

GLOSSARY OF BIOTECHNOLOGY TERMS

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A

Active immunity — A type of acquired immunity whereby resistance to a disease is built up by either having the disease or receiving a vaccine to it.

Adjuvant — Insoluble material that increases the formation and persistence of antibodies when injected with an antigen.

Agrobacterium tumefaciens — A common soil bacterium used as a vector to create transgenic plants.

Allele — Any of several alternative forms of a gene.

Allogenic — Of the same species, but with a different genotype. Also allogeneic.

Amino acids — Building blocks of proteins. There are 20 common amino acids: alanine, arginine, asparagine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine and valine. Two more amino acids have been discovered in microbes: selenocysteine and pyrrolysine.

Amplification — The process of increasing the number of copies of a particular gene or chromosomal sequence.

Antibiotic — Chemical substance formed as a metabolic byproduct in bacteria or fungi and used to treat bacterial infections. Antibiotics can be produced naturally, using microorganisms, or synthetically.

Antibody — Protein produced by humans and higher animals in response to the presence of a specific antigen.

Antigen — A substance that, when introduced into the body, induces an immune response by a specific antibody. Antigenic determinant.

Antiserum — Blood serum containing specific antibodies against an antigen. Antisera are used to confer passive immunity to many diseases.

Assay — Technique for measuring a biological response.

B

Bacillus subtilis — A bacterium commonly used as a host in recombinant DNA experiments. Important because of its ability to secrete proteins.

Bacillus thuringiensis (Bt) — Naturally occurring soil bacterium that generates a protein toxic to a variety of lepidoptera, such as corn borers, but is harmless to people and animals.

Bacteriophage — Virus that lives in and kills bacteria. Also called phage.

Bacterium — Any of a large group of microscopic organisms with a very simple cell structure. Some manufacture their own food, some live as parasites on other organisms, and some live on decaying matter.

Base — A key component of DNA and RNA molecules. Four different bases are found in DNA: adenine (A), cytosine (C), guanine (G) and thymine (T). In RNA, uracil (U) substitutes for thymine. Also known as nitrogenous bases. A base, a phosphate molecule and a sugar joined together constitute a nucleotide.

Base pair — Two nucleotide bases on different strands of the nucleic acid molecule that bond together. The bases can pair in only one way: adenine with thymine (DNA), or uracil (RNA) and guanine with cytosine.

Bioassay — Determination of the effectiveness of a compound by measuring its effect on animals, tissues or organisms in comparison with a standard preparation.

Bioaugmentation — Increasing the activity of bacteria that break down pollutants by adding more of their kind. A technique used in bioremediation.

Biocatalyst — In bioprocessing, an enzyme that activates or speeds up a biochemical reaction.

Biochemical — The product of a chemical reaction in a living organism.

Biochip — An electronic device that uses organic molecules to form a semiconductor.

Bioconversion — Chemical restructuring of raw materials by using a biocatalyst.

Biodegradable — Capable of being reduced to water and carbon dioxide by the action of microorganisms.

Bioenrichment — A bioremediation strategy that involves adding nutrients or oxygen, thereby bolstering the activity of microbes as they break down pollutants.

Bioinformatics — The science of informatics as applied to biological research. Informatics is the management and analysis of data using advanced computing techniques. Bioinformatics is particularly important as an adjunct to genomics research, because of the large amount of complex data this research generates.

Biostatic device — A device that shoots microscopic DNA-coated particles into target cells.

Biological oxygen demand (BOD) — The amount of oxygen used for growth by organisms in water that contains organic matter.

Biologic — A therapeutic or prophylactic derived from a living source (human, animal or unicellular). Most biologics are complex mixtures that are not easily identified or characterized, and many are manufactured using biotechnology. Biological products often represent the cutting-edge of biomedical research and are sometimes the most effective way to prevent or treat a disease.

Biomass — The totality of biological matter in a given area. As commonly used in biotechnology, refers to the use of cellulose, a renewable resource, for the production of chemicals that can be used to generate energy or as alternative feedstocks for the chemical industry to reduce dependence on nonrenewable fossil fuels.

Biomaterials — Biological molecules, such as proteins and complex sugars, used to make medical devices, including structural elements used in reconstructive surgery.

Bioprocess — A process in which living cells, or components thereof, are used to produce a desired product. Bioreactor vessel used for bioprocessing.

Bioremediation — The use of microorganisms to remedy environmental problems, rendering hazardous wastes nonhazardous.

Biosynthesis — Production of a chemical by a living organism.

Biotechnology — The use of biological processes to solve problems or make useful products.

Biotransformation — The use of enzymes in chemical synthesis to produce chemical compounds of a desired stereochemistry.

Blastocyst (Blastula) — The 4- to 5-day-old ball of undifferentiated cells from which a prospective embryo develops. In mammals it consists of two distinct parts: the inner cell mass and the trophoblast.

B lymphocytes (B-cells) — A class of lymphocytes, released from the bone marrow, that produce antibodies.

Bovine somatotropin (BST) — A hormone secreted by the bovine pituitary gland. It is used to increase milk production by improving the feed efficiency in dairy cattle milk. Also called bovine growth hormone.

BRCA1 and BRCA2 (Breast Cancer genes 1 and 2) — Two genes that normally help to restrain cell growth, but which can contain certain genetic mutations associated with the development of breast and ovarian cancer. Note, however, that inherited BRCA1 and BRCA2 mutations are thought to account for less than 10 percent of all breast and ovarian cancers. Recent evidence suggests that somatic cell genetic mutations (i.e., noninherited genetic mutations) in these two genes may also play a role in the development of cancer.

C

Callus — A cluster of undifferentiated plant cells that can, in some species, be induced to form the whole plant.

Carbohydrate — A type of biological molecule composed of simple sugars such as glucose. Common examples include starch and cellulose.

Carcinogen — Cancer-causing agent.

Catalyst — An agent (such as an enzyme or a metallic complex) that facilitates a reaction but is not itself changed during the reaction.

Cell — The smallest structural unit of a living organism that can grow and reproduce independently.

Cell culture — Growth of cells under laboratory conditions.

Cell differentiation — The process by which descendants of a common parental cell achieve specialized structure and function.

Cell line — Cells that grow and replicate continuously outside the living organism.

Cell-mediated immunity — Acquired immunity in which T lymphocytes play a predominant role. Development of the thymus in early life is critical to the proper development and functioning of cell-mediated immunity.

Chemical genomics — Using structural and functional genomic information about biological molecules, especially proteins, to identify useful small molecules and alter their structure to improve their efficacy.

Chimera — The individual (animal or lower organism) produced by grafting an embryonic part of one individual onto an embryo of either the same or a different species.

Chromosomes — Threadlike components in the cell that contain DNA and proteins. Genes are carried on the chromosomes.

Clinical studies — Human studies that are designed to measure the efficacy of a new drug or biologic. Clinical studies routinely involve the use of a control group of patients that is given an inactive substance (placebo) that looks like the test product.

Clone — A term that is applied to genes, cells or entire organisms that are derived from — and are genetically identical to — a single common ancestor gene, cell or organism, respectively. Cloning of genes and cells to create many copies in the laboratory is a common procedure essential for biomedical research. Note that several processes commonly described as cell “cloning” give rise to cells that are almost but not completely genetically identical to the ancestor cell. Cloning of organisms from embryonic cells occurs naturally in nature (e.g., identical twins). Researchers have achieved laboratory cloning using genetic material from adult animals of several species, including mice, pigs and sheep.

Co-enzyme — An organic compound that is necessary for the functioning of an enzyme. Co-enzymes are smaller than the enzymes themselves and sometimes separable from them.

Combinatorial chemistry — A product discovery technique that uses robotics and parallel synthesis to generate and screen quickly as many as several million molecules with similar structure in order to find chemical molecules with desired properties.

Co-metabolism — A microbe oxidizing not only its main energy source but also another organic compound.

Complementary DNA (cDNA) — DNA synthesized from a messenger RNA rather than from a DNA template. This type of DNA is used for cloning or as a DNA probe for locating specific genes in DNA hybridization studies.

Computational biology — A subdiscipline within bioinformatics concerned with computation-based research devoted to understanding basic biological processes.

Conjugation — Sexual reproduction of bacterial cells in which there is a one-way exchange of genetic material between the cells in contact.

Crossing over — Exchange of genes between two paired chromosomes.

Cross-licensing — Legal, contractual procedure in which two or more firms with competing, similar technologies and possible conflicting patent claims strike a deal to reduce the need for legal actions to clarify who is to profit from applications of the technology.

Culture — As a noun, cultivation of living organisms in prepared medium; as a verb, to grow in prepared medium.

Culture medium — Any nutrient system for the artificial cultivation of bacteria or other cells; usually a complex mixture of organic and inorganic materials.

D

Deoxyribonucleic acid (DNA) — The molecule that carries the genetic information for most living systems. The DNA molecule consists of four bases (adenine, cytosine, guanine and thymine) and a sugar-phosphate backbone, arranged in two connected strands to form a double helix.

DNA chip — A small piece of glass or silicon that has small pieces of DNA arrayed on its surface.

DNA fingerprinting — The use of restriction enzymes to measure the genetic variation of individuals. This technology is often used as a forensic tool to detect differences or similarities in blood and tissue samples at crime scenes.

DNA hybridization — The formation of a double-stranded nucleic acid molecule from two separate strands. The term also applies to a molecular technique that uses one nucleic acid strand to locate another.

DNA library — A collection of cloned DNA fragments that collectively represent the genome of an organism.

DNA polymerase — An enzyme that replicates DNA. DNA polymerase is the basis of PCR, the polymerase chain reaction.

DNA probe — A small piece of nucleic acid that has been labeled with a radioactive isotope, dye or enzyme and is used to locate a particular nucleotide sequence or gene on a DNA molecule.

DNA repair enzymes — Proteins that recognize and repair certain abnormalities in DNA.

DNA sequence — The order of nucleotide bases in the DNA molecule.

DNA vaccines — Pieces of foreign DNA that are injected into an organism to trigger an immune response.

Double helix — A term often used to describe the configuration of the DNA molecule. The helix consists of two spiraling strands of nucleotides (a sugar, phosphate and base) joined crosswise by specific pairing of the bases. See also Deoxyribonucleic acid; Base; Base pair.

Diagnostic — A product used for the diagnosis of disease or medical condition. Both monoclonal antibodies and DNA probes are useful diagnostic products.

Drug delivery — The process by which a formulated drug is administered to the patient. Traditional routes have been oral or intravenous perfusion. New methods deliver through the skin with a transdermal patch or across the nasal membrane with an aerosol spray.

E

Electrophoresis — A technique for separating different types of molecules based on their patterns of movement in an electrical field.

Electroporation — The creation of reversible small holes in a cell wall or membrane through which foreign DNA can pass. This DNA can then integrate into the cell's genome.

Enzyme-linked immunosorbent assay (ELISA) — A technique for detecting specific proteins by using antibodies linked to enzymes.

Embryonic stem cells — Cells that can give rise to any type of differentiated cell. They can be derived from two sources: the inner cell mass from a blastocyst or the primordial germ cells (eggs and sperm) of an older embryo.

Enzyme — A protein catalyst that facilitates specific chemical or metabolic reactions necessary for cell growth and reproduction.

Escherichia coli (E. coli) — A bacterium that inhabits the intestinal tract of most vertebrates. Much of the work using recombinant DNA techniques has been carried out with this organism because it has been genetically well characterized.

Eukaryote — A cell or organism containing a true nucleus, with a well-defined membrane surrounding the nucleus. All organisms except bacteria, viruses and cyanobacteria are eukaryotic. Compare Prokaryote. Exon In eukaryotic cells, that part of the gene that is transcribed into messenger RNA and encodes a protein. See also Intron; Splicing.

Expression — In genetics, manifestation of a characteristic that is specified by a gene. With hereditary disease, for example, a person can carry the gene for the disease but not actually have the disease. In this case, the gene is present but not expressed. In industrial biotechnology, the term is often used to mean the production of a protein by a gene that has been inserted into a new host organism.

F

Fermentation — The process of growing microorganisms for the production of various chemical or pharmaceutical compounds. Microbes are normally incubated under specific conditions in the presence of nutrients in large tanks called fermentors.

Functional foods — Foods containing compounds with beneficial health effects beyond those provided by the basic nutrients, minerals and vitamins. Also called nutraceuticals.

Functional genomics — A field of research that aims to understand what each gene does, how it is regulated and how it interacts with other genes.

Fusion — Joining of the membrane of two cells, thus creating a daughter cell that contains some of the same properties from each parent cells. Used in making hybridomas.

G

Gel electrophoresis — A process for separating molecules by forcing them to migrate through a gel under the influence of an electric field.

Gene — A segment of chromosome. Some genes direct the syntheses of proteins, while others have regulatory functions. See also Operator gene; Structural gene; Suppressor gene.

Gene amplification — The increase, within a cell, of the number of copies of a given gene.

Gene mapping — Determination of the relative locations of genes on a chromosome.

Gene sequencing — Determination of the sequence of nucleotide bases in a strand of DNA. See also Sequencing.

Gene therapy — The replacement of a defective gene in an organism suffering from a genetic disease. Recombinant DNA techniques are used to isolate the functioning gene and insert it into cells. More than 300 single-gene genetic disorders have been identified in humans. A significant percentage of these may be amenable to gene therapy.

Genetic code — The code by which genetic information in DNA is translated into biological function. A set of three nucleotides (codons), the building blocks of DNA, signifies one amino acid, the building blocks of proteins.

Genetic modification — A number of techniques, such as selective breeding, mutagenesis, transposon insertions and recombinant DNA technology, that are used to alter the genetic material of cells in order to make them capable of producing new substances, performing new functions or blocking the production of substances.

Genetic predisposition — Susceptibility to disease that is related to a genetic predisposition mutation, which may or may not result in actual development of the disease.

Genetic screening — The use of a specific biological test to screen for inherited diseases or medical conditions. Testing can be conducted prenatally to check for metabolic defects and congenital disorders in the developing fetus as well as postnatally to screen for carriers of heritable diseases.

Genome — The total hereditary material of a cell, comprising the entire chromosomal set found in each nucleus of a given species.

Genomics — The study of genes and their function. Recent advances in genomics are bringing about a revolution in our understanding of the molecular mechanisms of disease, including the complex interplay of genetic and environmental factors. Genomics is also stimulating the discovery of breakthrough health care products by revealing thousands of new biological targets for the development of drugs and by giving scientists innovative ways to design new drugs, vaccines and DNA diagnostics. Genomic-based therapeutics may include “traditional” small chemical drugs, as well as protein drugs and gene therapy.

Genotype — Genetic makeup of an individual or group. Compare Phenotype.

Germ cell — Reproductive cell (sperm or egg). Also called gamete or sex cell.

Glycoprotein — A protein conjugated with a carbohydrate group.

Growth hormone — A protein produced by the pituitary gland that is involved in cell growth. Human growth hormone is used clinically to treat dwarfism. Various animal growth hormones can be used to improve milk production as well as produce a leaner variety of meat.

H

Haploid — A cell with half the usual number of chromosomes, or only one chromosome set. Sex cells are haploid. Compare Diploid.

Hapten — The portion of an antigen that determines its immunological specificity. When coupled to a large protein, a hapten stimulates the formation of antibodies to the two-molecule complex. Also called antigenic determinant.

Hemagglutination — Clumping (agglutination) of red blood cells.

Homologous — Corresponding or alike in structure, position or origin.

Hormone — A chemical or protein that acts as a messenger or stimulatory signal, relaying instructions to stop or start certain physiological activities. Hormones are synthesized in one type of cell and then released to direct the function of other cell types.

Host — A cell or organism used for growth of a virus, plasmid or other form of foreign DNA, or for the production of cloned substances.

Host-vector system — Combination of DNA-receiving cells (host) and DNA-transporting substance (vector) used for introducing foreign DNA into a cell.

Human Genome Project — An international research effort aimed at discovering the full sequence of bases in the human genome. Led in the United States by the National Institutes of Health and the Department of Energy.

Human immunodeficiency virus (HIV) — The virus that causes acquired immune deficiency syndrome (AIDS).

Hybridization — Production of offspring, or hybrids, from genetically dissimilar parents. The process can be used to produce hybrid plants (by crossbreeding two different varieties) or hybridomas (hybrid cells formed by fusing two unlike cells, used in producing monoclonal antibodies). See DNA hybridization.

Hybridoma — The cell produced by fusing two cells of different origin. In monoclonal antibody technology, hybridomas are formed by fusing an immortal cell (one that divides continuously) and an antibody-producing cell. See also Monoclonal antibody; Myeloma.

Immune response — The response of the immune system to a challenge by a foreign antigen.

Immune serum — Blood serum containing antibodies.

Immune system — The combination of cells, biological substances (such as antibodies) and cellular activities that work together to provide resistance to disease.

Immunity — Nonsusceptibility to a disease or to the toxic effects of antigenic material. See also Active immunity; Cell-mediated immunity; Natural active immunity; Natural passive immunity; Passive immunity.

Immunoassay — Technique for identifying substances based on the use of antibodies.

Immunodiagnostic — The use of specific antibodies to measure a substance. This tool is useful in diagnosing infectious diseases and the presence of foreign substances in a variety of human and animal fluids (blood, urine, etc.). The approach is currently being investigated as a way of locating tumor cells in the body.

Immunofluorescence — Technique for identifying antigenic material that uses an antibody labeled with fluorescent material. Specific binding of the antibody and antigen can be seen under a microscope by applying ultraviolet light rays and noting the visible light that is produced.

Immunogen — Any substance that can elicit an immune response.

Immunoglobulin — General name for proteins that function as antibodies. These proteins differ somewhat in structure and are grouped into five categories on the basis of these differences; immunoglobulin G (IgG), IgM, IgA, IgE and IgD.

Immunology — Study of all phenomena related to the body's response to antigenic challenge (i.e., immunity, sensitivity and allergy).

In situ — In its original or natural place or position.

Interferon — A class of lymphokine proteins important in the immune response. There are three major types of interferon: alpha (leukocyte), beta (fibroblast) and gamma (immune). Interferons inhibit viral infections and may have anticancer properties.

Intron — In eukaryotic cells, a sequence of DNA that is contained in the gene but does not encode for protein. The presence of introns splits the coding region of the gene into segments called exons. See also Splicing.

Investigational New Drug Application (IND) — An application to begin studies of a new drug or biologic on humans. The IND gives the plan for the study and contains formulation, manufacturing and animal test result information.

In vitro — Literally, "in glass." Performed in a test tube or other laboratory apparatus.

In vivo — In a living organism.

Islet cells — Pancreatic cells that are the source of insulin and two other hormones involved in regulating glucose metabolism and absorption.

J-L

Leukocyte — A colorless cell in the blood, lymph and tissues that is an important component of the body's immune system. Also called white blood cell.

Library — A set of cloned DNA fragments that taken collectively contain the entire genome of an organism. Also called a DNA library.

Ligase — An enzyme used to join DNA or RNA segments together.

Linkage — The tendency for certain genes to be inherited together due to their physical proximity on the chromosome.

Linker — A fragment of DNA with a restriction site that can be used to join DNA strands.

Lipoproteins — A class of serum proteins that transport lipids and cholesterol in the bloodstream. Abnormalities in lipoprotein metabolism have been implicated in certain heart diseases.

Lymphocyte — A type of leukocyte found in lymphatic tissue in the blood, lymph nodes and organs. Lymphocytes are continuously made in the bone marrow and mature into antibody-forming cells. See also B lymphocytes; T lymphocytes.

Lymphokine — A class of soluble proteins produced by white blood cells that play a role, as yet not fully understood, in the immune response. See also Interferon; Interleukin.

Lymphoma — Form of cancer that affects the lymph tissue.

M

Macrophage — A type of white blood cell produced in blood vessels and loose connective tissues that can ingest dead tissues and cells and is involved in producing interleukin-1. When exposed to the lymphokine macrophage-activating factor, macrophages also kill tumor cells. See also Phagocyte.

Macrophage colony stimulating factor (M-CSF) — A natural hormone that stimulates the production of white blood cells, particularly monocytes (the precursors of macrophages).

Medium — A substance containing nutrients needed for cell growth.

Meiosis — Process of cell reproduction whereby the daughter cells have half the chromosome number of the parent cells. Sex cells are formed by meiosis. Compare Mitosis.

Messenger RNA (mRNA) — Nucleic acid that carries instructions to a ribosome for the synthesis of a particular protein.

Metabolism — All biochemical activities carried out by an organism to maintain life.

Microbial herbicides and pesticides — Microorganisms that are toxic to specific plants or insects. Because of their narrow host range and limited toxicity, these microorganisms may be preferable to their chemical counterparts for certain pest-control applications.

Microbiology — Study of living organisms that can be seen only under a microscope.

Microorganism — Any organism that can be seen only with the aid of a microscope. Also called microbe.

Mitosis — Process of cell reproduction whereby the daughter cells are identical in chromosome number to the parent cells. Compare Meiosis.

Molecular genetics — Study of how genes function to control cellular activities.

Monoclonal antibody (MAb) — Highly specific, purified antibody that is derived from only one clone of cells and recognizes only one antigen.

Monocytes — One of three types of white blood cells. Monocytes are precursors to macrophages.

Multigenic — Of hereditary characteristics, one that is specified by several genes.

Mutagen — A substance that induces mutations.

Mutant — A cell that manifests new characteristics due to a change in its DNA.

Mutation — A change in the genetic material of a cell.

Myeloma — A type of cancer cell (plasma cell) that is used in monoclonal antibody technology to form hybridomas.

N

Natural active immunity — Immunity that is established after the occurrence of a disease.

Natural passive immunity — Immunity conferred by the mother on the fetus or newborn.

Nuclease — An enzyme that, by cleaving chemical bonds, breaks down nucleic acids into their constituent nucleotides.

Nucleic acids — Large molecules, generally found in the cell's nucleus and/or cytoplasm, that are made up of nucleotides. The two most common nucleic acids are DNA and RNA.

Nucleotides — The building blocks of nucleic acids. Each nucleotide is composed of sugar, phosphate and one of four nitrogen bases. The sugar in DNA is deoxyribose and RNA's sugar is ribose. The sequence of the bases within the nucleic acid determines the sequence of amino acids in a protein. See also Base.

Nucleus — The structure within eukaryotic cells that contains chromosomal DNA.

O

Oligonucleotide — A polymer consisting of a small number (about two to 10) of nucleotides.

Oncogene — Gene thought to be capable of producing cancer.

Oncogenic — Cancer causing.

Oncology — Study of cancer.

Operator gene — A region of the chromosome, adjacent to the operon, where a repressor protein binds to prevent transcription of the operon.

Operon — Sequence of genes responsible for synthesizing the enzymes needed for biosynthesis of a molecule. An operon is controlled by an operator gene and a repressor gene.

Organic compound — A compound containing carbon.

P

Passive immunity — Immunity acquired from receiving preformed antibodies.

Pathogen — Disease-causing organism.

Peptide — Two or more amino acids joined by a linkage called a peptide bond.

Personalized medicine — The use of individual molecular (often genetic) information to prevent disease, choose medicines and make other critical decisions about health.

Phagocyte — A type of white blood cell that can ingest invading microorganisms and other foreign material. See also Macrophage.

Pharmacogenomics — The science that examines the inherited variations in genes that dictate drug response and explores the ways these variations can be used to predict whether a patient will have a good response to a drug, a bad response to a drug, or no response at all. See also Pharmacogenetics.

Pharmacogenetics — The study of inherited differences (variation) in drug metabolism and response. See also Pharmacogenomics.

Phenotype — Observable characteristics resulting from interaction between an organism's genetic makeup and the environment. Compare Genotype.

Phytoremediation — The use of plants to clean up pollution.

Plasma — The fluid (noncellular) fraction of blood.

Plasmapheresis — A technique used to separate useful factors from blood.

Plasmid — A small circular form of DNA that carries certain genes and is capable of replicating independently in a host cell.

Pluripotent cells — Having the capacity to become any kind of cell or tissue in the body. Embryonic stem cells and cells of the inner cell mass are pluripotent. Adult stem cells are multipotent. The mammalian embryo (blastocyst trophoblast plus inner cell mass) is totipotent because it can become an entire organism. Fully differentiated cells from many plants are totipotent.

Polymer — A long molecule of repeated subunits.

Polymerase — General term for enzymes that carry out the synthesis of nucleic acids.

Polymerase chain reaction (PCR) — A technique to amplify a target DNA sequence of nucleotides by several hundred thousandfold.

Polypeptide — Long chain of amino acids joined by peptide bonds.

Preclinical studies — Studies that test a drug on animals and in other nonhuman test systems. Safety information from such studies is used to support an investigational new drug application (IND).

Prokaryote — An organism (e.g., bacterium, virus, cyanobacterium) whose DNA is not enclosed within a nuclear membrane. Compare Eukaryote.

Promoter — A DNA sequence that is located in front of a gene and controls gene expression. Promoters are required for binding of RNA polymerase to initiate transcription.

Prophage — Phage nucleic acid that is incorporated into the host's chromosome but does not cause cell lysis.

Protein — A molecule composed of amino acids. There are many types of proteins, all carrying out different functions essential for cell growth.

Protein — A protein produced by the bacterium *Staphylococcus aureus* that specifically binds antibodies. It is useful in the purification of monoclonal antibodies.

Proteomics — Each cell produces thousands of proteins, each with a specific function. This collection of proteins in a cell is known as the proteome, and, unlike the genome, which is constant irrespective of cell type, the proteome varies from one cell type to the next. The science of proteomics attempts to identify the protein profile of each cell type, assess protein differences between healthy and diseased cells, and uncover not only each protein's specific function but also how it interacts with other proteins.

Protoplast — The cellular material that remains after the cell wall has been removed from plant and fungal cells.

Pure culture — In vitro growth of only one type of microorganism.

Q-R

Rational drug design — Using the known three-dimensional structure of a molecule, usually a protein, to design a drug molecule that will bind to it. Usually viewed as an alternative to drug discovery through screening many molecules for biological activity.

Reagent — Substance used in a chemical reaction.

Recombinant DNA (rDNA) — The DNA formed by combining segments of DNA from two different sources.

Regulatory gene — A gene that acts to control the protein synthesizing activity of other genes.

Replication — Reproduction or duplication, as of an exact copy of a strand of DNA.

Repressor — A protein that binds to an operator adjacent to a structural gene, inhibiting transcription of that gene.

Restriction enzyme — An enzyme that breaks DNA in highly specific locations, creating gaps into which new genes can be inserted.

Restriction fragment length polymorphism (RFLP) — The variation in the length of DNA fragments produced by a restriction endonuclease that cuts at a polymorphic locus. This is a key tool in DNA fingerprinting and is based on the presence of different alleles in an individual. RFLP mapping is also used in plant breeding to see if a key trait such as disease resistance is inherited.

Retrovirus — A virus that contains the enzyme reverse transcriptase. This enzyme converts the viral RNA into DNA, which can combine with the DNA of the host cell and produce more viral particles.

Ribonucleic acid (RNA) — A molecule similar to DNA that delivers DNA's genetic message to the cytoplasm of a cell where proteins are made.

Ribosome — A cellular component, containing protein and RNA, that is involved in protein synthesis.

RNA interference — A natural process used by organisms to block protein production.

S

Scale-up — Transition from small-scale production to production of large industrial quantities.

Selective medium — Nutrient material constituted such that it will support the growth of specific organisms while inhibiting the growth of others.

Sepsis — The presence in the blood or other tissues of pathogenic microorganisms or their toxins; the condition associated with such presence.

Sequencing — Decoding a strand of DNA or gene into the specific order of its nucleotides: adenine, cytosine, guanine and thymine. This analysis can be done manually or with automated equipment. Sequencing a gene requires analyzing an average of 40,000 nucleotides.

Serology — Study of blood serum and reactions between the antibodies and antigens therein.

Single-cell protein — Cells or protein extracts from microorganisms, grown in large quantities for use as protein supplements.

Somatic cells — Cells other than sex or germ cells.

Somatic cell gene therapy — Somatic cell gene therapy involves the insertion of genes into cells for therapeutic purposes; for example, to induce the treated cells to produce a protein that the body is missing. It does not affect genetic makeup of a patient's offspring and generally does not change all, or even most, cells in the recipient. Somatic cell gene therapy is only one way of applying the science of genomics to improve health care.

Somatic cell nuclear transfer — The transfer of a nucleus from a fully differentiated cell into an egg that has had its nucleus removed.

Splicing — The removal of introns and joining of exons to form a continuous coding sequence in RNA.

Stop codon — One of three codons in messenger RNA that signal the end of the amino acid chain in protein synthesis.

Structural gene — A gene that codes for a protein, such as an enzyme.

Substrate — Material acted on by an enzyme.

Suppressor gene — A gene that can reverse the effect of a mutation in other genes.

T

Technology transfer — The process of transferring discoveries made by basic research institutions, such as universities and government laboratories, to the commercial sector for development into useful products and services.

Template — A molecule that serves as the pattern for synthesizing another molecule.

Terminator — Sequence of DNA bases that tells the RNA polymerase to stop synthesizing RNA.

Tertiary structure — The total three-dimensional shape of a protein that is essential to protein function.

Therapeutics — Compounds that are used to treat specific diseases or medical conditions.

Thymus — A lymphoid organ in the lower neck, the proper functioning of which in early life is necessary for development of the immune system.

Tissue culture — In vitro growth in nutrient medium of cells isolated from tissue.

Tissue plasminogen activator (tPA) — A protein produced in small amounts in the body that aids in dissolving blood clots.

T lymphocytes (T-cells) — White blood cells that are produced in the bone marrow but mature in the thymus. They are important in the body's defense against certain bacteria and fungi, help B lymphocytes make antibodies and help in the recognition and rejection of foreign tissues. T lymphocytes may also be important in the body's defense against cancers.

Toxin — A poisonous substance produced by certain microorganisms or plants.

Transcription — Synthesis of messenger (or any other) RNA on a DNA template.

Transdifferentiation — The process whereby a specialized cell de-differentiates and re-differentiates into a different cell type; or the process whereby an adult stem cell from a specific tissue type becomes a cell type from a very different tissue (for example a nerve stem cell differentiates into a kidney cell).

Transduction — Transfer of genetic material from one cell to another by means of a virus or phage vector.

Transfection — Infection of a cell with nucleic acid from a virus, resulting in replication of the complete virus.

Transfer RNA (tRNA) — RNA molecules that carry amino acids to sites on ribosomes where proteins are synthesized.

Transformation — Change in the genetic structure of an organism by the incorporation of foreign DNA.

Transgenic organism — An organism formed by the insertion of foreign genetic material into the germ line cells of organisms. Recombinant DNA techniques are commonly used to produce transgenic organisms.

Translation — Process by which the information on a messenger RNA molecule is used to direct the synthesis of a protein.

Transposon — A segment of DNA that can move around and be inserted at several sites in bacterial DNA or in a phage, thus alerting the host's DNA.

Tumor necrosis factors (TNFs) — Rare proteins of the immune system that appear to destroy some types of tumor cells without affecting healthy cells.

U-V

Vaccine — A preparation that contains an antigen, consisting of whole disease-causing organisms (killed or weakened) or parts of such organisms, that is used to confer immunity against the disease that the organisms cause. Vaccine preparations can be natural, synthetic or derived by recombinant DNA technology.

Vector — The agent (e.g., plasmid or virus) used to carry new DNA into a cell.

Virion — An elementary viral particle consisting of genetic material and a protein covering.

Virology — Study of viruses.

Virulence — Ability to infect or cause disease.

Virus — A submicroscopic organism that contains genetic information but cannot reproduce itself. To replicate, it must invade another cell and use parts of that cell's reproductive machinery.

W-Z

White blood cells — Leukocytes.

Yeast — A general term for single-celled fungi that reproduce by budding. Some yeasts can ferment carbohydrates (starches and sugars) and thus are important in brewing and baking.

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