cells.

T The term **T_H3 cell** has been used to describe unique cells that produce mainly transforming growth factor- β in response to antigen; they develop predominantly in the mucosal immune response to antigens that are presented orally.

T T_{Reg}: Also known as regulatory T cells.

T4 DNA ligase An enzyme from bacteriophage T4 infected cells and that catalyzes the joining of duplex DNA molecules and repairs nicks in DNA molecules. The enzyme requires that one of the DNA molecules has a 5' phosphate group and the other DNA molecule has a 3' hydroxyl group.

T4 polynucleotide kinase An enzyme that adds phosphate groups to the 5' ends of DNA molecules.

T4 polynucleotide kinase to introduce a ³²P atom onto the end of a DNA molecule.

Tachyzoite Rapidly growing trophozoite form of a protozoan.

TACI, transmembrane activator and CAML-interactor TACI (transmembrane activator and CAML-interactor) is a member of the TNF-receptor family and is one of two major receptors for BLYS. It is

found on B cells, dendritic cells, and T cells and is probably the important receptor for receiving signals from BLYS.

Tacrolimus **Tacrolimus**, or FK506, is an immunosuppressive polypeptide drug that inactivates T cells by inhibiting signal transduction from the T-cell receptor. Tacrolimus and cyclosporin A are the most commonly used immunosuppressive drugs in organ transplantation.

TAF and initiator-dependent cofactor (TIC) A type of protein involved in initiation of transcription by RNA polymerase II.

TAFs TATA binding protein associated factors, which, along with TBP, constitute the general transcription factor TFIID required for the transcription of eukaryotic structural genes.

Taiga Coniferous evergreen forests found in the south of the tundra and north temperate region, characterized by harsh winters.

Tail Slapping The forceful slapping of tails on the surface of water by dolphins.

Tailing Also known as Homopolymeric tailing. The in vitro addition of same nucleotide by the enzyme terminal transferase, to the 3'-hydroxyl ends of a duplex DNA molecule.

Tandem array The existence of two or more identical DNA sequences in series, i.e. end to end.

Tandem duplication or **Tandem repeats** Many copies of the same DNA sequence that lie adjacent to each other on the chromosome.

Tandem repeat sequences Multiple copies of the same base sequence on a chromosome; used as markers in physical mapping.

Tandem-affinity purification or **TAP** A method for isolating protein complexes that makes use of a test protein with a C-terminal extension that binds to calmodulin.

Tandemly repeated DNA DNA sequence motifs that are repeated head to tail.

TAP1, TAP2 **TAP1** and **TAP2** (transporters associated with antigen processing) are ATP-binding cassette proteins involved in transporting short peptides from the cytosol into the lumen of the endoplasmic reticulum, where they associate with MHC class I molecules.

Tapasin, TAP-associated protein **Tapasin**, or the **TAP-associated protein**, is a key molecule in the assembly of MHC class I molecules; a cell deficient in this protein has only unstable MHC class I molecules on the cell surface.

Tapeworm A flatworm belonging to the class Cestoda.

Taq polymerase A heat stable DNA polymerase isolated from thermophilic bacterium *Thermus aquaticus*, and used in Polymerase Chain Reaction.

TaqMan™ A trademark term for a high throughput, closed tube assay to detect specific sequences in PCR products.

Target cells The functions of effector T cells are always assayed by the changes that they produce in antigen-bearing **target cells**. These cells can be B cells, which are activated to produce antibody; macrophages, which are activated to kill bacteria or tumor cells; or labeled cells that are killed by cytotoxic T cells

Target Region Amplification Polymorphism (TRAP) A molecular marker technique related to SRAP, but using a fixed primer designed from a targeted EST sequence.

Target site duplication A sequence of DNA that is duplicated when a transposable element inserts; usually found at each end of the insertion.

Targeted mutagenesis Deliberate change in the genetic structure directed at a specific site on the chromosome. Used in research to determine the targeted region's function.

Targeting sequence Stretch of polypeptide that determines the cellular compartment to which a synthesized protein is sent.

Tarsus The bone, which contributes in making the ankle joint, located between the tibia, fibula and metatarsus in mammals.

Tartar Calcium deposition on dental plaque forming a very rough, hard crust.

Tat The Tat protein is a product of the tat gene of HIV. It is produced when latently infected cells are activated, and it binds to a transcriptional enhancer in the long terminal repeat of the provirus, increasing the transcription of the proviral genome.

TATA binding protein or TBP A DNA binding protein that is required for transcription of all eukaryotic genes.

TATA box Sequence found about 20 bases upstream of the beginning of many eukaryotic genes that forms part of the promoter sequence and is involved in positioning RNA polymerase for correct initiation of transcription.

Tautomeric shift The transfer of a hydrogen atom from one position in an organic molecule to another position.

Tautomers Structural isomers that differ in the location of their hydrogen atoms and double bonds.

Taxis The movement of a cell that is triggered by external stimulus, towards or away from the stimulus source, is known as taxis.

Taxol Compound obtained from the bark of the Pacific yew, *Taxus brevifolia*; binds to tubulin. Taxol is a powerful anticancer drug.

Taxon (plural, taxa) A group into which related organisms are classified.

Taxonomic Classification The hierarchical system used for grouping and naming species of living organisms, usually Binomial or trinomial.

Taxonomy Study of scientific classification and nomenclature.

Tay-Sachs disease A genetic disease caused by a deficiency of the lysosomal enzyme N-acetylhexosaminidase A, which is involved in sphingolipid degradation. The deficiency results in accumulation of the ganglioside sphingolipid GM₂, particularly in the brain.

TBP domain A type of DNA-binding domain.

TBP-associated factor (TAF) One of several components of the general transcription factor TFIID, playing ancillary roles in recognition of the TATA box.

TCA cycle or Tricarboxylic acid cycle Also known as Citric acid cycle or Krebs's cycle.

T-cell antigen receptor Also known as T-cell receptor.

T-cell clone A T-cell clone is derived from a single progenitor T cell.

T-cell hybrids T-cell hybrids are formed by fusing an antigen-specific, activated T cell with a T-cell lymphoma. The hybrid cells bear the receptor of the specific T-cell parent and grow in culture like the lymphoma.

T-cell lines **T-cell lines** are cultures of T cells grown by repeated cycles of stimulation, usually with antigen and antigen-presenting cells. When single T cells from these lines are propagated, they can give rise to T-cell clones or cloned T-cell lines.

T-cell receptor, TCR The **T-cell receptor (TCR)** consists of a disulfide-linked heterodimer of the highly variable α and β chains expressed at the cell membrane as a complex with the invariant CD3 chains. T cells carrying this type of receptor are often called $\alpha\beta$ T cells. An alternative receptor made up of variable γ and δ chains is expressed with CD3 on a subset of T cells. Both of these receptors are expressed with a disulfide-linked homodimer of ζ chains.

T-cell zones The **T-cell zones** in lymphoid tissues are enriched in T cells and are distinct from the B-cell zones and the stromal elements.

T-dependent antigen B cells require T_H cells to respond to this type of antigen.

T-DNA A part of Ti plasmid that is transferred and get integrated into chromosomal DNA of a plant cell.

Tec kinase Activation of the lymphocyte antigen receptors is linked to activation of PLC- γ through members of the **Tec kinase** family of src-like tyrosine kinases. Other Tec kinases are Btk in B cells, which is mutated in the human immunodeficiency disease X-linked agammaglobulinemia (XLA), and Itk in T lymphocytes.

Technology transfer The process of transferring scientific findings from research laboratories to the commercial sector.

Teichoic acids All wall, membrane, or capsular polymers containing glycerophosphate or ribitol phosphate residues.

Teleomorph Sexual stage in reproduction in which cells are formed by the process of meiosis and genetic recombination.

Teleomorphic Sexual part of the life cycle of a fungus.

Telomerase binding protein (TBP) A protein that binds to and regulates the length of a telomere.

Telomerase Enzyme that elongates telomere sequences in DNA.

Telomerase The enzyme that directs the replication of telomeres.

Telomere End of a chromosome, associated with a characteristic DNA sequence that is replicated in a special way. Counteracts the tendency of the chromosome otherwise to shorten with each round of replication.

Telophase Final period of mitosis or meiosis in which the chromosomes decondense and the nuclear envelope reforms.

Telophase I Telophase of the first meiotic division (meiosis I).

Telophase II Telophase of the second meiotic division (meiosis II).

Temperate bacteriophage A bacteriophage that is able to follow a lysogenic mode of infection.

Temperate phage A phage whose DNA may be incorporated into the host-cell genome without being expressed; as distinct from a virulent phage, which destroys the host cell.

Temperate virus Virus which upon infection of a host does not necessarily cause lysis but whose genome may replicate in synchrony with that of the host.

Temperature abuse Improper food storage at a temperature that allows bacteria to grow.

Temperature-sensitive mutant Organism or cell carrying a genetically altered protein (or RNA molecule) that performs normally at one temperature but is abnormal at another (usually higher) temperature.

Template DNA The “template” DNA that is used for the initial reaction of a molecular marker analysis.

Template or Template strand A single strand of DNA or RNA whose nucleotide sequence acts as a guide for the synthesis of complementary strand.

Template-dependent DNA polymerase An enzyme that synthesizes DNA in accordance with the sequence of a template.

Template-dependent DNA synthesis Synthesis of a DNA molecule on a DNA or RNA template.

Template-dependent RNA polymerase An enzyme that synthesizes RNA in accordance with the sequence of a template.

Template-dependent RNA synthesis Synthesis of an RNA molecule on a DNA or RNA template.

Template-independent DNA polymerase An enzyme that synthesizes DNA without the use of a template.

Template-independent RNA polymerase An enzyme that synthesizes RNA without the use of a template.

Temporal summation The process in which action potentials in a presynaptic nerve cell occur at a high enough frequency that the depolarizations that they evoke in the postsynaptic cell do not have time to decay back to the resting voltage but rather ride on each other and depolarize the postsynaptic cell to threshold.

Temporary parasite A parasite that feeds on and then leaves its host (such as a biting insect).

Tendrils Tendrils are narrow stem-like structures which help the twining plants in attaching themselves to an object in order to gain support from it.

Tentacle The slender, elongated, flexible, appendages found in animals, located near their mouth.

Teratocarcinoma A malignant tumor arising from germ cells in the ovary or testis.

Teratogen An agent that induces defects during embryonic development.

Teratogenesis The induction of defects during embryonic development.

Teratogenic Substances such as chemicals or radiation that cause abnormal development of an embryo.

Teratoma A benign tumor arising in the ovary or testis.

terminal complement components The complement system can be activated directly or by antibody, but both pathways converge with the activation of the **terminal complement components**, which may assemble to form the membrane attack complex.

terminal deoxynucleotidyl transferase, TdT The enzyme terminal deoxynucleotidyl transferase (TdT) inserts nontemplated or N-nucleotides into the junctions between gene segments in T-cell receptor and immunoglobulin V-region genes. The N-nucleotides contribute greatly to junctional diversity in V regions.

Terminal electron acceptor- External oxidant (often oxygen) that accepts the electrons as they pass down the electron transport chain.

Terminal transferase An enzyme that catalyzes the addition of nucleotide residues of a single kind to the 3' end of DNA chains.

Terminally differentiated Term that describes a cell that cannot return to the cell division cycle. Nerve cells are terminally differentiated; glial cells are not.

Termination codon Codons UAA, UAG, and UGA are codons that signal protein synthesis to stop. Also known as stop codons.

Termination factors Proteins that are exclusively involved in the termination reactions of protein synthesis on the ribosome.

Termination sequence A DNA sequence that appears at the end of a transcriptional unit and signals the end of transcription.

Terminator (of transcription) DNA sequence that, when transcribed into mRNA, causes transcription to terminate.

Terminator codon Also known as nonsense codon or stop codon. A codon that signals the end of the information for a particular protein.

Terpenes Organic hydrocarbons or hydrocarbon derivatives constructed from recurring isoprene units. They produce some of the scents and tastes of plant products; for example, the scents of geranium leaves and pine needles.

Territory The area of belonging, which is guarded by animals against intruders, especially belonging to the same species.

Tertiary response, tertiary immunization When the same antigen is injected a third time, the response elicited is called a **tertiary response** and the injection a tertiary immunization.

Tertiary structure Complex three-dimensional form of a folded polymer chain, especially a protein or RNA molecule. Usually formed by weak bonds.

Tertiary structure The three-dimensional structure of a polypeptide chain that results from the way that the alpha helices and beta pleated sheets are folded and arranged.

Tertiary treatment Physical and chemical treatment of waste water to remove all biochemical oxygen demand, nitrogen, and phosphorus, following secondary treatment.

Test Cross The test cross is a process wherein a suspected heterozygote is tested by crossing it with a known homozygous recessive.

Test Hard external covering or shell.

Test of hypothesis The test of hypothesis is a process of testing of significance, which concerns with the testing of some hypothesis regarding a population parameter on the basis of a sample.

Testis (plural: testes) One of a pair of male reproductive glands that produce testosterone and sperm.

Tetanus Disease caused by *Clostridium tetani* in which muscle stiffness progresses to eventual paralysis and death.

Tetanus neonatorum Type of tetanus acquired through the raw stump of the umbilical cord.

Tetracyclines Broad-spectrum antibiotics that interfere with protein synthesis.

Tetrad A group of four cocci.

Tetrahedral intermediate An intermediate of peptide bond hydrolysis in which the carbonyl carbon of the scissile bond has undergone nucleophilic attack so that it has four substituents.

Tetrahedron A four-sided solid structure.

Tetrahydrobiopterin The reduced coenzyme form of biopterin.

Tetrahydrofolate or THF A cofactor for reactions that transfer one-carbon units in various oxidation states.

Tetrahydrofolate The reduced, active coenzyme form of the vitamin folate.

Tetramer An assembly consisting of four monomeric units.

T-even bacteriophage A complex virus with double-stranded DNA that infects *E.coli*, for example T2, T4, T6.

Texture Also known as soil texture. Texture indicates the relative content of particles of various sizes, such as sand, silt and clay in the soil. Texture influences the ease with which soil can be worked, the amount of water and air it holds, and the rate at which water can enter and move through soil.

Thalicarpine A potential antitumor agent isolated from *Thalictrum dasycarpum*. Its mechanism of action is unknown.

Thallus Vegetative body that is not differentiated into tissue systems or organs.

Theca A tightly affixed, secreted outer layer of dinoflagellates that often contains cellulose.

Therapeutic dosage level Level of drug dosage that successfully eliminates a pathogenic organism if maintained over a period of time.

Thermal cycle sequencing A DNA sequencing method that uses PCR to generate chain-terminated polynucleotides.

Thermal death point (TDP) The temperature required to kill all bacteria in a liquid culture in 10 minutes at pH 7.

Thermal death time (TDT) The length of time required to kill all bacteria in a liquid culture at a given temperature.

Thermoacidophile A member of one of the groups of the archaeobacteria that live in extremely hot, acidic environments.

Thermocline In a lake is the point where there is a rapid temperature drop with depth

Thermoduria Heat resistant.

Thermodynamics The study of the relationships among various forms of energy.

Thermogenin H⁺ channel found in the inner mitochondrial membrane of brown fat cells. Its presence uncouples NADH oxidation from ATP synthesis, that is, the electron transport chain can operate, pumping H⁺ out of the mitochondrial matrix, even when ATP synthase is not allowing H⁺ back in.

Thermography The use of an infrared detector to produce a photograph of the heat pattern of a tissue, particularly breasts, for detection of tumors. Tumors appear as hot spots in the thermogram because of their altered metabolism or increased blood supply. Thermography alleviates the hazards associated with x-irradiation, but it is not specific for cancer.

Thermolabile A substance which disintegrates or is unstable upon heating.

Thermophile Organism whose optimum temperature for growth is between 45 and 85°C.

Thermophilic anaerobic spoilage Spoilage of canned foods due to the growth of thermophilic bacteria.

Thermostable Able to withstand high temperatures.

Thermostable nuclease A heat-stable enzyme produced by *Staphylococcus aureus*.

Thiamine pyrophosphate The active coenzyme form of vitamin B₁; involved in aldehyde transfer reactions.

Thick filament One of the two filaments that form the cytoskeleton of striated muscle; composed of the motor protein myosin II.

Thin filament The sarcomere element that is composed primarily of f-actin.

Thioester An ester of a carboxylic acid with a thiol or mercaptan.

Thioester bond High-energy bond formed by a condensation reaction between an acid (acyl) group and a thiol group (-SH); seen, for example, in acetyl CoA and in many enzyme-substrate complexes.

Thiol Also known as Sulfhydryl or —SH group.

Thio-TEPA Triethylene triphosphoramidate. An alkylating agent used in the treatment of tumors.

Thoracic duct The lymph from most of the body, except the head, neck, and right arm, is gathered in a large lymphatic vessel, the **thoracic duct**, which runs parallel to the aorta through the thorax and drains into the left subclavian vein. The thoracic duct thus returns the lymphatic fluid and lymphocytes back into the peripheral blood circulation.

Thorax The part of the body in mammals situated between the neck and the abdomen, just above the diaphragm. In case of insects the part situated between the head and the abdomen.

Thorn Thorns, also referred to as spines, are the leaves of plants which are modified into cylindrical, hard structures featuring sharp ends.

Threatened Species A species which has the possibility of becoming endangered in the near future.

Three kingdom system Classification system in which organisms are assigned to one of three kingdoms; Eucaryota, Eubacteria or Archaeobacteria.

Threshold (voltage) Plasma membrane transmembrane voltage at which enough calcium or sodium channels open to initiate an action potential.

Thrombocytes Also known as platelets.

Thromboxanes A class of molecules derived from arachidonate and involved in platelet aggregation during blood clotting.

Thrush Milky patches of inflammation on oral mucous membranes: a symptom of candidiasis, caused by *Candida albicans*.

Thylakoid Flattened vesicle or sac of membrane found in chloroplast that contains chlorophyll and other pigments and carries out the light trapping reactions of photosynthesis. Stacks of thylakoids form the grana of chloroplasts.

Thymectomy Surgical removal of the thymus is called thymectomy.

Thymic anlage The thymic anlage is the tissue from which the thymic stroma develops during embryogenesis.

Thymic cortex, thymic cortical epithelial cells The **thymic cortex** is the outer region of each thymic lobe in which thymic progenitor cells proliferate, rearrange their T-cell receptor genes, and undergo thymic selection, especially positive selection on thymic cortical epithelial cells

- Thymic stroma** The thymic stroma consists of epithelial cells and connective tissue that form the essential microenvironment for T-cell development.
- Thymidine** One of the four nucleosides found in DNA.
- Thymine** A pyrimidine base found in DNA.
- Thymine dimer** Also known as pyrimidine dimer.
- Thymocytes** Thymocytes are lymphoid cells found in the thymus. They consist mainly of developing T cells, although a few thymocytes have achieved functional maturity.
- Thymus gland or Thymus** Multilobed lymphatic organ located beneath the sternum that processes lymphocytes into T cells.
- Thymus-dependent antigens, TD antigens, thymus-independent antigens, TI antigens, TI-1 antigens, TI-2 antigens** Some antigens elicit responses only in individuals that have T cells; they are called **thymus-dependent antigens** or **TD antigens**. Other antigens can elicit antibody production in the absence of T cells and are called **thymus-independent antigens** or **TI antigens**. There are two types of TI antigen: the **TI-1 antigens**, which have intrinsic B-cell activating activity, and the **TI-2 antigens**, which seem to activate B cells by having multiple identical epitopes that cross-link the B-cell receptor.
- Thymus-dependent lymphocyte** T cell and T lymphocyte are short designations for **thymus-dependent lymphocyte**, the lymphocyte population that fails to develop in the absence of a functioning thymus.
- Ti plasmid** Conjugative tumor-inducing plasmid present in the bacterium *Agrobacterium tumefaciens* which can transfer genes into plants.
- Tick paralysis** A disease characterized by fever and paralysis due to anticoagulants and toxins secreted into a tick's bite via the ectoparasite's saliva.
- Tight junction** Cell-cell junction that seals adjacent epithelial cells together, preventing the passage of most dissolved molecules from one side of the epithelial sheet to the other.
- Tiling array** A collection of oligonucleotide probes, each targeting a different position along a chromosome or a part of a chromosome.
- Tiling strategy** The detection of allelic variation at genes of known basic sequence by hybridization tests on microarrays using large series of sequence-overlapping probes.
- TIM complexes** Protein translocators in the mitochondrial inner membrane. The TIM23 complex mediates the transport of proteins into the matrix and the insertion of some proteins into the inner membrane; the TIM22 complex mediates the insertion of a subgroup of proteins in to the inner membrane.
- Time-lapse video microscopy** One uses time-lapse video microscopy to examine processes in biology, that are anywhere from cell migration (fast) to a flower blossoming (slow).
- Tincture** An alcoholic solution.
- T-independent antigen** B cells do not require T_H cells to respond to this type of antigen. Also known as T-dependent antigen.
- Tinea** A cutaneous fungal infection; also known as ringworm.
- Tinea barbae** Also known as Barber's itch, a type of ringworm that causes lesions in the beard.

Tinea capitis Also known as Scalp ringworm, a form of ringworm in which hyphae grow in hair follicles, often leaving circular patterns of baldness.

Tinea corporis Also known as Body ringworm, a form of ringworm that causes ring-like lesions with a central scaly area.

Tinea cruris Also known as Jock itch or Groin ringworm that occurs in skin folds in the pubic region.

Tinea pedis Also known as athlete's foot. A form of ringworm in which hyphae invade the skin between the toes, causing dry, scaly lesions.

Tinea unguium A form of ringworm that causes hardening and discoloration of fingernails and toenails.

Tingible body macrophages During the process of germinal center formation, cells called tingible body macrophages appear. These are phagocytic cells engulfing apoptotic B cells, which are produced in large numbers during the height of the germinal center response.

Tinsel Flagellum A flagellum which is covered with several minuscule hairlike projections is referred to as tinsel flagellum.

Tip Layering Tip layering is a plant propagation method wherein only the stem tip is buried in order to facilitate the growth of a new plant.

Tissue A tissue is an ensemble of cells featuring similar structure and performing a specific function.

Tissue Culture The maintenance or growth of tissue, *in vitro*, in a way that may allow differentiation and preservation of their function.

Tissue dendritic cells All dendritic cells arise from hematopoietic progenitors that migrate to various locations all over the body. Here, they are referred to as **tissue dendritic cells**

Tissue grafts Transplantation of organs or **tissue grafts** such as skin grafts is used medically to repair organ or tissue deficits.

Tissue-specific autoimmune disease Some autoimmune diseases attack particular tissues, such as the β cell in the islets of Langerhans in autoimmune diabetes mellitus; such diseases are called tissue-specific autoimmune disease.

Titer The titer of an antiserum is a measure of its concentration of specific antibodies based on serial dilution to an end point, such as a certain level of color change in an ELISA assay.

Titration curve The graphic presentation of the relationship between the pH of an acid- or base-containing solution and the degree of proton dissociation (roughly equal to the number of equivalents of strong base or strong acid that have been added to the solution).

TLR1-10 Also known as Toll-like receptors

T_m Stands for melting temperature.

Tn3-type transposon A type of DNA transposon that does not have flanking insertion sequences.

TNF Also known as lymphotoxin; tumor necrosis factor- α

TNF receptor, TNFR There are several members of the **TNF receptor (TNFR)** family. Some lead to apoptosis of the cell on which they are expressed (TNFR-I, II, Fas), while others lead to activation (CD40, 4-1BB). All of them signal as trimeric proteins.

Tocopherols Forms of vitamin E.

Togavirus A small, enveloped RNA virus that multiplies in many mammalian and arthropod cells.

Tolerance, tolerant **Tolerance** is the failure to respond to an antigen; the immune system is said to be **tolerant** to self antigens. Tolerance to self antigens is an essential feature of the immune system; when tolerance is lost, the immune system can destroy self tissues, as happens in autoimmune disease.

Toll pathway The **Toll pathway** is an ancient signaling pathway that activates the transcription factor NF κ B by degrading its inhibitor I κ B.

Toll-like receptor family or TLR Important family of mammalian pattern recognition receptors abundant on macrophages, neutrophils and the epithelial cells of the gut. They recognize pathogen-associated immunostimulants such as lipopolysaccharide and peptidoglycan.

Toll-like receptors, TLR, Toll-like receptor 4, TLR-4 All members of the Toll family of receptors so far discovered have been homologous to the original Toll in *Drosophila*. They have been named **Toll-like receptors (TLR)** followed by a number, as in **Toll-like receptor 4** or **TLR-4**.

TOM complex Multisubunit protein complex that transports proteins across the mitochondrial outer membrane.

Tonsillitis A bacterial infection of the tonsils.

Tonsils The palatine **tonsils** that lie on either side of the pharynx are large aggregates of lymphoid cells organized as part of the mucosal- or gut-associated immune system.

Top cross Crossing F1 hybrids with the dominant parent plant.

Topoisomerase (DNA topoisomerase) Enzyme that makes reversible cuts in a double-helical DNA molecule for the purpose of removing knots or unwinding excessive twists.

Topoisomers With respect to DNA, closed circular DNA molecules that are identical except in their sense or degree of supercoiling. DNA topoisomers can be interchanged only by cutting one or both strands using topoisomerases.

Topology The study of the geometric properties of an object that are not altered by deformations such as bending and stretching.

Topsoil (i) Layer of soil moved in cultivation. (ii) The A horizon. (iii) Presumably fertile soil material used to topdress roadbanks, gardens, and lawns.

TORCH series A group of blood tests used to identify teratogenic diseases in pregnant women and newborn infants.

Torsion angle The dihedral angle described by the bonds between four successive atoms. The torsion angles Φ and Ψ indicate the backbone conformation of a peptide group in a polypeptide.

Torsion The asymmetrical positioning of the body achieved, due to twisting and repositioning, during development. E.g. as seen in Gastropods.

Total estimation error In the estimation of a parameter the difference between the calculated value of the estimation and the true value of this parameter. It may be due to sampling error, measurement error, rounding off values, subdividing into classes, a basis of estimation and other errors.

Total magnification Magnification of a specimen, determined by multiplying the ocular lens magnification by the objective lens magnification.

Totipotency A cell characteristic in which the potential for forming all the cell types in the adult organism are retained.

Toxemia Symptoms due to toxins in the blood or the presence and spread of exo-toxins in the blood.

Toxic dosage level Amount of a drug necessary to cause host damage.

Toxic shock syndrome, toxic shock syndrome toxin-1, TSST-1 **Toxic shock syndrome** is a systemic toxic reaction caused by the massive production of cytokines by CD4 T cells activated by the bacterial superantigen toxic shock syndrome toxin-1 (TSST-1), which is secreted by *Staphylococcus aureus*.

Toxigenicity The capacity of a microorganism to produce a toxin.

Toxin Any substance that is poisonous to other organisms.

Toxoids Inactivated toxins called **toxoids** are no longer toxic but retain their immunogenicity so that they can be used for immunization.

Toxoplasmosis Disease caused by the protozoan *Toxoplasma gondii* that can cause congenital defects in newborns.

Trace element A chemical element required by an organism in only trace amounts.

Trace gas Gas other than nitrogen and oxygen in the atmosphere, particularly those gases that are active in the chemistry or radiation balance of the atmosphere.

Tracer Molecule or atom that has been labeled either chemically or radioactively so that it can be followed in a biochemical process or readily located in a cell or tissue.

Trachea The pipe serving as the principal passage for movement of air to and from the lungs, in humans and other vertebrates. It extends from the larynx to the bronchus.

Tracheid The elongated cells in the xylem which facilitate the transportation of water and mineral salts within the plants are known as tracheids.

Trachoma Eye disease caused by *Chlamydia trachomatis* that can result in blindness.

TRAFs The family of proteins known as TNF receptor-associated factors, or **TRAFs**, consists of at least six members that bind to various TNF family receptors or TNFRs. They share a domain known as a TRAF domain, and have a crucial role as signal transducers between upstream members of the TNFR family and downstream transcription factors.

Trailer Non-translated sequence at the 3' end of a messenger RNA following the termination codon.

Trailer segment The untranslated region of an mRNA downstream of the termination codon.

Trait Also known as characters.

Trans acting A term describing substances that are diffusible and that can affect spatially separated entities within cells.

Trans conformation An arrangement of the peptide group in which successive C α atoms are on opposite sides of the peptide bond.

Trans face The side of the Golgi dictyosome from which secretory vesicles are released toward the plasma membrane.

Trans Golgi network or TGN Network of interconnected cisternae and tubules at the trans face of the Golgi apparatus, through which material is transferred out of Golgi.

Trans peptide A conformation in which successive C α atoms are on opposite sides of the peptide bond.

Trans Side from which material is removed. Of the Golgi apparatus, the surface from which vesicles bud to pass to the plasma membrane and to lysosomes.

Transaminases Also known as aminotransferases.

Transamination Enzymatic transfer of an amino group from an α -amino acid to an α -keto acid.

Transamination In the cell, the enzymatic transfer of an amino group from an amino acid to a keto acid. The keto acid becomes an amino acid and vice versa.

Transcellular transport Transport of solutes, such as nutrients, across an epithelium, by means of membrane transport proteins in the apical and basal faces of the epithelial cells.

Transcript RNA product of DNA transcription.

Transcription attenuation Inhibition of gene expression in bacteria by the premature termination of transcription.

Transcription bubble Structure formed when two strands of DNA separate and one acts as the template for synthesis of an RNA molecule.

Transcription complex A complex of RNA polymerase and various transcription factors.

Transcription factor Term loosely applied to any protein required to initiate or regulate transcription in eucaryotes. Includes both gene regulatory proteins as well as the general transcription factors.

Transcription factory A large structure attached to the nuclear matrix; the site of RNA synthesis.

Transcription initiation The assembly, upstream of a gene, of the complex of proteins that will subsequently copy the gene into RNA.

Transcription Process by which an RNA molecule is polymerized on a DNA template with the aid of various enzymes.

Transcriptional control Control of gene expression by controlling when and how often the gene is transcribed.

Transcription-coupled repair A nucleotide excision repair process that results in repair of the template strands of genes.

Transcriptome The full complement of activated genes, mRNAs, or transcripts in a particular tissue at a particular time.

Transcriptomics The study of all the mRNA molecules that a cell transcribes.

Transcript-specific regulation Regulatory mechanisms that control protein synthesis by acting on a single transcript or a small group of transcripts coding for related proteins.

Transcytosis The uptake of material at one face of a cell by endocytosis, its transfer across a cell in vesicles, and its discharge from another face by exocytosis.

Trans-displacement Transfer of a nucleosome from one DNA molecule to another.

Transduction (1) Generally, the conversion of energy or information from one form to another. (2) The transfer of genetic information from one cell to another by means of a viral vector.

Transduction mapping The use of transduction to map the relative positions of genes in a bacterial genome.

Transfection Introduction of a foreign DNA molecule into a eukaryotic cell. It is usually followed by expression of one or more genes in the newly introduced DNA.

Transfer RNA (tRNA) A class of RNA having structures with triplet nucleotide sequences that are complementary to the triplet nucleotide coding sequences of mRNA. The role of tRNAs in protein

synthesis is to bond with amino acids and transfer them to the ribosomes, where proteins are assembled according to the genetic code carried by mRNA.

Transferase An enzyme that catalyzes the transfer of a functional group from one molecule to another.

Transfer-messenger (tm RNA) A bacterial RNA involved in protein degradation.

Transferred DNA Also known as T-DNA.

Transferrins Human iron-binding proteins that reduce iron available for a pathogen.

Transformant A cell that has been genetically altered through the uptake of foreign DNA.

Transformation Genetic exchange in bacteria that is mediated via purified DNA. In somatic cell genetics the term is also used to indicate the conversion of a normal cell to one that grows like a cancer cell.

Transformation mapping The use of transformation to map the relative positions of genes in a bacterial genome.

Transforming growth factor- β or TGB- β superfamily Large family of structurally related, secreted proteins that act as hormones and local mediators to control a wide range of functions in animals, including during development. It includes TGF- β s, activins and bone morphogenetic proteins (BMPs).

Transforming principle The compound, now known to be DNA, responsible for transformation of an avirulent *Streptococcus pneumoniae* bacterium into a virulent form.

Transfusion reaction Reaction that occurs when matching antigens and antibodies are present in the blood at the same time.

Transgene A foreign gene that is stably expressed in a host organism.

Transgenesis Foreign genes can be placed in the mouse genome by transgenesis.

Transgenic Describes genetically modified plants or animals containing foreign genes inserted by means of recombinant DNA techniques.

Transgenic mouse A mouse that carries a cloned gene.

Transgenic organism Plant or animal that has stably incorporated one or more genes from another cell organism and can pass them on to successive generations.

Transgenic Plant A plant which contains DNA inserted by some form of genetic engineering is known as transgenic plant.

trans-Golgi network Complex network of tubes and sheets that comprise the trans face of the Golgi apparatus. It is in the trans-Golgi network that proteins made on the rough endoplasmic reticulum are mobilized to their final destination.

Transient microbiota Collection of microorganisms those are present on an animal for a short time without causing a disease.

Transient microflora Microorganisms that may be present in or on an organism under certain conditions and for certain lengths of time at sites where resident microbiota are found.

Transient Of short duration or temporary.

Transmission electron microscopy (TEM) A type of electron microscopy in which a beam of electron passes through the object to be viewed and creates an image on a photographic plate or screen.

Transition A mutation in which one purine or pyrimidine replaces another.

Transition state An activated form of a molecule in which the molecule has undergone a partial chemical reaction; the highest point on the reaction coordinate.

Transition state analog A stable substance that geometrically and electronically resembles the transition state of a reaction.

Transition temperature The temperature at which a lipid bilayer shifts from a gel-like solid to a more fluid liquid crystal form.

Translation or RNA translation Process by which the sequence of nucleotides in a messenger RNA molecule directs the incorporation of aminoacids into protein. It occurs on a ribosome.

Translational bypassing A form of slippage in which a large part of an mRNA is skipped during translation, elongation of the original protein continuing after the bypassing event.

Translational control Control of gene expression by selection of which mRNAs in the cytoplasm are translated by ribosomes.

Translational repressor A repressor that binds to an mRNA, blocking translation.

Translocase (1) An enzyme that catalyzes membrane transport. (2) An enzyme that causes a movement, such as the movement of a ribosome along an mRNA.

Translocation The attachment of a segment of one chromosome to another chromosome. Also, the movement of a ribosome along an mRNA molecule during translation.

Translocon A multi-subunit protein that forms an aqueous pore across the endoplasmic reticulum membrane for the purpose of translocating a protein as part of the secretory pathway.

Transmembrane channels Pores in target cells membranes produced by complement.

Transmembrane protein Membrane protein that extends through the lipid bilayer, with part of its mass on either side of the membrane.

Transmembrane protein or TM Protein An integral protein that completely spans the membrane.

Transmembrane translocation Form of protein transport in which unfolded polypeptide chains are threaded across one or more membranes as a simple polypeptide chain and then (re)folded at their final destination.

Transmembrane voltage Voltage difference between one side of a membrane with reference to the other. It is usually stated as the voltage inside with respect to outside.

Transmissible spongiform encephalopathy or TSE An invariably fatal neurodegenerative disease resulting from prion infection.

Transmission electron microscope or TEM Type of microscope in which the image is formed by electrons that are transmitted through the specimen.

Transmission The passage of light through an object.

Transmitter Chemical that is released by one cell and acts on another and changes the behavior of that cell, as in case of Neurotransmitter released by a Presynaptic Neurone and acts on the Postsynaptic Neurone, in a chemical synapse.

Transmitter-gated ion channel Ion channel in the postsynaptic plasma membranes of nerve and muscle cells that opens only in response to the binding of a specific extracellular neurotransmitter. The resulting inflow of ions leads to the generation of a local electrical signal in the postsynaptic cell.

Transovarian transmission Passing of pathogen from one generation of ticks to the next as eggs leave the ovaries.

Transpeptidation The ribosomal process in which tRNA-bound nascent polypeptide is transferred to a tRNA-bound aminoacyl group so as to form a new peptide bond, thereby, lengthening the polypeptide by one residue at its C-terminus.

Transpiration Passage of water from the roots of a plant to the atmosphere via the vascular system and the stomata of the leaves.

Transplant rejection Destruction of grafted tissue or of a transplanted organ by the host immune system.

Transplantation An operation in which tissue or an organ is transplanted: *undergo a heart transplant; surgical transplant of a cornea.*

Transplanted organs The grafting of organs or tissues from one individual to another is called transplantation. The transplanted organs or grafts can be rejected by the immune system unless the host is tolerant to the graft antigens or immunosuppressive drugs are used to prevent rejection.

Transport protein A protein whose primary function is to transport a substance from one part of the cell to another, from one cell to another, or from one tissue to another.

Transport vesicle Membrane vesicle that transports proteins from one membrane compartment

Transporters Proteins that span a membrane and transport specific nutrients, metabolites, ions, or proteins across the membrane; sometimes called permeases.

Transposable element or Transposable genetic element Segment of DNA that can move from one position in a genome to another.

Transposable phage A bacteriophage that transposes as part of its infection cycle.

Transposal of virulence A laboratory technique in which a pathogen is passed from its normal host sequentially through many individual members of a new host species, resulting in a lessening or even total loss of its virulence in the original host.

Transposase An enzyme that is involved in the insertion of a bacterial transposon into a target site.

Transposition The movement of a DNA sequence from one site to another within the genome.

Transposon (transposable element) A segment of DNA that can move from one position in the genome to another.

Transposon mutagenesis Insertion of a transposon into a gene; this inactivates the host gene leading to a mutant phenotype and also confers the phenotype associated with the transposon gene.

Transposon tagging The insertion of a transposable element into or nearby a gene, thereby making that gene with a known DNA sequence.

Trans-splicing Type of RNA splicing present in a few eukaryotic organisms in which exons from two separate RNA molecules are joined together to form an mRNA.

Transverse diffusion The movement of a lipid from one leaflet of a bilayer to the other. Also called flip-flop.

Transversion A mutation in which a purine is replaced by a pyrimidine or vice versa.

Traumatic herpes Type of herpes infection in which the virus enters traumatized skin in the area of a burn or other injury.

- Traveller's diarrhoea** Gastrointestinal disorder generally caused by pathogenic strains of *Escherichia coli*.
- Treadmilling** The process by which a polymeric protein filament is maintained at constant length by addition of protein subunits at one end and loss of subunits at the other.
- Trench fever** Also known as shinbone fever. Rickettsial disease, caused by *Rochalimaea Quintana*, resembling epidemic typhus in that it is transmitted by lice and is prevalent during wars and under unsanitary conditions.
- Treponemes** Spirochetes belonging to the genus *Treponema*.
- Triacylglycerol (triglyceride)** Molecule composed of three fatty acids esterified to glycerol. The main constituent of fat droplets in animal tissues (where the fatty acids are saturated) and vegetable oils (where the fatty acids are mainly unsaturated).
- Trial** The performance of a random experiment is called a trial.
- Triangulation** The method used by animals to find out the distance between themselves and their prey using two or more fixed points. This technique is used especially by owls and harriers.
- Tribe** A category in the classification of organisms between a genus, which contains one or more genera.
- Tricarboxylic acid (TCA) cycle** The cyclical process whereby acetate is completely oxidized to CO₂ and water, and electrons are transferred to NAD⁺ and flavine. The TCA cycle is localized in the mitochondria in eukaryotic cells and in the plasma membrane in prokaryotic cells. Also called the Krebs or citric acid cycle.
- Trichinosis** A disease caused by a small nematode *Trichinella spiralis*, that enters the digestive tract as encysted larvae in poorly cooked meat, usually pork.
- Trichocyst** Tentacle-like structure on ciliates for catching prey for attachment.
- Trichome** Trichomes are the various extensions developing from the epidermis of the plant which are meant to provide protection to the plant.
- Trichomoniasis** A parasitic urogenital disease, transmitted primarily by sexual intercourse, that causes intense itching and a copious white discharge, especially in females.
- Trichuriasis** Parasitic disease caused by the whipworm *Trichuris trichura*, that damages intestinal mucosa and causes chronic bleeding.
- Trickling filter** A method of secondary sewage treatment.
- Triethylenemelamine** An alkylating agent used in the treatment of tumors.
- Trimer** An assembly consisting of three monomeric subunits.
- Trimeric** Formed of three subunits.
- Trimeric G protein** Protein with three subunits, α , β and γ , where the α subunit is a GTPase that dissociates from the $\beta\gamma$ units when it is in its GTP bound state. Both the α subunit, in its GTP bound state, and the now independent $\beta\gamma$ subunit, can activate target proteins. Examples are Gs, which activates adenylate cyclase, and Gq, which activates phospholipase C β .
- Trimeric GTP-binding protein** Also known as GTP-binding protein.
- Trimethylamine N-oxide** The compound CH₃ CH₃N CH₃O The arrow indicates a so-called dipolar bond between nitrogen and oxygen. This bond can also be represented as N⁺—O⁻. Trimethylamine N-oxide is generated from trimethylamine by the action of flavin-containing monooxygenase. A mutation in the *FMO3* gene causes the disorder trimethylaminuria. Affected individuals excrete

large amounts of trimethylamine in their urine, sweat, and breath and consequently have a fishy body odor.

Trimethylamine Substance that gives rotting fish its characteristic smell. A base; when dissolved in water, trimethylamine will accept an H⁺. Produced by the action of intestinal bacteria on trimethylamine N-oxide (from dietary fish), choline (from dietary phospholipid), or other chemicals containing a trimethylamine group. Trimethylamine is oxidized in mammalian liver by the action of flavin-containing monooxygenase. A mutation in the *FMO3* gene causes the disorder trimethylaminuria. Affected individuals excrete large amounts of trimethylamine in their urine, sweat, and breath and consequently have a fishy body odor. The structures of trimethylamine and protonated trimethylamine are CH₃ CH₃ N CH₃ CH₃ CH₃ N⁺ CH₃ H

Trinucleotide repeat expansion disease A disease that results from the expansion of an array of trinucleotide repeats in or near a gene.

Triose A simple sugar with a backbone containing three carbon atoms.

Triptolide A potential antitumor agent isolated from *Tripterygium wilfordii*. Its mechanism of action is unknown.

Tripeptide A polypeptide containing three amino acids.

Triplet binding assay A technique for determining the coding specificity of a triplet of nucleotides.

Triplex A DNA structure comprising of three polynucleotides.

Trisomy Possessing three copies of a particular chromosome instead of the normal two copies.

Triphosphate Having three phosphate groups attached at three different points on the molecule. Examples are ATP, GTP etc.

Trk A family of receptor tyrosine kinases that bind growth factors of the neurotrophin class.

tRNA nucleotidyltransferase The enzyme responsible for the posttranscriptional attachment of the triplet 5'-CCA-3' to the 3' end of a tRNA molecule.

Trophic level Describes the residence of nutrients in various organisms along a food chain ranging from the primary nutrient assimilating autotrophs to the predatory carnivorous animals.

Trophozoite The vegetative form of a protozoan.

Tropic hormone (tropin) A peptide hormone that stimulates a specific target gland to secrete its hormone; for example, thyrotropin produced by the anterior pituitary, stimulates secretion of thyroxine by the thyroid.

Tropism A biological process, which indicates the growth of a plant, in response to the environmental stimulus is known as tropism. Example. Phototropism and geotropism etc.

Tropomyosin Regulatory protein complexed with F-actin in the thin myofilament, along side of Myosin. A component of the muscles.

Troponin Regulatory protein bounded to the actin-tropomyosin complex and having Ca⁺⁺-binding properties consists of three subunits T1, TT & TC.

Tropophase Also known as log phase.

Trp RNA-binding attenuation protein (TRAP) A protein involved in attenuation regulation of some operons in bacteria such as *Bacillus subtilis*.

True tree A phylogenetic tree that depicts the actual series of evolutionary events that led to the group of organisms or DNA sequences being studied.

Truncated gene A gene relic that lacks a segment from one end of the original, complete gene.

Trypanosomiasis Also known as African sleeping sickness, caused by *Trypanosoma* sp., a protozoan endoparasite.

Trypsin A highly active proteolytic enzyme secreted by Pancreas. It cleaves the amide carbon-nitrogen bond between certain amino acids in a protein.

Tryptic peptide mapping The technique of generating a chromatographic profile characteristic of the fragments resulting from trypsin enzyme cleavage of the protein.

Tryptophan (*trp*) operon Cluster of five bacterial genes involved in the synthesis of the amino acid tryptophan.

Tube agglutination test Serologic test measures antibody titers by comparing various dilutions of the patient's serum against known quantities of an antigen.

Tuber The various types of modified plant structures which are enlarged to store nutrients are known as tubers.

Tubercle A solidified lesion or chronic granuloma that forms in the lungs in patients with tuberculosis.

Tuberculate An organism or part of an organism which is covered in fleshy and raised protuberances, also called tubercles.

Tuberculin hypersensitivity Cell-mediated hypersensitivity reaction that occurs in sensitized individuals when they are exposed to tuberculin.

Tuberculin skin test An immunological test for tuberculosis in which a purified protein derivative from the *Mycobacterium tuberculosis* is injected subcutaneously, resulting in an induration if there was previous exposure to the bacterium.

Tuberculin test The tuberculin test is a clinical test in which a purified protein derivative (PPD) of *Mycobacterium tuberculosis*, the causative agent of tuberculosis, is injected subcutaneously. PPD elicits a delayedtype hypersensitivity reaction in individuals who have had tuberculosis or have been immunized against it.

Tuberculoid leprosy Also known as leprosy.

Tuberculoid Referring to the anesthetic form of Hansen's disease (leprosy) in which areas of skin lose pigment and sensation.

Tuberculosis An infectious disease characterized by the growth of nodules (tubercles) in the tissues, esp. the lungs, caused chiefly by the bacterium. Example. *Mycobacterium tuberculosis*.

Tubulin Principal protein in many types of microtubules, occurring as a dimer whose two subunits (α and β) differ slightly from each other.

Tularemia Zoonosis (A disease that can be transmitted to humans from animals.) caused by *Franciscella tularensis*, most often associated with cottontail rabbits.

Tumor An anomalous tissue mass in the body, derived from preexisting cells that serves no purpose and grows independently of surrounding tissue. Most tumors must contain more than 1 billion (10^9) cells before they can be discerned clinically. Benign tumors remain localized, are usually slow growing, and produce symptoms only when they become large enough to interfere mechanically with

surrounding structures. The cells of benign tumors resemble adult body cells and the tumor generally does not recur when it is completely removed. Malignant or cancerous tumors invade surrounding tissues, disseminate to other parts of the body (metastasis), produce such symptoms as cachexia, and are generally fatal. The cells of malignant tumors resemble embryonic cells. The parenchyma of a tumor is the abnormal cells, while the stroma is the supporting network of connective tissues and blood vessels. The cause of most tumors is unknown.

Tumor angiogenesis factor (TAF) A substance secreted by tumors to stimulate the formation of blood vessels and thus enhance their own blood supply.

Tumor immunology It is the study of host defenses against tumors.

Tumor necrosis factor- α , TNF- α , tumor necrosis factor receptor, TNFR **Tumor necrosis factor- α (TNF- α)** is a cytokine produced by macrophages and T cells that has multiple functions in the immune response. It is the defining member of the TNF family of cytokines. These cytokines function as cell-associated or secreted proteins that interact with receptors of the tumor necrosis factor receptor (TNFR) family, which in turn communicates with the interior of the cell via components known as TRAFs (tumor necrosis factor receptor-associated factors).

Tumor necrosis factor- β , TNF- β Also known lymphotoxin.

Tumor progression The process by which an initial mildly disordered cell behavior gradually evolves into a full-blown cancer.

Tumor suppressor A protein whose loss or inactivation may lead to cancer.

Tumor suppressor gene Gene that appears to prevent formation of a cancer. Loss of function mutations in such genes enhance susceptibility to cancer.

Tumor-associated antigens Membrane components that are found only in malignant cells. Identification of tumor-associated antigens that are specific for particular types of tumors would provide a good method for the early detection of cancer.

Tumorigenesis The mechanism of tumor formation.

Tumor-specific transplantation antigens, TSTA, tumor rejection antigens Tumors transplanted into syngeneic recipients can grow progressively or can be rejected through T-cell recognition of tumor-specific transplantation antigens (TSTA) or tumor rejection antigens. TSTA are peptides of mutant or overexpressed cellular proteins bound to MHC class I molecules on the tumor cell surface.

TUNEL assay The **TUNEL assay** (TdT-dependent dUTP-biotin nick end labeling) identifies apoptotic cells *in situ* by the characteristic fragmentation of their DNA. Biotin-tagged dUTP added to the free 3' ends of the DNA fragments by the enzyme TdT can be detected by immunohistochemical staining with enzyme-linked streptavidin.

Turbidity A cloudy appearance in a culture tube indicating the presence of microorganisms.

Turgid In botany, the word turgid is used to refer to a plant with swollen tissues which are filled with moisture.

Turgor Pressure The outward pressure exerted by the water in the plant cells, which adds to the rigidity of these cells, is known as the turgor pressure.

Turner's syndrome Genetic disorder characterized by an XO karyotype, outwardly female phenotype, and various anomalies including sterility and growth retardation.

- Turnover number** Number of moles of substrate converted to product per mole of enzyme per unit time. Another term for catalytic rate constant, *k*_{cat}.
- Turtle** A reptile belonging to the Testudines species, which include aquatic animals. The trunk of these species is enclosed in a shell. Belongs to the order *Chelonea*.
- Tus** The protein that binds to a bacterial terminator sequence and mediates termination of genome replication.
- Twintron** A composite structure made up of two or more Group II or Group III introns embedded in each other.
- Twist (T)** With respect to a DNA double helix, the total number of times the two strands of the helix cross over each other, excluding writhing. It is a measure of how tightly the helix is wound.
- Two-dimensional gel electrophoresis** In two-dimensional gel electrophoresis, proteins are separated by isoelectric focusing in one dimension, followed by SDS-PAGE on a slab gel at right-angles to the first dimension. This can separate and identify large numbers of distinct proteins.
- Two-hybrid system** Technique for identifying interacting proteins using genetically engineered yeast cells.
- Tylosis** The tylosis is the process wherein an outgrowth from a parenchyma cell, through the pit cavity into a vessel, leads to the blockage of the vessel.
- Tympanic Membrane** It is the membrane which picks up vibrations through a medium and transmits them to the inner part of the ear. It is also called the 'eardrum'.
- Type 0 cap** The basic cap structure, consisting of 7-methylguanosine attached to the 5' end of an mRNA.
- Type 1 cap** A cap structure comprising the basic 5'-terminal cap plus an additional methylation of the ribose the second nucleotide.
- Type 2 cap** A cap structure comprising the basic 5'-terminal cap plus methylation of the riboses of the second and third nucleotides.
- Type A RNA viruses** A small group of virus like particles that have not been shown to be infectious, have not been found outside the confines of cells, and have not been shown to be oncogenic. They are encapsulated by a protein shell rather than by a lipid-containing membrane. Type A particles found in cellular cytoplasm are believed to be immature forms of Type B RNA viruses, to which they are immunologically similar; those found in cisternae (reservoirs for lymph and other body fluids) are suspected to be immature Type C RNA viruses.
- Type B RNA viruses** A family of RNA viruses whose principal member is the mouse mammary tumor virus. They are very similar to type C RNA viruses, differing primarily in the size of internal proteins (and thus the size of the core) and in the size and spacing of glycoprotein spikes on the surface of the viral envelope.
- Type C RNA viruses** The largest family of animal tumor viruses. Most type C RNA viruses are oncogenic, causing mainly leukemias, lymphomas and sarcomas in a variety of species. They are larger than most other RNA viruses: their genome has a mass of about 12×10^6 daltons. They also contain more species of proteins-most important, an RNA-directed DNA polymerase- and nucleic acids. Type A, B and C RNA viruses are thought to replicate in the nucleus of a cell, unlike most other RNA viruses, which replicate in the cytoplasm.
- Type I hypersensitivity reactions, type II hypersensitivity reactions, type III hypersensitivity reactions, type IV hypersensitivity reactions** Hypersensitivity reactions are classified by mechanism: **type I**

hypersensitivity reactions involve IgE antibody triggering of mast cells; **type II hypersensitivity reactions** involve IgG antibodies against cell surface or matrix antigens; **type III hypersensitivity reactions** involve antigen:antibody complexes; and **type IV hypersensitivity reactions** are T cell-mediated.

Type III secretion system A bacterial system for delivering toxic proteins into the cells of their host.

Type Specimen An organism which is used to represent a particular taxon. It becomes the standard for the original name and to describe the species.

Type strain Original reference strain of a bacterial species, descendants of a single isolation in pure culture.

Typhoid fever An epidemic enteric infection caused by *Salmonella typhi*; uncommon in areas with good sanitation.

Typhoidal tularemia Septicemia that resembles typhoid fever, caused by bacteria from tularemia lesions.

Typhus fever Rickettsial disease that occurs in a variety of forms including epidemic, endemic (murine) and scrub typhus.

Tyrocidin An antibacterial agent that disrupts cell membranes.

Tyrosine kinase A **tyrosine kinase** is an enzyme that specifically phosphorylates tyrosine residues in proteins. They are critical in T- and B-cell activation. The kinases that are critical for B-cell activation are Blk, Fyn, Lyn, and Syk. The tyrosine kinases that are critical for T-cell activation are called Lck, Fyn, and ZAP-70

Tyrosine kinase Enzyme that phosphorylates on tyrosine residues in proteins by transferring a phosphate group from ATP.

TΨC arm A conserved stem-loop structure in a tRNA molecule that usually contains the sequence TΨC, where Ψ is pseudouridine.

ϕ structure The appearance of a circular DNA molecule undergoing replication by the progressive separation of its two strands.

Ubiquinones -Low molecular weight, nonprotein carriers in the electron transport chain.

Ubiquitin Small, highly conserved protein present in all eukaryotic cells that becomes covalently attached to lysine of other proteins. Attachment of a short chain of ubiquitins to such a lysine tags a protein for intracellular proteolytic destruction by a proteasome, A 76-amino-acid protein which when attached to a second protein acts as a tag

Ubiquitin ligase Any one of a large number of enzymes that attach ubiquitin to a protein, thus making it for destruction in a proteasome. The process catalyzed by a ubiquitin ligase is called ubiquitylation..

UDP-N-acetylglucosamine (UDPNAc) -A compound necessary for the biosynthesis of peptidoglycan.

Ulceroglandular referring to the form of tularemia caused by entry of *Franciscella tularensis* through the skin and characterized by ulcers on the skin and enlarged regional lymph nodes

Ultra high temperature processing a method of sterilizing milk and dairy products by raising the temperature to 87.8°C for 3 seconds

Ultrafiltration The technique of filtering a solution under pressure through a semi permeable membrane which allows water and small solutes to pass through but retains macromolecules

Ultra-high-temperature (UHT) treatment -Treatment of food with high temperatures (140-150 °C) for very short times to make the food sterile so that it can be stored at room temperature.
Ultrastructure- Fine detail not seen with a compound light microscope.

Ultraviolet (UV) radiation- Radiation from 10 to 400 nm.

Uncoating process in which proteins coats of animal viruses that have entered cells are removed by proteolytic enzymes

Uncoating -The separation of viral nucleic acid from its protein coat.

Uncompetitive inhibition. A form of enzyme inhibition in which an inhibitor binds to the enzyme-substrate complex and thereby decreases its apparent K_M and its apparent V_{max} by the same factor.

Uncoupler. A substance that allows the proton gradient across a membrane to dissipate without ATP synthesis so that electron transport proceeds without oxidative phosphorylation.

Undulating membrane -A highly modified flagellum on some protozoa

Unequal crossing over: A recombination event that results in duplication of a segment of DNA

Unequal sister chromatid exchange: A recombination event that results in duplication of a

Unfolded protein response cellular response triggered by an accumulation of misfolded proteins in the endoplasmic reticulum. It involves increased transcription of ER chaperones and degradative enzyme

Uniporter. A transmembrane channel that transports a single molecule or ion. See also antiporter and symport.

Uniporter Carrier protein that transports a single solute from one side of the membrane to the other.

Unit factor: Mendel's term for a gene

Universal precautions a set of guide lines established by the CDC to reduce the risks of disease transmission in hospital and medical laboratory settings.

Unsaturated Describes a molecule that contains one or more double or triple carbon-carbon bonds, such as isoprene or benzene.

Unsaturated fatty acid a fatty acid that contain at least one double bond between adjacent carbon atoms,

Upper respiratory tract the nasal cavity, pharynx, larynx, trachea, bronchi and larger bronchioles

Upstream control element: A component of an RNA polymerase I promoter.

Upstream promoter element: Components of a eukaryotic promoter that lies upstream of the reaction

Upstream: Towards the 5' end of a polynucleotide.

Uracil- A pyrimidine nucleic acid base in RNA that pairs with adenine.

Urea Cycle. A catalytic cycle in which amino groups donated by ammonia and aspartate combine with a carbon atom from HCO_3^- to form urea for excretion and which provides the route for the elimination of nitrogen from protein degradation.

Ureaplasmas bacteria with unusual cell walls, requires sterols as nutrient

Urethrocystitis common term used to describe urinary tract infections involving the urethra and the bladder.

Uridine diphosphoglucose (UDPG) - Precursor for synthesis of glycogen

Urinary system body system that regulates the composition of body fluids and removes nitrogenous and other wastes from the body

U-RNA: A uracil-rich RNA molecule including the snRNAs and snoRNAs

Urogenital system body system that regulates the composition of body fluids and removes certain wastes from the body and enables the body to participate in sexual reproduction

Uronic acid. A sugar produced by oxidation of an aldose primary alcohol group to a carboxylic acid group.

Use dilution test a method of evaluating the antimicrobial properties of a chemical agent using standard preparation of certain test bacteria like using serial dilution

Uterine tube a tube that conveys ova from the ovaries to the uterus

Uterus the pear-shaped organ in which a fertilized ovum implants and develops

UvrABC endonuclease: A multienzyme complex involved in the short patch repair process of *Escherichia coli*

V factor (pronounced **factor five**) is a protein of the coagulation system, rarely referred to as **proaccelerin** or **labile factor**. In contrast to most other coagulation factors, it is not enzymatically active but functions as a cofactor. Deficiency leads to predisposition for hemorrhage, while some mutations (most notably factor V Leiden) predispose for thrombosis. **V gene segment** Gene segment encoding most of the variable region of the polypeptide chains of immunoglobulins and T cell receptor

V(D)J joining Recombination process in which gene segments are brought together to form a functional gene for a polypeptide chain of an immunoglobulin or T cell receptor

Vacuole Very large fluid-filled vesicle found in most plant and fungal cells, typically occupying more than a third of total volume, An intracellular inclusion, in eucaryotic cells, surrounded by a plasma membrane; in procaryotic cells, surrounded by a proteinaceous membrane and containing gas.

van der Waals attraction Type of (individually weak) noncovalent bond that is formed at close range between nonpolar atoms. : A particular type of attractive or repulsive noncovalent bond.

Variable region Region of an immunoglobulin light or heavy chain that differs from molecule to molecule; it comprises the antigenbinding site.

Vasodilation dilation of the capillary and venule walls during an acute inflammation, The increase in the internal diameter of a blood vessel that results from relaxation of smooth muscle within the wall of the vessel. This causes an increase in blood flow, but a decrease in systemic vascular resistance.

Variable number of tandem repeats(VNTR): A type of simple sequence length polymorphism comprising tandem copies of repeats that are a few tens of nucleotide in length. Also called a minisatellite.

- Vaccination-** The process of conferring immunity by administering a vaccine.
- Vaccine-** A preparation of killed, inactivated, or attenuated microorganisms or toxins to induce artificially acquired active immunity.
- Valence** The combining capacity of an atom or a molecule.
- Vancomycin** An antibiotic that inhibits cell wall synthesis, used in the prophylaxis and treatment of infections caused by Gram-positive bacteria
- Variolation** Early method of vaccination using infected material from a patient.
- Vasodilation** Dilation or enlargement of blood vessels.
- Vander Waals distance.** The Distances of closest approach between two non bonded atoms.
- Vander Waals forces.** The noncovalent associations between molecules that arise from the electrostatic interactions among permanent and/or induced dipoles.
- Variable arm.** A nonconserved region of a tRNA molecule that contains 3 to 21 nucleotides and that may include a base paired stem.
- Variable region.** The N-terminal portions of an antibody molecule where antigen binding occurs and which are characterized by high sequence variability.
- Variant.** A naturally occurring mutant form.
- van der waals radius (r)** The effective radius of an atom or a molecule that defines how close other atoms or molecules can approach; it is thus the effective radius for closest molecular packing
- VDRL test** A blood test for syphilis (VDRL stands for Venereal Disease Research Laboratory) that detects an antibody that is present in the bloodstream when a patient has syphilis..
- Vector** In cell biology, the DNA of an agent (virus or plasmid) used to transmit genetic material to a cell or organism, a self replicating carrier of DNA ;usually plasmid, bacteriophage or eukaryotic virus, an organism that transmits a disease-causing organism from one host to another, a plasmid or virus used in genetic engineering to insert genes into a cell
- Vesicle.** A fluid-filled sac enclosed by a membrane, Small, membrane-bounded, spherical organelle in the cytoplasm of a eukaryotic cell.
- Vegetal pole** The end at which most of the yolk is located in an animal egg. The end opposite the animal pole.
- Ventral** Situated toward the belly surface of an animal. or towards the underside of a wing or leaf
- Vesicular transport** Transport of proteins from one cellular compartment to another by means of membrane-bounded intermediaries such as vesicles or organelle fragments.
- Vegetation** a growth that forms on damaged heart valve surfaces in bacterial endocarditis,exposed collagen fibres elicit fibrin deposits, and transient bacteria attach to the fibrin

Vegetative cell a cell that is actively metabolizing nutrients

Vertical gene transfer genes pass from parent to offspring

Vertical transmission direct contact transmission of disease in which pathogens are passed from parent to offspring in an egg or sperm across the placenta

Vegetative cell : A nonreproductive cell; a cell that divides by mitosis

very low-density lipoprotein (VLDL) A type of lipoprotein particle that is manufactured in the liver and functions mainly to carry triacylglycerols from the liver to adipose and other tissues.

Vehicle transmission a non living carrier of an infectious agent from its reservoir to a susceptible host ,transmission of a pathogen to a large number of people by an inanimate reservoir.

Virulence gene Gene that contributes to an organism's ability to cause disease.

Virus An ultramicroscopic particle consisting of nucleic acid (RNA or DNA) enclosed in a protein coat and capable of replicating within a host cell and spreading from cell to cell. Many viruses cause disease.

Viral neutralisation the binding of antibodies to virus which is used in an immunological test to determine if a patient's serum contains virus

Viremia an infection in which viruses are transported in the blood but do not multiply in transit.

Viroid An infectious piece of "naked" RNA smaller than a virus and lacking a capsid that causes various plant diseases, it contains no genes.

Virusoid small, single-stranded RNA molecules usually 500 to 2000 nucleotides in length which lack genes required for their replication. They require a helper virus to replicate

Viral retroelement: A virus whose genome replication involves reverse transcriptase

Virulent bacteriophage: A bacteriophage that follows the lytic mode of infection.

Virusoid: An RNA molecule some 320-400 nucleotides in length which does not encode its own capsid proteins, instead moving from cell to cell within the capsid of a helper virus

Virulent bacteriophage: A bacteriophage that follows the lytic mode of infection.

Virusoid: An RNA molecule some 320-400 nucleotides in length which does not encode its own capsid proteins, instead moving from cell to cell within the capsid of a helper virus

Virion A single virus particle.

viruses Infectious entities that contain the nucleic acid to code for their own structure but that lack the enzymatic machinery of a cell; they replicate by invading a cell and using its machinery to express the viral genome. Most viruses consist of little but nucleic acid enclosed in a protein coat; some viruses also have an outer lipid-bilayer envelope.

Vibrio (1) A curved or comma-shaped bacterium (2) When written as a genus, refers to gram-negative, motile, facultatively anaerobic curved rods.

Viral hemagglutination The ability of certain viruses to cause agglutination of red blood cells in vitro.

Viral hemagglutination inhibition Antibodies against particular viruses prevent the viruses from agglutinating red blood cells in vitro.

Viremia The presence of viruses in the blood.

Virion A fully developed complete viral particle., The complete, infective form of a virus outside a host cell, with a core of RNA or DNA and a capsid.

Virulence The degree of pathogenicity of a microorganism.

Visible light] Radiation portion of the spectrum from 400 to 700 nm, which the human eye can see.

Vitamin. A metabolically required substance that cannot be synthesized by an animal and must therefore be obtained from the diet.

voltage-gated cation channel Type of ion channel found in the membranes of excitable cells (such as nerve cells and muscle) which opens in response to a shift in membrane potential past a threshold value, controlled by a change in membrane potential.

V Reaction velocity. Typically measured as the rate of appearance of product or Disappearance of reactant.

V_{MAX} Maximal velocity of an enzymatic reaction.

V₀ Initial velocity of an enzymatic reaction.

W Also known as writhing number. The number of energetically equivalent ways of arranging the components of a system.

'w' The thermodynamic term for the work done by a system on its surroundings. $E=W+H$ ($W=FxD$)

Walking pneumonia Also known as primary atypical pneumonia or mycoplasma pneumonia. It's a mild form of pneumonia with insidious onset.

Wandering macrophages A macrophage that leaves the blood and migrates to infected tissue.

Warburg effect The unexplained observation that many tumor cells rely on glycolysis for energy production to a much greater extent than do normal cells.

Warning Coloration Distinctive bold color patterns found on certain organisms, that works as a warning to predators. It is a survive strategy.

Wart Also called papilloma A growth on the skin and mucous membranes caused by infection

Wassermann test A complement fixation test used to diagnose syphilis.

Watch List A cooperative project of the National Audubon Society and Partners in Flight that keeps track of declining species those are not yet threatened or endangered.

Water content Water contained in a material expressed as the mass of water per unit mass of oven-dry material.

Water cycle Also called the hydrologic cycle. Process by which water is recycled through precipitation, ingestion by organisms, respiration and evaporation.

Water mold Also called Oomycota. A fungus like protist that produces flagellated asexual spores or zoospores and large, motile gametes.

Water of hydration The shell of relatively immobile water molecules that surrounds and interacts with a dissolved molecule.

Water Potential Also known as soil water potential. Amount of water that can be absorbed or released by a substance with respect to another substance is termed as water potential.

Water Vascular System A system of fluid filled tubes and ducts, that connects with the tube feet of most marine invertebrates. They help in functions of respiration, feeding, etc. (as in starfish)

Water-retention curve Graph showing soil-water content as a function of increasingly negative soil water potential.

Water-splitting (Photolysis) Phenomenon occurring in photosystem II of the process of photosynthesis, wherein water molecules split to release oxygen.

Watson-Crick base pair Also known as Hoogsteen base pair. A stable pairing of nucleotide bases, either adenine with thymine or guanine with cytosine that occurs in DNA and, to a lesser extent, in RNA.

Wattle A soft fleshy brightly colored appendage that hangs down from the throat or chin of certain birds.

Wave of advance A hypothesis which holds that the spread of agriculture into Europe was accompanied by a large scale movement of human populations.

Wavelength The distance between successive crests or troughs of a light wave. Denoted by λ measured in units of length meter.

Weak acid An acid that is only partially ionized in aqueous solution. A weak acid has a dissociation constant less than unity ($pK > 0$).

Weak promoter A promoter that directs relatively few productive initiations per unit time.

Weaning The period where the mother ceases to feed the young ones. This only refers to mammals.

Weanling A male or female horse that is between the ages of six months to one year.

Weathering All physical and chemical changes produced in rock by atmospheric agents.

Webbing According to telome theory of megaphyll origin, the lamina originated from parenchymatic cell production between the telomes.

Wee1 Protein kinase that phosphorylates and hence inactivates CDK1.

Wegener's granulomatosis Antibodies against the neutrophil granule proteinase-3 are formed in **Wegener's granulomatosis**, an autoimmune disease in which there is severe necrotizing

vasculitis. The presence of anti-neutrophil cytoplasmic antigen, or ANCA, helps in the diagnosis of this disease.

Weibel-Palade bodies **Weibel-Palade bodies** are granules within endothelial cells that contain P-selectin. Activation of the endothelial cell by mediators such as histamine and C5a leads to rapid translocation of P-selectin to the cell surface.

Weighted mean The sum of products of each value by its weight divided by the sum of weights.

West Nile fever Emerging viral disease new to U.S, transmitted by mosquitoes, causing seizures and encephalitis, lethal to crows.

Western blot A technique used to identify and locate proteins based on their ability to bind to specific antibodies.

Western blotting A mixture of proteins is separated, usually by gel electrophoresis and transferred by blotting to a nitrocellulose membrane; labeled antibodies are then used as probes to detect specific proteins.

Western equine encephalitis Type of viral encephalitis seen most often in the western United States; infects horses more frequently than humans.

Wet mount Microscopy technique in which a drop of fluid containing organisms (mostly living organisms) is placed on a slide.

Wetting agent A detergent solution often used with other chemical agents to penetrate fatty substances. Ex. anionic, cationic, amphoteric, and nonionic.

Wheal A small, burning or itching swelling on the skin, resulting from a skin test or a mosquito bite.

Wheal-and-flare reaction When small amounts of allergen are injected into the dermis of an allergic individual, a **wheal-and-flare reaction** is observed. This consists of a raised area of skin containing fluid and a spreading, red, itchy circular reaction.

Whey The liquid portion or waste product of milk resulting from bacterial enzyme addition or the fluid portion of milk that separates from curd.

Whiplash Flagellum Flagella featuring smooth surfaces are termed as whiplash flagellum.

Whipworm A worm that causes trichuriasis infestation by *Trichuris trichiura* in the intestine.

White blood cell (leucocyte) General name for all the nucleated blood cells lacking hemoglobin. Includes lymphocytes, neutrophils, eosinophils, basophils and monocytes.

White pulp The discrete areas of lymphoid tissue in the spleen are known as the **white pulp**.

White rot fungus Fungus that attacks lignin, along with cellulose, and hemicellulose, leading to a marked lightening of the infected wood.

Whitlow A herpetic lesion on a finger that can result from exposure to oral, ocular and probably genital herpes.

Whole-genome shotgun approach A genome sequencing strategy which combines random shotgun sequencing with a genome map, the latter is used to aid assembly of the master sequence.

Whooping cough Also known as pertussis. A highly contagious respiratory disease caused primarily by *Bordetella pertusis*.

Whorled Arrangement of three or more leaves, flowers or other plant structures positioned at a node.

Wide hybridization When individuals from two different species of the same genus or from two different genera are crossed.

Wild type A gene, cell or organism that displays the typical phenotype or genotype for the species and is therefore adopted as a standard.

Wild-type gene The form of a gene (allele) normally found in nature.

Wilms' tumor (also called embryonal carcinosarcoma) A malignant tumor arising in the kidney of children. It contains elements of both carcinomas and sarcomas.

Wilting point Also known as permanent wilting point.

Wing-Bar A line of color, usually contrasting across the middle, tip, or base of a bird's wing, which has been made by the wing coverts.

Winged helix-turn-helix A type of DNA-bonding domain.

Wing-Flicking Rapid movement made by the bird's wings when it is not in flight and is at rest.

Winogradsky column Glass column with an anaerobic lower zone and an aerobic upper zone, which allows growth of microorganisms under conditions similar to those found in nutrient-rich water and sediment.

Wiskott-Aldrich syndrome The **Wiskott-Aldrich syndrome** is characterized by defects in the cytoskeleton of cells due to a mutation in the protein WASP. Patients with this disease are highly susceptible to pyogenic bacteria.

Wobble (in tRNA binding) Flexibility in the base pairing between the 5' position of the anticodon and the 3' position of the codon.

Wobble hypothesis An explanation for the permissive tRNA-mRNA pairing at the third anticodon position that includes non-Watson-Crick base pairs. This allows many tRNAs to recognize two or three different degenerate codons.

Wood Secondary xylem produced in the stems of trees and other woody plants is called wood. Wood present in living trees perform the function of transferring water and nutrients to growing tissues.

Working Draft DNA Sequence Also known as Draft DNA Sequence.

Woronin body Spherical structure associated with the simple pore in the septa separating hyphal compartments of fungi in the phylum Ascomycota.

Wort The liquid extract from mash.

Wound botulism Rare form of botulism that occurs in deep wounds when tissue damage impairs circulation and creates anaerobic conditions in which *Clostridium botulinum* can multiply.

Writhe (W) With respect to a supercoiled DNA helix, the number of times the helix as a whole crosses over itself-that is, the number of superhelical turns that are present.

Writhing number (W) The number of turns that the duplex axis of a covalently closed circular double-helical DNA makes around the super helix axis. It is a measure of the DNA's superhelicity.

Wu and Kabat plot A **Wu and Kabat plot**, or variability plot, is generated from the amino acid sequences of related proteins by plotting the variability of the sequence against amino acid residue number. Variability is the number of different amino acids observed at a position divided by the frequency of the most common amino acid.

X factor : A precursor necessary to synthesize cytochromes.

Xendodiagnosis : Procedure involving the feeding of laboratory-reared triatomid bugs on patients suspected of having Chagas' disease; after several weeks, the faces of the bugs are checked for intermediate stages of *Trypanosoma cruzi*.

Xenograft : A tissue graft between animals of different species.

Xerophile : An organism adapted to growth at very low water potentials. These are extremophilic organisms that can grow and reproduce in conditions with a low availability of water, also known as water activity. Water activity (a_w) is a measure of the amount of water within a substrate an organism can use to support sexual growth. Xerophiles are often said to be "xerotolerant", meaning tolerant of dry conditions. They can survive in environments with water activity below 0.8. Endoliths and halophiles are often xerotolerant.

Zinc finger : A specialized protein motif involved in DNA recognition by some DNA-binding proteins; characterized by a single atom of zinc coordinated to four Lys residues or to two His and two Lys residues.

Zone of inhibition : The area of no bacterial growth around an antimicrobial agent in the disk-diffusion test.

Zooflagellates : Flagellate protozoa that do not have chlorophyll and are either holozoic, saprozoic, or symbiotic.

Zooglear mass : Jellylike matrix in which microorganisms may be embedded.

Zoonosis (pl. zoonoses) : A disease primarily occurs in wild and domestic animals which can be transmitted to humans. (e.g. tularemia).

Zoophilic : having an attraction to or preference for animals; *especially of an insect* : preferring animals to humans as a source of food.

Zoospore : A **zoospore** is a motile asexual spore that uses a flagellum for locomotion. Also called a swarm spore, these spores are created by some algae, bacteria and fungi to propagate themselves.

Zooxanthella : A symbiotic dinoflagellate found living symbiotically within cnidarians and other invertebrates.

Zwitterion : (a **zwitterion** "hybrid" and formerly called a **dipolar ion**) is a neutral molecule with a positive and a negative electrical charge (*n.b.* not dipoles) at different locations within that molecule. Zwitterions are sometimes also called **inner salts**

Zygomycetes :Group of fungi with nonseptate hyphae and spores produced within a sporangium.

Zygospore : A thick-walled sexual spore formed by the fusion of two gametangia in the Zygomycetes.

Example : Rhizopus.

Zygospore : Group of fungi with nonseptate hyphae and spores produced within a sporangium.

Zygote : The cell resulting from the fusion of male and female gametes; occur in the sexually reproducing organism. The original chromosome number ($2n$) is restored in the zygote.

Zymogen : An inactive precursor of an enzyme; for example, pepsinogen, the precursor of pepsin.

Zymogenous : Fermentation production. In environmental microbiology, the term refers to microorganisms, often transient or alien, that respond rapidly by enzyme production and growth when simple organic substrates become available.

Zoo. A **zoo** (short for **zoological park** or **zoological garden**, and also called a **menagerie**) is a facility in which animals are confined within enclosures, displayed to the public, and in which they may also be bred.

Zoo technology In zoos, the zoo keepers have a critical role in the care and welfare of the animals and as the animals' ambassadors to the public. As environmental and animal rights issues move to the forefront, zoos need keepers with technical expertise and a knowledge of science to provide the best animal care, educate the public and participate in regional, national and international cooperative programs. These programs are known as zootechnology.

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