

GLOSSARY



A grove of *Acacia* trees, from an Indian Plain

“Exactness cannot be established in the arguments unless it is first introduced into the definitions.”

–Henri Poincare

GLOSSARY

In studying any science, one must become familiar with its vocabulary. This involves acquiring a clear understanding of the technical terms of science. In general, these terms have been devised to enable scientists the world over to understand each other when discussing a structure, a process, a theory, or any other scientific method. Furthermore, the use of a scientific term often makes it possible to avoid lengthy descriptions and explanations. It is important, therefore, for a student/learner to make every effort to learn a new term the first time it is presented. If he does this, he will have made a major stride in learning the subject.

The technical names both in boldface and italics used in the text are defined in the glossary. However, some of the words, both boldfaced and italicized, in the text are not included here because they are sufficiently defined or otherwise understood as used in the text. The following glossary defines terms according to the way they are used in this book. In some cases, the terms have additional meanings which have also been provided.

A

Abaxial (*ab*^L = away) : Away from the axis

Abiotic : Something that is nonliving and never has been alive.

ABO blood group : A classification of blood which is based on natural variation in human blood types. There are 4 groups; A, B, AB and O, each classified by a particular combination of antigen(s) on the red blood cells (RBCs) and naturally-occurring antibodies in the blood plasma. The relative frequency of the 4 ABO groups (A, B, AB and O) differs widely between races. It is 41, 9, 4 and 46 in the same order for UK; 31, 28, 7 and 34 for China; and 57, 0, 0 and 43 for Australian aborigines. Antigens and antibodies of the same type cause agglutination when mixed, resulting in difficulties in blood transfusion. Although possessing no A or B antigens, group O individuals have an H-antigen, which is a precursor to the A and B types. H, A and B antigens are found also in human body secretions such as saliva and semen, often a useful fact in forensic tests. Inheritance of grouping is controlled by a single autosomal gene on chromosome 9 with 3 major alleles A, B and O (sometimes written as I^A, I^B and I^O). The 4 blood groups were mainly identified and named by Karl Landsteiner in 1901.

Abortion (*abortum*^L = miscarried) : The termination of pregnancy before the fetus reaches the stage of viability, which is approximately 20 to 28 weeks of gestation. Alternatively, the spontaneous or induced expulsion of a fetus before it becomes viable outside the uterus or womb.

Abscess (*abscessus*^L, from *ab* = away + *cedere* = to go) : A circumscribed collection of pus.

Abscissic acid (ABA) : A plant hormone (growth regulator) associated with water stress and the inhibition of growth; in ageing leaves, it is partly responsible for abscission (hence also called *abscisin*) and in buds and seeds, it causes induction of dormancy (hence also called *dormin*).

Abscission (*ab*^L = away + *scisso*^L = dividing) : In vascular plants, the detachment (or dropping) of leaves, flowers, fruits or stems at the end of a growing season, as the result of formation of a corky layer of young thin-walled cells, the abscission zone, at the base which rupture under stress, *e.g.*, wind.

Absorbance (A_λ) : A dimensionless number that indicates how well a solution of a substance absorbs light of a given wavelength. It is defined as the negative logarithm of the fraction of light of wavelength λ that passes through a sample of the solution; its value depends on the length of the light path, the concentration of the solution, and the extinction coefficient of the substance at that wavelength.

Absorption (*absorbere*^L = to swallow down) : The movement of water and of substances dissolved in water into a cell, tissue or organism.

Absorption spectrum : The range of photons that a given atom or molecule is capable of absorbing, depending on the electron energy levels available in the atom or molecule.

Accessory pigment : A pigment such as a carotenoid (β-carotene) or chlorophyll *b* that captures light energy and transfers it to chlorophyll *a*; an accessory pigment, in fact, increases the percentage of the photons of sunlight that are harvested.

Acetylcholine (ACh) : The most important of the numerous chemical neurotransmitters responsible for the passing of nerve impulses

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- across synaptic junctions. It is found both in the brain and in the peripheral nervous system.
- Acetylcholinesterase** : An enzyme found in cholinergic synapses and that removes the leftover acetylcholine from the synaptic cleft at the neuromuscular junction after the last impulse. It is one of the fastest acting enzymes in the vertebrate body.
- Acetyl-coenzyme A (Acetyl-CoA)** : A two-carbon water-soluble organic acid whose hydroxyl group has been replaced with coenzyme A; common to the metabolism of all major types of food, forming a step leading to the Krebs cycle.
- Acid** : Any substance that dissociates to form H⁺ ions (protons) when dissolved in water.
- Acidosis** : A body condition in which there is excessive acidity in body fluids, normally regulated by the kidney; opposite of *alkalosis*.
- Acquired immune deficiency syndrome (AIDS)** : An infectious and usually fatal human disease caused by a retrovirus, HIV, which attacks T-cells. The virus multiplies within and kills individual T-cells, until no T-cells remain, leaving the affected individual helpless in the face of microbial infections because his/her immune system is now incapable of putting a defense against them.
- Acridines** : A group of planar heterocyclic compounds that can intercalate between stacked bases in DNA and cause frameshift mutations.
- Acromegaly** (*acron*^G = tip, extremity + *megas*^G = big) : A chronic disease characterized by enlargement of extremities, *i.e.*, head, hands and feet; caused by oversecretion of the growth hormone by pituitary.
- Acropetal** (*acron*^G = apex) : (1) In the case of plant structures (*e.g.*, leaves and flowers), their production one after another from the base of the stem to the apex. (2) In the case of substances (*e.g.*, water), their movement from the base of a plant to the apex.
- Actin** (*actis*^G = ray) : One of the two major globular proteins that make up myofilaments in all eukaryotic cells (the other is myosin). It provides the cell with mechanical support and plays major roles in determining cell shape and cell movement. The monomeric form is sometimes called globular or G-actin; the polymeric form is filamentous or F-actin.
- Actinomycin D** : A substance that inhibits the transcription of RNA from DNA. When isolated from soil bacteria and used pharmaceutically, it acts as an antibiotic.
- Action spectrum** : The spectrum of light that elicits a particular response.
- Activation** : The process by which the regulatory protein binds to DNA and turns on the transcription of specific genes.
- Activation energy (ΔG^\ddagger)** : Extra energy that must be possessed by atoms or molecules in addition to their ground-state energy in order to undergo a particular chemical reaction. Activation energy can be applied externally as heat but this is inappropriate for living organisms. Instead, they rely on biological catalysts (enzymes) which decrease the activation energy needed for the reaction to take place.
- Active centre** : (1) The part of an enzyme molecule that interacts with and binds the substrate, forming an enzyme-substrate complex. (2) The part of an antibody molecule that interacts with and binds the antigen, forming an antibody/antigen complex.
- Active site** : An area of enzyme surface which has a shape complementary to a particular substrate, enabling the enzyme and substrate to become temporarily bonded to form an enzyme-substrate complex. It is often a cleft or pocket in the surface of the enzyme.
- Active transport** : The transport of a substance across a biological membrane by protein carrier molecules by a mechanism that can work against a concentration or electrochemical gradient (*i.e.*, to a region of higher concentration). It always requires the expenditure of cellular energy. Compare *facilitated transport*, *passive transport*.
- Adaptation** (*adaptare*^L = to fit) : Any peculiarity of structure, physiology, or behaviour that promotes the likelihood of an organism's survival and reproduction in a particular environment. Alternatively, the process by which organisms are modified to function in a given environment.
- Adaxial** (*ad*^L = toward) : Toward the axis or (in the case of a leaf) facing the stem.
- Addison's disease** (named after *Thomas Addison*, an English physician) : A disease caused by a deficiency of adrenocorticosteroid hormones, produced by the cortical cells of the adrenal gland; the major symptoms of the disease are lowered blood pressure, lowered blood-sugar levels, reduced kidney function, loss of weight, extreme muscular weakness and a brownish pigmentation of the skin and mucous membranes.
- Adenine** : An organic molecule composed of two

- carbon-nitrogen rings. It is a purine component of nucleic acids and nucleotides. Adenine always forms complementary base-pairing with thymine.
- Adenosine** : A nitrogen-containing compound consisting of an adenine base attached to a ribose sugar
- Adenosine phosphates** : A group of organic phosphates including adenosine monophosphate (AMP), adenosine diphosphate (ADP) and adenosine triphosphate (ATP). They function in phosphate transfer in the cell, particularly in the transfer of the high-energy phosphate bonds of ADP and ATP. ATP is the most directly utilizable source of energy of the cell.
- Adenylation** : In cells; the transfer of an adenyl moiety from ATP to another molecule. Some enzymes are regulated by reversible adenylation.
- Adenyl cyclase** : An enzyme which catalyzes the formation of cyclic AMP from ATP by the removal of pyrophosphate.
- Adhesion** (*adhaerere*^L = to stick to) : The molecular attraction exerted between the surfaces of unlike bodies in contact, as in water molecules to the walls of the narrow tubes that occur in plants.
- Adipocyte** : A fat cell; cell that is specialized for storing triacylglycerols and for releasing them to the blood in the form of fatty acids and glycerol as required.
- Adipose tissue** : A fatty connective tissue, the matrix of which contains large, closely-packed, fat-filled cells; occurs either round the liver and kidneys where it stores energy, or in the dermis of the skin where it stimulates the body from heat loss.
- Adrenal gland** : An endocrine organ consisting of a central medulla which secretes adrenaline and noradrenaline, and an outer cortex which secretes adrenal cortical hormones called corticosteroids. The two parts are closely associated in mammals, but are sometimes separated into distinct organs in other vertebrates, *e.g.*, fish. In mammals there is a pair of adrenal glands situated anteriorly to the kidneys, other vertebrates have more than two adrenals.
- Adrenalin** (*ad*^L = above; *renal* = kidney) : Hormone released by chromaffin cells (in the medulla of adrenal gland) and by some neurons in response to stress. It prepares the body for emergency action leading to “fight or flight” responses, which include increased heart rate, blood pressure and blood sugar levels, widening of the pupils, and erection of the hair.
- Adrenocorticotrophic hormone (ACTH)** : A small protein hormone secreted by anterior lobe of the hypophysis; controls the secretion of other hormones of the adrenal cortex.
- Adsorption** : The adhesion (attachment), in a very thin layer, of the molecules of gases, dissolved substances, or liquids to the surfaces of solid bodies with which they are in contact. In physical adsorption, molecules are held by van der Waal’s forces of attraction; in chemical adsorption, there is exchange or sharing of electrons.
- Aerobe** : Any organism (typically a microorganism) requiring free oxygen for respiration and life.
- Aerobic** (*aer*^G = air + *bios*^G = life) : Oxygen requiring.
- Aerobic pathway** : A metabolic pathway, at least one step of which is an oxidation/reduction reaction that depends on oxygen gas as an electron acceptor. It includes the citric acid cycle and pyruvate oxidation.
- Aerobic respiration** : A type of cellular respiration that requires oxygen. Glucose is broken down to release energy in a series of steps.
- Agar** : A gelatinous polysaccharide which, on forming a gel with water and allowed to solidify, is used extensively as a culture medium for the growth of bacteria and fungi; derived from certain red algae (*Gelidium*, *Gracilaria*, *Gigartina*, *Ahnfeltia*).
- Agglutination** : A clumping together of cells, usually as a result of reaction between specific antigens and antibodies in blood and lymph, forming a natural defence against foreign materials, including bacterial cells.
- Aglycon** : The nonsugar part of a glycoside.
- Albinism** : The inability to produce melanin. Albinism is a recessive mutation, but mutations in several different genes can result in this phenotype.
- Albumin** (*albus*^L = white) : A protein constituent of blood, sometimes found in the urine.
- Aldose** : A simple monosaccharide in which the carbonyl group comes at the end of the chain and thus represents an aldehyde group, *e.g.*, glucose; compare *ketose*.
- Aleurone** : A proteinaceous material in the form of small grains found in the outer layer of the endosperm of many grains. Aleurone releases large quantities of hydrolytic enzymes (amylases, proteases, nucleases) for digestion of the endosperm by the growing embryo.

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- Alkaloid** : A small but complex organic substance in which at least one nitrogen is part of a ring, having strong basic properties and produced in some families of plants (*e.g.*, Papaveraceae) as a defense against herbivores. Examples include caffeine, nicotine, cocaine, morphine, colchicine, quinine and strychnine.
- Alkalosis** : A body condition in which there is excessive alkalinity in body fluids; opposite of *acidosis*.
- Alkane** : A compound of carbon and hydrogen that has only single covalent bonds, *e.g.*, ethane ($\text{CH}_3\text{--CH}_3$).
- Alkene** : A hydrocarbon with one or more carbon-carbon double bonds, *e.g.*, ethylene ($\text{CH}_2=\text{CH}_2$).
- Alkyl group** : General term for a group of covalently-linked carbon and hydrogen atoms, such as methyl ($-\text{CH}_3$) or ethyl ($-\text{CH}_2\text{CH}_3$) groups. These groups can be formed by removing a hydrogen atom from an alkane.
- Allantoin** : A heterocyclic end product of purine catabolism in some reptiles, and mammals other than primates.
- Allele** (originally *allelomorph*, *allelon*^G = of one another) : Either of a pair of contrasting Mendelian characters such as round peas and wrinkled peas; also applied to one of the two or more differing forms (or mutants) of the same gene. In a diploid cell, each gene will have normally two alleles, each occupying the same position (locus) on homologous chromosomes. Alleles are detected only when the differences in phenotype can be detected.
- Allele frequency** : The relative proportion of a particular allele among individuals of a population. In other words, the total set of alleles of a given gene. Not equivalent to *gene frequency*, although the two terms are sometimes confused.
- Allergen** : Any antigenic substance that initiates a strong immune response in a particular individual.
- Allergy** : The overreaction of the immune response of the body to minute traces of foreign substances (antigens). The reaction is usually visible in the form of rashes, itching, breathing difficulties etc.
- Allosteric interaction** (*allos*^G = other + *stereos*^G = shape) : The change in shape that occurs when an activator or inhibitor binds to an enzyme. These changes result when specific, small molecules bind to the enzyme, molecules that are not substrates of that enzyme.
- Allozyme** : Distinct allelic forms of an enzyme that can be physically separated by electrophoresis.
- Alpha-cell (α -cell)** : A cell in the islets of Langerhans that produces the hormone glucagon, which causes liver cells to release stored glucose and fat cells to break down triglycerides.
- Alpha-helix (α -helix)** : Common structural motif of proteins in which a linear sequence of amino acids folds into a right-handed helix, which are stabilized by internal hydrogen bonds between backbone atoms.
- Alzheimer's disease** : A type of dementia seen in the elderly, probably resulting from a deficiency of acetylcholine, which leads to degeneration and death of neurons.
- Amide** : Molecule containing a carbonyl group linked to an amine. Adjacent amino acids in a protein molecule are linked by amide groups.
- Amino acids** (*Ammon*^G, referring to the Egyptian sun god, near whose temple ammonium salts were first prepared from camel dung) : Organic molecules containing both an amino group(s) and a carboxyl group(s). Those that serve as building blocks of proteins are alpha-amino acids, since both the amino and carboxyl groups are linked to the same carbon atom. They have the general formula, $\text{R--CHNH}_2\text{--COOH}$. They are amphoteric, *i.e.*, act as acids or bases, if the pH is shifted.
- Amniocentesis** : A technique for genetic testing of a fetus by isolating fetal cells from amniotic fluid. Amniocentesis is often used for determining the fetal karyotype.
- Amino group** : A weakly basic functional group derived from ammonia (NH_3) in which one or more hydrogen atoms are replaced by another atom. In aqueous solution, it can accept a proton and carry a positive charge.
- Aminoacyl-transfer RNA (aa-tRNA)** : The molecule produced when an amino acid is activated into its amino-acyl form and attached to its specific transfer-RNA molecule, the whole process being catalyzed by a specific aminoacyl-tRNA synthetase enzyme.
- Aminopeptidase** : An enzyme that catalyzes the sequential hydrolysis of amino acids in a polypeptide chain from the N-terminal.
- Amino terminus (N-terminus)** : The end of a polypeptide chain that carries a free or unreacted amino group. A ribosome synthesizes a polypeptide in the direction from N-terminus to C-terminus.

- Aminotransferases** : Enzymes that catalyze the transfer of amino groups from α -amino to α -keto acids; also called *transaminases*.
- Amphipathic** : For a molecule, the property of having both hydrophilic and hydrophobic proteins. Usually one end or side of the molecule is hydrophilic and the other end or side is hydrophobic.
- Ampholyte** : A substance whose molecules have both acidic and basic groups.
- Amphoteric** : A chemical that can act both as an acid and as a base, *e.g.*, amino acids.
- Amylase** (*amylon*^G = starch + *-ase* = enzyme suffix) : A digestive enzyme that breaks up starches and other carbohydrates into sugars; found in the saliva of most mammals; the amount of amylase can also vary, being high when meat is eaten; previously called *ptyalin*.
- Amylopectin** : A highly branched polymer of more than 50,000 molecules of alpha-glucose; forms a major (80 – 85%) component of natural starches.
- Amylose** : An unbranched (or linear) polymer of up to 50,000 molecules of alpha-glucose; forms a minor (15 – 20%) component of natural starches.
- Anabolism** (*ana*^G = up + *bolein*^G = to throw) : A constructive process in which complex molecules are synthesized from simpler ones; consumes rather than produce cellular energy; includes processes such as photosynthesis and assimilation; opposite of *catabolism*.
- Anaemia** : (*an*^G = not + *haima*^G = blood) A deficiency in the number of red blood cells, their volume, or the hemoglobin content.
- Anaerobe** : An organism capable of living in the absence of free oxygen.
- Anaerobic** (*an*^G = without + *aer*^G = air + *bios*^G = life) : Any process that can occur in the absence of air or, more precisely, without molecular oxygen, *e.g.*, glycolysis and fermentation.
- Anaesthesia** (*an*^G = not + *aisthesis*^G = sensation) : Insensibility
- Analgesic** : A substance reducing pain without causing unconsciousness.
- Analogy** : In comparative anatomy, the relationship of different structures serving similar functions, for example, gills and lungs, both means of respiration.
- Angiosperm** (*angein*^G = vessel + *sperma*^G = seed) : Any plant whose seeds are born in a fruit; an informal name for flowering plant (Division – Anthophyta or Magnoliophyta)
- Angström** (named in honour of *Anders J. Angström*, a spectroscopist) : A unit used for measuring lengths shorter than 100 Å such as those of atoms and molecules (nanometer, nm is used for longer dimensions); 1 Å = 10⁻¹⁰ meter or 10⁻⁸ centimeter or 0.1 nanometer.
- Anion** (*aiion*^G = to go up) : A negatively charged ion that is attracted to the anode during electrolysis.
- Annual** (*annus*^L = year) : A plant that germinates from seed, grows to maturity and produces new seed all within one year or growing season. Since the life cycle duration is so short, annuals are usually herbaceous rather than woody, *e.g.*, *Capsella* and groundsel.
- Anorexia** (*an*^G = not + *orexis*^G = appetite) : Loss of appetite
- Antagonism** : (1) The inhibiting or nullifying action of one substance or organism on another, *e.g.*, the antibiotic effect of penicillin. (2) The normal opposition between certain muscles.
- Anterior** (*ante*^L = before) : Situated before or toward the front. In animals, the head end of an organism.
- Anthocyanin** : Any red or blue water-soluble pigment that is a flavonoid; they are the primary pigments of red and blue plant parts (*e.g.*, flowers, fruits and leaves).
- Antibiotic** : The naturally occurring or synthetic product of a living organism (usually a microbe) that inhibits the growth of another organism (usually another microbe), *e.g.*, penicillin or streptomycin. *Unfortunately, most antibiotics are not lethal to viruses.*
- Antibody** (*anti*^G = against) : A highly specific protein produced in the blood by B lymphocytes in response to a foreign molecule (antigen) and released into the bloodstream. Often binds to the foreign molecule or cell extremely tightly, thereby inactivating it or marking it for destruction by phagocytosis or complement-induced lysis. Each antibody protein is composed of 4 subunits, two heavy chains and two light chains.
- Anticoagulant** : A substance that hinders agglutination or clotting of blood cells.
- Anticodon** : A three-nucleotide sequence at the end of a transfer RNA (tRNA) molecule, that is complementary to the three-nucleotide codon on a messenger RNA (mRNA) molecule; the anticodon is matched to a specific amino acid that is covalently attached to the tRNA molecule.

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- Antidiuretic hormone (ADH)** : See **vasopressin**.
- Antigen** (*anti*^G = against + *genos*^G = origin) : A large, foreign molecule (such as a protein or polysaccharide) that stimulates its host lymphocytes to proliferate and secrete specific antibodies that bind to the foreign molecule, labelling it as foreign and destined for destruction.
- Antimetabolite** : A substance that is a structural analogue of a normal metabolite or otherwise resembles it and that interferes with the utilization of the metabolite by the cell.
- Antiparallel** : Refers to double-stranded DNA, in which the direction of each strand is opposite to its complementary strand.
- Antiport** : Membrane carrier protein that transports two different ions or small molecules across a membrane in opposite directions, either simultaneously or sequentially. *Compare symport*.
- Antisense strand** : In DNA, the antisense strand of a gene is the one that does not contain a coding sequence for a molecule of RNA; the antisense strand is not transcribed.
- Antiseptic** : A substance that prevents infection in a wound. *Antisepsis* is carried out by disinfection or sterilization using nontoxic, noninjurious substances, and has the effect of killing or inactivating microbes which cause infection.
- Antiserum** : Serum that contains a high concentration of antibodies against a particular antigen.
- Antithetic theory** : A theory of the alternation of generations that visualizes a gradual decrease in gametophyte and increase in sporophyte as parts of the life cycle of most plants. In fact, it is the theory of an increase in importance of one generation at the expense of another.
- Antitoxin** : Antibody molecule that unites specifically with toxin molecule to neutralize it.
- Anuria** (*an*^G = not + *ouron*^G = urine) : Failure to secrete urine
- Amyloplast** (*amylon*^G = starch + *plastos*^G = formed) : A type of plant organelle found particularly in storage organs such as the potato tuber; stores starch in a unit membrane.
- Apical** : Describes the tip of a cell, a structure, or an organ. The apical surface of an epithelial cell is the exposed free surface, opposite to the basal surface. The basal surface rests on the basal lamina that separates the epithelium from other tissue.
- Apical dominance** : The influence exerted by a terminal bud in suppressing the growth of lateral buds.
- Apical meristem** (*apex*^L = top + *meristos*^G = divided) : A region of active cell division that occurs at or near the tips of the plant axis (*i.e.*, root and shoot apices in a vascular plant).
- Apoenzyme** : The basic or protein part of a holoenzyme.
- Aqueous** : Pertaining to water, as in an aqueous solution.
- Aromatic** : Refers to a molecule that contains carbon atoms in a ring, linked through alternating single and double bonds. Often a molecule related to benzene.
- Arthritis** (*arthron*^G = joint + *-itis* = inflammation) : Inflammation of a joint.
- Ascorbic acid (C₆H₈O₆)** : A water-soluble vitamin, designated as vitamin C; not as widely distributed as other vitamins: among plants, it is present in all fresh fruits and vegetables, and acerola fruit (*Malpighia punctifolia*) being the richest source and among animals, it occurs in liver, adrenals, thymus etc and absent from fish, fats and oils; a colourless, odourless crystalline substance, slightly sour in taste and is easily oxidizable and hence a powerful reducing agent; functions in the biosynthesis of the adrenal steroid hormones and of collagen, also plays a key role in tyrosine metabolism. Avitaminosis C leads to scurvy, a disease characterized by petechial hemorrhages in the skin, mucous membrane and degenerative changes in the cartilage and bone matrices; ascorbic acid acts as a vitamin in man but rats and most other mammals can synthesize their own supply from D-glucose; also called *antiscorbutic factor* or *cevitamin*.
- Asphyxia** (*a*^G = not + *sphysis*^G = pulse) : Suffocation, lack of oxygen.
- Aspirin** : An analgesic that relieves pain without loss of consciousness; chemically known as acetylsalicylic acid.
- Assimilation** : The transformation of food into the living substance, protoplasm.
- Association constant (K_a)** : Measure of the association of a complex. For the binding equilibrium $A + B \rightleftharpoons AB$, the association constant is given by $[AB]/[A][B]$, and it is larger the tighter the binding between A and B.
- Asthenia** (*a*^G = not + *sthenos*^G = strength) : Loss of strength
- Atom** (*atomos*^G = indivisible) : A core (nucleus) of protons and neutrons surrounded by an orbiting cloud of electrons. The chemical behaviour of an atom is largely determined by the distribution of its electrons, particularly the number of electrons in the outermost shell. Alternatively,

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- an atom may also be defined as a unit of an element that cannot be further subdivided without losing the quality of an element.
- Atomic mass** : The atomic mass of an element consists of the combined weight of all its protons and neutrons.
- Atomic number** : It is the number of protons in the nucleus of an atom. In an atom that does not bear an electric charge (that is, one that is not an ion), the atomic number is also equal to the number of electrons.
- Atomic weight** : It is the sum of the relative weights of the protons, neutrons, and electrons of an atom.
- ATP phosphohydrolase (ATPase)** : One of a large class of enzymes that catalyze a process involving the hydrolysis of ATP. The energy so released is used to actively transport ions or other solutes against their concentration gradient.
- ATP synthase** : Enzyme complex in the inner membrane of the mitochondrion and the thylakoid membrane of a chloroplast that catalyzes the formation of ATP from ADP and inorganic phosphate during oxidative phosphorylation and photosynthesis, respectively. Also present in plasma membrane of bacteria.
- Atrophy** (a^G = not + $trophe^G$ = nourishment) : Wasting or the reduction in size of an organism or tissue mass, often after disuse.
- Autocatalysis** : A reaction that is catalyzed by one of its products, creating a positive feedback (self-amplifying) effect on the reaction rate.
- Autoclave** : (1) A strong metallic vessel, gastight when closed, using steam under pressure at temperatures in excess of 100°C for sterilization. (2) A sealed vessel in which chemical reactions can occur at high pressure.
- Autolysis** : The breakdown of tissues, usually after death, by their own enzymes.
- Autoradiography** : A technique in which a radioactive object produces an image of itself on a photographic film. The image is called an autoradiograph or autoradiogram.
- Autosome** ($autos^G$ = self + $soma^G$ = body) : A chromosome not directly involved in determination of sex.
- Autotroph** ($autos^G$ = self + $trophikos^G$ = food) : An organism that produces its own food, usually by photosynthesis; *virtually all plants are autotrophs*. Compare *heterotroph*.
- Auxin** ($auxein^G$ = to grow) : A plant hormone (growth regulator) that controls cell elongation, among other effects. Of the various auxins, indole-3-acetic acid (IAA) is the most commonly-used auxin.
- Axil** ($axilla^L$ = armpit) : The upper angle between a branch or leaf and the stem from which it arises.

B

- B-DNA** : The naturally-occurring form of DNA duplexes *in vivo*, that is the same as the model proposed by by Watson and Crick in 1953.
- B lymphocyte** : A type of lymphocyte that recognizes invading pathogens much as T-cells do but instead of attacking the pathogens directly, it marks them for destruction by the nonspecific body defenses; also called as *B cell*.
- Bacillus, plural bacilli** ($baculus^L$ = rod) : A straight or rod-shaped bacterium; for example, *Bacillus subtilis*.
- Bactericide** : A substance causing death to bacteria; for example, an antibiotic.
- Bacteriophage** ($bakterion^G$ = little rod + $phagein^G$ = to eat) : A type of virus that infects and destroys bacterial cells and often replicate within them; extensively used in virus and DNA studies. Also called a *phage*.
- Bacterium, plural bacteria** ($bakterion^G$, diminutive of $baktron^G$ = a staff) : The simplest cellular organism. Its cells are smaller and prokaryotic in nature, and they lack internal organization.
- Bar** : A unit of pressure; one bar is the atmospheric pressure of air at sea level and room temperature.
- Barbiturate** : Any ureide such as amytal, seconal, phenobarbital etc; have depressant effect on the central nervous system (CNS), usually producing sleep.
- Bark** : All the tissues of a stem or root, exterior to the vascular cambium.
- Basal** : Situated near the base. The basal surface of a cell is opposite the apical surface.
- Basal metabolic rate (BMR)** : The minimal rate of metabolism in a resting organism in an environment with a temperature the same as its own body heat, whilst not digesting or absorbing food. The rate is commonly expressed in terms of energy per unit surface area per unit time, usually as $\text{kJm}^{-2}\text{h}^{-1}$; also called *basal metabolic level (BML)*.
- Base** : Any substance that combines with H^+ ions (protons) present in a solution and thereby increasing the number of hydroxyl ions.

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- Base pair (bp)** : Two nucleotides in a DNA or an RNA molecule that are paired by hydrogen bonds, for example, G pairs with C, and A pairs with T or U.
- Basipetal** : (1) In the case of plant structures (*e.g.*, stem), their production one after the other from the apex down to the base, so that the oldest are at the apex. (2) In the case of substances (*e.g.*, auxins), their movement away from the apex to lower parts of the plant.
- Basophil** : A white blood cell containing granules that rupture and release histamine that enhances the inflammatory response; closely related to a mast cell and important in causing allergic responses.
- Batesian mimicry** (after *Henry W. Bates*, an English naturalist) : A situation in which a palatable or nontoxic organism resembles another kind of organism that is distasteful or toxic. Both species exhibit warning colouration.
- Benign** : Nonmalignant, as in a growth.
- Benzene** : An organic cyclic compound composed of a six-membered carbon ring having 3 double bonds; occurs as part of many biological molecules.
- Beriberi** (*beri*^{Singhalese} = weakness) : A human disease caused by vitamin B₁ (thiamine) deficiency; characterized by wasting of muscles, paralysis of the extremities, mental confusion and sometimes heart failure.
- Beta-carotene** : An orange pigment that is composed of 8 isoprene units; it occurs in most plants as an accessory pigment to photosynthesis; a precursor of vitamin A.
- Beta-cell (β-cell)** : A cell in the islets of Langerhans that secretes the hormone insulin when a person eats, storing glucose to be used later.
- Beta-oxidation (β-oxidation)** : A sequence of biochemical reactions that oxidize fatty acids into a series of two-carbon compounds that are converted to acetyl-CoA.
- Biennial** (*biennium*^L = a two-year period) : A plant that normally requires two years (*i.e.*, two growing seasons) to complete its life cycle and then dies usually it produces a rosette of leaves the first year, and flowers and undergoes fruiting the second year. Such plants are herbaceous rather than woody, *e.g.*, *Campanula* and carrot.
- Bile** : A thick brown-green fluid secreted by the liver which is alkaline in its reactions, containing bile salts, bile pigments, cholesterol and inorganic salts; contains no enzymes; the secretion of bile from the liver is stimulated by the hormone *secretin*.
- Bile pigments** : The pigments secreted in bile, bilirubin and biliverdin, which result from the breakdown of hemoglobin in red blood corpuscles, giving the bile its colouration which in turn affects the colour of the feces.
- Bile salts** : The sodium salts secreted in bile, sodium taurocholate and sodium glycocholate, which greatly lower surface tension and are important in emulsifying fats.
- Binomial system** (*bi*^L = twice + *nomos*^G = usage, Law) : A system of nomenclature that uses two words: the first word designates the genus (*generic* name), and the second word signifies the species (*specific* name). Both words are italicized or underlined, if handwritten.
- Bioassay** : A technique in which the presence of a chemical is quantified by using a part of or an entire living organism, rather by carrying out chemical analysis.
- Biochemical** : Organic and inorganic chemicals that occur in living organisms and are involved in the processes of life.
- Biodegradation** : The breaking down of inorganic and organic substances by biological action, a process usually involving bacteria and fungi, which are known as saprobionts when the substrate is biological.
- Biodeterioration** : The unwanted breakdown of materials such as foodstuffs, surface coatings, rubber, lubricants, by microorganisms, resulting in significant financial losses in many industries.
- Bioenergetics** : The energy relationships of living organisms.
- Biogenesis** (*bios*^G = life + *gen*^G = origin) : The production of organisms from other, parental organisms.
- Biological warfare** : The use of living organisms, particularly microbes, or their products, to induce illness or death in a population, usually during wartimes.
- Bioluminescence** : The emission of light from living organisms as a result of internal oxidative changes.
- Biomass** (*bios*^G = life + *maza*^G = lump or mass) : The collective dry weight of all the organisms in a population, area, or sample.

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Biopoiesis : The production of living from nonliving material.

Biosphere : The world of living organisms; the narrow zone, where land, water and atmosphere meet, that supports life.

Biota : The living organisms (both plants and animals) present in a specific region or area, ranging in size from a small.

Biotic : Pertaining to living organisms.

Biotin (C₁₀H₁₆O₃N₂S) : A water-soluble vitamin of the B-complex group and designated as vitamin B₇; has a wide range of distribution : yeast, liver, kidney, milk and molasses are among the richest sources; also occurs in nature in its combined form as *biocytin*; heat-stable and is resistant to both acids and alkalis; serves as a prosthetic group for many enzymes which bring about carboxylation and synthesis of fatty acids; a deficiency (rare in humans) of biotin causes dermatitis, and decrease in weight and edema; also called as *antiegg white injury factor* or *coenzyme R*.

Blanching : Treatment with heat for a short period of time to destroy cellular enzymes.

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 O₂ from hemoglobin in the tissues and the release of CO₂ from the blood to the air in the lungs.

Bolting : An unusual lengthening of plant stems, due to elongation of cells, which can be induced by a group of plant hormones called gibberellins, producing a stem with long internodes.

Bond : A force holding atoms together in a chemical compound; the principal types of bond are covalent, ionic, and hydrogen.

Bond energy : Strength of the chemical linkage between two atoms, measured by the energy in kilocalories or kilojoules needed to break it.

Bradycardia (*bradys*^G = slow + *kardia*^G = heart) : Slow action of the heart.

Bromellin : A protease obtained from ripe pineapples.

Brown fat : A special fat layer found between the neck and shoulders of some mammals, *e.g.*, bats and squirrels; brown fat is heavily vascularized and has many mitochondria, the latter giving it its brown colour due to the presence of mitochondrial cytochrome oxidase; enables the production of large amounts of heat, particularly after hibernation.

Buffer : A chemical substance which has the capacity to bond to H⁺ ions, removing them from solution when their concentration begins to rise and releasing H⁺ ions when their concentration begins to fall. In this way, buffers stabilize the pH of biological solutions and are thus important in maintaining homeostasis. As an example, hemoglobin maintains a stable pH in the erythrocyte.

C

Calciferol : Vitamin D₂, a fat-soluble antirachitic vitamin.

Calcitonin (*calcem*^L = lime) : A polypeptide hormone, secreted by both thyroid and parathyroid glands, that lowers the calcium content of the blood.

Callose : A complex carbohydrate in sieve tubes of sieve tube members; callose is especially abundant in injured sieve tubes.

Callus : A parenchymatous tissue formed as an overgrowth of a wound or in tissue culture.

Calmodulin : An ubiquitous protein that is activated when it binds to calcium ions (Ca²⁺); calmodulin activates enzymes in membranes; as much as 2% of the plasma membrane may be calmodulin.

Calorie, Cal (*calorie*^L = heat) : A unit of heat which is equal to 1,000 calories. One Calorie (capital "C") is the amount of energy in the form of heat required to raise the temperature of 1 kilogram of water by 1°C. A slice of apple pie contains about 365 Cal (Capital "C").

calorie, cal (*calorie*^L = heat) : Also a unit of heat which is equal to 1/1,000 = 0.001 Calories. One calorie (small "c") is the amount of heat energy required to raise the temperature of 1 gram (1 cm³) of water by 1°C. Used as a unit of energy content or output, but now largely superseded by the S.I. unit joule (1 cal = 4.12 J).

calvin cycle (after *Melvin Calvin*, an American chemist) : A major enzymatically-catalyzed metabolic pathway in which CO₂ is reduced to 3-phosphoglyceraldehyde (a C-3 compound) and the CO₂ acceptor (ribulose-1,5-bisphosphate) is regenerated.

Cancer : An unrestrained invasive cell growth. A tumour or cell mass resulting from uncontrollable cell division.

Cap : The altered 5' end of eukaryotic mRNA that includes a 7-methylguanosine.

Capsid : Protein coat of a virus, formed by the self-

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- assembly of one or more protein subunits into a geometrically regular structure.
- Carbohydrazase** : Any enzyme that catalyzes the hydrolysis of carbohydrates.
- Carbohydrate** : General term for sugars and related compounds containing carbon, hydrogen and oxygen, usually with the empirical formula $(\text{CH}_2\text{O})_n$.
- Carbon fixation** : A process by which green plants incorporate carbon atoms from atmospheric carbon dioxide into sugars. It is the second stage of photosynthesis.
- Carbonic anhydrase** : An enzyme that accelerates the reaction between CO_2 and water to form carbonic acid in the erythrocytes.
- Carbonyl group** : A pair of atoms consisting of a carbon atom linked to an oxygen atom by a double bond ($\text{C} = \text{O}$).
- Carboxyl group** : A carbon atom linked both to an oxygen atom by a double bond and to a hydroxyl group ($-\text{C} \begin{array}{l} \text{=O} \\ \text{OH} \end{array}$). Molecules containing a carboxyl group are weak (carboxylic) acids.
- Carboxyl terminus (C-terminus)** : The end of a polypeptide chain that carries a free or unreacted α -carbonyl group.
- Carboxylase** : An enzyme capable of splitting off CO_2 from the carboxyl group (COOH) of certain organic acids.
- Carcinogen** (*karkinos*^G = a crab, symbolizing cancerous growth + *-gen* = producing) : An agent, such as a chemical or a form of radiation, that causes cancer.
- Carcinoma** (*karkinos*^G = a crab) : A malignant growth from epithelial tissues that cover the body surface and line the intestine and other internal organs; the most common form of human cancer; carcinomas account for about 90% of malignant tumours.
- Carnitine** : A low-molecular-weight lysine derivative or betaine 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 shuffled back for reuse.
- Carotenoids** : A group of yellow/orange fat-soluble accessory pigments that are derived from 8 isoprene units linked together; subdivided into carotenes (orange) and xanthophylls (yellow); the most widespread carotenoid in plants is beta-carotene.
- Carotenols** : Any of a class of yellow plastid carotenoid pigments, differing from the carotenoids by having oxygen in the molecules; also called as *xanthophylls*.
- Carrageenan** : A slimy polysaccharide, consisting mostly of a specific mixture of α -galactose sulfates and found in certain red algae (*Chondrus*, for example); of economic importance as a gel, used as a food, and as a stabilizer in ice cream and other products; also spelt as *carrageenin*.
- Carrier protein** : Membrane transport protein that binds to a solute and transports it across the membrane by undergoing a series of conformational changes.
- Cartilage** : A form of connective tissue composed of cells (called chondrocytes) embedded in a matrix rich in type II collagen and chondroitin sulfate.
- Castration** (*castratus*^L = to prune) : The act of pruning in any of its senses.
- Catabolism** (*katabole*^G = throwing down) : A degradative process in which complex molecules are broken down into simpler ones; includes processes such as respiration and digestion; opposite of anabolism; also spelt as *katabolism*.
- Catalase** : An iron-containing enzyme found in tissues such as liver and potato tubers; catalyzes the breakdown of toxic hydrogen peroxide into water and oxygen and works by lowering (or reducing) the activation energy required from 80 kJ to 10 kJ; has a very high turnover number of about 6 million.
- Catalysis** (*katalysis*^G = dissolution + *lyein* = to loosen) : The enzyme-mediated process in which the subunits of polymers are held together and their bonds are stressed.
- Catalyst** (*kata*^G = down + *lysis* = a loosening) : A substance that changes the rate of a chemical reaction (usually accelerating it), without itself undergoing a change. Enzymes are biological catalysts and are proteinaceous in nature.
- Catecholamine** : Any catechol-derived compound (such as adrenalin or dopamine) which exerts an action similar to that of sympathetic nervous system; closely related to tyrosine and phenylalanine; chemically known as *dihydroxyphenylamines*.
- Cell** (*cella*^L = a chamber or small compartment) :

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- The basic organizational unit of all organisms; the smallest unit of life; composed of a nuclear region containing the hereditary apparatus within a larger volume called the cytoplasm, bounded by a lipid membrane.
- Cell cycle :** Reproductive cycle of the cell; the orderly sequence of events by which the cell duplicates its contents and divides into two.
- Cell membrane :** *See plasma membrane.*
- Cell plate :** A flattened membrane-bound structure that forms from the fusion of vesicles at the equator of the spindle apparatus during early telophase of mitosis in plants and some algae; when mature, the cell plate becomes the middle lamella.
- Cell sap :** The contents of a cell found within the vacuoles. It may include a variety of substances such as water, pigments, sugars, and inorganic substances.
- Cell theory :** The theory, now universally accepted, that organisms are cells or are composed principally of cells.
- Cell wall :** A mechanically strong extracellular matrix deposited by a cell outside its plasma membrane and is composed mainly of cellulose secreted by the protoplasm of the cell. It is prominent in most plants, bacteria, algae, and fungi. *Not present in most animal cells.*
- Cellobiase :** An enzyme facilitating the hydrolysis of cellobiose into glucose; one of the enzymes active in the digestion of cellulose.
- Cellobiose (C₁₂H₂₂O₁₁) :** A disaccharide consisting of two molecules of glucose; a hydrolytic product of cellulose.
- Cellulase :** An enzyme facilitating the hydrolysis of cellulose to cellobiose and ultimately to glucose; used particularly in the softening or digestion of plant cell walls; produced in large quantities in the abscission layer formed in leaf stalks of higher plants, causing a weakening of cell walls prior to leaf fall.
- Cellulose :** A complex carbohydrate (polysaccharide) found in the cell walls of plants; consists of long chains of covalently-linked glucose units; undoubtedly the most abundant of all biomolecules in the biosphere; although a chemically-inert material but provides tensile strength in plant cell walls.
- Central dogma of molecular genetics :** The hypothesis (based on Weismannism) that genetical information flows only in one direction, from DNA to RNA to protein, and not in the opposite direction; refers to how genes work to make proteins; each protein-coding gene is transcribed into a molecule of mRNA, which is translated into a sequence of amino acids that comprise a polypeptide (*i.e.*, a protein).
- Centripetal :** Developing from the outside toward the centre; said of an inflorescence in which the lower or outer flowers bloom first.
- Chaperone :** A protein that helps other proteins avoid misfolding pathways that produce inactive or aggregated states.
- Chargaff's equivalence rules** (after *Erwin Chargaff*, an American biochemist) : The observation that, in all natural DNA molecules, the amount of adenine is always equal to the amount of thymine, and the amount of guanine is always equal to the amount of cytosine.
- Chelate :** Combine reversibly, usually with high affinity, with a metal ion such as iron, calcium, or magnesium.
- Chelation :** The binding of a metal ion to an organic molecule from which it can later be released. The process enables plants to take up metal ions such as iron that are not readily available in free state.
- Chemical bond :** The force that holds atoms together in molecules.
- Chemiosmosis :** A biochemical process in which energy from electrons powers the movement of protons across the bacterial membrane, a process that leads to ATP formation. This cellular process is responsible for almost all of the ATP harvested from eaten food and for all the ATP produced by photosynthesis.
- Chemosynthesis :** A process by which a chemical source of energy, instead of light, is used by certain bacteria such as the hydrogen bacteria and the nitrifying bacteria, in making carbohydrates out of CO₂ and water.
- Chemotherapy :** The use of chemical substances to combat disease caused by microorganisms; the term is often extended to include cancer treatment by chemicals.
- Chiral** (*cheir*^G = hand) : 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 carbon with 4 different substituents) is called asymmetric or chiral atom or centre of chirality.
- Chitin :** A tough, horny, resistant, nitrogenous polymer of high molecular weight, commonly found in the exoskeleton of arthropods but occurring also in the cell walls of many fungi, and in a few other animals and protists.

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- Chloramphenicol (CAP)** : A bacteriostatic antibiotic produced by the ascomycetous fungus, *Streptomycin*; inhibits protein synthesis in a variety of organisms.
- Chlorophyll** : A light-absorbing green pigment found in chloroplasts; a methyl-phytol ester of the chlorophyllins; responsible for trapping light energy in the primary events of photosynthesis.
- Chloroplast** (*chloros*^G = green + *plastos*^G = moulded) : A complex, energy-producing, cytoplasmic organelle containing bacteria-like elements with vesicles containing chlorophyll; chloroplasts occur in the cells of aboveground parts of plants and are the site of photosynthesis.
- Chlorosis** : A yellowing of plant leaves caused by lack of chlorophyll pigment due to mineral deficiency (e.g., magnesium, iron) or disease (e.g., virus yellows) which results in a decrease in photosynthetic rate.
- Cholecalciferol** : One of at least 10 different fat-soluble group of vitamins, collectively designated vitamin D group; of these, 2 vitamins, vitamin D₂ (ergocalciferol) and vitamin D₃ (cholecalciferol) are physiologically more important; vitamin D₂ is of plant origin and produced commercially by irradiation with UV light of a provitamin called ergosterol, while D₃ is of animal origin and produced from 7-dehydrocholesterol also by irradiating with UV light; both D₂ and D₃ have the same degree of activity in the human beings; the best natural sources of vitamin D are the liver oils of many fishes such as cod and halibut; the flesh of oily fishes (sardine, salmon, herring) is also an excellent source; a white, almost odourless, crystalline substance, fairly heat-resistant and not affected by acids and teeth and encourages the absorption, into the blood, of calcium salts and phosphorus; avitaminosis D results in rickets in children and osteomalacia in human adults, particularly women after many pregnancies; also called *antirachitic factor* or 'sunshine' vitamin.
- Cholecystitis** (*chole*^G = bile + *kystis*^G = bladder + *-itis*^G = inflammation) : Inflammation of gall bladder.
- Cholecystokinin (CCK)** : A polypeptide hormone secreted by the upper part of the small intestine; contains 33 amino acid residues with a molecular weight 3,883; it stimulates contraction of the gall bladder so as to release its contents into the duodenum; both cholecystokinin (CCK) and pancreaticozym (PZ) are now considered to be a single factor under the name *cholecystokinin-pancreozym (CCK-PZ)*.
- Cholesterol** : A lipid molecule with a characteristic four-ringed steroid structure (called a sterane nucleus); occurs in the plasma membranes of animal cells, but not in plants; precursor of the animal steroid hormones and bile acids.
- Choline** : An organic base which is a constituent of acetylcholine.
- Chondriosome** : *See mitochondrion*
- Chromaffin cell** : A cell that stores adrenalin in secretory vesicles and secretes it in times of stress when stimulated by the nervous system.
- Chromatid** (*chroma*^G = colour + *-id*^L = daughters of) : One of the two daughter strands of a duplicated chromosome, formed by DNA replication, that is still joined by a single centromere to the other daughter strand.
- Chromatin** (*chroma*^G = colour) : The complex of DNA, histones and nonhistone proteins found in the nucleus of a eukaryotic cell; the material of which eukaryotic chromosomes are made; that part of the cell nucleus which becomes deeply stained with basic dyes.
- Chromatography** (*chroma*^G = colour + *graphein*^G = to write) : A biochemical technique in which a mixture of substances is separated by charge, size, or some other property by allowing it to partition between a mobile phase and a stationary phase.
- Chromosome** (*chroma*^G = colour + *soma*^G = body) : A generally threadlike or rodlike structure within a cell, composed essentially of protein and nucleic acid, containing the hereditary units or genes; a cell usually contains a definite number of chromosomes. Chromosomes contain, or consist of, a linear sequence of genes.
- Chronic disease** : A disease that lingers for a long time, rarely reaches a climax, and disappears slowly.
- Chylomicron** : A type of lipoprotein which is largest in size (180-500 nm diameter) and has very low density ($d < 0.95\text{g/cm}^3$) because of a high triacylglycerol contents (about 85%) in it; synthesized in the smooth ER of epithelial cells lining the small intestine and serves to transport dietary lipids in the circulation.
- Chymase** : *See rennin.*
- Cirrhosis** (*kirrhos*^G = tawny-yellow) : Fibrosis, generally of the liver.
- Cis and trans isomers** : *See geometric isomers.*
- Cisterna**, plural **cisternae** : A flattened membrane-bound tube or saclike region, as found in the endoplasmic reticulum or Golgi apparatus.

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- 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** : A six-carbon organic acid that is converted to isocitric acid in the second step of the citric acid cycle.
- Citric acid cycle, CAC** : A central metabolic pathway found in all aerobic organisms and by which acetyl-CoA, derived from food molecules, is oxidized in mitochondria to CO₂; each of the citric acid cycle also forms one ATP by substrate-level phosphorylation, reduces one NAD⁺ to NADH, and reduces one ubiquinone to ubiquinol; also known as *Krebs cycle* or *tricarboxylic acid (TCA) cycle*.
- Clathrin** : A protein that assembles into a polyhedral cage on the cytoplasmic side of a membrane so as to form a clathrin-coated pit, which buds off to form a clathrin-coated vesicle.
- Clitoris** : An erectile structure occurring ventral to the uterus in female mammals, which is homologous with the penis in the male.
- Clone** (*klon*^G = twig) : A population of cells or organisms formed by repeated (asexual) division from a common cell or organism. Also used as a verb: "to clone a gene" means to produce many copies of a gene by repeated cycles of replication.
- Coagulation** : The separation or precipitation of suspended particles from a dispersed state.
- Coated pit** : Invagination of the plasma membrane associated with a bristlelike layer of protein on its cytoplasmic surface. Pinches off to form a coated vesicle in the process of endocytosis.
- Coated vesicle** : Small membrane-bound organelle formed by the pinching off a coated region of membrane. Some coats are made of clathrin, whereas others are made from other proteins.
- Cobalamin** : See **cyanocobalamin**.
- Coccarboxylase** : The coenzyme of carboxylase.
- Codon** (*code*^L =) : A sequence of three nucleotides in a DNA or messenger RNA molecule that represents the instruction for incorporation of a specific amino acid or of a stop signal into a growing polypeptide chain; of the 64 possible codons, 61 are codes for amino acids and 3 are stop codons.
- Coenzyme** : A dialyzable, nonprotein prosthetic group of an enzyme; like enzymes, coenzymes are not altered or used up in the reaction and can be used many times; most of them are derived metabolically from vitamins; NAD⁺ and coenzyme A are examples of coenzyme.
- Coenzyme A** : A derivative of the B-complex vitamin, pantothenic acid (vitamin B₃); a small molecule, used in the transfer of the acyl (CH₃CO-) group.
- Coenzyme Q** : See **ubiquinone**.
- Cofactor** : An inorganic, dialyzable nonprotein prosthetic group of enzyme-catalyzed reactions.
- Cognitive** (*cognoscere*^L = to know) : Thinking. Using the mind.
- Coiled coil** : Especially stable rodlike protein structure formed from two α helices coiled around each other.
- Colchicine** : A poisonous alkaloid, derived from the corms of a monocot plant, *Colchicum autumnale*; interferes with spindle formation during nuclear and cell division, thus inducing polyploidy due to nondisjunction.
- Coleoptile** : In monocotyledons of the grass type, a nonchlorophyllous covering over the young foliar leaves in the growing stem tip of the seedling.
- Coleorrhiza** : A structure of the grass embryo that is similar to the coleoptile but located around the radicle of young seedlings.
- Collagen** : A fibrous protein abundant in glycine and proline that is a major component of the extracellular matrix and connective tissues; exists in many forms : *type I*, the most common, is found in skin, tendon, and bone; *type II* is found in cartilage; *type IV* is present in basal laminae.
- Colloid** : A mixture of two substances which are immiscible, but where the particles of one are too small to settle out, and so remain suspended indefinitely; colloids are common in cells; colloid particles measure between 0.000001 to 0.0001 mm in diameter; does not diffuse through cell membranes; a liquid colloid is called a *sol*, and a solid colloid, a *gel*.
- Coma** (*koma*^G = deep sleep) : Deep unconsciousness.
- Combinatorial** : Describes any process that is governed by a specific combination of factors (rather than by any single factor), with different combinations having different effects.
- Competitive inhibition** : A form of enzyme control in which an inhibitor molecule, very similar in structure to the normal substrate of an enzyme, becomes reversibly bound to the active site, thus reducing the quantity of enzyme available. However, if excess substrate is present, the inhibitor can be forced out by the substrate molecule which takes its place and the reaction proceeds. Compare *noncompetitive inhibition*.

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- Complementary DNA, cDNA** : DNA that is made by reverse-transcribing mRNA into its DNA complement and therefore lacking the introns that are present in genomic DNA; used to determine the amino acid sequence of a protein by DNA sequencing or to make the protein in large quantities by cloning followed by expression; the collection of vector-cloned cDNA fragments of an organism are its *cDNA library*.
- Complex** : Assembly of molecules that are held together by noncovalent bonds; protein complexes perform most cell functions.
- Compound** : A substance composed of two or more elements.
- Concentration gradient** : The concentration difference of a substance as a function of distance. In a cell, a greater concentration of its molecules in one region than in another.
- Configuration** : The spatial arrangement of an organic molecule that is conferred by the presence of either (a) double bonds, around which there is no freedom of rotation, or (b) chiral centres, around which substituent groups are arranged in a specific sequence. Configurational isomers cannot be interconverted without breaking one or more covalent bonds.
- Conformation** : The spatial arrangement of substituent groups that are free to assume different positions in space, without breaking any bonds, because of the freedom of bond rotation.
- Conjugate acid-base pair** : A proton donor and its corresponding deprotonated species; for example, acetic acid (donor) and acetate (acceptor).
- Conjugate redox pair** : An electron donor and its corresponding electron acceptor form; for example, Cu^+ (donor) and Cu^{2+} (acceptor) or NADH (donor) and NAD^+ (acceptor).
- Conjugated protein** : A protein containing one or more prosthetic groups.
- Consensus sequence** : A most typical form of a sequence that occurs with minor variations in a group of related DNA, RNA, or protein sequences. The consensus sequence shows the nucleotide or amino acid most often found at each position. The preservation of a consensus sequence implies that the sequence is functionally important.
- Conservative replication** : A form of DNA replication, where both strands of the parent DNA are transferred to one daughter molecule, whereas the other molecule has 2 newly-synthesized strands. Compare *semi-conservative replication*, where one strand of the parent molecule ends up in each of the progeny molecule.
- Constitutive enzyme** : An enzyme that is made all the time at a constant rate, unaffected by inducers.
- Cooley's disease** (named after the American paediatrician, *Thomas B. Cooley*, LT 1871–1945) : A type of human anemia in which there is a deficiency of either α or β hemoglobin chains. Various causes have been found for the condition, including a recessive mutant allele for β chain deficiency that is present in high frequencies in areas, particularly found at sea borders, *e.g.*, mediterranean, often associated with high incidence of mosquito activity. Also called *thalassemia*.
- Cori cycle** : The metabolic cycle by which lactate produced by tissues engaging in an aerobic glycolysis (such as exercising muscles) is regenerated to glucose in the liver and returned to the tissues *via* the bloodstream.
- Correlation** : The tendency of 2 variables to vary together.
- Correlation coefficient** : A statistic that measures the strength of association of 2 variables.
- Corticotropin** : *See adrenocorticotrophic hormone.*
- Cortisol** : An adrenocortical steroid with effects similar to cortisone; also called *hydrocortisone*.
- Cortisone** : A glucocorticoid hormone secreted by the adrenal cortex whose function is to combat stress; causes shrinkage of lymph nodes and lowers the WBC count, reduces inflammation, promotes healing, and stimulates gluconeogenesis.
- Cotyledon** (*kotyledon*^G = a cup-shaped hollow) : (1) An embryonic leaf-like storage organ in angiosperm seeds. Monocot embryos have one cotyledon, and dicots have two. (2) A part of the mammalian placenta on which a tuft of villi occurs, particularly in ruminants.
- Coupled reactions** : Two chemical reactions that have a common intermediate and thus a means of energy transfer from one to the other.
- Covalent bond** (*co*^L = together + *valare*^L = to be strong) : A stable chemical bond formed by the sharing of one or more pairs of electrons among the atoms in a molecule.
- Creatinine** : The nitrogenous waste material of muscle creatine.
- Cresols** : Phenol derivatives containing methyl groups.

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- Cretinism** (*cretin*^{Fr} = from Swiss patois + *crestin*, from *Christianum*^L = a Christian creature) : Disease resulting from thyroid cell degeneration in children; characterized by dwarfism and mental suppression.
- Crista, plural cristae** (Latin, for *crest*) : (1) In mitochondria, the infoldings of the inner mitochondrial membrane, which forms a series of “shelves” containing the electron transport chains involved in ATP formation. (2) A sensory structure in the inner ear.
- Crossing over** : An essential feature of meiosis occurring during prophase when nonsister chromatids exchange portions of DNA strand. Alternatively, it is an exchange of corresponding segments between chromatids of homologous chromosomes.
- Curie** (named in honour of Madame) : The basic unit of radioactive decay; an amount of radioactivity equivalent to that produced by 1g of radium, namely 2.22×10^{12} disintegrations per minute.
- Cuticle** (*cutis*^L = skin) : A waxy layer found on the outer walls of epidermal cells, especially of leaves, floral parts and fruits in many plants.
- Cutin** (*cutis*^L = skin) : A waxy, waterproof substance that is the chief ingredient of the cuticle of a plant; consists of hydroxylated fatty acids that are linked together in a complex array.
- Cyanocobalamin** ($C_{63}H_{88}O_{14}N_{14}PCo$) : A water-soluble vitamin of the B complex group and designated as vitamin B₁₂; occurs only in animals: the chief source being liver, although also present in milk, meat, eggs, fish, oysters etc; its chemical structure, one of the most complex known, was established by Dorothy C. Hodgkin who was awarded Nobel prize for the same in 1964; a cobalt-containing, deep-red, crystalline substance, soluble in alcohol and acetone but not in chloroform; functions in nucleic acid metabolism, in the formation of red blood cell and acts as a carrier of methyl group; a nutritional deficiency of cyanocobalamin leads to pernicious anemia especially among old people, which is characterized by RBCs becoming abnormally large and fewer; also called simply as *cobalamin* or *antipernicious anemia (APA) factor*.
- Cyclic AMP, cAMP** : A second messenger within cells that is generated from ATP in response to hormonal stimulation of cell-surface receptors; cAMP acts as a signalling molecule by activating A-kinase; it is hydrolyzed to AMP by phosphodiesterase.
- Cytochrome oxidase** : An enzyme acting as the last hydrogen electron carrier in the electron transport system, receiving an electron from cytochrome and passing it on to oxygen, with the formation of water.
- Cytochromes** : Coloured heme-containing metalloproteins that serve as electron carriers during cellular respiration, photosynthesis, and other oxidation-reduction reactions; usually designated as cytochromes a, b, and c.
- Cytokinins** : A group of hormones (growth regulators) that promote growth by stimulating cell division; also called *kinins*.
- Cytoplasm** (*kytos*^G = hollow vessel + *plasma*^G = anything moulded) : The semifluid living contents of a cell that are contained within its plasma membrane but, in the case of eukaryotic cells, outside the nucleus; it contains sugars, amino acids, proteins, and the organelles (in eukaryotes) such as mitochondria, endoplasmic reticulum, Golgi bodies etc.
- Cytosine** : An organic molecule composed of one carbon-nitrogen ring. It is a pyrimidine component of nucleic acids and nucleotides. Cytosine always forms complementary base-pairing with guanine.
- Cytoskeleton** (*kytos*^G = hollow vessel + *skeleton*^G = a dried body) : An organized network of protein filaments in the cytoplasm of all eukaryotic cells that maintain the shape of the cell and anchor organelles (such as nucleus) to fixed locations; consists mostly of actin filaments, microtubules and 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); a semisolid concentrated solution or suspension.
- Cytosol** : The continuous aqueous phase of the cytoplasm with its dissolved solutes; excludes the organelles such as mitochondria.
- Cytosome** : The cytoplasm of a cell.

D

- Dalton** (after *John Dalton*, a British chemist) : A unit of molecular mass; approximately equal to the weight of a single hydrogen atom (1.66×10^{-24} g).
- Datum, plural data** : An observation used as a basis for inference or induction.
- de novo pathway** : Pathway for synthesis of a biomolecule, such as a nucleotide, from simple precursors, as distinct from a salvage pathway.
- Deamination** : The enzymatic removal of amino

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- group from a biomolecule, such as amino acids or nucleotides. Deamination of adenine or cytosine causes base-pairing changes.
- Decarboxylation :** The removal of carbon dioxide from a biomolecule, as in the conversion of oxalosuccinic acid (C_6) to α -ketoglutaric acid (C_5) in the third step of the Krebs cycle.
- Decomposition :** (1) The break-up of a chemical substance into two or more simpler substances. (2) The breakdown of organic material by microbes.
- 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 B_1), scurvy (vitamin C), rickets (vitamin D) and kwashiorkor (protein) among humans; among plants, deficiency of magnesium causes chlorosis of the leaves.
- Degenerate Code :** A code in which one amino acid is specified by more than one codon.
- 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.
- Dehydrogenases :** The oxidizing enzymes catalyzing the removal of pairs of hydrogen atoms from their substrates.
- Delirium** (*delirium*^L, from *de* = away from + *lira* = furrow) : Mental excitement with confusion and sometimes hallucinations.
- Denaturation :** Partial or complete change in conformation of a polypeptide, protein, or nucleic acid caused by heating or by exposure to chemicals and usually resulting in the loss of biologic property; usually a irreversible process.
- Denitrification :** The breaking down of nitrates to nitrites and ultimately to free gaseous nitrogen by soil organisms, especially denitrifying bacteria.
- Deoxyribonucleic acid, DNA :** A polynucleotide having a specific sequence of deoxyribonucleotide units covalently joined through 3',5'-phosphodiester bonds; two of the polymers wind around each other, like the outside and inside rails of a winding staircase; serves as a carrier of genetic information.
- Deoxyribonucleotide :** A nucleotide containing 2-deoxy-D-ribose as its pentose component.
- Deoxyribose :** A 5-carbon sugar with one oxygen atom less than the related sugar ribose; a component of deoxyribonucleic acid.
- Depurination :** Cleavage of the glycosidic bond between C-1' of deoxyribose and a purine base in DNA; used in Maxam-Gilbert sequence analysis.
- Desaturases :** Enzymes that catalyze the introduction of double bonds into the hydrocarbon portion of fatty acids.
- 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.
- Detergent :** A type of small amphipathic molecule that tends to coalesce in water, with its hydrophobic tails buried and its hydrophilic heads exposed; when dissolved in water, a detergent acts as a cleansing agent for the removal of grease by altering the interfacial tension of water with other liquids or solids; widely used to solubilize membrane proteins; powerful detergents are used to break up oil spillages at sea.
- 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.
- Dextrin :** A polysaccharide carbohydrate that may form an intermediate step in the hydrolysis of insoluble starch to soluble glucose which is ready for cell respiration, translocation or further synthesis. Dextrins possess adhesive properties and are used as adhesives on paper products.
- Dextrorotatory isomer :** A stereoisomer that rotates the plane of plane-polarized light to the right or clockwise; represented by the symbol *d* or (+).
- Dextrose ($C_6H_{12}O_6$) :** A monosaccharide sugar of wide occurrence in plants; also known as *glucose*.
- Diabetes insipidus** (*diabetes*^G, a siphon, from *dia* = through + *benai* = to go; *insipidus*^L = tasteless) : A metabolic disorder resulting 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) : A metabolic disease resulting 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.
- Diacylglycerol** : Lipid produced by the cleavage of inositol phospholipids in response to extracellular signals; composed of two fatty acid chains linked to glycerol; serves as a signalling molecule to help active protein kinase C.
- Dialysis** : A process by which small molecules can be separated from larger ones using a semipermeable membrane (*e.g.*, collodion) to contain the larger molecules but which allows the smaller molecules to pass through into the excess water on the other side. The kidney functions by means of this principle, which is also the basis for kidney machines used in cases of kidney disease or failure.
- Diarrhoea** (*diarrhoia*^G, from *dia* = through + *rhoia* = flowing) : Increased frequency and fluidity of the stools.
- 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.
- 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.
- Dicotyledon** : A class of flowering plants characterized by having two cotyledons in their embryo, leaves with reticulate venation, and flower parts in twos, fours or fives; also called *dicot*.
- Dictyosome** : *See Golgi body*.
- 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.
- Differential centrifugation** : Separation of cell organelles or other particles of different size by their rates of sedimentation in a centrifugal field.
- Diffusion** (*diffundere*^L = 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.
- Digestion** (*digestio*^L = 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.
- Dihydroxyphenylalanine (DOPA)** : A precursor in the biochemical pathway leading to melanin formation in animals; DOPA is not metabolized in individuals with albinism.
- Denitrification** : The breaking down of nitrates to nitrites and ultimately to free gaseous nitrogen by soil organisms, especially denitrifying bacteria.
- 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 $-NH_2$ group of one amino acid being united with the $-COOH$ group of the other.
- Diphosphopyridine nucleotide (DPN)** : *See nicotinamide adenine dinucleotide (NAD+)*.
- Diphtheria** (*diphthera*^G = skin, leather) : An infection with *Corynebacterium diphtheriae*, generally affecting the pharyngeal area.
- Dipole** : A molecule having both positive and negative charges.
- Diprotic acid** : An acid having two dissociable protons.
- 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.

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- Disease** : An abnormality of an animal or plant caused by a pathogenic organism that affects performance of the vital functions and usually gives diagnostic symptoms.
- Disinfectant** : A chemical substance used to control microorganisms on a lifeless object.
- Dismutation** : A reaction in which 2 identical substrate molecules have different fates; particularly, a reaction in which one of the substrate molecules is oxidized and the other reduced.
- Dissociation constant (K_a)** : Measure of the tendency of a complex to dissociate. For the binding equilibrium $A + B \rightleftharpoons AB$, the dissociation constant is given by $[A][B]/[AB]$, and it is smaller the tighter the binding between A and B.
- Disulfide bond** : A type of covalent bond formed between two sulfur atoms of two cysteine molecules in the same protein; disulfide bonds strengthen the tertiary structure of proteins.
- Diterpene** : A compound that consists of four isoprene units linked together; gibberellins are examples of diterpenes.
- Diuresis** : The increased output of watery urine by the kidneys.
- DNA fingerprint** : The use of highly variable regions of the DNA sequence to identify an individual.
- DNA library** : Collection of cloned DNA molecules, representing either an entire genome (*genomic library*) or DNA copies of the mRNA produced by a cell (*cDNA library*).
- DNA ligase** : An enzyme that joins adjacent nucleotides together by catalyzing the formation of sugar-phosphate bonds in a strand of DNA.
- DNA polymerase** : An enzyme that catalyzes DNA replication only at the OH ends of DNA strands.
- DNA sequencing** : Determination of the order of nucleotides in a DNA molecule.
- DNA topoisomerases** : See **topoisomerases**.
- Domain** : A distinct structural unit of a polypeptide, which may be encoded separately by a specific exon; domains may have separate functions and may fold as independent, compact units. Large globular proteins often consist of several domains, which are connected to each other by stretches of relatively extended polypeptide.
- Dopamine (C₈H₁₁O₂N)** : The decarboxylation product of dihydroxyphenylalanine (DOPA).
- Dormancy** : A state in which seeds and other structures (such as underground stems) reduce their metabolic activities to a minimum level during unfavourable conditions (low temperature, drought etc.) so as to survive until conditions improve.
- Dormin** : See **abscisic acid**.
- Dorsal** (*dorsum*^L = the back) : (1) In animals, the part that normally occurs uppermost. 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*.
- Dose** : The known amount of chemical or other treatment received by an organism.
- Double bond** : A covalent bond sharing two pairs of electrons.
- Double helix** : The natural coiled conformation of two complementary, antiparallel DNA chains.
- Double reciprocal plot** : A plot of $1/V_0$ versus $1/[S]$, which allow a more accurate determination of V_{max} and K_m than a plot of V_0 versus $[S]$; also called the *Lineweaver-Burk plot*.
- Drosophila melanogaster** : A species of small dipterous fly, commonly called a fruit fly; extensively used in genetical studies of development.
- Drug** : (1) Any substance used as an ingredient in medical preparations. (2) Any substance that affects the normal body functions.
- 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.
- Dysentery** : A severe disorder of the ileum and colon caused by the bacterium *Shigella dysenteriae* (and many other species), resulting in abdominal cramps, diarrhea, and fever. The disease is spread by 'food, feces, fingers and flies', and can be controlled by sanitary precautions.
- Dyspepsia** (*dys*^G = bad + *peptos*^G = cooked) : Deranged digestion.
- Dyspnea** : Laboured breathing, with breathlessness.
- 2,4-dichlorophenoxyacetic acid, 2,4-D** : A growth substance widely used as a herbicide.

E

- e value** : The solar energy present on other planets expressed as a percentage of the earth's solar energy.
- 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.
- Ecdysis** (*ekdysis*^G = 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.
- Ecdysone** : A hormone secreted by the thoracic gland of insects which brings about the moulting of the cuticle and subsequent growth (ecdysis). It raises the metabolic rate and increases the build-up of proteins from amino acids in growing tissue. Also called as *moulting hormone*.
- 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; in Old English, also spelt as *oedema*.
- Effector** : 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.
- Egestion** : The evacuation of feces or unused food substances from the body.
- Ejaculation** : The process by which semen is expelled from the penis by strong muscular contractions of the urethral wall.
- Elastin** : The protein found in elastin fibres.
- 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.
- Electrolyte** : A compound with ionic bonds, forming ions and capable of transmitting electric current in solution.
- 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.
- Electron** : A minute negatively-charged particle in 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 (and thereby becoming reduced) in an oxidation-reduction reaction.
- Electron carrier** : A protein, such as a flavoprotein or a cytochrome, that can reversibly gain and lose electrons; functions in the transfer of an electron from a donor molecule to an acceptor molecule.
- Electron donor** : A molecule that readily gives up electrons (and thereby becoming oxidized) in an oxidation-reduction reaction.
- Electron microscope (EM)** : An instrument that uses an electron beam to magnify images of specimens.
- 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.
- Electrophile** : An electron-deficient group with a strong tendency to accept electrons from an electron-rich group (nucleophile).
- Electrophoresis** : Movement of charged solutes in response to an electric field; a technique often used to separate mixtures of ions, proteins, or nucleic acids.
- Element** : A chemical substance that cannot be separated into different substances by ordinary chemical methods; comprises atoms of a single kind.
- Elongation factors** : Specific nonribosomal proteins required for the addition of amino acids to growing polypeptide chains on ribosomes.
- Emendation** : The correction of a previously published misspelt scientific name.
- Emphysema** : The pulmonary disorder involving overdistention and destruction of the air spaces in the lungs.
- Enantiomers** : Stereoisomers that are nonsuperimposable mirror images of each other. The enantiomers of a compound rotate polarized light in opposite direction, hence also called as *optical isomers*.
- Encephalitis** (*enkephalos*^G = brain, from *en* = in + *kephale* = head + *-itis* = inflammation) : Inflammation of the brain.
- Endemic** : Refers to organisms or disease whose occurrence is limited to a particular geographical area, such as an island.

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- Endergonic reaction** ($endon^G = \text{within} + \text{ergon}^G = \text{work}$) : 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; compare *exergonic reaction*.
- Endocrine gland** ($endon^G = \text{within} + \text{krinein}^G = \text{to separate or distinguish}$) : A ductless gland producing hormonal secretions that pass directly into the bloodstream or lymph.
- Endocytosis** ($endon^G = \text{within} + \text{kytos}^G = \text{cell}$) : 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.
- Endonuclease** : An enzyme that hydrolyzes the interior phosphodiester bonds of a nucleic acid; that is, it acts at points other than the terminal bonds.
- Endopeptidase** : See **protease**.
- Endoplasmic reticulum, ER** ($endon^G = \text{within} + \text{plasma}^G$, from cytoplasm; $reticulum^L = \text{network}$) : An extensive network of double membranes distributed throughout the cytosol of eukaryotic cells; portions that are studded with ribosomes are called *rough ER*, and other portions with fewer ribosomes are called *smooth ER*; concerned with the synthesis of lipids and membrane-bound proteins.
- Endorphin** : A small protein produced in the nervous system of vertebrates exhibiting actions similar to morphine.
- Endorphins** : A class of endogenous brain peptides that exert analgesic effects in the CNS by binding to opiate receptors. These consist of 16-27 amino acids and are derived from a precursor proopiomelanocortin (POMC).
- Endoskeleton** ($endon^G = \text{within} + \text{skeletos}^G = \text{hard}$) : In vertebrates, an internal scaffold of bone to which muscles are attached.
- Endosperm** ($endon^G = \text{within} + \text{sperma}^G = \text{seed}$) : A nutritive, storage tissue characteristic of the seeds of angiosperms that 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.
- Endothelial** ($endon^G = \text{within} + \text{thel}^G = \text{nipple}$) : Describes the innermost layer of tissue that lines the heart, blood vessels and lymph vessels of vertebrates.
- Endothermic reaction** : A chemical reaction that takes up heat (that is for which ΔH is positive), as in photosynthesis.
- End-product inhibition** : See **feedback inhibition**.
- 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).
- Energy charge** (a term coined by Daniel Atkinson in 1970) : 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,

$$\text{Energy charge} = \frac{[\text{ATP}] + \frac{1}{2}[\text{ADP}]}{[\text{ATP}] + [\text{ADP}] + [\text{AMP}]}$$
- Energy charge** : The fractional degree to which the ATP/ADP/AMP system is filled with high-energy phosphate groups.
- 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.
- 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.
- Enterotoxin** : A toxin affecting the gastrointestinal tract in humans.
- Enthalpy (H)** : The heat content of a system. A thermodynamic property of a substance given by $H = U + pV$, where U is the internal energy, p the pressure, and V the volume.
- Entropy, S** ($en^G = \text{in} + \text{tropos}^G = \text{change in manner}$) : A thermodynamic quantity that expresses (or measures) the amount or degree of disorder of a system; the higher the entropy, the more 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.
- Environment** : The surroundings of any organism, including the medium, substrate, climatic conditions, other organisms, light and pH.
- Enzyme** ($enzymos^G = \text{leavened}$, from $en = \text{in} + \text{zyme} = \text{leaven}$) : A biomolecule, either protein or RNA, that catalyzes a specific chemical reaction; it does not affect the equilibrium of the catalyzed reaction; remains unaltered in the process.
- Epidemic** : The occurrence of many cases of a disease within an area.
- Epilepsy** ($epilepsis^G$, from $epi = \text{upon} + \text{lambanein} = \text{to seize}$) : A nervous condition due to abnormalities in the brain cortex that results in

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- seizures ranging from a sense of numbness in certain body areas (*petit mal*) to extreme muscular convulsions and fits (*grand mal*). Epileptics exhibit large, abnormal brain waves, which can be detected on an electroencephalogram (EEG).
- Epimerases** : Enzymes that catalyze the reversible interconversion of the two epimers.
- Epimers** : Two stereoisomers differing in configuration at one asymmetric centre, in a compound having two or more asymmetric centres.
- Epinephrine** : See **adrenalin**.
- 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.
- Epithelium** (*epi*^G = on + *thele*^G = nipple) : A thin layer of cells forming a tissue that covers the internal and external surfaces of the body.
- Equilibrium** : The state of a system in which no further net change is occurring; the free energy is at a minimum.
- Equilibrium constant (K_{eq})** : A ratio of forward and reverse rate constants for a reaction and equal to the association constant; a constant characteristic for each chemical reaction.
- Eradicant** : Any biocide (*e.g.*, a fungicide) used to cure an established infection.
- Ergosterol (C₂₈H₄₃OH)** : A white crystalline 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.
- Erythema** (*erythema*^G = a flush) : Redness of the skin.
- Erythrocyte** (*erythros*^G = red + *kytos*^G = 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 and mitochondria, and its endoplasmic reticulum is reabsorbed; also called *red blood corpuscle*.
- Escherichia coli** : A common rodlike bacterium normally found in the small intestine (colon) of humans and other mammals; the most well-studied organism; widely used in biomedical research; also called *E.coli*.
- Essential amino acids** : Amino acids that cannot be synthesized by humans (and other vertebrates) and must be obtained from the diet.
- Essential fatty acids** : The group of polyunsaturated fatty acids produced by plants, but not by humans; required in the human diet.
- Ester** : A molecule formed by the condensation reaction of an alcohol group with an acidic group; most phosphate groups are esters.
- Esterases** : A class of enzymes involved in the hydrolysis (digestion) of fats and other esters.
- 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*.
- Estrogen** (*oestros*^G = frenzy + *genos*^G = origin) : A hormone produced by the ovary of the female vertebrate; also produced by the female placenta and in small quantities by the adrenal cortex and the male testis. Estrogen maintains the female secondary sex characters and is involved in the repair of the uterine wall after menstruation.
- 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*^L = frenzy) : The period of maximum female sexual receptivity. Associated with ovulation of the egg. Being “in heat”.
- Ethylene, ETH (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*.
- Etiolation** : The abnormal elongation of stems caused by insufficient light; etiolated stems are pale yellow due to lack of chlorophyll, have long internodes and rudimentary leaves.
- Etiology** : The study of causes (usually of a disease); in Old English, also spelt as *aetiology*.
- Euchromatin** (*eu*^G = good + *chroma*^G = colour) : Lightly staining portion of chromatin, not easily visible by light microscopy; “normal” chromatin, as opposed to the more condensed heterochromatin.
- Eukaryote** (*eu*^G = good + *karyon*^G = kernel) : Living organism composed of one or more cells with a distinct membrane-bound nucleus, multiple chromosomes and internal organelles; includes all forms of life except viruses and bacteria (prokaryotes).
- Exergonic reaction** (*ex*^L = out + *ergon*^G = work) : A chemical reaction that proceeds with the release of free energy (that is, for which ΔG is negative); exergonic reactions occur spontaneously; compare *endergonic reaction*.
- Euthanasia** : The act of painless killing to relieve human suffering from an incurable disease.
- Exocytosis** : An active process in which vesicles containing excretory or secretory materials are actively carried to the periphery of the cell, and

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- released to the outside when the vesicle membrane fuses with the cell membrane; opposite of endocytosis.
- Exon** : A region in the coding sequence of a gene that is translated into protein (as opposed to an intron, which is not). The name comes from the fact that exons are the only parts of an RNA transcript that are present outside the nucleus. Compare *intron*.
- Exon** : A sequence of DNA within a gene that codes for an amino acid sequence.
- Exonuclease** : An enzyme that removes a terminal nucleotide (3' or 5') in a polynucleotide chain; exonucleases remove the nucleotides in a successive way, one by one, and are highly specific in their action.
- 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** ($ex^G = out + ophthalmos^G = eye$) : Prominence of the eyes.
- 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).
- Exothermic reaction** : A chemical reaction that releases heat (that is, for which ΔH is negative), as in respiration.
- 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.
- Explant** : An actively dividing plant tissue that can be induced to produce callus tissue in tissue culture.
- 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 $10 \times 10 \times 10 \times 10 = 10,000$.
- 3' end** : The end of a nucleic acid that lacks a nucleotide bound at the 3' position of the terminal residue.
- 5' end** : The end of a nucleic acid that lacks a nucleotide bound at the 5' position of the terminal residue.

F

- Facilitated transport** : The transport of a substance across a biological membrane in response to a concentration or electrochemical gradient (*i.e.*, in the direction of lowest concentration) where the movement is facilitated by membrane pores or by specific transport proteins; also called *facilitated diffusion*. Compare *active transport*, *passive transport*.
- Faeces** (*faeces*^L, 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.
- Fastidious** : Having special requirement.
- Fat** : An organic compound used as a food and consisting of carbon, hydrogen and oxygen, with relatively more carbon and hydrogen and less oxygen than a carbohydrate; glycerol esters of fatty acids, insoluble in water but soluble in ether and chloroform; found in almost all organisms; abundant in plant seeds, and are also found in roots, stems and leaves, forming about 5% of the total dry weight; in animals, fats are stored in specialized cells making up adipose tissue.
- Fatigue** : Exhaustion in muscles resulting from excretion or overstimulation following a period of activity.
- 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 acids, $C_nH_{2n+1}COOH$** : A long-chain aliphatic carboxylic acid found in natural fats and oils; also a component of membrane phospholipids and glycolipids; used as a major source of energy during metabolism.
- Fauna** : The total of all animals of a specified region or time.
- Fecundity** : The number of young ones produced by an organism during the entire course of its life.
- 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*.
- Fermentation** (*fermentum*^L = ferment) : A process by which energy is obtained from organic compounds without the use of oxygen as an

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- electron acceptor; yields lactate, ethanol, or some other simple 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.
- Ferritin** : A conjugated, electron-dense protein concerned in the absorption of iron through the intestinal mucosa; serves as a storage protein for iron in the liver and spleen.
- Fertilization** (*ferre*^L = to bear) : The union of male and female gametes to form a zygote which then subsequently develops into a new organism.
- 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 until birth; also spelt as *foetus*.
- Fever** (*febris*^L = fever, through O.E. *fēfor*) : Rise of body temperature above normal, or diseases characterized by this phenomenon.
- Fibrin** : See **fibrinogen**.
- 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*.
- Fibrosis** (*fibra*^L = a fibre) : Formation of scar tissues.
- Fibrous proteins** : Insoluble, elongated proteins that serve in protective or structural role. Compare *globular proteins*.
- 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-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*.
- 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*.
- Flaccid** (*flaccid*^L, from *flaccus* = flabby) : Relaxed; flabby.
- Flagellum**, plural **flagella** (*flagellum*^L = whip) : A fine, long, threadlike organelle protruding the surface of a cell. Bacterial flagella have much simpler structure than eukaryotic flagella, which are similar to cilia (a cilium is a small flagellum); common in protists and motile gametes; used in locomotion and feeding.
- Flatulence** (*flatus*^L = a blowing) : Excess of gas in the digestive tract.
- Flavin nucleotides** : Nucleotide coenzymes (FMN and FAD) containing riboflavin.
- Flavin-linked dehydrogenases** : Dehydrogenases requiring one of the riboflavin coenzymes, FMN or FAD.
- Flavone** : A water-soluble yellowish pigment related to the anthocyanins.
- Flavonoid** : Any phenylpropanoid-derived compound that is linked to 3 acetate units and condensed into a multiple-ringed structure; the most common flavonoid is *rutin*; flavonoids also include *naringin*, which is a bitter substance in grapefruits.
- Flavoprotein** : An enzyme containing a flavin nucleotide as a tightly bound prosthetic group; acts as an intermediate carrier in respiratory chains between dehydrogenases and cytochromes.
- Flocculation** : The formation of jellylike masses of coagulated material.
- Flora** : The total of all plants of a specified region or time.
- 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.
- 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.
- Flux** : With reference to a chemical pathway, the rate (in moles per unit time) at which reactant ‘flows through’ the pathway to emerge as a product. The term can be used for the rate at which particles undergo any process in which they either flow or can be thought of metaphorically as flowing.
- Folic acid** ($C_{19}H_{19}O_6N_7$) : 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; on a worldwide basis, deficiency of folic acid is believed to be the most common form of vitamin undernutrition: in man, folic acid deficiency leads to megaloblastic anemia, glossitis and gastrointestinal disorders; also called *liver*

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Lactobacillus casei factor or vitamin M.

Follicle (*folliculus*^L = small ball) (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.

Follicle-stimulating hormone (FSH) : A glycoprotein hormone secreted by the anterior lobe of the pituitary gland that stimulates the growth of the ovarian follicles and oocytes in the ovary, and spermatogenesis in the seminiferous tubules of the testis.

Food : An organic substance (carbohydrate, protein, or fat) furnishing energy or building material for protoplasm.

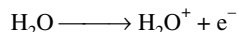
Food poisoning : An acute disorder of the gut caused by food contaminated with bacteria or their toxins (*e.g.*, botulism) or by some chemical.

Formalin : A 37% solution of formaldehyde in water.

Free energy (G) : The component of the total energy of a system that can do work at constant temperature and pressure and defined by the equation, $G = H - TS$, where H is the heat content (*enthalpy*), T the *thermodynamic temperature*, and S the *entropy*; takes into account changes in both energy and entropy.

Free radical : See **radical**.

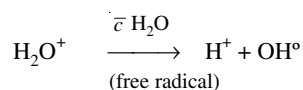
Free radicals are natural by-products of metabolism and are involved in the body's defence against microorganism. But, if in excess, they damage body cells and tissues and, thus play a role in degenerative disorder such as heart ailments and cancer. Free radicals are highly reactive, unstable molecules that normally attach cellular proteins, lipids and even DNA. It may be an atom or groups of atoms containing an unpaired electron, usually free radicals are formed in radiation as intermediates free radicals are formed in radiation as intermediates between final chemical products an ion pairs. During an ionizing radiation, an electron is ejected from a water molecule as :



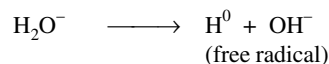
This high energy electron may be picked up by another water molecule as :



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 as :



or as :



The H° and OH^- will combine to form water. The H° and OH° 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 also react with oxygen to enhance the effect of radiation. 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.

Free-energy change (ΔG) : The amount of free energy released (negative ΔG) or absorbed (positive ΔG) in a reaction at constant temperature and pressure.

Fructose ($\text{C}_6\text{H}_{12}\text{O}_6$) : A monosaccharide found in many plants; also called *fruit sugar*.

Fugacious : (of plant organs) Withering or falling quickly.

Fumaric acid : A C-4 organic acid that takes on a molecule of water and becomes malic acid in the 7th step of the Krebs cycle, the reaction being catalyzed by fumarate hydratase.

Functional group : The specific atom or group of atoms that confers a particular chemical property on a biomolecule.

Fungicide : Any substance such as *benomyl* or *captan* that kills fungi.

Furanose : A simple sugar containing the 5-membered furan ring.

G

G proteins : A large family of heterotrimeric proteins that are important intermediaries in cell-signaling pathways. Usually activated by the binding of a hormone or other signaling ligand to seven-pass transmembrane receptor protein. They are called G proteins because binding of GTP and GDP is essential for their functioning.

Galactosaemia : A rare inborn error of metabolism in which the breast-fed human infant is literally poisoned by mother's milk. The affected infants are unable to metabolize the milk sugar galactose, which normally is converted to glucose ready for oxidation and the release of energy. Instead, affected infants store the galactose in various tissues including the brain, resulting in severe malnutrition along with mental retardation. Galactosaemia is due to

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- blockage of the step galactose-1-phosphate to glucose-1-phosphate because the enzyme uridylyltransferase is absent or inactive.
- Galactose** : A monosaccharide carbohydrate that does not occur freely in nature, but is combined with glucose to form lactose, a disaccharide sugar found in milk.
- Gamete** (Greek, for *wife*) : A haploid reproductive cell that fuses with another gamete to form a diploid zygote; the female is an *egg* and the male gamete is a *sperm*; in certain kinds of algae and fungi, however, the gametes are neither male nor female.
- Gamma-aminobutyric acid (GABA)** : One of many neurotransmitters that vertebrate nervous systems use, each with specific receptors on postsynaptic membranes. GABA opens the channel, which leads to the exit of positively-charged potassium ions and a more negative interior.
- Ganglion, plural ganglia** (Greek, for *swelling*) : A group of nerve cells forming a nerve centre in the peripheral nervous system.
- Gangliosides** : Sphingolipids, containing complex oligosaccharides as head groups; found in the plasma membrane of eukaryotic cells and especially abundant in nervous tissue.
- Gastric juice** : The fluid secreted by glands of the stomach, containing pepsin, renin, and hydrochloric acid.
- Gastrin** : A polypeptide hormone produced by gastrin cells of the pyloric gland that regulates the synthesis of HCl by the parietal cells of the gastric pits.
- Geiger-Müller counter, G-M tube** (named after *Hans Geiger*, LT, 1882–1947) : A widely-used apparatus for the determination of radioactive isotopes.
- Gel** : The gellylike solid state of a colloid, as distinct from the liquid *sol*.
- Gel electrophoresis** : A technique by which nucleic acids or proteins are separated in a gel that is placed in an electric field.
- Gel filtration** : A chromatographic procedure for the separation of a mixture of molecules on the basis of size; based on the capacity of porous polymers to exclude solutes above a certain size.
- Gene** ($genos^G$ = birth, race) : The basic unit of heredity. A sequence of DNA nucleotides on a chromosome that codes for a polypeptide or RNA molecule and thus determines of an individual's inherited traits. A gene can be defined either genetically or physically. The genetic test for a gene is the *cis-trans* test or complementation test. In physical terms, the gene is defined as the coding region of DNA that determines a protein product.
- Gene amplification** : A process in which many copies are made of some genes at one time, while other genes are not replicated. The replicated genes enable enhanced manufacture of product in a short time.
- Gene bank** : (1) A collection of clones containing all the genes of a particular organism, such as *Escherichia coli*. (2) A collection of many lines of a particular crop plant, used as a genetic resource by plant breeders.
- Gene cloning** : The technique of genetic engineering in which specific genes are excised from host DNA, inserted into a vector plasmid and introduced into a host cell, which then divides to produce many copies (clones) of the transferred gene.
- Gene expression** : Transcription and, in the case of proteins, translation to yield the product of a gene; a gene is expressed when its biological product is present and active.
- Gene frequency** : The frequency with which individuals in a population possess a particular gene; often confused with *allele frequency*.
- Gene pool** : The sum total of all the genes of all breeding individuals in a population at a particular time, represented by their gametes.
- Gene splicing** : The enzymatic attachment of one gene, or part of a gene, to another; also called *splicing*.
- Genetic code** : The “language” of the genes. The set of triplet code words in DNA (or mRNA) that code for the amino acids of proteins. Of the 64 possible codons, 61 are the codes for amino acids, and the remaining being termination codons that are not translated. With a few minor exceptions, all living beings use the same code, *i.e.*, the genetic code is *universal*.
- Genetic counselling** : The process of identifying parents at risk, for producing children with genetic defects and of assessing the genetic state of early embryos.
- Genetic engineering** : A collective term for the techniques of transferring genes from one organism to another and multiplying them; synonymous with *recombinant DNA technology*.
- Genetic map** : A diagram showing the relative sequence and position of specific genes along a chromosome.
- Genome** ($genos^G$ = offspring + oma^L = abstract group) : Total genetic information encoded in a cell or an organism, or a virus.
- Genomic library** : The set of fragments of an organism's genome that are cloned in a virus or bacterial plasmid.

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- Genotype** (*genos*^G = offspring + *typos*^G = form) : The genetic constitution of an organism, as distinct from its physical (or visible) characteristics actually developed during its life history, or phenotype; also used to refer to the set of alleles at a single gene locus; compare *phenotype*.
- Genus, plural genera** (Latin, for *race*) : A taxonomic category between family and species; includes one or more closely-related species; it forms the first part of the binomial of the scientific name of organism and is written or printed with an initial capital letter.
- Geometric isomers** : Isomers related by rotation about a double bond; also called *cis and trans isomers*.
- Geraniol (C₁₀H₁₇OH)** : A liquid terpene alcohol; present either free or as an ester, in many essential oils; b.p. 107°C.
- Germicide** : A substance that kills microorganisms.
- Germination** (*germinare*^L = to sprout) : The resumption of growth and development by a spore, seed or other structure.
- Gestation** : The development of the embryo in the uterus of mammals. The gestation period is the time elapsing from fertilization and the implantation of the embryo to birth. This takes 60 days in the domestic cat, 9 months in humans, and 18 months in the Indian elephant.
- Gibberellin** (*Gibberella*, a genus of fungi) : A type of plant hormone, produced in the apical regions of shoots and roots; controls stem elongation and seed germination, in particular but, unlike auxins, does not inhibit root growth.
- Gigantism** (*gigas*^G = giant) : A rare human condition in which excess production of growth hormone by the anterior pituitary gland during childhood and adolescence causes over-elongation of bones, producing a pituitary giant. Compare *dwarfism*.
- Gland** (*glandis*^L = acorn) : Any of several organs in the body, such as exocrine or endocrine, that secrete substances for use in the body. Glands are composed of epithelial tissue.
- Gladiin** : A simple protein, belonging to the group 'prolamines'; a storage protein in the grains of wheat.
- Globular protein** : Any protein with an approximately rounded shape (the value of axial ratio being between 1 and 4) such as insulin and ribonuclease; contrasts with highly elongated, *fibrous proteins*, such as collagen and fibrinogen.
- Globulins** : A group of proteins that are soluble in salt solution and coagulated by heat; occur in blood plasma and antibodies, and are the main proteins of plant seeds.
- Glucagon** : A polypeptide hormone (of 29 amino acids) produced by the α -cells in the islets of Langerhans that raises blood sugar level by breaking down glycogen to glucose; has effect opposite to *insulin*.
- Glucocorticoid** : A steroid endocrine secretion produced by the adrenal cortex, influencing the metabolism of carbohydrates and proteins, *e.g.*, cortisol and corticosterone.
- Glucogenic amino acids** : Amino acids with carbon chains that can be metabolically converted into glucose or glycogen *via* gluconeogenesis.
- Gluconeogenesis** : The biosynthesis of a carbohydrate from simpler, noncarbohydrate precursors such as oxaloacetate or pyruvate.
- Glucose (C₆H₁₂O₆)** : The commonest simple sugar which is colourless, crystalline and soluble in water; m.p. 146°C; occurs in honey and sweet fruits; the instant source of energy in organisms; 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; used in brewing, jam-making, confectionery etc; also known as *dextrose* or *grape sugar*.
- Glucoside** : An organic compound yielding glucose on hydrolysis.
- Glutathione (GSH)** : An autooxidizable, widely-distributed tripeptide containing glutamic acid, cysteine and glycine; involved in certain oxidations in the cell.
- Glutelins** : A composite term for a group of simple coagulable proteins isolated from plant seeds only; includes *glutelin* from wheat and *oryzenin* from rice.
- Glycan** : Another term for polysaccharide; a polymer of monosaccharide units joined by glycosidic bonds.
- Glycerol** : A sweet, syrupy trihydroxyalcohol, colourless and odourless; formed by the digestion of fats and fixed oils in the plants; parent compound of many small molecules in the cell, including phospholipids; also called *glycerine*.
- Glycerophospholipid** : A amphipathic lipid with a glycerol backbone; fatty acids are ester-linked to C-1 and C-2 of glycerol, and a polar alcohol is attached through a phosphodiester linkage to C-3.
- Glycogen** (*glykys*^G = sweet + *gen*^G = of a kind) : A white, amorphous, tasteless polysaccharide composed exclusively of glucose units and used to store energy in animal cells. Large granules of glycogen are especially abundant in liver and muscle cells. Also called "animal starch".
- Glycolipid** : A membrane lipid molecule with a short carbohydrate chain attached to a hydrophobic tail.

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- Glycolysis** (*glykys*^G = sweet + *lyein*^G = to loosen) : The ubiquitous catabolic pathway, taking place in the cytosol, by which a molecule of glucose is oxidatively broken down into 2 molecules of pyruvic acid; the substrate-level phosphorylation of 2 molecules of ADP to ATP and the reduction of 2 molecules of NAD⁺ to NADH occur for the breakdown of each molecule of glucose; constitutes the early stages of respiration.
- Glycoprotein** : Any protein with one or more covalently-linked oligosaccharide chains; includes most secreted proteins and most proteins exposed on the outer surface of the plasma membrane such as *extensin*.
- Glycosaminoglycan (GAG)** : A heteropolysaccharide of two alternating units: one is either *N*-acetylglucosamine or *N*-acetylgalactosamine, the other is a uronic acid (usually glucuronic acid); hyaluronic acid and heparin are common examples; formerly called *mucopoly-saccharide*.
- Glycoside** : An organic compound yielding a sugar on hydrolysis. Glycosides containing glucose are called *glucosides*, those with galactose are called *galactosides*.
- Glycosidic bond** : 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.
- Glycosuria** : The condition where glucose is excreted in the urine because the blood sugar level exceeds the normal (*hyperglycemia*). Glycosuria is one of the symptoms of diabetes.
- Glycosylation** : The addition of a carbohydrate to an organic molecule such as a protein.
- Glyoxylate cycle** : A variant of the citric acid cycle that converts acetyl-CoA into succinate and, eventually, new carbohydrate; occurs in bacteria and some plant cells.
- Glyoxysome** : A specialized peroxisome containing the enzymes of the glyoxylate cycle; found in cells of germinating oilseeds and seedlings that arise from them.
- Goitre** (*goitre*^{Fr}, from *goitreux*; *guttur*^L, from *guttur* = the throat) : An enlargement of the thyroid gland resulting from a deficiency of iodine in the diet.
- Golgi body** (after *Camillo Golgi*, an Italian physician) : A stack of flattened, membranous vesicles, often branched and present in the cytoplasm of eukaryotic cells; Golgi bodies are the sites where precursors of cell wall materials and other cellular components are assembled and prepared for secretion from the cell or are incorporated into the plasma membrane or organellar membranes; also known as *dictyosome*.
- Golgi complex** (after *Camillo Golgi*, an Italian physician) : A collective term for Golgi bodies.
- Gonad** (*gone*^G = generation) : An organ in which gametes, male or female, are produced.
- Grain** : A simple, indehiscent, dry, single-seeded fruit in which the seed coat is fused to the pericarp over its entire surface, as in cereal grasses such as wheat, rice, maize etc; grain is a caryopsis fruit.
- Gram molecular weight** : The weight in grams of a compound that is numerically equal to its molecular weight; the weight of one mole.
- Gram reaction** : A method of differential staining of bacteria by treating them with a special iodine solution after they have been stained with Gentian violet. Certain species of bacteria (gram-positive) retain the purple dye and others (gram-negative) are decolorized, thus affording a basis for classification.
- Granum, plural grana** (Latin, for *grain* or *seed*) : In chloroplasts, stacks of membrane-bound disks called thylakoids; the thylakoids contain the chlorophylls and carotenoids and are the sites of the photochemical (*i.e.*, "light") reactions of photosynthesis.
- Ground state** : The normal, stable form of an atom or molecule; as distinct from the *excited state*.
- Growth hormone (GH)** : See **somatotrophic hormone (STH)**.
- Guanine (C₅H₅ON₅)** (Sp. from *Quechua*, huanu, dung) : A purine base found in DNA and RNA; occurs in high concentration as a white crystalline base in guano (=bird manure), hence its nomenclature.
- Gum** : Any of a class of colloidal, water-soluble substance (chemically, a hemicellulose) that is exuded by or extracted from plants; gluey when wet but hardening on drying; consists of many kinds of monosaccharides. An example is *gum arabic* (extracted from *Acacia senegal*), which is a complex branched-chain hemicellulose consisting of the monosaccharides arabinose, galactose, glucose, and rhamnose.

H

Half-life : (1) For a chemical reaction, the time at which half of the substance has been consumed and turned into product. (2) In biochemistry, the time required for the disappearance or decay of one-half of a given component in a system. Half-lives vary from isotope to isotope, some being less than a millionth of a second and some more than a million years; symbol, $T_{1/2}$; also called *half-time*.

Half-time : See **half-life**.

Homeothermy (*homeo*^G = similar + *therme*^G heat) :

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- The maintenance of a stable body temperature independent of the environmental temperature by the organisms such as birds and mammals.
- Heat-shock protein** : Protein synthesized in response to an elevated temperature or other stressful treatment; usually helps the cell to survive the stress; also called *stress-response protein*.
- Heat-labile** : Destroyable by heat.
- Heavy isotope** : A stable atom in which there are more neutrons than in the normal isotope of the element, giving it a greater mass; for example, ^{15}N is the heavy isotope, ^{14}N is the common form.
- Hierarchy** (*hieros*^G = sacred + *archos*^G = leader) : Refers to a graded system of classification in which each step of category includes all those below it; especially the Linnean hierarchy used in classification of organisms.
- HeLa cell** : Line of human epithelial cells that grows vigorously in tissue culture that is grown as a standard in research laboratories all over the world; derived from a human cervical carcinoma obtained from *Henrietta Lacks* in 1951.
- Helicase** : An enzyme that breaks hydrogen bonds between complementary base pairs of DNA, thereby causing separation of 2 strands in a DNA molecule before replication.
- Helix** : Anything of a spiral shape; in biology, it refers to the shape of DNA molecules, which occur as double helices.
- Heme** : A complex organic ring structure, called a protoporphyrin, to which an iron atom is bound; occurs in cytochromes of all organisms and in the hemoglobin of animals; also spelt as *haem*.
- Heme protein** : A protein containing a heme as a prosthetic group.
- Hemicellulose** : Primarily a cell wall polysaccharide of variable composition and structure; less complex than cellulose and easily hydrolyzable to simple sugars; hemicellulose that is secreted by plants is also called a *gum*.
- Hemoglobin** (*haima*^G = blood + *globus*^L = a ball) : A globular heme protein in vertebrate red blood cells and in the plasma of many invertebrates that carries oxygen and carbon dioxide; heme group binds oxygen and carbon dioxide and as well as imparts red colour to the blood; also spelt as *haemoglobin*.
- Hemolytic** (*haima*^G = blood + *lytikos*^G = able to loosen) : An agent causing dissolution of the red blood corpuscles.
- Hemophilia** : An individual that lacks a clotting factor and consequently bleeds easily. Some of the genes for clotting factors are sex-linked.
- Hemopoiesis** : Generation of blood cells, mainly in the bone marrow; also called *hematopoiesis*.
- Hemorrhage** (*haima*^G = blood + *rhegnunai*^G = to break) : An escape of blood from the blood vessels, due to a wound or disease.
- Henderson–Hasselbalch equation** : An equation relating the pH, pK_a , and the ratio of the concentrations of the proton-acceptor (A^-) and proton-donor (HA) species in a solution. Alternatively, it is a formula for calculating the pH of a buffer solution.
- Heparin** : A mucopolysaccharide molecule produced in the liver that acts as an anticoagulant, inhibiting the transformation of prothrombin to thrombin, a vital step in blood clotting.
- Hepatitis** : A serious disorder of the liver that leads to severe jaundice, liver degeneration and even death. The condition is caused by two viruses : hepatitis A virus, which produces *infective hepatitis* transmitted by the intestinal-oral route, and hepatitis B virus, which produces *serum hepatitis* transmitted *via* infected blood or its products. Of the two viral types, type A usually has a shorter incubation period than type B.
- Hepatocyte** : The major cell type of liver tissue.
- Herbicide** : Any chemical that kills plants. Herbicides can be highly selective; for example, 2,4-D only kills dicotyledons (broad-leaved plants), leaving monocotyledons unharmed.
- Heredity** : Transmission of traits from one generation to the next.
- Heterochromatin** (*heteros*^G = different + *chroma*^G = colour) : Region of a eukaryotic chromosome that remains permanently condensed and therefore is not transcribed into RNA; stains darkly with Giemsa stain; most centromere regions are heterochromatic; easily visible by light microscopy. Heterochromatin is either constitutive or facultative. Constitutive heterochromatin is composed of repeated sequences of DNA. Facultative heterochromatin is a transient form of inactive DNA (an inactive X chromosome, for example) that is usually the result of methylation of cytosine.
- Heterogeneous nuclear RNA (hn RNA)** : The pool of primary RNA transcripts in the nucleus which are of various, usually large sizes. It is, in fact, the immediate product of transcription in an eukaryote, containing both introns and exons; also known as *pre-mRNA*.
- Heteropolymer** : A polymer that is made of more than one kind of monomer; for example, polypeptides and nucleic acids. Compare *homopolymer*.
- Heteropolysaccharide** : A polysaccharide containing more than one type of monosaccharide units.

- Heterotroph** (*heteros*^G = different; *trophikos*^G = food) : An organism that cannot synthesize its own food (*i.e.*, organic compounds) entirely from inorganic precursors but must consume at least some organic compounds made by other organisms. In particular, these organisms can not use CO₂ as a carbon source. Compare *autotroph*.
- Hexose** : A simple sugar with a backbone having six carbon atoms.
- High-energy bond** : A covalent bond that has a low activation energy and is broken easily and which on hydrolysis releases an unusually large amount of free energy under the conditions existing in a cell. A group linked to a molecule by such a bond is readily transferred from one molecule to another; common examples are the phosphodiester bonds in ATP and the thioester linkage in acetyl-CoA.
- High-energy compound** : A compound that on hydrolysis undergoes a large decrease in free energy under standard conditions.
- Histamine** (C₅H₉N₃) : A small molecule derived from the amino acid histidine, released from mast cells and basophils in allergic reactions; causes irritation, dilation of blood vessels, and contraction of smooth muscle.
- Histone** (*histos*^G = tissue) : The family of five very basic positively-charged, low-molecular-weight polypeptides, rich in arginine and lysine, that are tightly associated with DNA in the chromosomes of all eukaryotic cells. Histones form the core of nucleosomes, around which DNA is wrapped. The 5 major histones are represented as H1, H2A, H2B, H3 and H4.
- Holoenzyme** : A complete or intact, catalytically-active, enzyme consisting of a protein part, apoenzyme and a nonprotein part, prosthetic group, which may be an organic molecule (*coenzyme*) or a metal ion (*cofactor*). It is, thus, the entire molecular structure required to carry on an enzymatic function (for example, polymerase III, with all of its 7 subcomponents).
- Homeosis** : The transformation of one tissue or organ into another.
- Homopolymer** : A polymer that is made of only one kind of monomer; for example, starch which is made only of glucosyl units. Compare *heteropolymer*.
- Hominid** (*homo*^L = man) : Human beings and their direct ancestors, *i.e.*, a member of the family, Hominidae; *Homo sapiens* is the only living member.
- Homologous chromosome** (*homologia*^G = agreement) : One of the two nearly identical versions of each chromosome. Chromosomes that associate in pairs in the first state of meiosis. In diploid cells, one chromosome of a pair that carry equivalent genes.
- Homologous proteins** : Proteins having sequences and functions similar in different species, for example, the hemoglobins.
- Homology** (*homologia*^G = agreement) : Similarity in structure of an organ or a molecule, reflecting a common evolutionary origin, specifically such a similarity in protein or nucleic acid sequence; structures related by homology are homologous and are called as homologues; contrasted with *analogy*– a similarity that does not reflect a common evolutionary origin.
- Homoplasy** : Resemblance among organisms not due to inheritance from a common ancestry (not homologous).
- Homopolymer** : A polymer that is made of only one kind of monomer; for example, starch which is made only of glucosyl units. Compare *heteropolymer*.
- Hormone** (*hormaein*^G = to excite) : A chemical substance (often a steroid or peptide), synthesized in minute quantities by an endocrine gland 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 in, or on the surface of, target cells that binds a specific hormone and initiates the cellular response.
- Human Genome Project (HPG)** : An international effort to determine the sequence of nucleotides in the human genome.
- Human immunodeficiency virus (HIV)** : The virus responsible for acquired immunodeficiency syndrome (AIDS), a deadly disease that destroys the human system. HIV is a retrovirus (its genetic material is RNA) that is believed to have been introduced to humans from African green monkeys.
- Hyaluronidase** : An enzyme present in snake venom and bacteria that catalyzes the hydrolysis of hyaluronic acid, thus making it ineffective in stopping the spread of invading microbes and other toxic substances.
- Hybrid** : (*hybrida*^L = the offspring of a tame sow and a wild boar) – An individual that results from the crossing of dissimilar parents.
- Hydration** : Union of a chemical substance with water without chemical decomposition.
- Hydrazine** (H₂N.NH₂) : A fuming, strongly basic liquid; b.p. 113°C; a powerful reducing agent and is highly reactive; used in organic synthesis and as a rocket propellant, either alone or mixed with the dimethyl derivative.
- Hydrocarbon** : A compound that has only carbon and hydrogen atoms.

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Hydrogen bond : A weak electrostatic chemical bond that forms between one electronegative atom (such as oxygen or nitrogen) and a hydrogen atom covalently linked to a second electronegative atom. Hydrogen bonds hold the 2 complementary strands of DNA together. Life would be impossible without this type of linkage.

Hydrolases : Enzymes that catalyze hydrolysis reactions; common examples are lipases, nucleases, phosphatases and proteases.

Hydrolysis (*hydro*^G = water + *lyse*^G = break) : Cleavage of a covalent bond, such as an anhydride or peptide bond, by the addition of elements of water, yielding two or more products. Common examples are conversion of maltose to glucose and dipeptide to 2 amino acids; essentially the reverse of *dehydration*.

Hydronium : The hydrated hydrogen ion (H₃O⁺).

Hydrophathy index : A scale that expresses the hydrophilic and hydrophobic tendencies of a chemical group.

Hydrophilic (*hydro*^G = water + *philic*^G = loving) : Polar or charged; describing molecules or groups that form enough hydrogen bonds with water and hence dissolve freely in water; sugars are hydrophilic; compare *hydrophobic*.

Hydrophobic (*hydro*^G = water + *phobos*^G = hating) : Nonpolar or uncharged; describing molecules or groups, which do not form hydrogen bonds with water and hence are not soluble in water (but are soluble in nonpolar solvents such as ether, acetone); lipids and hydrocarbons are generally hydrophobic; also called as *lipophilic*; compare *hydrophilic*.

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.

Hydroxyl (-OH) : A chemical group consisting of a hydrogen atom linked to an oxygen atom, as in an alcohol.

Hyperchromic effect : The large increase in light absorption at 260 nm occurring as a double-helical DNA is melted (unwound).

Hyperemia : An increased blood flow to an organ or tissue.

Hyperplasia : An increase in tissue mass caused by an increase in cell number.

Hypertonic (*hyper*^G = above + *tonos*^G = tension) : Refers to the solution surrounding a cell that has a sufficiently high concentration of solutes to cause water to move out of the cell due to osmosis.

Hypertrophy (*hyper*^G = too much + *trophe*^G = nurture) : An excessive growth or development of an organ or tissue.

Hypophysectomy : The removal of the pituitary gland.

Hypothalamus (*hypo*^G = under *thalamos*^G = inner room) : The region of the brain under the thalamus that controls temperature, hunger, and thirst, and that produces hormones that influence the pituitary gland.

Hypothesis, plural hypotheses (*hypo*^G = under + *tithenai*^G = to put) : A proposal that might be true. No hypothesis ever proven correct. All hypotheses are provisional—proposals that are retained for the time being as useful but that may be rejected in the future if found to be inconsistent with new information. Alternatively, a hypothesis may be defined as a supposition put forward in explanation of observed facts. A hypothesis that stands the test of time – often tested and never rejected – is called a *theory*.

Hypotonic (*hypo*^G = under + *tonos*^G = tension) : Refers to the solution surrounding a cell that has a sufficiently low concentration of solutes to cause water to move into the cell due to osmosis.

I

Iatrochemistry : Medieval medical chemistry; early attempts at the application of drugs to medicine.

Imbibition : The adsorption of water onto the internal surfaces of materials; one of the methods by which root hair and other plant parts obtain water.

Immune response : Response made by the immune system of a vertebrate when a foreign substance or microorganism enters its body; the response is exhibited by generating antibodies and T-cells against a foreign specific antigen.

Immunoglobulin, I_g : An antibody protein generated against, and capable of binding specifically to, an antigen. Higher vertebrates have five classes of immunoglobulin – I_gA, I_gD, I_gE, I_gG and I_gM—each with a different role in the immune response.

In vitro (Latin, for “*in glass*”) : A 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 usually taken in glass equipments, as opposed to in an organism (*in vivo*).

In vivo (Latin, for “*in life*”) : Refers to a process taking place in an intact (*i.e.*, living) cell or an organism, as opposed to in a culture (*in vitro*).

Inbreeding : The mating of related individuals.

Indeterminate growth : Growth that is not inherently limited, as with a vegetative apical meristem that produces an unrestricted number of organs indefinitely.

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- Indole-3-acetic acid, IAA** : A plant hormone (growth regulator) that influences cellular elongation, among other things.
- Indole-3-acetonitrile (IAN)** : A plant growth-regulating hormone.
- Induced fit** : A change in the conformation of an enzyme in response to substrate binding that renders the enzyme catalytically active.
- Inducer** : A signal molecule that, when bound to a regulatory protein, produces an increase in the expression of a given gene. It is an environmental agent that triggers transcription from an operon.
- Inducible enzyme** : An enzyme that is produced in response to the presence of its substrate (the inducer).
- Infection** : The invasion of tissues by microorganisms with or without disease production.
- Informational macromolecules** : Biomolecules containing information in the form of specific sequences of different monomers; for example, many proteins, lipids, polysaccharides and nucleic acids.
- Infusion** : The liquid extract of any substance which has been soaked in water.
- Inhibitor** : A chemical whose binding alters the shape of a protein and shuts off enzyme activity.
- Initiation complex** : A complex of a ribosome with an mRNA and the initiating Met-tRNA^{Met} or fMet-tRNA^{fMet}, the formation of which begins polypeptide (or protein) synthesis.
- 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; also called *start codon*.
- Initiation factor** : A protein that promotes the proper association of ribosomes with mRNA and is required for the initiation of protein synthesis.
- Innate** (*innatus*^L = born) : Describing a characteristic based partly or wholly on inherited gene differences.
- Inorganic compound** : A type of molecule that either lacks carbon or *contains carbon but not hydrogen*; carbon dioxide (CO₂) and water (H₂O) are examples of inorganic compounds.
- Inorganic pyrophosphatase** : An enzyme that hydrolyzes a molecule of inorganic pyrophosphate to yield two molecules of (ortho) phosphate; also known simply as *pyrophosphatase*.
- Inositol phospholipids** : See **phosphoinositides**.
- Inositol** : A cyclic molecule with 6 hydroxyl (OH) groups that forms the hydrophilic head group of inositol phospholipids.
- Inositol phosphate** : A mediator molecule produced during insulin receptor-induced enzyme activity.
- Insane** (*insanus*^L, from *in* = not + *sanus* = sane) : Unsound in mind or lunatic.
- Insecticide** : Any substance that is used to kill insects; for example, DDT or malathion.
- Insulin** (*insula*^L = an island, from the 'islets of Langerhans') : A peptide hormone secreted by the β-cells of islets of Langerhans in the pancreas that acts as a storage hormone. It enables the body to use sugar and other carbohydrates by regulating the body's sugar metabolism in animals. Insulin has three targets : the liver, the muscles and adipose tissue.
- Interferon** : In vertebrates, a class of glycoproteins produced naturally in virus-infected cells that inhibits viral multiplication.
- Intermediary metabolism** : In cells, the enzyme-catalyzed reactions that extract chemical energy from nutrient molecules and utilize it to synthesize and assemble cell components. It does not include nucleic acid and protein synthesis.
- Internal membrane** : An eukaryotic cell membrane other than the plasma membrane; for example, the membranes of the endoplasmic reticulum and Golgi apparatus.
- Internode** : The part of the plant stem between two successive nodes, where branches and leaves attach.
- Intracellular digestion** : Digestion occurring within a cell.
- Intron** (*intra*^L = within) : A noncoding sequence of nucleotides within a eukaryotic gene that is transcribed into an mRNA molecule but is then excised by RNA splicing before the gene is translated. These untranslated regions of DNA make up the bulk of most eukaryotic genes; also called as *intervening sequence*. Compare exon.
- Inulin** : A white, tasteless soluble polysaccharide, yielding fructose on hydrolysis and found especially in the roots, tubers, and rhizomes of the members of Compositae (*Dahlia*, *Helianthus*, *Taraxacum*).
- Invertase** : An enzyme which catalyzes the breakdown of sucrose by hydrolysis into glucose and fructose; also called as *saccharase*, *sucrase*, or β, (+)-*fructosidase*.
- Iodine number** : A measure of the degree of unsaturation (content of double bonds) of a product such as an oil or fat; it is expressed in grams of iodine absorbed by 100 g of the given oil or fat; also called as *Koettstorfer number* or *Hübl number*.
- Ion** : An atom in which the number of electrons does not equal the number of protons; an ion does carry an electrical charge. Alternatively, an ion

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- is an electrically-charged atom or groups of atoms.
- Ion channel** : An integral membrane protein that provides for the regulated transport of a specific ion or ions, across a membrane.
- Ion exchange resin** : A polymeric that contains fixed charged groups; used in chromatographic columns to separate ionic compounds.
- Ion product of water (K_w)** : The product of the concentrations of H^+ and OH^- in pure water; $K_w = [H^+][OH^-] = 1 \times 10^{-14}$ at $25^\circ C$.
- Ionic bond** : A noncovalent bond formed between two ions, one with a positive charge and the other with a negative charge, as a result of the attraction of opposite electrical charges.
- Ionization** : The process of spontaneous ion formation.
- Ionizing radiation** : A type of radiation such as x rays and gamma rays, that causes loss of electrons from some organic molecules, thus making them more reactive.
- Ionophore** : A small hydrophobic molecule that binds one or more metal ions and is capable of diffusing across a membrane, carrying the bound ion.
- Iron-sulfur centre (Fe-S centre)** : A prosthetic group of certain redox proteins involved in electron transfers; Fe^{2+} and Fe^{3+} is bound to inorganic sulfur and to cysteine groups in the protein.
- Isotope** (*isos*^G = equal + *topos*^G = place) : Different forms of an element that differ in atomic weight but are otherwise chemically identical to the naturally abundant form of the element; the various forms have the same number of protons but different numbers of neutrons; may be either stable or radioactive; used as tracers.
- Islets of Langerhans** (after *Paul Langerhans*, a German anatomist) : The small, scattered endocrine glands in the pancreas that secrete the hormones, insulin and glucagon.
- Isocitric acid** : A C-6 organic acid that loses a molecule of CO_2 in the third step of the Krebs cycle, thereby being converted to α -ketoglutaric acid; also during this conversion, one molecule of NAD^+ is reduced to $NADH$.
- Isoelectric point (pI)** : The pH at which a solute has no net electric charge and thus does not move in an electric field.
- Isoenzyme** : Multiple forms of an enzyme that catalyze the same reaction but differ from each other in their amino acid sequence, substrate affinity, V_{max} , and/or regulatory properties; also called *isozyme*.
- Isoforms** : Multiple forms of the same protein that differ somewhat in their amino acid sequence.
- Isomerases** : Enzymes that catalyze the transformation of compounds into their positional isomers, *i.e.*, from D to L, or L to D forms.
- Isomers** (*isos*^G = same; *meros*^G = part) : Molecules that are formed from the same atoms in the same chemical linkages but have different three-dimensional conformations; alternatively, molecules with the same molecular formulae but with different structural formulae.
- Isoprene** : A small, unsaturated hydrocarbon containing 5 carbon atoms; chemically called 2-methyl-1,3-butadiene; a parent compound of isoprenoids such as retinoic acid and cholesterol.
- Isoprene rule** : Refers to the statement that nearly all the terpenoids are made of varying number of repetitive units (C_5H_8), called isoprene units.
- Isothermal** : Occurring at constant temperature.
- Isotonic** (*isos*^G = equal + *tonos*^G = tension) : Refers to the solution surrounding a cell that has the same concentration of solutes as in the cell.
- Isotope** (*homeos*^G = similar + *stasis*^G = standing) : The maintenance of a relatively stable internal physiological environment in an organism, or steady-state equilibrium in a population or ecosystem, by regulatory mechanisms that compensate for changes in external circumstances.
- Isozyme** : *See isoenzyme.*

J

- Jaundice** (M.E. jaundice from *jaunice*^{Fr} = yellowness) : Condition characterized by yellowness of the skin and mucous membranes and the secretion of bile pigments in the urine, turning it dark yellowish.
- Joint** : The part of a vertebrate where one bone meets and moves on another.
- Joule (J)** : The amount of energy needed to move one kilogram through one meter with an acceleration of one metre per second per second; one joule is the energy delivered in one second by a one-watt power source; 10^7 erg; approximately equal to 0.24 calories; a slice of apple pie contains about 1.5×10^6 J.
- Juvenile hormone (JH)** : A hormone present in juvenile insects and secreted by the corpus allatum of the brain. So long as it is produced, the cuticle maintains the characteristics of the nymphal or larval form at each moult. Only when it ceases to be present or the level falls below a threshold value does the insect moult to the adult form. Also called *status quo hormone* (*SQH*).

K

Karyotype (*karyon*^G = kernel + *typos*^G = stamp or print) : Full set of chromosomes of a cell arranged with respect to size, shape and number.

Keratins : Hard, fibrous, insoluble, sulfur-containing, structural or protective proteins consisting of parallel polypeptide chains in α -helical or β -conformations, found in the epidermis of vertebrates, mainly in the outermost layers of skin; can have several forms : in scales, feathers, hooves, horns, claws and nails, it is hard, while wool and hair are made up of a soft and flexible form.

Keratitis (*keras*^G = horn + *-itis*^G = inflammation) : Inflammation of the cornea.

Kenins : A group of substances that promotes cell division; kinetin is one of the common kinins.

Keto-enol tautomerism : A type of tautomerism that occurs in ketones as the result of the migration of a hydrogen atom from an alkyl group to the carbonyl group.

Ketogenic amino acids : Amino acids with carbon skeletons that can serve as precursors of the ketone bodies.

Ketone : An organic molecule containing a carbonyl group linked to two alkyl groups.

Ketone bodies : Water-soluble fuels normally exported by the liver but overproduced during fasting or in untreated diabetes mellitus; aminoacetate, D- β -hydroxybutyrate and acetone common examples.

Ketonuria (*ketone*^{Eng} = variant of a acetone, from *acetum*^L = vinegar + *ouron*^G = urine) : The presence of ketone bodies in the urine.

Ketose : A simple monosaccharide in which the carbonyl group occurs within the chain and, hence, represents a ketone group, *e.g.*, fructose; compare *aldose*.

Kilocalorie : Unit of heat energy, equal to 1,000 calories.

Kelvin scale : An absolute scale of temperature where a range of 1° kelvin (K) is equal to a range of 1°C. $0^{\circ}\text{K} = -273.15^{\circ}\text{C}$ or -459.67°F .

Kilojoule : Standard unit of energy, equal to 1,000 joules, or 0.24 kilocalories.

Kinases : Enzymes that catalyze the phosphorylation of certain molecules by ATP.

Kinetic energy : The energy of motion; a solute that moves down its concentration gradient has kinetic energy.

Kinetics : The study of reaction rates.

Kinetin, K (C₁₀H₉ON₅) : A growth substance prepared from deoxyribonucleic acid; chemically known as 6-furfurylaminopurine;

acts as a cytokinin, *i.e.*, promotes cell division in plants.

Kinetochore (*kinetikos*^G = putting in motion + *choros*^G = chorus) : A discoid complex of proteins that is bound on one side to a centromere and on the other side to a spindle fibre.

Kingdom : The highest grouping (taxon) in biological classification, such as animal kingdom (*Animalia*) and plant kingdom (*Plantalia*).

Ketosis : A condition in which the concentration of ketone bodies in the blood, tissues, and urine is abnormally high.

Krebs cycle : See **citric acid cycle**.

Kwashiorkor : The most widespread and serious human nutritional disease brought on by acute protein starvation. The disease is characterized by apathy, impaired growth, skin ulcers, swollen hands and feet and an enlarged liver. If left untreated, it is fatal. Kwashiorkor typically affects children in the early stages after weaning.

Kyphosis (a Greek word, meaning *humpback*) : Abnormal curvature of the vertebral column.

L

Lac operon : A cluster of genes encoding 3 proteins that bacteria use to obtain energy from the sugar lactose.

Lachrymal gland : The tear gland that lies below the upper eyelid of mammals and serves to moisten and cleanse the surface of the eye by secreting sterile and antiseptic liquid. Excess fluid is drained away through the lachrymal duct in the corner of the eye which leads eventually into the nasal cavity.

Lactase : An enzyme that splits the disaccharide lactose into galactose and glucose, secreted as part of the intestinal juice by glands in the wall of small intestine.

Lactation : The production of milk by the adult female mammal from the mammary gland, and with which it suckles its young. Lactation is induced by luteotrophic hormone (LTH), from the anterior pituitary gland.

Lactose : A disaccharide carbohydrate found in the milk of mammals; produced by condensation reaction between galactose and glucose; broken into its component monosaccharides by lactase; souring of milk is due to the conversion of lactose to lactic acid by microbes present in the air.

Lagging strand : One of the two newly-made strands of DNA found at a replication fork. The lagging strand is synthesized in the direction opposite to that in which the replication fork moves and is made in discontinuous lengths that are later joined covalently. Compare *leading strand*.

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- Lamella, plural lamellae** (Latin, for a *little plate*) : A thin plate-like structure. In chloroplasts, a layer of chlorophyll-containing membranes. In bivalve mollusks, one of the two plates forming a gill. In vertebrates, one of the thin layers of bone laid concentrically around the Haversian canals.
- Lateral meristem** : Meristem that produces secondary tissue; the vascular cambium and cork cambium are examples of lateral meristem.
- Latex** : A milky, usually white, fluid found in the laticiferous ducts of certain plants and used commercially in the production of rubber, chicle and gutta-percha.
- Law of mass action** : The law stating that the rate of any given chemical reaction is proportional to the product of the activities (or concentrations) of the reactants.
- Leader sequence** : (1) For an mRNA, the nontranslated sequence at the 5' end of the molecule that precedes the initiation codon. (2) For a protein, a short, hydrophobic sequence of amino acids from amino terminal that signals the cellular fate or destination of a newly-synthesized protein, also called *signal sequence*.
- Leader sequence** : A short, noncoding sequence of DNA, immediately upstream from the beginning of a gene, that is transcribed into RNA; also called *signal sequence*.
- Leading strand** : One of the two newly-made strands of DNA found at a replication fork. The leading strand is synthesized in the same direction in which the replication fork moves and is made by continuous synthesis in the 5' → 3' direction. Compare *lagging strand*.
- Lecithin** : Any of a group of phospholipids, composed of choline, phosphoric acid, fatty acids and glycerol; found in animal and plant tissues.
- Leprosy** : A chronic loathsome disease characterized by mutilating and disfiguring lesions, with loss of sensation in fingers and toes; caused by infection with the bacterium *Mycobacterium leprae*; transmitted by contact between an affected area in the donor and skin abrasions in the recipient, although it is not highly contagious; treatment by sulfone drugs over long periods can produce gradual improvement.
- Lesion** : A localized area of diseased tissue.
- Lethal dose (LD)** : The amount of a treatment (e.g., viral inoculation, insecticide) that induces death in a laboratory animal in a standard time. Because the response to treatment is often nonlinear, it is more conventional to measure the amount of a treatment that causes 50% mortality in a standard time, the so-called LD₅₀. In some tests, the treatment dosage is fixed and the duration of the treatment period is varied, producing an estimate of lethal time and an LT₅₀.
- Leucocyte** : A nucleated blood cell lacking hemoglobin; includes lymphocytes, neutrophils, eosinophils, basophils and monocytes; also called *white blood corpuscle*; also spelt *leukocyte*; compare erythrocyte.
- Leukaemia** (*leukos*^G = white + *haima*^G = blood) : Disease characterized by gross excess of white blood cells in body organs and often in the blood itself. Together with lymphomas, they account for about 8% of all malignant tumours.
- Leukotrienes** : A family of molecules derived from arachidonate by the lipoxygenase pathway and function as local hormones, primarily to promote inflammatory and allergic reactions (such as the bronchial constriction of asthma).
- Levorotatory isomer** : A stereoisomer that rotates the plane of plane-polarized light to the left or anticlockwise; represented by the symbol *l* or (–).
- Leydig cells** : The cells of the testes that secrete testosterone when stimulated by luteinizing hormone (LH); also called *interstitial cells*.
- Ligament** (*ligare*^L = to bind) : A band on sheet of elastic connective tissue that links bone to bone.
- Ligand** (*ligare*^L = to bind) : A small molecule that binds specifically to a larger one; for example, a hormone is the ligand for its specific protein 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.
- Ligase** : An enzyme that joins together (ligates) two molecules in an energy-dependent process. DNA ligase, for example, links two DNA molecules together through a phosphodiester bond.
- Ligation** : The joining of 2 DNA molecules with a covalent bond.
- Light chains** : The two identical short strands of the 4 polypeptide chains of an antibody molecule.
- Light compensation point** : Light intensity at which photosynthesis equals respiration.
- Light microscope** : Any optical instrument that uses light to magnify images of specimens.
- Light reactions** : The reactions of photosynthesis that require light and cannot occur in the dark; also known as the *light-dependent reactions*.
- Light year** : The distance light travels in one year or 5.9×10^{12} miles.
- Lignin** : A complex phenylpropanoid polymer that makes cell walls stronger, more water-proof, and more resistant to pests, herbivores, and disease organisms; in case of the xylem of plants, lignin combines with cellulose to form lignocellulose;

- since lignin forms an impermeable barrier, the cells are dead.
- Lineage analysis** : Tracing the ancestry of individual cells in a developing embryo.
- Lineweaver–Burk equation** : An algebraic transform of the Michaelis-Menten equation, allowing determination of V_{\max} and K_m by extrapolation of [S] to infinity.
- Linkage** : The condition of having genes on the same chromosome (linked); alleles of genes that are linked tend to be inherited together; the greater the linkage, the lower the frequency of recombination between the two loci.
- Linoleic acid (C₁₇H₃₁ COOH)** : An unsaturated fatty acid which occurs in various vegetable oils, particularly linseed and cottonseed oils; contains 2 double bonds at C₉ and C₁₂.
- Linolenic acid (C₁₇H₂₉COOH)** : A yellow oily liquid unsaturated fatty acid, b.p. 229°C, which occurs in various vegetable oils, particularly linseed oil; contains 3 double bonds at C₉, C₁₂ and C₁₅; once known as *vitamin F*, its function in this capacity is discredited.
- Lipase** (*lipos*^G = fat + *-ase* = suffix, used for enzymes) : An enzyme that hydrolyzes fats (= triacylglycerols) to fatty acids and glycerol. Under certain conditions, it can reverse this action and synthesize fats out of glycerol and fatty acids. The main source of lipase is the pancreatic juice.
- Lipid** (*lipos*^G = fat) : A loosely-defined group of small biomolecules that are insoluble in water but dissolve readily in nonpolar organic solvents, and contain fatty acids, sterols, or isoprenoid compounds. Oils, such as olive and coconut, as well as waxes, such as beeswax and earwax, are all lipids. One class, the phospholipids, forms the structural basis of biological membranes.
- Lipogenesis** : The formation of fats from nonfatty sources.
- Lipoic acid (C₈H₁₄O₂S₂)** : A cyclic disulfide vitamin for some microorganisms; exceptional in being fat-soluble, rather than water-soluble; an intermediate carrier of hydrogen atoms and acyl groups in α -keto acid dehydrogenases.
- Lipophilic** : See **hydrophobic**.
- Lipoprotein** : A lipid–protein conjugate that serves to carry water-insoluble lipids in the blood. The protein component alone is an apolipoprotein.
- Liposome** : An artificial phospholipid bilayer vesicle formed from an aqueous suspension of phospholipid molecules.
- Locus plural loci** (Latin, for *place*) : In genetics, the position of a gene on a chromosome. Different alleles of the same gene all occupy the same locus.
- Longevity** : Length of life.
- Low-energy phosphate compound** : A phosphorylated compound with a relatively small standard free energy of hydrolysis.
- Lumen** : A cavity enclosed by an epithelial sheet (in a tissue) or by a membrane (in a cell).
- Luteinizing hormone (LH)** : A glycoprotein hormone produced by the anterior pituitary gland; in females, it brings about ovulation on the stimulus of increasing estrogen from the ovarian tissues and causes a change in the graafian follicle to form a corpus luteum; in males, it causes androgens to be secreted by the testis; also called *interstitial cell-stimulating hormone (ICSH)*.
- Luteol** : A xanthophyll pigment, commonly found in leaves.
- Luteotrophic hormone (LTH)** : A protein hormone secreted by the anterior pituitary gland of vertebrates; most versatile of all the adenohypophyseal hormones, hence jocularly called as “jack-of-all-trades”; influences the onset of lactation, stimulates progesterone secretion and also stimulates maternal behaviour in all vertebrates; also called *luteotropin* or *mammotrophic hormone (MH)* or *prolactin (PL)*.
- Lycopene** : A carotenoid pigment found in the fruit of tomato and of other members of the family Solanaceae.
- Lymph** (*lymp^a* = clear water) : In animals, a colourless, plasma-like transparent fluid (95% water), widespread in the body outside the blood circulatory system; derived from blood by filtration through capillary walls in the tissues; carries lymphocytes in a special system of ducts and vessels—the lymphatic vessels.
- Lymphocytes** (*lymp^a*^G = water + *kytos*^G = hollow vessel) : A subclass of leucocytes involved in the immune response when activated by a foreign molecule (an antigen); *B lymphocytes* develop in the bone marrow in mammals and are responsible for the production of circulating antibodies; *T lymphocytes* develop in the thymus and are responsible for cell-mediated immunity or kill foreign and virus-infected cells.
- Lymphomas** : Cancers of the lymph system. Together with leukemia, they account for about 8% of all malignant tumours.
- Lysergic acid diethylamide (LSD)** : An hallucinogenic drug prepared from lysergic acid.
- Lysis** : Destruction of a cell's plasma membrane or of a bacterial cell wall, releasing the cellular contents and killing the cell.
- Lyso-geny** : State of a bacterium in which it carries the DNA of an inactive virus integrated into its genome. The virus can subsequently be activated to replicate and lyse the cell.

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Lysosome (*lysis*^G = a loosening + *soma*^G = a body) : A membrane-bounded organelle in the cytoplasm of eukaryotic cells, containing many digestive enzymes which are most active at the acid pH found in the lumen of lysosomes; serves as a degrading and recycling centre for unneeded components.

Lysozyme : An enzyme that breaks down bacterial cell walls and provides protection against bacterial invasion in the skin, mucus membranes and many body fluids.

M

Macromolecule (*macro*^G = large + *moliculus*^L = a little mass) : A large molecule having a molecular weight in the range of a few thousand to many millions; refers specifically to polysaccharides, proteins, enzymes, lipids, and nucleic acids.

Malaise : A general feeling of illness.

Malaria : (*mal' aria*^{lt}, for *mala aria* = bad air) : A febrile disease due to infection with specific parasites.

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*^L = of an evil nature) : Describes tumours and tumour cells that are invasive and/or able to undergo metasis; a malignant tumour is a cancer.

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.

Maltose (C₁₂H₂₂O₁₁) : A hard, crystalline, soluble, reducing sugar, made up of two molecules of glucose; less sweet than canesugar; 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 and mammary glands in females; have 3 living subclasses:

Monotremata – primitive egg-laying mammals such as the duck-billed platypus and *Echidna*, the spiny anteater.

Marsupialia – which transfer their young to pouches for the latter part of their early development, such as kangaroos.

Eutheria – which have a placenta, such as cat, cow, monkey, man etc.

Mammary gland : A gland present in female

mammals that produces milk used to suckle their young; usually concentrated on the underbelly beneath the pelvic girdle; in most mammals, the size of the gland is determined by the state of the estrus cycle; probably evolved from a modified sweat gland and at least two are normally present (as in humans), though in many mammals more than two are developed (as in bitch).

Marrow : The soft tissue that fills the cavities of most bones and is the source of red blood cells.

Mass : In chemistry, the total number of protons and neutrons in the nucleus of an atom, approximately equal to the atomic weight.

Matrix : The aqueous contents of a cell or organelle (the mitochondria, for example) with dissolved solutes.

Medium : A substance on or in which microorganisms and other small organisms can be cultured. A medium can be liquid or solid. If solid, it frequently contains agar, a stiffening agent extracted from seaweed. Culture media can contain all necessary nutrients and trace elements for normal growth (a minimal medium) but can also be supplemented. For example, antibiotics can be added to test for antibiotic resistance in bacteria.

Medulla (Latin, for *marrow*) : The inner portion of an organ, in contrast to the cortex or outer portion, as in the kidney or adrenal gland. 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*.

Megapascal (MPa) : A unit of pressure; one million (10⁶) 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.

Melanin : A dark-brown or black pigment found in skin or hair.

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*.

Melatonin (from *mela* [nin] + [sero] *tonin*) : A hormone secreted by the pineal gland, whose removal causes the ovaries to undergo hypertrophy.

Membrane : Double layer of lipid molecules and associated proteins that encloses all cells and, in eukaryotic cells, many organelles.

Membrane channel : Transmembrane protein complex that allows inorganic ions or other

- small molecules to diffuse passively across the lipid bilayer.
- Membrane protein** : Protein that is normally closely associated with a cell membrane.
- Membrane transport** : Movement of molecules across a membrane *via* a specific membrane protein (a transporter).
- Menarche** : The onset of menstruation which occurs at puberty.
- Menopause** : The time at which women stop ovulating, with the result that the normal menstrual cycle no longer occurs. This is normally at about 45 to 50 years of age. Also called *climacteric*.
- Menstruation** (*mens*^L = *month*) : Periodic shedding of the blood-enriched lining of the uterus with accompanying bleeding when pregnancy does not occur in female mammals.
- Menstrual cycle** (*mens*^L = *month*) : Monthly cycle. The term used to describe the reproductive cycle, usually occurring every twenty-eight days, in women. The menstrual cycle in the primates is the cycle of hormone-regulated changes in the condition of the uterine lining, which is marked by the periodic discharge of blood and disintegrated uterine lining through the vagina, a process called *menstruation*.
- Meristem** (*merizein*^G = to divide) : A zone of unspecialized (and organized), dividing cells whose derivatives give rise to other tissues and organs of a flowering plant. Key examples are the root apical meristem and shoot apical meristem.
- Mesophyll** (*mesos*^G = middle + *phyllon*^G = leaf) : The photosynthetic parenchyma of a leaf, located within the epidermis. The vascular strands (veins) run through the mesophyll.
- Messenger RNA (mRNA)** : 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.
- Metabolic pathway** : The sequence of enzymatic reactions followed in the formation of one substrate from another.
- 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 Q_{10} .
- 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** (*metabole*^G = change) : The entire set of enzyme-catalyzed transformations of organic molecules in living cells; the sum total of all the processes involved in the building up and tearing down of protoplasm; the synthetic or building up processes constitute the anabolic phase of metabolism and the degradative or tearing down processes, the catabolic phase. A special energy-carrying molecule called ATP is involved in these processes.
- Metabolite** : A chemical intermediate in the enzyme-catalyzed reactions of metabolism.
- Metalloprotein** : A protein having a metal ion as its prosthetic group.
- Metaplasia** : The transformation of a tissue to another form.
- Metaplastm** : 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.
- Methyl (-CH₃)** : A hydrophobic chemical group derived from methane (CH₄).
- Micelle** : An aggregate of amphipathic molecules in water, with the nonpolar portions in the interior and the polar portions at the exterior surface, exposed to water.
- Michaelis-Menten constant (K_m)** : The substrate concentration (in moles/litre) at which the enzyme-catalyzed reactions proceed at one-half its maximum velocity.
- Michaelis-Menten equation** : The equation describing the hyperbolic dependence of the initial reaction velocity, V_0 , on substrate concentration, $[S]$, in many enzyme-catalyzed reactions:
- $$V_0 = \frac{V_{\max} [S]}{K_m + [S]}$$
- Michaelis-Menten kinetics** : A kinetic pattern in which the initial rate of an enzyme-catalyzed reaction exhibits a hyperbolic dependence on substrate concentration.
- Microbodies** : Cytoplasmic, single-membrane-bounded vesicles, containing peroxide-forming and peroxide-destroying enzymes; generally derived from endoplasmic reticulum; includes lysosomes, peroxisomes and glyoxysomes.

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- Microsomes** : Membranous vesicles formed by fragmentation of the endoplasmic reticulum of eukaryotic cells; recovered by differential centrifugation.
- Mil** : One thousandth (1/1,000) of an inch.
- 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
- Mimicry** (*mimos*^G = 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.
- Miscarriage** : The expulsion of a foetus before it is viable outside the womb.
- 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 one.
- Mitochondrion**, plural **mitochondria** (*mitos*^G = thread + *chondrion*^G = small grain) : A membrane-bounded, tubular or sausage-shaped organelle in the cytoplasm of eukaryotes; closely resemble the aerobic bacteria from which they were originally derived; 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 in eukaryotic cells; also called *chondriosome* or in common parlance as 'powerhouse' of the cell.
- Mixed-function oxidase** : An oxygenase enzyme that catalyzes a reaction in which two different substrates are oxidized, one by the addition of an oxygen atom from O₂ and the other by supplying two hydrogen atoms to reduce the remaining oxygen atom to H₂O.
- Mixed-function oxidases** : Enzymes, often flavoproteins, that use molecular oxygen (O₂) to simultaneously oxidize a substrate and a cosubstrate (usually NADH or NADPH).
- Modulator** : A metabolite that, when bound to the allosteric site of an enzyme, alters its kinetic characteristics.
- Module** : With reference to a protein or nucleic acid, a unit of structure or function that is used in a variety of different contexts.
- Molar solution** : One mole of solute dissolved in water to give a total volume of 1,000 mL.
- Mole** : A mole is the amount of a substance, in grams, that equals the combined atomic mass of all the atoms in a molecule of that substance.
- Mole, mol** (*moles*^L = mass) : The atomic weight of a substance, expressed in grams. One mole of any substance is defined as the mass of 6.0222×10^{23} atoms.
- Molecular genetics** : Field of genetics devoted to the study of the biochemical mechanisms by which heredity information is stored in nucleic acid and transmitted to proteins.
- 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 weight of the atoms in a molecule.
- Molecule** (*moliculus*^L = a small mass) : A group of atoms joined together by covalent bonds; the smallest unit of a compound that displays the properties of that compound and cannot be further subdivided without losing the quality of the compound.
- Monoamine** : An amine containing one amino group especially one that functions as a neurotransmitter. Acetylcholine and norepinephrine are monoamines.
- Monochromatic light** : Light consisting of vibrations of the same or nearly the same frequency; light of one colour.
- Monocotyledon (monocot)** : A class of flowering plants characterized by having one cotyledon in their embryo, leaves with parallel venation and flower parts often in threes. Compare *dicotyledons*.
- Monococious** (*monos*^G = one + *eikos*^G = house, dwelling) : Having male and female flowers on the same individual.
- Monomer** : Small molecular building block that can be linked to others of the same type to form a larger molecule (a polymer).
- Monoprotic acid** : An acid having only one dissociable proton.
- Monosaccharide** (*monos*^L = one + *sakcharon*^G = sugar) : A simple sugar that cannot be broken down by hydrolysis and having the general formula (CH₂O)_n, where n = 3 to 7; glucose and fructose are examples of monosaccharide. Monosaccharides are usually white, crystalline solids with a sweet taste and are generally soluble in water.
- Monosodium glutamate (MSG), HOOC.(CH₂)₂CH(NH₂).COONa** : A white soluble crystalline substance; used to intensify the flavour of foods; also called *sodium hydrogen glutamate* or 'taste powder'.
- Monoterpene** : A compound that consists of two isoprene units linked together; menthol is an example of monoterpene.
- Morphine (C₁₇H₁₉O₃N)** : A white, crystalline, narcotic alkaloid drug obtained from opium (*Papaver somniferum*).
- Morphogenesis** (*morphe*^G = form + *genesis*^G = origin) : The development of form in the growth of an individual; the growth and differentiation

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- of cells and tissues during development.
- Mosaic** : In genetics, an organism made of a mixture of cells with different genotypes.
- Motif** : An element of structure or pattern that recurs in many contexts ; specifically, a small structural domain that can be recognized in a variety of proteins.
- Mucopolysaccharide** : An older name for a *glycosaminoglycan*.
- Mucoprotein** : A complex of protein with polysaccharide.
- Mucosa** : Any epithelium that secretes mucus, such as the mucous membrane lining the alimentary canal.
- 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** (*mucus*^L = snivel) : Jellylike viscous, slimy substance secreted by mucous membranes.
- Multienzyme system** : A group of related enzymes participating in a given metabolic pathway.
- Murein** : The cross-linked mucopeptides that form the rigid framework of bacterial cell walls.
- Muscle** (*musculus*^L = 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.
- Muscular dystrophy (MD)** : A disease characterized by the progressive wasting of muscles and eventual death. One type, called *Duchenne MD*, is controlled by a recessive sex-linked gene and consequently affects more boys than girls. 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.
- Mustard gas, (CH₂CH₂Cl)₂ S** : An oily liquid that has been used as a 'war gas'; destroyed by oxidizing agents, *e.g.*, bleaching powder; synonymous with *yperite* or *dichlorodiethyl sulfide*.
- Mutagen** (*mutare*^L = to change) : A chemical capable of damaging DNA, thus causing mutation.
- Mutant** (*mutare*^L = to change) : A mutated gene. An organism carrying a gene that has undergone a mutation.
- Mutarotation** : The change in specific rotation of a pyranose or furanose sugar or glycoside accompanying the equilibration of its α - and β -anomeric forms.
- Mutases** : Enzymes that catalyze the transposition of functional groups.
- Mutation** (*mutare*^L = to change) : Heritable changes in the nucleotide sequence of genomic DNA (or genomic RNA, in the case of an RNA virus).
- Myeloma** : A cancerous tumour of the bone marrow.
- 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 × 35 × 25 Å; 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.
- Myosin** (*myos*^G = muscle + *in*^G = belonging to) : A contractile protein; one of the two protein components of myofilaments (the other is actin). *Myosin II* is a very large protein that forms the thick filament of skeletal muscle that slide over actin filaments during contraction. *Myosin I* is smaller, more widely distributed, and not assembled into filaments.
- Myxedema** (*myxa*^G = slime + *oidema*^G = 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*.

N

- Nail** : A horny, keratinized layer protecting the distal end of each finger and toe in humans and most other primates; in other terrestrial vertebrates, the nail is shaped into a claw.
- Native conformation** : The biologically-active conformation of a macromolecule.
- Nausea** (*nausia*^G = sea-sickness, from *naus* = a ship) : Feeling of sickness.
- Nectar** (Greek, *nektar*) : A sweet liquid rich in sugar and amino acids and found in many flowers; attracts insects and birds that bring about pollination.
- Negative feedback** : Regulation of a biochemical pathway achieved when a reaction product inhibits an earlier step in the pathway.
- Neonatal** : (of newborn offspring, particularly human) the first month of independent life.
- Neontology** : The study of life of recent living organisms. Compare *palaeontology*.
- Neurohormone** : A hormone secreted by nerve cells, such as enkephalin or endorphin.
- Neurohormones** : Substances that are secreted from neurons and modulate the behaviour of target cells, which are often other neurons; unlike neurotransmitters, they do not act strictly across a synapse; most neurohormones are peptides.

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- Neuron** (Greek, for *nerve*) : A nerve cell with long processes specialized to receive, conduct, and transmit signals in the nervous system; also spelt as *neurone*.
- Neurotransmitter** (*neuron*^G = nerve + *trans*^G = across + *mitere*^G = to send) : A small signaling compound (usually containing nitrogen) secreted from the terminal of a neuron and bound by a specific receptor protein in the next neuron; serves to transmit a nerve impulse; examples include acetylcholine, glutamate, GABA, glycine, and many neuropeptides.
- Neutron** (*neuter*^L = neither) : A subatomic particle located within the nucleus of an atom; similar to a proton in mass, but as its name implies a neutron is neuter and possesses no charge.
- Nick** : A single-stranded cut or break in a DNA molecule; nicking of DNA may form part of a DNA repair mechanism, as occurs after damage caused by ultraviolet light.
- Nicotinamide adenine dinucleotide (NAD⁺)** : A coenzyme derived from the vitamin B₅ (nicotinic acid); participates in an oxidation reaction by accepting a hydride (H⁻) ion from a donor molecule and the NADH, thus formed, is an important carrier of electrons for oxidative phosphorylation; formerly called as *diphosphopyridine nucleotide (DPN)*.
- Nicotinamide adenine dinucleotide phosphate (NADP)** : A coenzyme closely related to NAD⁺; functions as an electron donor in many of the reduction reactions of biosynthesis, thus used extensively in biosynthetic, rather than catabolic, pathways; NADP⁺ is the oxidized form of NADP, and NADPH₂ is the reduced form; formerly called as *triphosphopyridine nucleotide (TPN)*.
- Nicotine** : An alkaloid derived from tobacco.
- Nipple** : An conical projection at the centre of a mammary gland on which the milk ducts have outlets.
- Nicotinic acid (C₆H₅O₂N)** : A water-soluble vitamin of the B complex group and designated vitamin B₅; widely distributed in nature in plant and animal tissues, mainly as its amide called *nicotinamide*; most abundantly found in yeast, although liver, meat and poultry are also good sources; milk and eggs are usually devoid of nicotinic acid; simplest in structure of all the known vitamins; a white crystalline substance, soluble in ethyl alcohol and stable in air and heat; acts as a constituent in two pyrimidine nucleotide coenzymes, NAD and NADP; avitaminosis B₅ leads to pellagra in man, which is characterized by 3 "Ds", namely dermatitis of the exposed parts, diarrhea and dementia; also called as *pellagra preventive (PP) factor* or *antiblacktongue factor*.
- Ninhydrin reaction** : A colour reaction given by amino acids and peptides on heating with ninhydrin; widely used for their detection and estimation.
- Nitrification** : The oxidation of ammonia and ammonium compounds into nitrites and nitrates through the action of nitrifying bacteria in the soil.
- Nitrogen cycle** : The cycling of various forms of biologically-available nitrogen through the plant, animal, and microbial worlds, and through the atmosphere and geosphere. Alternatively, the natural circulation of nitrogen between organic molecules in living organisms and inorganic molecules in the soil.
- Nitrogen fixation** : A biochemical process that reduces atmospheric nitrogen (N₂) to ammonia (NH₃) and hence into various nitrogen-containing metabolites by certain free-living and symbiotic bacteria; the process fixes the free, nonavailable, atmospheric nitrogen into nitrogen compounds and makes it available to the plant in its combined form.
- Nitrogenase complex** : An enzyme complex that converts (reduces) atmospheric nitrogen gas into ammonia in the presence of ATP.
- Nocturnal** (*nocturnus*^L = night) : Active primarily at night.
- Node** (*nodus*^L = knot) : The part of a stem where leaves and axillary buds arise.
- Noncompetitive inhibition** : A form of enzyme control in which the enzyme has 2 kinds of active site, one for an inhibitor, the other for the enzyme substrate. The inhibitor prevents catalytic activity of the enzyme by licking or even changing the shape of the substrate active site. The enzyme inhibition is not reversed by increasing the substrate concentration. Compare *competitive inhibition*.
- Noncovalent bond** : A chemical bond in which, in contrast to a covalent bond, no electrons are shared. Noncovalent bonds are relatively weak but they can sum together to produce strong, highly specific interactions between molecules.
- 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 containing iron but no porphyrin groups; usually acting in oxidation-reduction reactions.
- Nonhistone proteins** : Proteins associated with chromosomes that are not histones. For example, they may be enzymes involved in DNA replication or structural components of the chromatin.
- Nonpolar molecules** : Molecules or groups that are poorly soluble in water (*i.e.*, hydrophobic); lack

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- any asymmetric accumulation of positive or negative charge; also called as *apolar molecules*.
- Nonreducing sugar** : A sugar in which the carbonyl (anomeric) carbon is involved in the formation of a glycosidic bond and hence cannot undergo oxidation, such as sucrose, glycogen and inulin.
- Nonsense codon** : A codon that does not specify an amino acid, but signals the termination of a peptide chain; the three nonsense codons are: UAA, UAG and UGA; also called *stop codon* or *termination codon*.
- Nonsense mutation** : A mutation that creates an abnormal stop codon and thus causes translation to terminate prematurely; the resulting truncated protein is usually nonfunctional.
- Nor** : (1) A combining form of *normal*. (2) The prefix is also used to indicate the loss of a *methyl group*, e.g., noradrenaline or the loss of a *methylene group* from a chain.
- Noradrenalin** : A transmitter substance produced at the nerve endings of adrenergic nerves giving effects very similar to those of adrenalin. After transmission, it is inactivated by monoaminooxidase in order to prevent a build-up. The action of noradrenalin can be inhibited by various drugs, such as mescaline, which produce hallucinatory effects.
- Nuclear envelope** : The double membrane surrounding the nucleus of eukaryotes; consists of outer and inner membranes perforated by nuclear pores.
- Nuclear pore** : Shallow depressions, like the craters of the moon, that are scattered over the surface of the nuclear envelope. Such pores contain many embedded proteins that act as molecular channels, permitting selected molecules to pass into and out of the nucleus.
- Nucleases** : Enzymes that hydrolyze the inter-nucleotide (phosphodiester) linkages of nucleic acids.
- Nucleic acids** : Biologically-occurring polynucleotides in which the nucleotide residues are linked in a specific sequence by phosphodiester bonds. The two types of nucleic acids are deoxyribonucleic acid (DNA) which is double-stranded, and ribonucleic acid (RNA) which is typically single-stranded.
- Nucleoid** : The large circular DNA molecule of a prokaryotic cell, along with its associated proteins; is supercoiled and forms a dense mass within the cell, and the term nucleoid often refers to the cell region occupied by this mass, but has no surrounding membrane; also sometimes called *bacterial chromosome*.
- Nucleolus, plural nucleoli** (Latin, for *small nucleus*) : A densely staining rounded structure in the nucleus of eukaryotic cells; a nucleus may contain one or more nucleoli; involved in ribosomal RNA (rRNA) 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.
- Nucleoplasm** : The portion of a cell's contents enclosed by the nuclear membrane; also called as *nuclear matrix*.
- Nucleoprotein** : A compound of one or more proteins with a nucleic acid.
- Nucleoside** : A compound composed of a purine or pyrimidine base covalently linked to a pentose sugar, either a ribose (*ribonucleoside*) or a deoxyribose (*deoxyribonucleoside*).
- Nucleosome** (*nucleus*^L = kernel + *soma*^L = body) : The structural, beadlike packaging unit of a eukaryotic chromosome, composed of a short DNA strand wrapped around a core of histone proteins; the fundamental subunit of chromatin.
- Nucleotide** : A monomeric unit of nucleic acids, composed of a phosphate, a pentose sugar (ribose or deoxyribose) and a nitrogenous base (purine or pyrimidine); DNA and RNA are polymers of nucleotides. Alternatively, a nucleotide is a nucleoside with one or more phosphate groups joined in ester linkages to the sugar moiety.
- Nucleus, plural nuclei** (Latin, for *a kernel*, dim. fr. *nux* = nut) : In a eukaryotic cell, a prominent, membrane-bounded organelle that contains chromosomes; the nucleus is the repository of the genetic information that directs all activities of a living cell. In atoms, the central core, containing positively-charged protons and (in all but hydrogen) electrically-neutral neutrons.
- Numerator** : The number above the line in a vulgar fraction, e.g., 5 in 5/16.
- Nutrient** : A substance derived from outside a cell and providing it with energy and structural material.

O

Occam's razor : See **Ockham's razor**.

Ockham's razor : (named after *William of Ockham*, died circa 1349) – A principle of logic that holds that the best explanation of an event is the simplest, using the fewest assumptions of hypothesis; also spelt as *Occam's razor*.

Ocytocin (*ocy*^G = quick + *tokos*^G = birth) : A hormone of the posterior pituitary gland that accelerates uterine contractions during menstruation and childbirth and stimulates lactation.

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Oestradiol : See **estradiol**.

Oestrogen : See **estrogen**.

Oestrous cycle : See **estrous cycle**.

Okazaki filaments (after *R. Okazaki*, the discoverer) : Short lengths of DNA produced on the lagging strand during DNA replication; usually about 1,000–1,200 bp in length; they are rapidly joined by DNA ligase to form a continuous DNA strand.

Oleic acid, C₁₇H₃₃COOH (*oleum*^G = oil) : A monoethenoid, oily liquid found in almost all natural fats; used in cosmetics, soaps and lubricating oils.

Oligomer (*oligos*^G = few, little) : A short polymer, usually consisting (in a cell) of amino acids (*oligopeptide*), sugars (*oligosaccharide*), or nucleotides (*oligonucleotide*); the definition of “short” is somewhat arbitrary, but usually less than 50 subunits.

Oligomeric proteins : A multisubunit protein having two or more identical polypeptide chains.

Oligonucleotide : A short polymer of nucleotides (usually less than 50) joined by phosphodiester bonds.

Oligopeptide : A few amino acids joined by peptide bonds.

Oligosaccharide : A carbohydrate composed of a small number of monosaccharide residues.

Oncogene (*oncos*^G = tumour) : A cancer-causing gene; any of several mutant genes that cause cells to exhibit rapid and uncontrolled proliferation.

Oncogene theory (*oncos*^G = tumour) : The hypothesis that cancer results from the action of a specific tumour-inducing *onc* gene.

One-gene/one-enzyme hypothesis : The hypothesis that genes produce their effects by specifying the structure of enzymes and that each gene encodes the structure of a single enzyme; put forward by George Beadle and Edward Tatum in 1941.

Ontogeny : The whole of the development of an organism from fertilization to the completion of life history.

Open reading frame (ORF) : A group of contiguous nonoverlapping nucleotide codons in a DNA or RNA molecule between an initiation codon and a termination codon. It represents the coding sequence for a polypeptide.

Open system : A system that exchanges matter and energy with its surroundings.

Operator : A short region of DNA in a bacterial chromosome that interacts with a repressor protein to control the expression (transcription) of adjacent gene(s).

Operon (*operis*^L = work) : In bacterial chromosome, a group of contiguous functionally-related genes

that are transcribed into a single mRNA molecule; although a common mode of gene regulation in prokaryotes, it is rare in eukaryotes except fungi.

Opiate : A narcotic substance derived from opium (*Papaver somniferum*).

Opsin : A protein that occurs in rods and cones of the retina of the eye, which combines with retinal₁ or retinal₂ to form visual pigments.

Optical activity : The capacity of a substance to rotate the plane of plane-polarized light.

Optimum pH : The characteristic pH at which an enzyme has maximal catalytic activity.

Organ (*organon*^L = tool) : A complex body structure, composed of one or more kinds of tissues and acting as a structural and functional unit, such as the liver, eye or leaf.

Organelle (*organella*^G = little tool) : Membrane-bounded structures (except ribosomes) found in eukaryotic cells; nuclei, chloroplasts, mitochondria and ribosomes are all organelles; contain enzymes and other components required for specialized cell functions.

Organic compound : A type of molecule that contains carbon except carbon dioxide and the carbonates that have a mineral origin.

Organism : Any individual living creature; either unicellular or multicellular plant or animal.

Organogenesis : The period during embryonic development of an organism when the main body organs are formed.

Organophosphate : A phosphate with insecticidal properties; probably the most commonly used group of insecticides.

Ornithine cycle : See **urea cycle**.

Osmic acid : See **osmium tetroxide**.

Osmium tetroxide (OsO₄) : An inorganic compound, used as a fixative for cytological preparations that is characterized by the small amount of distortion it causes; also called *osmic acid*.

Osmoregulation : The maintenance of a constant internal solute concentration by an organism, regardless of the environment in which it lives.

Osmosis (*osmos*^G = act of pushing, thrust) : The diffusion of water (or other solvent) through a differentially permeable membrane—a membrane that permits the free passage of water but not that of one or more solutes—into another aqueous compartment containing solute at a higher concentration.

Osmotic pressure : Pressure generated by the osmotic flow of water through a differentially permeable membrane into an aqueous compartment containing solute at a higher concentration; osmotic pressure is an indicator of how concentrated a solution is on the other

P

- side of a membrane from pure water; a molar solution of any nonelectrolyte has an osmotic pressure of 22.4 atm.
- Osteoblast** (*osteon*^G = bone + *blastos*^G = bud) : A bone-forming cell.
- Osteocyte** (*osteon*^G = bone + *kytos*^G = hollow vessel) : A mature osteoblast.
- Ovary** (*ovum*^L = egg) : (1) In animals, the organ that produces eggs. (2) In flowering plants, the enlarged, basal portion of a carpel (or of a cluster of fused carpels) which contains the ovule(s); the ovary matures to become the fruit.
- Ovulation** : The successful development and release of an egg by the ovary which then normally passes into the oviduct.
- Ovule** (*ovulum*^L = a little egg) : A structure in a seed plant that becomes a seed when mature.
- Ovum, plural ova** (Latin, for *egg*) : A mature egg cell; a female gamete. The human egg is about 0.14 mm in diameter, which is some 50,000 times larger than the human sperm.
- Oxaloacetic acid (OAA)** : A C-4 organic acid that is converted to citric acid by the addition of an acetyl group in the first step of the Krebs cycle; OAA is also the product of the CO₂ fixation of phosphoenolpyruvic acid in C₄ and CAM photosynthesis.
- Oxidase** : Any of a group of enzymes that promote the oxidation of a substrate with oxygen as the electron acceptor. Most oxidases are proteins with metallic groups attached.
- Oxidation** (*oxider*^{Fr} = to oxidize) : The loss of an electron during a chemical reaction from one atom to another; occurs simultaneously with reduction; the second stage of the ten reactions of glycolysis; opposite of *reduction*.
- Oxidation–reduction reaction** : A reaction in which electrons are transferred from a donor to an acceptor molecule; also called a *redox reaction*.
- Oxidative phosphorylation** : Phosphorylation of ADP to ATP that uses energy from a proton pump fuelled by the electron transport system. The process is the major means by which aerobic organisms obtain their energy from foodstuffs.
- Oxidizing agent** : The acceptor of electrons in an oxidation–reduction reaction; also called *oxidant*.
- Oxidoreductase** : One of a group of enzymes that catalyzes oxidation–reduction reactions.
- Oxygenases** : Enzymes that catalyze the incorporation of oxygen into a substrate reactions in which oxygen is introduced into an acceptor molecule.
- Ozone (O₃)** : A form of oxygen in the stratosphere when compared with ordinary oxygen (O₂), more effectively shields living organisms from intense ultraviolet radiation.
- Pain** : A conscious sensation produced in the brain and stimulated by pain receptors in, for example, the skin; pain has a protective function and often produces a reflex action in response.
- Palaeontology** : The study of fossil animals and plants. Compare *neontology*.
- Palindrome** : A segment of duplex DNA with a nucleotide sequence that is identical to its complementary strand when each is read in the same chemical direction; for example, TGAC in the following DNA segment:
5' XXX TGAC XXX 3'
3' XXX CAGT XXX 5'
- Palisade parenchyma** (*palus*^L = stake; *para*^G = beside + *en*^G = in + *chein*^G = to pour) : Parenchyma cells that are chlorophyllous and columnar, closely packed together, and located between the upper epidermis and the spongy parenchyma of a leaf.
- Pancreas** (*pan*^G = all + *kreas*^G = flesh) : In vertebrates, the large, principal digestive gland situated between the stomach and the small intestine that secretes a host of digestive enzymes and the hormones, insulin and glucagon.
- Pancreozymin (PZ)** : A polypeptide hormone elaborated by the intestinal mucosa; contains 33 amino acid residues; PZ is thermostable but alkali-labile; along with secretin, it functions to stimulate the release of pancreatic juice, which is rich in enzymes or their zymogens as well as in bicarbonate. Jorpes (1968) believes that the two gastrointestinal hormones, cholecystokinin (CCK) and pancreozymin (PZ), are identical. They are now believed to be a single factor and represented as CCK-PZ.
- Pantothenic acid (C₉H₁₇O₅N)** : A water-soluble vitamin of the B complex group and designated as vitamin B₃; although widespread in nature (hence so named, *pantos*^G = everywhere), yeast, liver and eggs are richest sources; in most animals and microbes, it occurs as its coenzyme; participates in the formation of coenzyme A, which when bonded to acetic acid, forms acetyl-coenzyme A (acetyl-CoA); a deficiency of pantothenic acid causes adrenal cortical insufficiency and achromotrichia in man; also called *filtrate factor* or *yeast factor*.
- Papain** : A proteolytic enzyme obtained from the juice of the green fruit of the papaya or papaw tree (*Carica papaw*).
- Paradigm** : In biochemistry, an experimental model or example.
- Paralysis** (*paralyein*^G = to loose from the side, to

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- disable) : Loss of muscular power from a lesion of the nervous system.
- Parasite** (*para*^G = beside + *sitos*^G = food) : A symbiotic relationship in which one organism benefits and the other is harmed.
- Parathyroid hormone, PTH** (*para*^G = beside + thyroid + hormone) : A hormone produced by the parathyroid glands that regulates the way the body uses calcium.
- Parthenocary** (*parthenos*^G = virgin + *carpos*^G = fruit) : The development of fruit without seeds due to the lack of pollination, fertilization or embryo development.
- Parthenogenesis** (*parthenos*^G = virgin + *genesis*^{Eng} = beginning) : The development of an adult from an unfertilized egg; a common form of reproduction in insects and some fruits.
- Partition coefficient** : A constant that expresses the ratio in which a given solute will be partitioned or distributed between two given immiscible liquids at equilibrium.
- Parturition** : The act of giving birth to an offspring.
- Pascal (Pa)** : The pressure unit (*i.e.*, energy per unit volume) used to measure water potential; one pascal equals the force of one newton per square meter; one atmosphere of pressure equals 1.0×10^5 Pa.
- Passive transport** : The movement of a substance across a biological membrane by molecular diffusion through the lipid bilayer; also called *passive diffusion*. Compare *active transport*, *facilitated transport*.
- Pathogen** (*pathos*^G = suffering + *genesis*^{Eng} = beginning) : An organism or other agent that causes disease, such as viruses or bacteria.
- Pectin** (*pektos*^G = curdled, congealed, *pegnynai*^{Fr} = to make fast or stiff) : A gluey polysaccharide that holds cellulose fibrils together; pectins are mostly polymers of galacturonic acid monomers with α -1,4 linkages. When heated, pectin forms a gel which can 'set', a feature used in the making of jams.
- Penicillin** : An antibiotic obtained from the fungus *Penicillium* that is toxic to a number of bacteria, both pathogenic and nonpathogenic; discovered by Sir Alexander Fleming in 1928.
- Penis** (Latin, for *tail*) : The male organ of copulation which conveys the sperm to the genital tract of the female; in mammals, it is also the male urinary organ; also called *phallus*.
- Pentose** : A simple sugar with a backbone containing five carbon atoms.
- Pentose phosphate pathway (PPP)** : A pathway that serves to interconvert hexoses and pentoses and is a source of reducing equivalents and pentoses for biosynthetic processes; present in most organisms; during this pathway, NADP is reduced to NADPH, but no ATP is produced; also called the *phosphogluconate pathway* or *hexose monophosphate shunt*.
- Pepsin** : A proteolytic enzyme secreted in the inactive form (pepsinogen) by chief or peptic cells in the gastric pits of the stomach of vertebrates, and which breaks down proteins in acid solution into short polypeptide chains which are subsequently broken down further by peptidases.
- Peptidase** : An enzyme present in pancreatic juice that releases free amino acids from polypeptide chains. *Exopeptidases* split off terminal amino acids, whereas *endopeptidases* split links within the chain.
- Peptide** (*peptin*^G = to soften, digest) : Two or more amino acids covalently joined by peptide bonds.
- Peptide bond** : A substituted amide linkage between the α -amino group of one amino acid and the α -carboxyl group of another, with the elimination of a molecule of water.
- Peptide hormone** : A hormone that interacts with a receptor on the cell surface and initiates a chain of events within the cell by increasing the levels of secondary messengers.
- Peptidoglycan** : A major component of bacterial cell walls; generally consists of parallel heteropolysaccharides cross-linked by short peptides.
- Peptidyl site** : A tRNA binding site on the ribosome at which a peptide bond occurs.
- Peptidyl transferase** : An enzyme in the large ribosomal subunit that catalyzes the formation of a peptide bond between the amino acid at the end of a growing polypeptide and the next amino acid to be added to the chain.
- Peptone** : Any of a class of initial, water-soluble decomposition products of protein digestion; noncoagulable by heat and not capable of being precipitated with saturated ammonium sulfate.
- Perennial** (*per*^L = through + *annus*^L = a year) : A plant continuing to live from year to year; one that lives more than two years.
- Perfusion** : The passage of a liquid through an organ or tissue.
- Peripheral nervous system** (*peripherein*^G = to carry around) : All of the neurons and nerve fibres outside the central nervous system, including motor neurons, sensory neurons, and the autonomic nervous system.
- Peristalsis** (*peri*^G = around + *stellein*^G = to wrap) : The alternate contraction and relaxation of circular and longitudinal muscle which produces waves that pass along the intestine (and other tubular systems) of animals, moving the tube contents in one direction.
- Permeases** : See **transporters**.

- Pernicious anemia** : A severe condition in which there is a progressive decrease in the number of red blood cells together with an increase in their size, producing poor colour, weakness and gut disorders. The disease can be fatal but may be treated by dosing with vitamin B₁₂.
- Peroxidase** : An enzyme involved in the transfer of oxygen from peroxides to substances to be oxidized, such as catalase.
- Peroxisome** : A small, membrane-bounded spherical organelle in the cytoplasm of eukaryotic cells, and derived from smooth endoplasmic reticulum; contains peroxide-forming and peroxide-destroying enzymes.
- Pesticide** : Any agent that causes the death of a pest. The general definition is usually restricted to chemicals with pesticidal properties such as herbicides, insecticides, acaricides and fungicides. Pesticide application can produce many problems such as (a) destruction of organisms useful to man and (b) directly harmful effects to man, if used incorrectly.
- pH** (p stands for power of 10 and H stands for hydrogen ion concentration) : The number of grams of hydrogen ions per litre of solution. It is useful as a measure of the *acidity* of a solution and in this context is usually expressed in terms of $\text{pH} = \log_{10} 1/[\text{H}^+]$, where $[\text{H}^+]$ is the hydrogen ion concentration. Alternatively, pH is also defined as the negative logarithm of the hydrogen ion concentration of an aqueous solution. As pure water at ordinary temperature (of 25°C) dissociates slightly into hydrogen ions and hydroxyl ions ($\text{H}_2\text{O} = \text{H}^+ + \text{OH}^-$), the concentration of each type of ion being 10^{-7} mole per litre, the pH of pure water will therefore be $\log_{10} 1/10^{-7} = 7$; this figure is accordingly taken to represent neutrality on the pH scale. If acid is added to water, its hydrogen ion concentration will increase and its pH will therefore decrease. Thus, a pH below 7 indicates acidity and similarly a pH above 7 indicates alkalinity. In fact, the pH values extend from 0 to 14 : the lower the pH value, the higher the acidity or the more hydrogens the solution contains; 0 is maximum acidity, 14 is maximum alkalinity and 7 is neutrality. Since the pH is logarithmic, each of 1 pH unit means a 10-fold change in the number of hydrogen ions. The pH can be measured by using indicators which change colour with changing pH, or by electrical means using a pH meter. The term pH was introduced by a Danish biochemist, Soren Sørensen in 1909.
- pH buffers** : Chemical substances that maintain a constant pH in a solution.
- Phage** : See **bacteriophage**.
- Phagocyte** (*phagein*^G = to eat + *kytos*^G = hollow vessel) : A general term for a cell that kills invading cells by engulfing them; includes macrophages and neutrophils; capable of discriminating between different particles, for example phagocytic white blood cells will engulf only certain bacteria.
- Phagocytosis** (*phagein*^G = to eat + *kytos*^G = hollow vessel) : A form of endocytosis in which cells engulf organisms or fragments of organisms; prominent in carnivorous cells such as *Amoeba proteus*, and in vertebrate macrophages and neutrophils.
- Phallus** : See **penis**.
- Phasic** : Transient.
- Phenocopy** : Situation that occurs when an environment agent induces a phenotype that resembles a particular mutant phenotype.
- Phenolic** : Any compound that contains a fully unsaturated six-carbon ring that is linked to an oxygen-containing side group.
- Phenotype** (*phainein*^G = to show + *typos*^G = stamp or print) : The observable characteristics of a cell or an organism, either individually or collectively; the phenotype results from the interaction of the genotype of an organism with its environment. The interaction is that between nature and nurture. Variations due to nature are the inherited aspects of the organism, the genotype, while nurture denotes the (usually not inherited) effects of the environment upon the organism. Compare *genotype*.
- Phenylketonuria (PKU)** : An inborn error of metabolism in humans in which there is the inability to convert phenylalanine to tyrosine, due to the absence of a functional *phenylalanine hydroxylase* enzyme. The condition is controlled by the recessive allele of an autosomal gene present on chromosome 1. The effects of PKU are many and extremely serious. Most of the phenylketonurics (about 90%) have an IQ of less than 40 and thus are severely *mentally retarded* because of an abnormal accumulation of phenylalanine in their blood and other tissues which adversely affects their nervous system. There is *microcephally* (reduced brain size) in about 65% of the affected individuals and about 75% show 'tailor posture', in which muscular hypertonicity causes contraction of the leg and arm muscles so that individuals sit cross-legged with their arms drawn into the body. The disease can be treated if discovered in very early childhood. Treatment consists of a diet low in phenylalanine (as some of this amino acid must be present in the diet since it is an essential amino acid).
- Phenylpropanoid** : A complex phenolic that has a three-carbon side chain; generally derived from the amino acids phenylalanine and tyrosine;

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- myristicin, the main flavour ingredient of nutmeg, is a phenylpropanoid.
- Pheromone** (*pherein*^G = to carry + [hor]mone) : A chemical substance used in communication between organisms of the same species, especially with regard to their reproductive readiness; found mainly in animals but they occur in some lower plant groups where a chemical is secreted into water by female gametes to attract male gametes; in animals, for example, pheromones are transmitted in the air, as in female emperor and eggar moths, which secrete a chemical that is attractive to males over long distances, or by a dog marking out his territory with urine; insect pheromones have been used to trap females of serious pests.
- Phloem** (*phloos*^G = bark) : In vascular plants, a specialized complex tissue, basically composed of sieve elements, companion cells, parenchyma cells, fibres and sclereids; transports nutrients from the leaves downward in the plant.
- Phosgene** (COCl₂) : A colourless poisonous gas with a penetrating smell, resembling musty hay or green corn; heavier (3.43 times) than air, hence was used extensively in gas warfare in World War I; used as an intermediate in organic synthesis.
- Phosphagen** : A type of chemical found in the muscles of all animals, whose function is to pass on high-energy phosphate to ADP to form ATP. Phosphagens thus act as energy-storage molecules and are especially useful when cellular respiration is not providing sufficient ATP molecules, for example when sudden muscular activity takes place. Phosphagens are of 2 types; *creatine phosphate* found in vertebrates and echinoderms, and *arginine phosphate* found in many other invertebrates.
- Phosphatase** : An enzyme that removes a phosphate group from a protein by hydrolysis; for example, in the mammalian liver phosphorylated glucose can be broken down to glucose with a phosphatase system; also called *phosphoprotein phosphatase*.
- Phosphate group** (PO₄) : A chemical group commonly involved in high-energy bonds.
- Phosphatidylinositol** : An inositol phospholipid.
- Phosphocreatine** : A compound used in the production of ATP from ADP in muscles, being converted to creatine with the release of inorganic phosphorus.
- Phosphodiester bond** (-O-P-O-) : A covalent chemical bond formed when two hydroxyl groups are linked in ester linkage to the same phosphate group, such as adjacent nucleotides in RNA or DNA.
- Phosphoenolpyruvic acid (PEP)** : A high-energy compound which when dephosphorylated to pyruvic acid, gives rise to the synthesis of ATP from ADP in glycolysis.
- Phosphogluconate pathway** : See **pentose phosphate pathway**.
- 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; also called *inositol phospholipids*.
- Phospholipid** (*phosphoros*^G = light-bearer + *lipos*^G = fat) : A lipid composed of two fatty acids linked through glycerol phosphate to one of a variety of polar groups. One end of a phospholipid molecule is therefore strongly nonpolar (water-insoluble), whereas the other end is extremely polar (water-soluble). The two nonpolar fatty acids extend in one direction, roughly parallel to each other, and the polar alcohol group points in the other direction; the principal lipid molecule that is used to construct biological membranes; phospholipids in the blood are responsible for the transport and utilization of fats in the body.
- Phosphoprotein phosphatase** : See **phosphatase**.
- Phosphoric acid** : An important component of nucleic acids, connecting the pentose sugars to form a polynucleotide chain.
- Phosphorolysis** : Cleavage of a compound with phosphate as the attacking group; analogous to *hydrolysis*.
- Phosphorylation** : A reaction in which a phosphate group becomes covalently linked to another molecule. Such reactions occur regularly in biological systems. For example, in aerobic respiration glucose is phosphorylated in glycolysis; ADP is phosphorylated to ATP at the substrate-level and *via* the electron transport system ; in plants ATP is produced by photophosphorylation.
- Photochemical reactions** : The “light” reactions of photosynthesis; these reactions occur on the grana of chloroplasts and produce ATP and reduced NADP.
- Photon** (*photos*^G = light) : The elementary particle of light and other electromagnetic radiation.
- Photooxidation** : A chemical reaction occurring as a result of absorption of light in the presence of oxygen.
- Photophosphorylation** (*photos*^G = light + *phosphoros*^G = bringing light) : The enzymatic formation of ATP from ADP coupled to the light-dependent transfer of electrons in photosynthetic cells.
- Photoreduction** : The light-induced reduction of an electron acceptor in photosynthetic cells.
- Photorespiration** : The light-dependent formation

- of glycolic acid in chloroplasts and its subsequent oxidation in peroxisomes; a process in which carbon dioxide is released without the production of ATP or NADPH and mitochondria are not involved; because it produces neither ATP nor NADPH, photorespiration acts to undo the work of photosynthesis.
- Photosynthesis** (*photos*^G = light + *-syn*^G = together + *tithenai*^G = to place) : The process by which plants, algae, and some bacteria use the energy of sunlight to create, from carbon dioxide and water, the more complicated molecules (carbohydrates), that make up living organisms; occurs in chloroplasts and releases oxygen.
- Phylloquinone** : One of the 2 fat-soluble group of vitamins, collectively designated vitamin K group; these 2 vitamins are vitamin K₁ (phyloquinone) and vitamin K₂ (flavinoquinone); vitamin K₁ occurs in green vegetables like spinach, alfalfa, cabbage etc, while K₂ is found in intestinal bacteria, besides putrefied fish meal; vitamin K₁ is a yellow viscid oil, while vitamin K₂ is a yellowish crystalline solid; both are sensitive to light and hence kept in dark bottles; destroyed by irradiation, strong acids, alkalies and oxidizing agents; plays a key role in the biosynthesis of prothrombin, oxidative phosphorylation and electron transport system; avitaminosis K results in hemorrhage in infants and steatorrhea in human adults; also known as *antihemorrhagic vitamin* or *coagulation vitamin*.
- Phylogeny** (*phylon*^G = race, tribe) : The evolutionary relationships among any group of organisms; often presented in chart form as a phylogenetic tree.
- Phylum** (*phylon*^G = race, tribe) : A major taxonomic category between kingdom and class in animals; it is equivalent to *division* in plants.
- Physiology** (*physis*^G = nature + *logos*^G = a discourse) : The study of the function of cells, tissues, and organs.
- Phytochrome** : A group of blue-green, photo-receptive, proteinaceous pigments produced in plants and involved in phenomena such as photoperiodism, the germination of seeds, and leaf formation; occurs in 2 forms: P₆₆₀, which is biologically inert and absorbs red light and P₇₂₅, which is biologically active in that it stimulates enzymic reactions and absorbs far-red light. The conversion of one form into the other occurs simultaneously.
- Phytohormones** : Hormones produced by plants.
- Phytol (C₂₀H₃₉OH)** : A long-chain alcohol derived from the hydrolysis of chlorophyll; an acyclic diterpene with 2 chiral centres, b.p. 145°C.
- Pigment** (*pigmentum*^L = paint) : A molecule that reflects and absorbs light at particular wavelengths.
- Piloerection** : The standing up of hair on the skin to increase thermal insulation.
- Pineal body** : See **pineal gland**.
- Pineal gland** (*pinus*^L = pine tree) : An outgrowth of the roof of the forebrain. The posterior part (epiphysis) has an endocrine function and secretes the hormone, melatonin. It appears to function in humans as a light-sensing organ and in a variety of other roles concerning sexual development. Exposure to light inhibits the production of melatonin. The anterior part forms an eye-like structure (third eye) in some lizards; it is vestigial in the lamprey and absent in other vertebrates. Also called as *pineal body*.
- Pinocytosis** (*pinein*^G = to drink + *kytos*^G = cell) : A type of endocytosis in which soluble materials are taken up from the environment and incorporated into vesicles for digestion.
- Pituitary** (*pituita*^L = phlegm) : The major hormone-producing gland of the brain and is under the control of the hypothalamus; secretes hormones that promote growth, stimulate glands, and regulate many other bodily functions.
- pK** : The negative logarithm of an equilibrium constant.
- Placebo** : (1) Any inactive substance given to satisfy a patient's psychological need for medication. (2) A control in an experiment to test the effect of a drug.
- Placenta, plural placentae** (Latin, for a flat cake) : (1) In animals, a specialized organ, held within the womb in the mother across which she supplies the offspring with food, water and oxygen and through which removes wastes. (2) In plants, a part of the ovary wall on which ovules are borne.
- Plasma** (Greek, for *form*) : (1) The fluid of vertebrate blood; contains dissolved salts, metabolic wastes, hormones, and a variety of proteins, including antibodies and albumen; blood minus the blood cells. (2) The cellular protoplasm inside a plasma membrane.
- Plasma membrane** : A lipid bilayer with embedded proteins that control the cell's permeability to water and dissolved substances. Alternatively, the differentially permeable membrane that surrounds the cytoplasm of a cell and is next to the cell wall. Also called the *cell membrane* or the *plasmalemma* or *ectoplast*.
- Plasma proteins** : The proteins present in blood plasma.
- Plasmalogen** : A phospholipid with an alkenyl ether substituent on the C-1 of glycerol.
- Plasmid** (*plasma*^G = a form or something moulded) : A small fragment of circular double-stranded DNA that replicates independently of the bacterial chromosome; because of their ability

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- to take up foreign DNA, bacterial plasmids are used as vectors for genetic engineering and research; many different types of plasmids exist, some conferring antibiotic resistance, and others, the ability to metabolize unusual organic compounds.
- Plasmodesma**, plural **plasmodesmata** (*plasma*^G = something moulded + *desma*^G = band) : A tiny, membrane-lined channel between adjacent cells in plants through which cytoplasmic connections extend; in some textbooks, *singular* plasmodesmus, *plural* plasmodesmi are used.
- Plasmolysis** : The shrinkage of plant cell contents due to loss of water, resulting in the cell membrane pulling away from the cell wall, leaving a fluid-filled space. Plasmolysis occurs when plant cells are placed in a hypertonic medium so that they lose water by osmosis.
- Plastid** : A cytoplasmic, self-replicating, large (3–6, μm in diameter) organelle in plants, bounded by a double membrane; colourless or pigmented, with definite physiological functions; the types are leucoplasts, chloroplasts and chromoplasts.
- Platelets** (dim. of *plattus*^G = flat) : Small enucleated cells that arise from cells called megakaryocytes in the bone marrow and are found in large numbers in the bloodstream; they help initiate blood clotting when blood vessels are injured; also known as *thrombocytes*.
- Pleated sheet** : The side-by-side hydrogen-bonded arrangement of polypeptide chains in the extended β -conformation.
- Pneumonia** (*pneumon*^G = lung) : Inflammation of the lungs, commonly due to pneumococcal infection.
- Poikilothermy** : Changeable temperature in an animal, dependent on environmental temperature, exercise, and other irregular factors. All animals apart from Aves and Mammals are poikilotherms.
- Polar** : Hydrophilic or "water-loving; describing molecules or groups that are soluble in water.
- Polar bond** : Covalent bond in which the electrons are attracted more strongly to one of the two atoms, creating a polarized distribution of electric charge.
- Polar molecule** : A molecule with positively and negatively charged ends. One portion of a polar molecule attracts electrons more strongly than another portion, with the result that the molecule has electron-rich (–) and electron-poor (+) regions, giving it magnetlike positive and negative poles. Polar molecules are usually soluble in water. Water is one of the most polar molecules known.
- Polarity** : (1) In *biology*, establishment of poles of specialization at opposite ends of a cell, tissue, organ, or organism; for example, polarity leads to the differentiation of roots and shoots. (2) In *chemistry*, the nonuniform distribution of electrons in a molecule. (3) In *molecular biology*, the distinction between the 5' and 3' ends of nucleic acids.
- Poliomyelitis** : A paralytic disease in which cells of the central nervous system become destroyed by the polio virus, leading to crippling, although most infections are not serious and the patient usually recovers full health. The disease can be kept in check by the administration of vaccines, the most popular being a live, attenuated type.
- Poly-A tail** : A chain of adenylic acid molecules that is added to a molecule of RNA immediately after it has been transcribed and cleaved from its DNA template.
- Polydipsia** (*polys*^G many + *dipsa*^G = thirst) : Increased thirst.
- Polymer** (*polus*^G = many + *meris*^G = part) : A large molecule formed by the linking together of similar smaller molecules (monomers). The number of monomers in a polymer may range up to millions.
- Polymerase** : An enzyme that catalyzes the joining of DNA or RNA nucleotides.
- Polymerase chain reaction (PCR)** : A repetitive procedure that results in geometric amplification of a specific region of DNA by multiple cycles of DNA polymerization, each followed by a brief treatment to separate complementary strands; the PCR is cycled 30 or more times to produce million-fold amplification of the target DNA sequence; the free nucleotides are assembled in a nucleic acid chain in a test tube by enabling the activity of a bacterial DNA polymerase to bind them together.
- Polymerization** (*polus*^G = many + *meris*^G = part + *izein*^G = to combine with) : A process in which many small identical subunits (monomers) combine to one another chemically to form a long chain of a polymer molecule.
- Polymorphism** (*polys*^G = many + *morphe*^G form) : The presence of distinctly different, genetically-determined phenotypic characteristics within a population of a single species.
- Polynomial** (*polys*^G = many + *nomos*^G = naming) : Before Linnaeus, the propounder of binomial system of nomenclature, naming a genus by use of a cumbersome string of Latin words and phrases; the system is now abandoned.
- Polynucleotide** : A covalently-linked sequence of nucleotides in which the 3' hydroxyl of the pentose of one nucleotide residue is joined by a phosphodiester bond to the 5' hydroxyl of the pentose of the next residue.
- Polypeptide** (*polys*^G = many + *peptein*^G to digest) : A general term for a long chain of amino acids linked end-to-end by peptide bonds. A protein

- is a long, complex polypeptide; the two terms are often used interchangeably.
- Polyribosome** : A complex of an mRNA molecule and two or more ribosomes; such an arrangement ensures that the mRNA is 'read' at the maximum speed; also known as *polysome* (poly + [ribo] some).
- Polysaccharide** (*polys*^G = many + *sakcharon*^G = sugar) : A linear or branched polymer of monosaccharide units linked by glycosidic bonds. Polysaccharides are insoluble, unsweet and are important as storage molecules (starch, glycogen, inulin) and as reinforcing materials (cellulose, chitin).
- Polysome** : See **polyribosome**.
- Polyuria** (*polys*^G = many + *ouron*^G = urine) : Increased urine output.
- Porphyrin** : A complex nitrogenous compound containing 4 substituted pyrroles covalently joined into a ring; often complexed with a centrally-located atom of a heavy metal; forms part of several important biological molecules; examples include the heme group of myoglobin and hemoglobin, chlorophyll (with magnesium) and cytochromes (with iron).
- Posttranslational modification** : Enzyme-catalyzed changes (or modifications) in a polypeptide chain after it is synthesized (or translated) from its mRNA; the various modifications include cleavage, glycosylation, phosphorylation, methylation, and prenylation.
- Posterior** (*post*^L = after) : Situated behind or tail end of the body.
- Posttranscriptional processing** : The enzymatic processing of the primary RNA transcript, producing functional mRNA, tRNA and/or rRNA molecules.
- Postulate** : A basic or essential assumption; a set of postulates that address the same phenomenon can be taken together as a *theory*.
- Potential difference** : A difference in electrical charge on two sides of a membrane, caused by an unequal distribution of ions.
- Potential energy** : Any stored energy that can be released (or has the potential) to do work.
- Pre-mRNA** : See **hn mRNA**.
- Prenylation** : Covalent attachment of an isoprenoid lipid group to a protein.
- Primary structure** : Sequence of units in a linear polymer, such as amino acid sequence of a protein.
- Primary transcript** : The immediate RNA product of transcription before any posttranscriptional processing reactions.
- Primase** : An enzyme that catalyzes the formation of RNA oligonucleotides used as primers by DNA polymerase.
- Primer** : A short oligomer (of sugars or nucleotides, for example) to which an enzyme adds additional monomeric subunits.
- Prion** : An infectious agent that contains protein but no nucleic acid.
- Probe** : In genetic research, a fragment of labelled (radioactively or chemically labelled) DNA or RNA, containing a nucleotide sequence complementary to a gene or genomic sequence that one wishes to detect in a hybridization experiment.
- Prochiral molecule** : A symmetric molecule that can react asymmetrically with an enzyme having an asymmetric active site, generating a chiral product.
- Progesterone** ($C_{21}H_{30}O_2$) : A C_{21} steroid female sex hormone, secreted by the corpus luteum during the second half of the menstrual cycle; closely resembles deoxycorticosterone in structure; makes the lining of the uterus more receptive to a fertilized ovum, brings the mammary glands to full maturity during pregnancy, inhibits contraction of the uterus during pregnancy, and serves as a precursor of cortisol and corticosterone in the adrenal glands.
- Projection formulae** : A method for representing molecules to show the configuration of groups around chiral centres; also known as *Fischer projection formulae*.
- Prokaryote** (*pro*^G = before + *karyon*^G = kernel) : A unicellular organism with a single chromosome, no nuclear envelope, no membrane-bounded organelles and no mitosis or meiosis; prokaryotes include bacteria and cyanobacteria; also spelt as *procaryote*; compare *eukaryote*.
- Prolactin (PL)** : See **luteotrophic hormone (LTH)**.
- Promoter** : A DNA sequence at which RNA polymerase may bind, leading to initiation of transcription.
- Proofreading** : The ability of DNA polymerases to remove mismatched nucleotides with 3' to 5' exonuclease activity during DNA synthesis.
- Prostaglandins** (from *prosta*[te] *gland* + *-in*) : A class of lipid-soluble, hormonelike, regulatory molecules derived from arachidonate and other polyunsaturated fatty acids by virtually all cells; stimulate contraction or expansion of smooth muscles and contraction of blood vessels, have also been used in the induction of labour and abortion.
- Prostate gland** : (*prostates*^G = one standing in front) : A large gland surrounding the male urethra just below the bladder. Its secretions, which transport sperm cells, make up a large part of the semen. Androgens affect the size and secretion of the prostate gland, whose exact function is unknown.

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- Prosthetic group** : A metal ion or an organic compound (other than an amino acid) that is covalently bound to a protein and is essential to its activity. For example, many enzymes contain metallic ions, as in carboxypeptidase which contains zinc; hemoglobin contains heme with an iron atom at the centre.
- Protease** (*proteios*^G = primary + *-ase* = suffix for an enzyme) : An enzyme that breaks up proteins into amino acids by hydrolyzing some of their peptide bonds located *inside* the chain, but not at the ends; pepsin, erepsin, rennin and trypsin are proteases; also called *proteinase* or *proteolytic enzyme*.
- Protein** (*proteios*^G = pre-eminent, primary) : The major macromolecular constituent of cells, consisting of carbon, hydrogen, oxygen, nitrogen, and usually sulfur and phosphorus; a linear polymer of amino acids linked together by peptide bonds in a specific sequence; various proteins exhibit 4 levels of structural organization: primary, secondary, tertiary and quaternary.
- Protein kinase** : Enzyme that transfers the terminal phosphate group of ATP to a specific amino acid of a target protein.
- Protein targeting** : The process by which newly-synthesized proteins are sorted and transported to their proper locations in the cell.
- Proteinase** : See **protease**.
- Proteoglycan** : A hybrid molecule consisting of one or more heteropolysaccharide (glycosaminoglycan, GAG) chains joined to a core protein; the polysaccharide is the major component; an important component of the intercellular matrix.
- Proteolytic enzyme** : See **protease**.
- Proteolysis** : Degradation of a protein, usually by hydrolysis at one or more of its peptide bonds.
- Proton** : A subatomic particle in the nucleus of an atom that carries a positive charge. The number of protons determines the chemical character of the atom because it dictates the number of electrons orbiting the nucleus and available for chemical activity.
- Proton acceptor** : An anionic compound capable of accepting a proton from a proton donor, that is, a *base*.
- Proton donor** : The donor of a proton in an acid-base reaction, that is, an *acid*.
- Proton-motive force** : The electrochemical potential inherent in a transmembrane gradient of H⁺ concentration; used in oxidative phosphorylation and photophosphorylation to drive ATP synthesis.
- Protoplasm** : A general term referring to the entire contents of a living cell.
- Pruritis** : Itching.
- Psoriasis** (from a Greek word, meaning *to have the itch*) : A noncontagious disease of the skin marked by scaly red patches, due probably to a disorder of the immune system.
- Ptyalin** : See **amylase**.
- Puberty** (*pubertas*^L = of ripe age, adult) : The state of physical development at which persons are first capable of begetting or bearing children. In law, the age of puberty is usually fixed at 14 in the male and 12 in the female.
- Pupation** : The formation of puparium by an insect larva, the first step in metamorphosis.
- Purine** (C₅H₄N₄) : A nitrogenous heterocyclic base found in nucleotides and nucleic acids; contains a 6-membered pyrimidine ring fused to the 5-membered imidazole ring; the most common purine derivatives are adenine and guanine; purine derivatives always pair with pyrimidine derivatives in the two strands of DNA, ensuring a parallel-sided molecule.
- Puromycin** : An antibiotics that inhibits polypeptide synthesis by being incorporated into a growing polypeptide chain, causing its premature termination.
- Pus** : A yellowish fluid consisting of serum, white blood cells, bacteria and tissue debris formed during the liquefaction of inflamed tissue.
- Putrefaction** : The anaerobic decomposition of organic substances, particularly proteins, brought about by bacteria and other microbes and which gives rise to foul-smelling products.
- Pyorrhoea** (*pyon*^G = pus + *rhoia*^G = flowing) : Refers to inflammation of gums with purulent discharge.
- Pyranose** : A simple sugar containing the 6-membered pyran ring.
- Pyrethrum** : An insecticide prepared from the dried flowers of the chrysanthemum plant, the active ingredient being called *pyrethrin*.
- Pyrexia** (*pyrexia*^G = fever) : Fever.
- Pyridine nucleotide** – A nucleotide coenzyme containing the pyridine derivative nicotinamide; NAD or NADP.
- Pyridoxal phosphate** : A coenzyme containing the vitamin pyridoxine (vitamin B₆); functions in reactions involving amino group transfer.
- Pyridoxine** (C₈H₁₁O₃N) : A water-soluble vitamin of the B complex group and designated as vitamin B₆; in fact, vitamin B₆ group includes 3 closely-related vitamins: pyridoxine, pyridoxal (C₈H₉O₃N) and pyridoxamine (C₈H₁₂O₂N₂); B₆ vitamins are widely distributed in nature in

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plant and animal tissues, *e.g.*, cereal grains (wheat, rice), yeast, egg yolk and meat; pyridoxal and pyridoxamine also occur in nature as their coenzymes, namely, pyridoxal phosphate (PALP) and pyridoxamine phosphate (PAMP), respectively; pyridoxine is a white crystalline substance, soluble in alcohol and sensitive to light and ultraviolet radiation; various forms of vitamin B₆ serve as growth factors to a number of bacteria; also act as a carrier in the active transport of amino acids across cell membranes; avitaminosis B₆ leads to convulsions and anemia in human infants; also known as *antidermatitis factor*.

Pyrimidine (C₄H₄N₂) : A nitrogenous heterocyclic base found in nucleotides and nucleic acids; contains a 6-membered ring only; the most common pyrimidine derivatives are cytosine, thymine and uracil; pyrimidine derivatives always pair with purine derivatives in DNA.

Pyrimidine dimer : A covalently-joined dimer of two adjacent pyrimidine residues in DNA, induced by absorption of ultraviolet light; most commonly derived from two adjacent thymines (a *thymine dimer*).

Pyrogallol, C₆H₄(OH)₃ : A soluble phenol which, in alkaline solution, will absorb oxygen and is used to estimate the volume of oxygen in a gaseous sample; also called *trihydroxybenzene*.

Pyrophosphatase : *See inorganic pyrophosphatase*.

Pyrrole : A porphyrin building block that has a 5-membered heterocyclic structure and contains nitrogen.

Pyruvate dehydrogenase : The complex of enzymes that removes carbon dioxide from pyruvate; one of the largest known enzymes, containing 48 polypeptide chains.

Pyruvic acid : A C-3 compound that is the starting material of the citric acid cycle; it is also the end product of glycolysis where it is formed from glucose and glycerol.

Q

Q₁₀ : A measure of the rate of increase in metabolic rate over a 10-degree range in temperature. Thus, if an organism has a metabolic rate at 10°C of T units, a rate of twice T units at 20°C, the Q₁₀ = 2. A Q₁₀ of 2 is the typical exponential increase in rate exhibited by enzymes up to a certain maximum rate, after which denaturation occurs faster than increase, causing an overall reduction of the rate.

Quantum : The ultimate unit of energy.

Quarantine : A forced stoppage of the transportation of diseased plants from one region to another.

Quart : Unit of capacity equal to one quarter of a gallon.

Quaternary structure : The three-dimensional structure of a multisubunit protein; particularly the manner in which the subunits fit together.

Quinone : Any of the various compounds derived from benzene.

R

R group : (1) Formally, an abbreviation denoting any alkyl group (2) Occasionally, used in a more general sense to denote virtually any organic substituent, such as a methyl group, a hydroxyl group, or a monosaccharide.

Racemic mixture : An equimolar mixture of the D and L stereoisomers of an optically-active compound.

Radial symmetry (*radius*^L = a spoke of a wheel + *summetros*^G = symmetry) : The regular arrangement of parts around a central axis so that any plane passing through the central axis divides the organism or an organ into two halves that are approximate mirror images; for example, human beings, starfish and tulip flowers.

Radiation : The electromagnetic energy that travels through empty space with the speed of light (2 × 10⁸ ms⁻¹). All objects emit radiation, at room temperature mostly in the infrared range, whereas at high temperatures visible radiation is produced.

Radical : (1) A functional group of atoms recurring as part of various different molecules. (2) An atom or group of atoms possessing an unpaired electron; also called a *free radical*. (3) A leaf *seemingly* arising from the apical portion of a root.

Radicle (*radicula*^L = root) : The part of the plant embryo that develops into the root.

Radioactive isotope : An isotopic form of an element with an unstable nucleus that stabilizes itself by emitting ionizing radiation; in fact, the nucleus tends to break up into elements with lower atomic numbers in a process called radioactive decay, such as carbon-14 which breaks up into a stable carbon-12.

Radioautography : *See autoradiography*.

Radioimmunoassay (RIA) : A sensitive and quantitative method for detecting trace amounts of a biomolecule, based on its capacity to displace a radioactive form of the molecule from combination with its specific antibody.

Raffinose : A trisaccharide found in barley, cottonseeds, beet roots and other parts of plants.

Ramachandran plot (named in honour of Gopalasamudram Narayana Ramachandran, an

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- Indian biochemist** : A plot that constitutes a map of all possible backbone configurations for an amino acid in a polypeptide chain. The axes of the plot consist of the rotation angles of the 2 backbone bonds that are free to rotate (ϕ and ψ , respectively); each point ϕ , ψ on the plot, thus, represents a conceivable amino acid backbone configuration.
- Random coil** : 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.
- Ras protein** : One of a large family of GTP-binding proteins that help relay signals from cell-surface receptors to the nucleus; named for the *ras* gene, first identified in viruses that cause *rat* sarcomas.
- Rate-limiting step** : (1) Generally, the step in an enzymatic reaction with the greatest activation energy or the transition state of highest free energy. (2) The slowest step in a metabolic pathway.
- Reaction** : In chemistry, any process in which the arrangement of atoms into molecules is changed.
- Reaction intermediate** : Any chemical species in a reaction in a pathway that has a *finite* (definite) chemical lifetime.
- Reading frame** : A contiguous and nonoverlapping set of three nucleotide codons in DNA or RNA; an mRNA molecule can be read in any one of three reading frames.
- Rebonucleotide** : A nucleotide containing D-ribose as its pentose component.
- Recapitulation theory** : The rejected hypothesis, developed by Thomas Huxley, that *ontogeny repeats phylogeny*.
- Receptor** : Protein that binds a specific extracellular signalling molecule (ligand) and initiates a response in the cell. Cell surface receptors (acetylcholine receptor, insulin receptor) are located in the plasma membrane with their ligand-binding site exposed to the external medium. Intracellular receptors (steroid hormone receptors) bind ligands that diffuse into the cell across the plasma membrane.
- Recombinant DNA** : Any DNA molecule created in the laboratory by joining segments from two or more precursor DNA molecules; widely used in the cloning of genes, in the genetic modification of organisms and in molecular biology generally.
- Recombinant DNA technology** : See **genetic engineering**.
- Recombination** : A process in which chromosomes or DNA molecules are broken and the fragments are rejoined in new combinations. In *bacteria*, it is accomplished by the transfer of genes into cells, often in association with viruses. In *eukaryotes*, it is accomplished by reassortment of chromosomes during meiosis and by crossing-over.
- Recon** : The smallest genetic unit between two of which recombination can take place, effectively a DNA base.
- Red blood corpuscle (RBC)** : See **erythrocyte**.
- Redox pair** : An electron donor and its corresponding oxidized form; for example, NADH and NAD⁺.
- Redox potential** : A quantitative measurement of the willingness of an electron carrier to act as a *reducing* or *oxidizing* agent. Redox potential is measured in volts; the more negative the value, the better the carrier will act as a reducing agent. Thus, in an electron transport system the carriers are arranged in order of increasing redox potentials (negative to positive).
- Redox reaction** : See **oxidation–reduction reaction**.
- Reducing agent** : The electron donor in an oxidation–reduction reaction; also called *reductant*.
- Reducing end** : The end of a polysaccharide having a terminal monosaccharide moiety with a free anomeric carbon; the terminal residue can act as a reducing sugar.
- 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 equivalent** : A general or neutral term for an electron or an electron equivalent in the form of a hydrogen atom or a hydride ion.
- Reducing power** : The use of light energy to extract atoms from water.
- Reducing sugar** : A sugar in which the carbonyl (anomeric) carbon is not involved in the formation of a glycosidic bond and hence can undergo oxidation with metal hydroxides which are themselves reduced to lower oxides or free metals; common examples are glucose, fructose, lactose and maltose.
- Reduction** (*reduction*^L = a bringing back; originally, “bringing back” a metal from its oxide)
- Recapitulation theory** : The rejected hypothesis, developed by Thomas Huxley, that *ontogeny repeats phylogeny* : (1) In *biochemistry*, the gain of an electron during a chemical reaction from one atom to another, as occurs during the addition of hydrogen to a molecule or the removal of oxygen from it; occurs simultaneously with oxidation; reduction involves the addition of energy to one substance, which is coupled with the simultaneous removal

- of energy from another substance by oxidation.
(2) In *genetics*, division of chromosomes in meiosis.
- Reductionism** : The approach of studying simpler components in order to understand the functions of complex systems.
- Regulatory enzyme** : An enzyme having a regulatory function through its capacity to undergo a change in catalytic activity by allosteric mechanisms or by covalent modification.
- Regulatory gene** : A gene that gives rise to a product involved in the regulation of the expression of another gene; for example, a gene coding for a repressor protein.
- Regulatory sequence** : A DNA sequence involved in regulating the expression of a gene; for example, a promoter or operator.
- Regulon** : A group of unlinked (non-adjacent) genes or operons that are all regulated by a common mechanism.
- Relative molecular weight** : Mass of a molecule expressed as a multiple of the mass of a hydrogen atom.
- Release factors** : *See* **termination factors**.
- Releasing factors** : Peptide hormones released by the hypothalamus that stimulate the release (secretion) of other hormones by the anterior pituitary (adenohypophysis).
- Renaturation** : Refolding of an unfolded (denatured) globular protein so as to restore native structure and protein function.
- Rennin** : An enzyme, present in the gastric juice, secreted by the gastric glands of the stomach wall that coagulates caseinogen in milk to form casein, which forms an insoluble curd (a calcium-casein compound) which is then attacked by pepsin. It is important particularly in young mammals because it increases retention time in the stomach, allowing for a more efficient digestion of the primary food source.
- Replication** : Synthesis of a daughter duplex DNA molecule identical to the parental duplex DNA.
- Replication fork** : Y-shaped region of a replicating DNA molecule at which the two daughter strands are formed and separate.
- Replication origin** : The point of initiation of DNA synthesis along the double helix; two replication forks form at the replication origin and move in opposite directions from one another during DNA synthesis.
- Replicon** : A block of DNA capable of replication (for example, a plasmid or a chromosome).
- Replisome** : The multiprotein complex that promotes DNA synthesis at the replication fork.
- Repressible enzyme** : In bacteria, an enzyme whose synthesis is inhibited when its reaction product is readily available to the cell.
- Repression** (*reprimere*^L = to press back, keep back) : The state in which a gene is prevented from being transcribed, in response to a change in the activity of a regulatory protein, so that no protein is produced.
- Repressor** (*reprimere*^L = to press back, keep back) : A protein that prevents transcription of mRNA from DNA by binding to the operator (a specific region of DNA) and so preventing RNA polymerase from attaching to the promoter.
- Repetitive DNA** : Sequences of DNA that occur in many copies in a genome; some sequences of repetitive DNA can occur in a million copies per nucleus.
- Reserpine** : An alkaloid extracted from *Rauwolfia serpentina*, that is used as a sedative and as an antihypertensive agent to reduce hypertension.
- Reserves** : Any stored food supplies which may be drawn on in times of food shortage.
- Residue** : A general term for the unit of a polymer; for example, an amino acid within a polypeptide chain and a mononucleotide within a nucleic acid; the term reflects the fact that sugars, amino acids, and nucleotides lose a few atoms (generally the elements of water) when incorporated in their respective polymers.
- Resin** : A thick, translucent, combustible, organic fluid usually secreted into resin ducts in pines and many other seed plants.
- Resolving power** : The ability of a microscope to distinguish two lines as separate.
- Respiration** (*respirare*^L = to breathe) : The catabolic process in which electrons are removed from nutrient molecules and passed through a chain of carriers to oxygen. Alternatively, a general term for any process in a cell in which the uptake of O₂ molecules is coupled to the production of CO₂.
- Respiratory chain** : The electron transport chain; a sequence of electron-carrying proteins that transfer electrons from substrates to molecular oxygen in aerobic cells.
- Restriction endonuclease** : A special kind of enzyme that can recognize and cleave both strands of DNA molecules into fragments at points within or near the specific site recognized by the enzyme; one of the basic tools of genetic engineering.
- Restriction fragment** : A segment of double-stranded DNA produced by the action of a restriction endonuclease on a larger DNA.
- Restriction map** : Diagrammatic representation of a DNA molecule indicating the sites of cleavage by various restriction endonucleases.
- Retinene** : The main carotenoid pigment found in the retina of the eye; turns yellow in light.

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Retinoblastoma : A childhood cancer of the retina.

Retinol (C₂₀H₃₀O) : A fat-soluble vitamin and designated as vitamin A; liver oils of various fishes (shark, halibut, cod) are the richest natural sources of vitamin A; butter, milk, eggs, kidneys and pigmented (especially yellow) vegetables and fruits are other good sources; vitamin A is absent from vegetable fats and oils; found in two forms: Vitamin A₁ (retinol) and vitamin A₂ (3-dehydroretinol); retinol is a viscous colourless oil and is destroyed on exposure to UV light; participates in visual cycle and also helps maintain the epithelial cells of the skin and the linings of the digestive, respiratory and genitourinary systems; avitaminosis A leads to nyctalopia (inability to see in night), xerophthalmia (drying of the eyes), keratomalacia (softening of the cornea), phrynoderma (hard and horny skin) and stunted growth; also called as *antixerophthalmic factor* or '*bright eyes*' vitamin or *anti-infection vitamin*.

Retrovirus (*retro*^L = turning back) : An RNA virus containing a reverse transcriptase and that which replicates in a cell by first making a double-stranded DNA intermediate, which it can then insert into the cellular DNA as if it were a cellular gene. Human immunodeficiency virus (HIV) is a common example.

Reverse transcriptase : An RNA-dependent, DNA polymerase enzyme, present in retroviruses such as AIDS, that catalyzes the synthesis of a double-stranded DNA copy from a single-stranded RNA template molecule; in genetics, reverse transcriptase is used for making complementary DNA (cDNA) of eukaryotic genes.

Rhesus blood group : A form of human blood variation in which most of the world population (about 85% of the UK population, for example) possess an *Rh factor* (D-antigen) on the surface of red blood cells. Such people are described as being *Rh-positive*, those without the factor are *Rh-negative*. Unlike the ABO blood group, there is normally no rhesus antibody, unless an Rh-negative person is sensitized by a rhesus antigen, for example in a blood transfusion or when an Rh-negative mother receives blood cells from an Rh-positive fetus. The blood group factor is controlled by a single autosomal gene on chromosome 1, with 2 principal alleles; the allele for the Rh-factor is dominant. It was named for the Rhesus monkey in which it was first described.

Rhodopsin : A purple pigment found in the rods of the retina of the vertebrate eye. Lack of rhodopsin causes night blindness (*nyctalopia*). When bleached by light, rhodopsin liberates a protein called opsin and a yellow

pigment called retinene. As a result of this reaction, energy is released which triggers off an action potential. Also called *scotopsin*.

Riboflavin : A water-soluble vitamin of the B complex group and designated as vitamin B₂; found in a wide variety of foods including heart, liver, kidney, milk and green vegetables; occurs almost exclusively as a constituent of either FMN or FAD; required in the metabolism of all animals, acting as a carrier in the electron transport system; persons deficient in vitamin B₂ may show glossitis, cheilosis, corneal vascularization and a typical dermatitis; also called '*yellow enzyme*' because of its colour.

Ribonuclease : A nuclease that catalyzes the hydrolysis of certain internucleotide linkages of RNA.

Ribonucleic acid, RNA : A polynucleotide having a specific sequence of ribonucleotide units covalently joined through 3',5'-phosphodiester bonds; molecules of RNA, which are made as complements of DNA segments called genes, function in protein synthesis; differentiated into 3 types: mRNA, rRNA and tRNA.

Ribose : A 5-carbon sugar with one oxygen atom more than the related sugar deoxyribose; a component of ribonucleic acid.

Ribosomal RNA (rRNA) : A class of RNA molecules serving as components of ribosomes and often distinguished by their sedimentation coefficient, such as 28 s rRNA or 5 s rRNA; participate in the synthesis of proteins.

Ribosome : A cell organelle composed of rRNAs and proteins (approximately 18 to 22 nm in diameter) that are arranged in two subunits, one large and one small; prokaryotes have ribosomes with 70 s size and mass and eukaryotes have larger ribosomes with 80 s size and mass; ribosome associates with mRNA and catalyzes the synthesis of proteins.

Ribozymes : Ribonucleic acid molecules with catalytic activities; RNA enzymes.

Ribulose (C₅H₁₀O₅) : A ketopentose sugar, found in syrup; plays important role in carbohydrate metabolism.

Ribulose biphosphate (RBP) : A C-5 ketose that acts as a receptor of CO₂ in Calvin cycle.

Rickets : A vitamin D-deficiency disease in children, which is primarily a disease of growing bones; characterized by hunched back, beaded ribs, protruding chest, enlarged skulls, swollen joints and bow legs; more prevalent where climate or custom prevents individuals from exposure to sun, whereby checking vitamin D production by irradiation of the skin.

RNA polymerase : An enzyme that catalyzes the synthesis of an RNA molecule from ribonucleoside 5'-triphosphate precursors, using

- a strand of DNA or RNA as a template.
- RNA processing** : See **RNA splicing**.
- RNA splicing** : The trimming of larger primary RNA transcripts, in the nucleus, into smaller, coding sequences that are exported into the cytosol. Alternatively, a process in which intron sequences are excised from RNA molecules in the nucleus during formation of mRNA. Synonymous with *RNA processing*.
- Rochelle salt, COOK (CHOH)₂ COONa . 4H₂O** : A white crystalline soluble salt, m.p. 70 – 80°C; used in the preparation of baking powder, Seidlitz powder etc.
- Royal Society** : An English scientific society of physicists, chemists and biologists founded in 1660s and in existence today.
- Rubisco (short for ribulose biphosphate carboxylase-oxygenase)** : The enzyme that carries out carbon fixation in photosynthesis by adding CO₂ to ribulose-1,5-bisphosphate. It can also add O₂ in place of CO₂, initiating photorespiration.
- Rut** : The period of maximum testicular activity in male mammals; the term particularly applied to the period of sexual activity in deer; compare *estrus cycle*.

S

- Saccharin, C₆H₄SO₂CONH** : A white, crystalline, sparingly soluble solid with a m.p. 227°C; about 400 times sweeter than sugar; manufactured from toluene, C₆H₅. CH₃; 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, C₆H₄COSO₂NNa.2H₂O.
- Saccharase** : See **invertase**.
- Saccharomyces** : An ascomycetous genus of unicellular fungi that reproduce asexually by budding or sexually by conjugation; economically important in brewing and baking, also widely used in genetic engineering and as simple model organisms in the study of eukaryotic cell biology.
- Saccharose** : See **sucrose**.
- S-adenosylmethionine (adoMet)** : An enzymatic cofactor involved in methyl group transfers.
- 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.
- Salmonella** : A rodlike, motile, aerobic genus of bacteria; includes species that cause food poisoning.
- Salt** : A chemical compound 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.
- Salvage pathway** : Synthesis of a biomolecule (such as a nucleotide) from intermediates in the degradative pathway for the biomolecule; a recycling pathway, as distinct from a *de novo* pathway.
- Saponification** : The hydrolysis of an ester; the term is often confined to the hydrolysis of an ester by an alkali, thus forming a salt (a soap, in the case of some of the higher fatty acids) and the free alcohol.
- Sarcoma** : Solid tumour or the cancer of connective tissue (muscle and bone). Sarcomas are the least frequent type of tumour, constituting about 2% of all malignant tumours.
- Sarcoma** : Cancer of connective tissue.
- Satellite DNA** : DNA consisting of multiple tandem repeats of very short, simple 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.
- Saturated fatty acid** : A fatty acid containing a fully saturated (*i.e.*, having only single bonds) alkyl chain; palmitic and stearic acids are common examples of saturated fatty acids.
- Schiff's reagent** (named after *Hugo Schiff*, LT, 1834-1915) : A reagent consisting of the dye magenta, which has been decolourized 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.
- 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.

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Scotopsin : See **rhodopsin**.

Scurvy (substantive use of adj. scurvy from scurf, influenced by *scorbut*^{Fr} = scurvy) : A disease characterized by petechial hemorrhages (bleeding) in the skin and mucous membrane, swelling of limbs, bleeding of gums and dropping of teeth; results from insufficient intake of vitamin C (ascorbic acid) in the diet; normal health being restored by administration of fresh fruits, particularly citrus fruits.

Scutellum : The single cotyledon of the grass embryo; the scutellum is specialized for absorbing nutrients from the endosperm as the seed germinates.

Sebaceous gland : One of many glands occurring in the skin; secretes oil or sebum into the hair follicles in mammals as a result of cell destruction; maintains an oily coating to the hair and contributes to its waterproofing.

Second : (1) The SI unit of time defined as the duration of 9 192 631 770 periods of the radiation corresponding to the transition between two hyperfine levels of the ground state of the caesium-133 atom. Symbol s. (2) A measure of angle: 1/60 of a minute.

Second law of thermodynamics : The law stating that in any physical or chemical process, the entropy (degree of disorder) of the universe tends to increase.

Second messenger : A small effector molecule that is formed in or released into the cytosol in response to an extracellular signal (first messenger) such as a hormone; helps to relay the signal to the interior of the cell; examples include cAMP, IP₃, and Ca²⁺.

Second order reaction : A reaction in which 2 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 2 molecules of the same reactant) or on the product of 2 reactant concentrations (for 2 different reactants). Compare *first-order reaction*.

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.

Secondary sex characters : Features of a male or female animal that develop when sexual maturity occurs; in humans, the *female secondary sex characters* are induced by estrogens at puberty and include mature genitalia, prominent breasts, high-pitched voice,

passive attitude, less body hair and more scalp hair, and feminine body shape, particularly a broadening of the pelvis and fat deposition around the hips; the *male human secondary sex characters* are induced by androgens at puberty and include mature genitalia, normal chests, deeper voice, active attitude, more body hair and less scalp hair, and masculine body shape, particularly broadened shoulders and narrow hips; all these characters are excellent examples of sex limitation.

Secondary structure : Regular local folding pattern of a polymeric molecule, *i.e.*, residue-by-residue conformation of the backbone of a polymer; for example, the B- and Z-forms of DNA helix and the α helices and β pleated sheets in proteins.

Secondary metabolite : A product of microbial cells in culture when growth is slowing down. While having no obvious role in the cellular physiology of the producer, secondary metabolites are sometimes most useful to humans, for example as antibiotics.

Secretin : A peptide hormone of 27 amino acid residues and with molecular weight of 3,056; formed by the upper intestinal mucosa and liberated by HCl present in the acid chyme; causes the flow of pancreatic juice; also stimulates the flow of bile and intestinal juices; the first compound to be designated as hormone.

Secretory vesicle : Membrane-bounded organelle in which molecules destined for secretion are stored prior to release; also called *secretory granule* because darkly staining contents make the organelle visible as a small solid object.

Sedative : A drug that reduces nervousness and excitement.

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.

Sedimentation coefficient : A physical constant specifying the rate of sedimentation of a particle in a centrifugal field under specified conditions.

Seed : 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.

Seed coat : The outer layer of a seed; develops from the integuments of the ovule.

Selectively permeable membrane (*seligere*^L = to gather apart + *permeare*^L = 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 *semipermeable membrane*.
- Selfish DNA** : Refers to DNA that can perpetuate itself by semi-autonomous replication; transposons are considered to be selfish DNA because they can move copies of themselves to several sites in a genome.
- Self-replication** : Refers to the ability of DNA to make exact copies of itself.
- Semen** (Latin, for *seed*) : The ejaculate from the male reproductive organs which in mammals contains the sperms together with secretions from the seminal vesicles and prostate gland which are essential for maintaining the viability of the sperms.
- Semiconservative replication** : A form of DNA replication wherein half of each new double strand consists of one newly-synthesized strand and the other strand derived from the parent double helix. This is the way DNA replication actually occurs. Compare *conservative replication*, wherein both parent strands would end up in one progeny molecule.
- Seminal fluid** : The fluid in which the sperms are bathed.
- Semipermeable membrane** : *See selectively permeable membrane*.
- Senescence** : The process of growing old which occurs in all species and is characterized by a gradual slowing down of metabolism and breakdown of tissues, often accompanied by endocrinal changes.
- Sense organ** : Any receptor of external or internal stimuli.
- Sense strand** : For a gene, the DNA strand that is homologous to an RNA transcript of the gene, that is it carries the same sequence as the transcript, except with T in place of U. It is, thus, complementary to the strand that served as a template for the RNA.
- Sense strand** : In DNA, the sense strand of a gene is the one that contains the coding sequence for a molecule of RNA and, in the case of mRNA, indirectly for a polypeptide.
- Septicaemia** : An infection of the bloodstream by a variety of pathogenic microorganisms, such as *Salmonella* and *Pseudomonas*, usually from a nonintestinal source, leading to fever, lesions in many body organs and even death; commonly known by the name *blood poisoning*.
- Secretory granule** : *See secretory vesicle*.
- Serotonin** : A pharmacologically-active compound, derived from tryptophan; acts as a vasodilator, increases capillary permeability, and causes contraction of smooth muscle.
- Serum** : Plasma with clotting factors removed.
- Sex chromosome** : A chromosome pair in eukaryotes that usually differ in size and shape and control sex determination. The presence of identical pairs is usually present in the female and non-identical pair in males, although the reverse also occurs; also called *allosome*; compare *autosome*.
- 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 gestogens (corpus luteal hormones); synthesized in mammals by the ovary (or testis), adrenal cortex, corpus luteum, and the placenta.
- Shine-Dalgarno sequence** : A sequence in an mRNA required for binding prokaryotic ribosomes.
- SI units** : Those units of measurement forming the *Systeme International d'Unites*, consisting of the metre, kilogram, second, mole, kelvin, ampere, candela and katal.
- Sickle-cell anemia** : A genetic human disease resulting from a hemoglobin mutation; caused by a homozygous allele coding for the β chain of hemoglobin; produces fragile erythrocytes, leading to anemia.
- Signal recognition particles (SRPs)** : Cytoplasmic particles that dock ribosomes on the surface of the ER if the nascent polypeptide is destined to be processed by the ER. The SRP recognizes and binds to a specific N-terminal signal sequence on the nascent polypeptide.
- Signal sequence** : *See leader sequence*.
- Silk** : A thread-like substance produced by the silkworm; composed mainly of the proteins, sericin and fibroin.
- Simple protein** : A protein yielding only amino acids on hydrolysis.
- Single bond** : A covalent bond that shares only one electron pair.
- Small nuclear RNAs (snRNAs)** : RNAs 100-300 nucleotides in length that are involved in the splicing reaction in eukaryotes.
- Soap** : A compound of fatty acid and potassium or sodium hydroxide; soaps are important cleansing agents because of their emulsifying action.
- Sol** : The fluid state of a colloid.

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- Soluble** : Refers to polar molecules that dissolve in water and are surrounded by a hydration shell.
- Solute** : The molecules dissolved in a solution.
- Solution** : A mixture of molecules, such as sugars, amino acids, and ions, dissolved in water.
- Solvent** : The most common of the molecules dissolved in a solution; usually a liquid, commonly water; the solvent is the larger part of the solution.
- Somatic cell** (*soma*^G = body) : Any cell of a plant or animal other than a germ cell or germ-cell precursor.
- 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)*.
- Sorbitol, CH₂OH (CHOH)₄CH₂OH** : 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.
- Species**, plural also **species** (*speci*^L = a kind or sort) : A basic category in the classification system between a genus and a variety; a group of plants or animals 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; the scientific names of species are binomials consisting of a genus (generic) name and a specific epithet; unitary in evolution and ecological role.
- Species-specific** : Limited in reaction or effect to one species.
- Specific activity** : The number of micromoles (μ mol) of a substrate transformed by an enzyme preparation per minute per milligram of protein at 25°C; a measure of enzyme purity.
- 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 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** : The ability of an enzyme or receptor to discriminate among competing substrates or ligands.
- Sperm** (*sperma*^G = sperm, seed) : A sperm cell or the male gamete.
- Sphingolipids** : An amphipathic lipid with a sphingosine backbone to which are attached a long-chain fatty acid and a polar alcohol.
- Spliceosome** : A large complex of nucleic acids and proteins in the nucleus that catalyzes the splicing reaction in eukaryotes.
- Splicing** : See **gene splicing**.
- 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.
- 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_0')** : The electromotive force exhibited at an electrode by 1M concentrations of a reducing agent and its oxidized form at 25°C and pH 7.0; a measure of the relative tendency of the reducing agent to lose electrons.
- Standard state** : A reference state, with respect to which thermodynamic quantities (such as chemical potentials) are defined. For substances in solution, standard state indicates 1M concentration at 1 atm pressure and 25°C.
- Starch** : The most important homopolysaccharide, acting as reserve food material of the higher plants; occurs in cereals, legumes, potatoes and other vegetables; consists of 2 components: an unbranched straight-chain component, *amylose* (15 – 20%) and a branched chain component, *amylose* (80 – 85%); a white, soft, unsweet, amorphous powder, insoluble in water and alcohol; breaks down into large fragments called *dextrins* on heating, especially in the presence of moisture; readily hydrolyzed by mineral acid with the final production of glucose.
- Start codon** : See **initiation codon**.
- Steady state** : A nonequilibrium state of a system through which matter is flowing and in which all components remain at a constant concentration.
- Stearic acid** (*stear*^G = hard fat) : A C-18 saturated fatty acid; commonly found in animal and plant fats.

- Steatorrhea** (from two Greek words meaning *fat* + *a flow*, respectively) : A disease characterized by stools with increased fluidity due to excess of fat content.
- Stereoisomers** : Compounds that have the same molecular formula and the same structure, but differ only in spatial configuration of the atoms in the molecule.
- Steroid** (*stereos*^G = solid + *oil*^L = from oleum, oil) : A hydrophobic molecule related to cholesterol; derivatives of a fused and fully saturated ring system called cyclopentanoperhydrophenanthrene or sterane, which consists of 3 cyclohexane rings fused in nonlinear phenanthrene manner and a terminal cyclopentane ring; many important hormones such as estrogen and testosterone are steroids.
- 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.
- Sterols** : A class of lipids containing the steroid nucleus with hydroxyl groups, *i.e.*, they are hydroxy steroids; resist saponification; common example is cholesterol.
- Stoichiometry** : The part of chemistry dealing with the composition of substances; more particularly with the determination of combining proportions or chemical equivalents; also spelt as *stoicheiometry*.
- Stop codons** : RNA codons that signal a ribosome to stop translating an mRNA and to release the polypeptide. In the normal genetic code, there are 3 stop codons, : UAA, UAG and UGA.
- Strain** : A population of individuals that all share the same trait. Strains are maintained by interbreeding individuals within the same strain.
- Streptomycin, C₂₁H₃₉O₁₂N₇** : An antibiotic substance produced by the fungus, *Streptomyces*; effective against several types of disease bacteria, including some against which *Penicillin* is inactive; used in the treatment of tuberculosis.
- 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.
- 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 polysaccharide** : A polysaccharide that holds cells and organisms together; *cellulose* is the most abundant structural polysaccharide in plants.
- 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 direct into vapour, and subsequent condensation, without melting.
- Substrate** : (1) The specific compound acted upon by an enzyme molecule. (2) The medium on which an organism (especially a microorganism) can grow.
- Substrate-level phosphorylation** : Phosphorylation of ADP (or some other nucleoside 5'-diphosphate) coupled to the dehydrogenation of an organic substrate; results in ATP production; independent of the electron transport system used in oxidative phosphorylation.
- Subunit** : A polypeptide that combines with other polypeptides to comprise a multisubunit protein.
- 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 substratelevel phosphorylation of one molecule of ADP to ATP in the fifth step of the Krebs cycle.
- Sucrase** : *See invertase.*
- Sucrose (C₁₂H₂₂O₁₁)** : A common, nonreducing, disaccharide made up of a molecule of glucose and one of fructose; obtained from sugarcane and sugar beet; used as a sweetening agent; also called *table sugar* or *saccharose*.
- Sugar** : A general term usually applied for any monosaccharide or disaccharide.
- Sulfhydryl (-SH)** : A chemical group containing sulfur and hydrogen which is present in the amino acid cysteine and other molecules; two sulfhydryl groups 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, SO₂ NH₂ or

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- its derivative; the group includes sulfanilamide, sulfadiazine, sulfadiazine, sulfathiazole and many others; some of the sulfonamides are sulfa drugs and act as powerful inhibitors of bacterial activity.
- Supercoiled DNA** : A region of DNA in which the double helix is further twisted on itself.
- Supernatant** : The clear liquid above a precipitate which has settled out.
- Surface tension** : A tautness of the surface of a liquid, caused by the cohesion of the liquid molecules. Alternatively, it is the attraction between a surface and a particle lying on it. Water has an extremely high surface tension.
- Svedberg (S)** : A unit of measure of the rate at which a particle sediments in a centrifugal field. It is equal to 10^{-13} second.
- 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.
- Symport** : A form of cotransport in which a membrane carrier protein transports two solute species across the membrane in the same direction. Compare *antiport*.
- Syndrome** (*syn*^G = together + *dramein*^G = to run) : Refers to a disease characterized by a group of symptoms; often named after their discoverer, for example Down's syndrome, Klinefelter's syndrome and Turner's syndrome.
- 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.
- Synovial fluid** : A viscous fluid contained within a membrane enclosing moveable joints such as the elbow and knee. The fluid lubricates the cartilages which make the surface contact between the bones at the joints.
- Synthases** : Enzymes that catalyze condensation reactions in which no nucleoside triphosphate is required as an energy source.
- Synthetases** : Enzymes that catalyze condensation reactions using ATP or another nucleoside triphosphate as an energy source.
- System** : An isolated collection of matter; all other matter in the universe apart from the system is called the *surroundings*.

T

- T cell** : A type of lymphocyte involved in cell-mediated immune responses and interactions with B cells; includes both cytotoxic T cells and helper T cells; also called *T lymphocyte*.
- T lymphocyte** : See **T cell**.
- Tachycardia** (*tachys*^G = fast + *kardia*^G = heart) : Rapid beating of the heart.
- Tallow** : The rendered hard fat of animals, particularly cattle and sheep; composed of long, saturated fatty acids.
- Tannin** : A bitter astringent organic substance; found widely in plant sap, particularly in bark, leaves and unripe fruits; used in the production of leather and ink.
- Target cell** : Any cell that responds to specific hormones.
- Tartrazine** : An azo dye that produces a yellow colour; widely used as a food additive (E102).
- TATA box** : Consensus sequence in the promoter region of many eukaryotic genes that binds a general transcription factor and hence specifies the position where transcription is initiated.
- Tautomers** (*tauto*^G = same, *meros*^G = part) : A term coined by Laar in 1225; structural isomers that differ in the location of their hydrogens and double bonds; aldehydes, ketones and other carbonyl compounds such as esters exhibit tautomerism.
- Taxol** : A drug obtained from Pacific yew, and also from a fungus that grows on the yew; has potential for treating certain forms of cancer.
- Taxon, plural taxa** : Any taxonomic category within the classification of organisms, such as class, order, family, genus or species.
- Tay-Sachs disease** : A common hereditary disorder, in which children who are apparently normal at birth show signs within 6 months of marked deterioration of brain and spinal cord. By the age of one year, the child can only lie helplessly, becoming mentally retarded, increasingly blind, and paralyzed. Death occurs between 3 and 4 years with no known survivors and no cure. The disease is caused due to a deficiency of the enzyme hexosaminidase A (= *N acetylgalactosaminidase*), which cleaves a specific bond (β -8 \rightarrow 4) between an N-acetyl-D-galactosamine and a D-galactose residue in the polar head of the ganglioside, G_{M2} . In effect, G_{M2} is not degraded to G_{M1} . With the result, G_{M2} is accumulated in large amounts in the lysosomes, particularly in the brain cells, causing degeneration of the

- nervous system. The disease is controlled by the recessive allele of a gene located on chromosome 15, double recessives producing a deficient amount of the enzyme hexosaminidase A which leads to the accumulation of complex fatty substances in the central nervous system. Although the disease is rare in the population at large (1 in 3,00,000 births), it has a very high incidence (1 in 3, 600 births), in Ashkenazic Jews.
- Temperature** : The degree of hotness or coldness, usually related to a zero at the melting point of ice (Celsius scale) or absolute zero (Kelvin scale).
- Temperature quotient** : See **Q₁₀**.
- Template** : A macromolecular mould or pattern for the synthesis of an informational macromolecule.
- Tendon** (*tenon*^G = stretch) : A bunch of parallel collagen fibres making up a band of connective tissue which serves to attach a muscle to a bone.
- Tensile strength** : The tensile (pulling) stress that has to be applied to a material to break it; measured as a force per unit area, *e.g.*, *newtons* per square metre, *dynes* per square centimetre, *pounds* or *tons* per square inch.
- Teratogen** : A chemical that causes developmental abnormalities in an organism.
- Terminal transferase** : An enzyme that catalyzes the addition of nucleotide residues of a single kind to the 3' end of DNA chains.
- Termination codons** : UAA, UAG and UGA; in protein synthesis, these three codons signal the termination of a polypeptide chain; also known as *stop codons* or *nonsense codons*.
- Termination factors** : Protein factors of the cytosol required in releasing a completed polypeptide chain from a ribosome; also known as *release factors*.
- Termination sequence** : A DNA sequence that appears at the end of a transcriptional unit and signals the end of transcription.
- Terpenes** : Organic hydrocarbons or hydrocarbon derivatives derived from recurring 5-C precursor units called *isoprene units*; terpenes produce some of the scents and tastes of plant products, for example, the scents of geranium leaves and pine needles; examples include menthol (2 isoprene units), β -carotene (8 isoprene units) and rubber (500 to 5,000 isoprene units).
- Tertiary structure** : The three-dimensional conformation of a polymer in its native folded state, especially that of a protein; in the case of protein, conformation (shape) of the molecule is maintained by disulfide bonds, ionic interactions or hydrophobic attraction between amino acids.
- Testa** : A protective coat around the seed, formed from the *integuments* of the ovule. At one area of the testa is the *hilum*, at one end of which is often found the *micropyle*. Sometimes, the testa is responsible for seed dormancy, a state which is broken when the coat ruptures.
- Testis, plural testes** (Latin, for *witness*) : In animals, the organ producing male gametes; in mammals a testicle. It also produces androgens, the male sex hormones.
- Testosterone** (*testis*^G = testicle + *steiras*^G = barren) : A steroid hormone secreted by the testes that is responsible for the development of secondary sex characters of males.
- Tetany** (*tetanie*^{Fr}, from *tetanos*^G = stretching) : An abnormal increase in nerve and muscle excitability resulting in spasms of the arms and legs, caused by a deficiency of parathyroid secretion, called parathormone (PTH) or Collip's hormone. Tetany can be relieved either by the administration of a soluble calcium salt or of PTH. Also called *muscular twitchings*.
- Tetanus** (*tetanos*^G = stretching) : A soil-borne disease produced by toxins from the bacterium *Clostridium tetani* which usually enters the body through a wound, producing spasm of the voluntary muscle, especially of the jaw (lockjaw). Bacterial tetanus can be treated by administering antitetanus serum containing ready-made antibodies, or by antitetanus vaccine which induces the formation of antibodies by the recipient.
- Tetracycline** : An antibiotic of the *broad spectrum type*, so called because of its effects on a wide variety of bacterial types. Since they can adversely affect host cells as well as bacteria, tetracyclines are prescribed medicinally with extreme caution.
- Tetrahydrobiopterin** : The reduced coenzyme form of biopterin.
- Tetrahydrofolate** : The reduced, active coenzyme form of the vitamin B₉ (folic acid).
- Thalassemia** (from two Greek words, meaning *sea* + *blood*, respectively) : See **Cooley's disease**.
- Theory** (*theorein*^G = to look at) : A well-tested hypothesis supported by a great deal of sound, convincing factual evidence, obtained as a result of properly-controlled experiments.
- Thermoduric** : Heat-enduring.
- Thermodynamics** (*therme*^G = heat + *dynamis*^G = power) : The study of transformations of energy,

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- using heat as the most convenient form of energy measurements. There are two well-defined laws (first and second) of thermodynamics.
- Thermoregulation** : The control of body heat in homoiotherms.
- Thiamine** : A water-soluble vitamin of the B complex group and designated as vitamin B₁; found practically in all plant and animal foods, and cereals, heart, liver and kidney are excellent sources; a white crystalline substance and destroyed at high temperatures unless the pH is low; acts as a coenzyme in sugar breakdown by forming part of the NAD molecule; deficiency of thiamine results in a human disease called beriberi; also called *antiberiberi factor* or *antineuritic factor*.
- Thiamine pyrophosphate** : The active coenzyme form of vitamin B₁; involved in aldehyde transfer reactions.
- Thioester bond** : A high-energy bond formed by a condensation reaction between an acid (acyl) group and a thiol (–SH) group; present in acetyl-CoA and many enzyme-substrate complexes.
- Thiols** : A class of organic compounds of the general formula, RSH, with sulfur attached directly to carbon. They are the sulfur analogues of alcohols, containing SH instead of OH groups. Formerly called *mercaptans*.
- Threshold** : The lowest value of any stimulus, signal, or agency that results in a specified effect or response, *e.g.*, threshold frequency. Below the threshold value, there is no response despite the application of a stimulus.
- Thrombin** : An enzyme formed in the blood of vertebrates that acts upon fibrinogen to form fibrin; it is hence, essential to the process of blood clotting; formed from a blood protein called prothrombin.
- Thrombocytes** : See **platelets**.
- Thrombosis** (Greek, for a *curdling*) : Stoppage of blood circulation by the formation of a clot (thrombus) of blood in a blood vessel; clotting.
- Thromboxanes** : A class of molecules derived from arachidonate and involved in platelet aggregation during blood clotting.
- Thrombus** (Greek, for *clot*) : A coagulation (clotting) that forms in a blood vessel and obstructs circulation.
- Thylakoid** (*thylakos*^G = sac + *-oides*^G = like) : A flattened, saclike, chlorophyll-bearing membrane in the chloroplast of a eukaryote; thylakoids are stacked on top of one another in arrangements called grana; carries out the light-gathering reactions of photosynthesis.
- Thymine** : A pyrimidine occurring in DNA but not in RNA; always base-pairs with a DNA purine base called adenine.
- Thymine dimer** : See **pyrimidine dimer**.
- Thymus** : An endocrine gland present in all jawed vertebrates, situated in the neck region of most vertebrates but close to the heart in mammals. In humans, it is a flat, pinkish, bilobed structure located in the chest behind the sternum. The gland reaches its greatest development at the age of 14 to 16, after which it atrophies because of the activity of sex cells. It produces lymphocytes which then move to lymph nodes. The thymus produces a hormone called *thymosin* which causes the lymphocytes to form antibody-producing plasma cells immediately after birth, but regress in adult animals.
- Thyroglobulin** : A protein containing and storing tetraiodothyronine (= thyroxine) and triiodothyronine in the thyroid gland.
- Thyroid gland** (*thyreoides*^G = shield-shaped) : The largest endocrine gland in human body. The gland consists of two lobes near the trachea, connected across with a narrow bridge called *isthmus*, making the entire gland more or less H-shaped in appearance. Thyroid receives blood flow about 5 times its own weight per minute. Thyroid produces 2 hormones : tetraiodothyronine (= thyroxine) and triiodothyronine, of which the latter is 5 to 10 times more potent in biologic activity than the former. Thyroxine controls the basal metabolic rate (BMR) in humans. Undersecretion of thyroid leads to *cretinism* in children and *myxedema* in adults. Its oversecretion causes *exophthalmic goitre*, where the thyroid, and thus the neck, swells and the eyewalls protrude. Hyperthyroidism can be cured by surgical removal of the thyroid or by treating with antithyroid drugs.
- Thyroid-stimulating hormone (TSH)** : A hormone secreted by the anterior lobe of the pituitary gland which triggers the shedding of thyroxine from the colloidal follicles of the thyroid gland into the bloodstream. Excess thyroxine inhibits the production of TSH – an example of a negative feedback mechanism. Also called

- thyrotropin.*
- Thyrotropin** : See **thyroid-stimulating hormone (TSH)**.
- Thyroxine** (*thyros*^G = shield) : An iodine-containing hormone secreted by the thyroid that increases metabolic rate and promotes growth.
- Tincture of iodine** : A 2% iodine solution in ethyl alcohol.
- Tints** : Colours that have the same hue but different saturation.
- Tissue** (*texere*^L = to weave) : A group of cells organized into a structural and functional unit such as muscle and xylem; simple tissues are made up of similar cells, and complex tissues of different kinds of cells.
- Tissue culture** : A technique for growing and manipulating pieces of tissue in a liquid medium after their removal from the multicellular organism.
- Titration curve** : A plot of the pH versus the equivalents of base added during titration of an acid.
- Titre** : The concentration of a substance in solution, for example, the amount of specific antibody in a serum. The concentration is usually expressed as the reciprocal dilution. For example, when 1 : 250 gives a positive test and greater dilutions are negative, the titre is 250.
- Tocopherols** : A fat-soluble vitamin and designated as vitamin E; of widespread occurrence in many plant oils such as wheat germ, rice, corn, cottonseed, soybean but not olive oil; also present in small amounts in meat, milk, eggs, leafy plant and some fruits; fish liver oils are devoid of vitamin E; there are at least 7 types of tocopherols, designated as alpha (α) through eta (η), of which α -tocopherol is biologically most potent; α -tocopherol is a light yellow oil, resistant to heat (up to 200°C) and acids but acted upon by alkalis, easily but slowly oxidized and is destroyed by UV rays; act as antioxidants, control O₂ consumption and participate in nucleic acid metabolism; avitaminosis E leads to sterility in rats and muscular dystrophy in rabbits and guinea pigs; there is, however, little evidence that man is ever short of vitamin E; also called *antisterility factor*.
- Tonoplast** : The cytoplasmic membrane bordering a vacuole and controlling movements of ions into and out of the vacuole.
- Topoisomerases** : Enzymes that make reversible cuts in a double helical DNA molecule for the purpose of removing knots or unwinding excessive twists. They change the supercoiling of DNA helices by either allowing the superhelical torsion to relax (thus reducing the supercoiling) or adding more twists (thus increasing the supercoiling). Topoisomerase I makes one incision in double-stranded DNA and allows rotation of the other strand and reseals the end. Topoisomerase II makes double-stranded cuts, allows rotation and then reseals; also called *DNA isomerases*.
- Torsion** : 'Twisting' about an axis, produced by the action of two opposing couples acting in parallel planes.
- Totipotent cell** : A cell that has the capability to give rise to all structure or cell types.
- Toxins** : Proteins produced (or secreted) by some organisms and toxic to certain other species.
- Trace element** : A chemical element required by an organism in only trace amounts of less than 10⁻⁵ M. Absence can cause disease and death.
- Tracer** : A molecule or atom that has been labelled either chemically or radioactively so that it can be followed in a biochemical process or readily located in a cell or tissue.
- Trachea, plural tracheae** (Latin, for *windpipe*) : (1) In air-breathing vertebrates, the windpipe. (2) In insects, a tube distributing air to internal cells.
- Transition State** : A structure that forms transiently, in the course of a chemical reaction and has the highest free-energy of any reaction intermediate; a rate-limiting step in the reaction.
- Tranquilizer** : A drug used to reduce tension and anxiety, without impairing alertness or causing drowsiness.
- Transaminases** : See **aminotransferases**
- Transamination** : In the cell, the enzymatic transfer of an amino group from an α -amino acid to an α -keto acid. The keto acid becomes an amino acid and vice versa.
- Transcript** : A RNA product of DNA transcription.
- Transduction** : (1) Generally, the conversion of energy or information from one form to another (2) The transfer of DNA from one bacterium to another, using a virus as a vector.
- Transcription** (*trans*^L = across + *scribere*^L = to write) : Copying of one strand (sense strand) of DNA into a complementary sequence of bases

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- in an mRNA molecule by the enzyme RNA polymerase; in eukaryotes, transcription takes place in the nucleus. Compare *translation*.
- Transfection** : Introduction of a foreign DNA molecule into a eukaryotic cell; usually followed by expression of one or more genes in the newly-introduced DNA.
- Transfer RNA, tRNA** (*trans*^L = across + *ferre*^L = to bear or carry) : A class of small molecules (M.W. 25,000 – 30,000) that float free in the cytoplasm and each of which combines covalently with a specific amino acid and to a codon on messenger RNA and later transfers the amino acid to mRNA in ribosome for assembly into proteins.
- Transferase** : Any enzyme that catalyzes the transfer of a chemical group (such as amino, methyl or alkyl) from one substrate to another substrate.
- Transformation** (*trans*^L = across + *formare*^L = to shape) : (1) The incorporation of a piece of foreign DNA into the genome of a bacterial cell, causing the recipient to acquire a new phenotype. The process is important historically since, following transformation experiments by Frederick Griffith on *Pneumococcus* bacterium, DNA was shown to be the genetic material of cells by Avery, MacLeod and McCarthy. (2) In the case of cultured animal cells, the term usually refers to the acquisition of cancerlike properties following treatment with a virus or a carcinogen.
- Transgenic** : Refers to an organism that has genes from another organism incorporated within its genome as a result of recombinant DNA technology and can pass them on to successive generations.
- Translation** (*trans*^L = across + *latus*^L = that which is carried) : The process by which the sequence of nucleotides in a messenger RNA molecule directs the incorporation of amino acids into protein; occurs on a ribosome. Compare *transcription*.
- Transition state** : Structure that forms transiently in the course of a chemical reaction that has the highest free energy of any reaction intermediate; a rate-limiting step in the reaction.
- 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.
- Translucent** : Permitting the passage of light in such a way that an object cannot be seen clearly through the substance; for example, an oily paper or a frosted glass.
- Transplantation** : The transfer of an organ or tissue from a donor to a recipient in need of a healthy organ or tissue. Kidney, lung, heart and liver transplants are in vogue these days. For successful transplantation to occur, similar tissues types must be involved and genetical similarities is one of the best ways of ensuring this.
- Transporters** : Proteins that span a membrane and transport specific nutrients, metabolites, ions, or proteins across the membrane; sometimes called *permeases*.
- Transposition** : The movement of a gene or set of genes from one site in the genome to another.
- Transposon** : A segment of DNA that can multiply and move spontaneously from one position in the genome to another; also called *transposable element*.
- Traumatic acid** : See **wound hormone**.
- Triacylglycerol** : An ester of glycerol with three molecules of fatty acids which may be saturated (in animal fats) or unsaturated (in vegetable oils); also called *triglyceride* or *neutral fat*.
- Tricarboxylic acid cycle (TCA cycle)** : See **citric acid cycle**.
- Trichromatic theory** : The theory that all colours can be produced by the mixing of blue, green and red.
- Triglyceride** : See **triacylglycerol**
- Trihydroxybenzene** : See **pyrogallol**.
- Triiodothyronine (TIT or T₃)** : A minor hormone of the thyroid gland that has the same function as that of tetraiodothyronine (T₄) but is 5 to 10 times more potent in biologic activity than T₄.
- Triose** : A simple sugar with a backbone containing three carbon atoms.
- Triphosphopyridine nucleotide (TPN)** : See **nicotinamide adenine dinucleotide phosphate (NADP)**.
- Triplet** : Refers to a sequence of three nucleotides that together comprise a codon.
- Trisaccharide** : An oligosaccharide whose molecule has 3 linked monosaccharide moieties.

- Rhamninose, gentianose and raffinose are common examples.
- Triterpene** : A compound that consists of six isoprene units linked together; lanosterol and squalene are common examples of triterpenes.
- Tritium, T** : ${}^3_1\text{H}$. A radioactive isotope of hydrogen with mass number 3 and atomic mass 3.016. The abundance of tritium in natural hydrogen is only one atom in 10^7 , and its half-life is 12.5 years. It can, however, be made artificially in nuclear reactors, and tritiated compounds are used in radioactive tracing.
- Tropic hormone** : A peptide hormone that stimulates a specific target gland to secrete its hormone; for example, thyrotropin produced by the pituitary stimulates secretion of thyroxine by the thyroid gland; also called *tropin*.
- Tropin** : See **tropic hormone**.
- Trypsin** : A proteolytic enzyme produced by the pancreas; in the process of digestion, it breaks up proteins into amino acids; secreted as an inactive precursor trypsinogen, which is converted to trypsin by enterokinase secreted in the small intestine.
- Tuberculosis** (*tuberculum*^L = a small swelling) : A disease caused by *Mycobacterium tuberculosis*.
- Tumour** (Latin, for *swollen*) : A mass of cells, growing in an uncontrolled manner.
- Turgor pressure** : The pressure developed as a result of diffusion of water into a living cell; pressure exerted against the cell wall.
- Turnover number** : The number of times an enzyme molecule transforms a substrate molecule per unit time, under conditions giving maximal activity at substrate concentrations that are saturating. For most enzymes, the turnover number falls between 1 to 10^4 per second. It is equivalent to the catalytic rate constant, k_{cat} .
- Turpentine** : The volatile, combustible component of resin.
- Twist (T)** : With respect to a DNA double helix, the total number of times the 2 strands of the helix cross over each other, excluding writhing. It is a measure of how tightly the helix is wound. See also *writhe*.
- Tyndall effect** (named after *John Tyndall*, LT, 1820–1893) : The scattering of light by particles of matter in the path of the light, thus making a visible ‘beam’, such as is caused by a ray of light illuminating particles of dust floating in the air of a room.
- Tyrosinase** : An oxidizing enzyme of the copper oxidase type, attacking the amino acid tyrosine.
- Tyrosine kinase** : An enzyme that transfers the terminal phosphate of ATP to a specific tyrosine residue on its target protein.
- 2,4,5-trichlorophenoxyacetic acid (2,4,5-T)** : A plant hormone widely used as a herbicide to kill woody species.

U

- Ubiquinol** : The reduced form of ubiquinone; ubiquinol donates electrons to cytochrome b in the electron transport chain.
- Ubiquinone** : A lipid-soluble quinone; ubiquinone accepts electrons from electron donors like NADH and from the oxidation of fatty acids; also called *coenzyme Q*.
- Ubiquitin** : A small, highly conserved protein present in all eukaryotic cells that becomes covalently attached to lysines of other proteins. Attachment of a chain of ubiquitones tags a protein for intracellular proteolytic destruction in a proteasome.
- Ultracentrifuge** : A high-speed centrifuge that is capable of spinning 1,00,000 revolutions per minute (rpm), producing up to 10,00,000 g forces. The high speeds enable the separation of tiny particles, which are identified by the rate at which they move down the centrifuge tube. The units of rate are called Svedberg (S), after the inventor of the centrifuge.
- Ultrafiltration** : The technique of filtering a solution under pressure through a semipermeable membrane, which allows water and small solutes to pass through but retains macromolecules.
- Ultrasound** : A noninvasive procedure that uses sound waves to produce an image of the fetus but that harms neither the mother nor the fetus.
- Ultraviolet (UV) radiations** : Electromagnetic radiation in the region of 200 to 400 nm.
- Umbilical cord** : The cord that joins the embryo of placental mammals to the placenta consisting of blood vessels supported by connective tissue. The cord is usually severed at birth.
- Uncoupling agent** : A substance that uncouples phosphorylation of ADP from electron transfer; for example, 2,4-dinitrophenol (DNP).

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Unicellular : Composed of a single cell.

uniport : A transport system that carries only one solute, as distinct from cotransport.

Universal acceptor : An individual with an AB blood type who may receive any type of blood.

Universal code : The genetic code is exactly the same in all species.

Universal code : The genetic code is exactly the same in all species.

Universal donor : A type O blood donor, whose blood is compatible with any individual's immune system.

Unsaturated fatty acid : A fatty acid containing one or more double bonds; oleic, linoleic, and linolenic are common examples of unsaturated fatty acids, containing one, two and three double bonds in their molecules, respectively.

Uracil : A pyrimidine found in RNA (during transcription) but not in DNA; always base-pairs with a purine base called adenine in DNA (during transcription) or RNA (during translation).

Urea cycle : A metabolic pathway in vertebrates, for the synthesis of urea from amino groups and carbon dioxide; occurs in the liver. The reaction is essentially: $2\text{NH}_3 + \text{CO}_2 \longrightarrow \text{NH}_2\text{CONH}_2 + \text{H}_2\text{O}$; Also called *ornithine cycle*.

Urea, H_2NCONH_2 (*ouron*^G = urine) : An organic molecule formed in the vertebrate liver; the principal form of disposal of nitrogenous wastes by mammals.

Urease : An enzyme which hydrolyzes urea to ammonia and carbon dioxide.

Ureotelic : Excreting excess nitrogen in the form of urea.

Urethra (*ourein*^G = to urinate) : A tube which passes both semen (during ejaculation) and urine (during liquid elimination) in males but only urine in females.

Uric acid, $\text{C}_5\text{H}_4\text{O}_3\text{N}_4$: An organic compound belonging to the purine group; a colourless crystalline solid that is slightly soluble in water; occurs in very small amounts in the urine of some animals (reptiles and aves) as a breakdown product of amino acids and nucleic acids; being quite insoluble in water, it is thus nontoxic when released during embryonic development within the egg; also permits the removal of nitrogen with a minimum of water loss and is eliminated

as a thick paste or even dry pellets; sodium and potassium salts of the acid are deposited in the joints in cases of gout.

Uricotelic : Excreting excess nitrogen in the form of uric acid (urate).

Urine (*ouron*^G = urine) : The liquid waste product of metabolism filtered from the blood by the kidneys. In mammals, elasmobranch fishes, amphibia, tortoises and turtles, nitrogen is excreted in the form of urea which, in humans, forms 2% of the urine on average.

Uterus (Latin, for *womb*) : A mammals, a chamber in which the developing embryo is contained and nurtured during pregnancy.

V

Vaccination : The injection of a harmless microbe into a person or animal to confer resistance to a dangerous microbe.

Vaccine (*vacca*^L = cow) : A suspension of dead or weakened bacteria or other pathogens which may be injected into an organism to immunize against the same species or kind of pathogen or its toxins. Vaccines are, thus, not quick-acting, but rely on the recipient to build up a supply of antibodies gradually. For example, the Salk polio vaccine contains attenuated viruses.

Vacuole (*vacuus*^L = empty) : A cavity or vesicle in the cytoplasm of a cell that is bound by a single membrane called tonoplast and contains a watery solution of pigments and waste products of cell metabolism called *cell sap*; typically found in plant cells.

Vagina (Latin, for *sheath*) : The membranous passage in female animals that leads to the mouth of the uterus; the female copulatory organ into which the penis is introduced during copulation.

van der Waals interactions : The weak bonds formed between electrically-neutral molecules or parts of molecules when they lie close together. Such interactions are common in the secondary and tertiary structure of protein.

Varicosities : Swellings that occur on blood vessels or nerve fibre.

Vascular bundle : In vascular plants, a strand of tissue containing primary xylem and primary phloem (and possibly procambium) that runs up through the roots, into the stems and out into the leaves; often enclosed by a bundle sheath; conducts water with dissolved minerals and

- carbohydrates throughout the plant body.
- Vasoconstriction** : A narrowing of the blood vessels, often in response to cold, which through a contraction of involuntary muscles in the walls of the vessels brought about by a stimulus from the sympathetic nervous system.
- Vasodilation** : The expansion of blood vessels by relaxation of muscles, mainly controlled by the sympathetic nervous system.
- Vasopressin** : A posterior pituitary hormone that regulates the kidney's retention of water; also referred to as *antidiuretic hormone (ADH)*.
- Vector** : (1) In cell biology, an agent (virus or plasmid) that can take up a foreign gene and transmit it into the genome of a target organism. For example, the *Anopheles* mosquito transmits the malarial parasite. (2) In plant reproduction, an animal that carries pollen (a pollinator) from a pollen sac to a stigma or to an ovule.
- Velaman** : Multiple epidermis covering the aerial roots of some orchids and aroids.
- Venereal disease** : Any contagious disease transmitted usually during sexual intercourse, such as gonorrhoea or syphilis.
- Ventral** (*venter*^L = belly) : Situated toward the belly surface of an animal or that side which is normally directed downwards in the usual stance or resting position. In bipedal primates such as humans, the ventral side is the front, but would obviously be the underside if a four-legged gait were assumed; opposite of *dorsal*.
- Vertebrate** : An animal having a backbone made of bony segments called vertebrae, such as fish, amphibia, reptiles, birds and mammals. In addition, they are characterized by having a skull which surrounds a well-developed brain and a bony or cartilaginous skeleton.
- Vertigo** (*vertigo*^L = a whirling, from *vertere* = to turn) : Dizziness.
- Vesicle** (*vesicula*^L = a little bladder) : A small, membrane-bounded spherical organelle in the cytoplasm of a eukaryotic cell; created by weaving sheets of endoplasmic reticulum through the cell's interior.
- Viral vector** : A virus DNA altered so that it can act as a vector for recombinant DNA.
- Virion** : A complete virus particle outside its host cell.
- Viroid** : A plant-infecting viruslike particle with a single circular strand of RNA that is not associated with any protein.
- Virulence** : The collective properties of an organism that render it pathogenic to another one, the host.
- Virus** : An ultramicroscopic pathogenic particle, capable of passing through bacteriological filters; consists of nucleic acid (DNA or RNA) enclosed in a protein coat; capable of replicating within a living host cell only and spreading from cell to cell; infect cells of bacteria, plants and animals, and whilst viruses carry out no metabolism themselves, they are able to control the metabolism of the infected cell.
- Virusoid** : A particle similar to a viroid but located inside the protein coat of a true virus.
- Viscosity** : (1) The property of stickiness by which substances resist change or shape. (2) A measure of the ease with which layers of fluid pass each other.
- Visible light** : The range of colours from violet (380 nm) to red (750 nm) that a human eye can see.
- Vitamin** (*vita*^L = vital for life + *amine* = of chemical origin) : An organic compound required by an organism, which cannot synthesize it in minute quantities for growth and activity; either fat-soluble (vitamins A, D, E and K) or water-soluble (vitamins of the B complex group and vitamin C); vitamins of the B complex group generally function as a component of coenzymes.
- Vitamin A** : *See retinol.*
- Vitamin B complex** : A group of at least 13 vitamins, designated by using Arabic numerals as subscript of B, such as B₁, B₂, B₃ etc; although not related either chemically or physiologically, B complex vitamins have many features in common: (a) all of them, except lipoid acid, are water-soluble, (b) most of them are components of enzymes that play vital roles in metabolism, (c) most of these can be obtained from the same source, *i.e.*, liver and yeast, and (d) most of them can be synthesized by the intestinal bacteria.
- Vitamin B₁** : *See thiamine.*
- Vitamin B₂** : *See riboflavin.*
- Vitamin B₃** : *See pantothenic acid.*
- Vitamin B₅** : *See niacin.*
- Vitamin B₆** : *See pyridoxine.*
- Vitamin B₇** : *See biotin.*

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- Vitamin B₉** : See **folic acid**.
- Vitamin B₁₂** : See **cyanocobalamin**.
- Vitamin C** : See **ascorbic acid**.
- Vitamin D** : See **ergocalciferol and cholecalciferol**.
- Vitamin E** : See **tocopherols**.
- Vitamin F** : See **linoleic acid**.
- Vitamin G** : See **riboflavin**.
- Vitamin H** : See **biotin**.
- Vitamin K** : See **phylloquinone and farnokinone**.
- Vitamin M** : See **folic acid**.
- Vitiligo** (plural of *vitiliginis*^L) : Smooth light-coloured patches of the skin.
- Vmax** : The maximum velocity of an enzymatic reaction when the binding site is saturated with substrate.
- Vomitus** (*vomitus*^L, from *vomere* = to vomit) : Substance vomited.
- Vulgar fraction** : Common fraction. A fraction expressed in terms of a numerator and a denominator, *e.g.*, 3/4.

W

- Warfarin (C₁₉ H₁₆ O₄)** : A colourless crystalline substance, m.p. 161°C; used as a rat poison.
- Warm-blooded animal** : See **homoiotherm**.
- Water (H₂O)** : A colourless, odourless and tasteless liquid which is most abundant of all other substances on earth; mother liquor of all forms of life as there is no life without water; life almost certainly originated in water, provides the medium for biological reactions to take place; accounts for about 70% or more of the weight of most organisms; unlike rest other substances, occurs in 3 states – solid, liquid and gaseous – at the same time; has a melting point 0°C, boiling point 100°C, surface tension 72.8 and dielectric constant 80.
- Water potential** : The potential energy of water to move down its concentration gradient; water potential is expressed in units of pressure instead of units of energy, because pressure is simpler to measure.
- Water-soluble vitamins** : All vitamins soluble in water; perform the same general functions wherever they occur; most of them act as components of coenzymes and as such form vital links in the chains of biochemical reactions characteristic of all living objects; being water-soluble and excretable, required daily in meagre amounts (in milligrams or even less) for the normal growth and good health of individuals; include vitamins of the B complex group (from B₁ through B₁₂), vitamin C, choline, inositol, PABA, bioflavonoids, lipoic acid etc.
- Wavelength** : The distance between two successive points at which the wave has the same phase. For example, visible light has a wavelength from 400 nm (violet) to 750 nm (red).
- Wax** (O.E. *weax*, meaning 'the material of the honey comb', reminding of the beeswax, the honeycomb is made of) : Esters of long-chain saturated and unsaturated fatty acids with long-chain monohydroxy alcohols; far less spread than fats; insoluble in water; usually inert due to their saturated nature of the hydrocarbon chain; acts as major food and storage lipids in marine organisms, such as whale, herring and salmon. The term is often loosely applied to solid, nongreasy, insoluble substances that soften or melt at fairly low temperatures, *e.g.*, paraffin wax.
- Weed** : Any plant growing in cultivated or otherwise utilized ground that competes for resources with a crop or desired vegetation or disfigures the area it grows; an economically, useless, unsightly, or undesired plant, of no particular kind; usually have a high viability and can use up disproportionate amounts of water, sunlight and nutrients.
- Western blotting** : A technique by which proteins are separated and immobilized on a paper sheet and then analyzed, usually by means of a labelled antibody.
- Whey** : The clear liquid portion of milk remaining after the protein curd has been removed.
- White blood corpuscle (WBC)** : See **leucocyte**.
- Wild type** : The normal unmutated form of an organism; the form found in nature (in the wild); wild type alleles are usually given a 'plus' symbol. Thus, the wild type allele of the vestigial wing mutation (vg) in *Drosophila* is vg⁺.
- Wobble hypothesis** : The ability of a base in the third position of an anticodon to hydrogen-bond

to different bases, so as to read more than one codon.

Wood sugar : See *xylose*.

Work : Energy where mechanical effort is involved; measured in joules. A joule is defined, in work terms, as a force of 1 newton moving its point of application through 1 meter.

Wound hormone, COOH – CH = CH – (CH₂)₈ – COOH : An open-chain dicarboxylic acid with a single double bond; a plant hormone that stimulates the development of a protective layer of tissue over a cut or wound, specifically in bean pods; also known as *traumatic acid* or *traumatin*.

Writhe (W) : With respect to a supercoiled DNA helix, the number of times the helix as a whole crosses over itself, *i.e.*, the number of superhelical turns that are present. See also *twist*.

X

Xanthophyll : A yellow carotenoid pigment, present in plant cells and sap.

Xenopus laevis : A species of frog, not a toad; frequently used in studies of early vertebrate development; also used to test for pregnancy in women: injections of urine from a pregnant woman results in egg-laying in the frog.

X-ray crystallography : A technique for determining the three-dimensional arrangement of atoms in a molecule, based on the diffraction pattern of x-rays passing through a crystal of the molecule.

Xylem (*xylon*^G = wood) : In vascular plants, a specialized complex tissue, composed primarily of vessels, tracheids, parenchyma and fibres; the location of xylem is different in roots and stem, and the area of xylem is greatly increased by secondary thickening; transports water and dissolved minerals from the roots upward in the plant.

Xylol, C₆H₄(CH₃)₂ : A liquid resembling toluene that occurs in coal tar; exists in 3 isomeric forms, a mixture of which boils at 137 – 140°C; used in the manufacture of dyes; also called *xylene* or *dimethylbenzene*.

Xylose, C₅H₁₀O₅ : A colourless, crystalline pentose sugar with a m.p. 144°C; present in plant cell walls, especially in xylem; also called *wood sugar*.

Y

Year : A measure of time, commonly understood to be the time taken by the Earth to complete its orbit round the sun. The *civil year* has an average value of 365.2425 mean solar days; three consecutive years consisting of 365 days, the fourth or leap year of 366 days. *Century years do not count as leap years unless divisible by 400*.

Yeast : A common term for many families of unicellular fungi; includes species used for brewing beer and making bread, as well as pathogenic species; contains enzymes to convert grape sugar to wine and other products of fermentation.

Yolk (O.E. *geolu* = yellow) : The stored substance in egg cells, made up mainly of fat and protein granules; provides the embryo's primary food supply.

Z

Zeatin : A natural cytokinin isolated from the endosperm of immature corn (*Zea mays*) grains.

Zeaxanthin : See *zeaxanthol*.

Zeaxanthol : The chief yellow carotenoid pigment of corn; also called *zeaxanthin*.

Zein : A simple protein belonging to the group prolamines; stored in the kernels of corn (*Zea mays*).

Zero : Nought. The starting-point of any scale of measurement.

Zero-order reaction : A chemical reaction in which the rate is independent of the concentration of the reactants.

Zwitterion (German, for '*ions of both kind*') : A dipolar ion, with spatially separated positive and negative charges.

Zygote (*zygotos*^G = paired together) : A diploid (2N) cell that is formed by the fusion of a male and female gamete; a fertilized egg. A zygote may either develop into a diploid individual by mitotic divisions or undergo meiosis to form haploid (N) individuals that divide mitotically to form a population of cells.

Zymase : An enzyme complex present in yeast; acts on sugar with the formation of alcohol and

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carbon dioxide, *i.e.*, brings about alcoholic fermentation of sugar.

Zymogen : An inactive precursor of an enzyme, particularly by those concerned with protein digestion; for example, *pepsinogen*, the precursor of pepsin and *trypsinogen*, the

precursor of trypsin; zymogens require activation energy to become functional; generally, prefix *pro-* or suffix *-ogen* is added to enzyme's name to denote its zymogen, such as prothrombin, proelastase, trypsinogen, fibrinogen etc.