Glossary

**acetyl** Chemical group derived from acetic acid. Acetyl groups are important in metabolism and are added covalently to some proteins as a posttranslational modification.

**actin** Abundant protein that forms actin filaments in all eucaryotic cells. The monomeric form is sometimes called globular or G-actin; the polymeric form is filamentous or F-actin.

**actin-binding protein** Protein that associates with either actin monomers or actin filaments in cells and modifies their properties. Examples include myosin, α-actinin, and profilin.

**actin filament (microfilament)** Helical protein filament formed by the polymerization of globular actin molecules. A major constituent of the cytoskeleton of all eucaryotic cells and part of the contractile apparatus of skeletal muscle.

**active site** Region of an enzyme surface to which a substrate molecule binds in order to undergo a catalyzed reaction.

**active transport** Movement of a molecule across a membrane or other barrier driven by energy other than that stored in the electrochemical gradient of the transported molecule.

**adaptation** Adjustment of sensitivity following repeated stimulation. This is the mechanism that allows a neuron, a photodetector, or a bacterium to react to small changes in stimuli even against a high background level of stimulation.

**adaptor protein** General term for proteins in intracellular signaling pathways that link different proteins in the pathway directly together.

**ADP (adenosine 5′-diphosphate)** Nucleotide that is produced by hydrolysis of the terminal phosphate of ATP. It regenerates ATP when phosphorylated by an energy-generating process such as oxidative phosphorylation.

**allosteric protein** Protein that changes from one conformation to another when it binds another molecule or when it is covalently modified. The change in conformation alters the activity of the protein and can form the basis of directed movement.

**amino acid** Organic molecule containing both an amino group and a carboxyl group. Those that serve as the building blocks of proteins are alpha amino acids, having both the amino and carboxyl groups linked to the same carbon atom.

**AMP (adenosine 5′-monophosphate)** One of the four nucleotides in an RNA molecule. Two phosphates are added to AMP to form ATP.

**antisense RNA** RNA complementary to a specific RNA transcript of a gene that can hybridize to the specific RNA and block its function.

**ARP complex (ARP2/3 complex)** Complex of proteins that nucleates actin filament growth from the minus end.
ATP (adenosine 5′-triphosphate) Nucleoside triphosphate composed of adenine, ribose, and three phosphate groups that is the principal carrier of chemical energy in cells. The terminal phosphate groups are highly reactive in the sense that their hydrolysis, or transfer to another molecule, takes place with release of a large amount of free energy.

bacteriophage (phage) Any virus that infects bacteria. Bacteriophages were the first entities used for the study of molecular genetics and are now widely used as cloning vectors.

binding site A region on the surface of one molecule (usually a protein or nucleic acid) that can interact with another molecule through noncovalent bonding.

budding yeast Common name often given to the baker's yeast Saccharomyces cerevisiae, a common experimental organism, which divides by budding off a smaller cell.

cell-cycle control system Network of regulatory proteins that governs progression of a eucaryotic cell through the cell cycle.

checkpoint Point in the eucaryotic cell-division cycle where progress through the cycle can be halted until conditions are suitable for the cell to proceed to the next stage.

chemotaxis Directed movement of a cell or organism towards or away from a diffusible chemical.

chromatin Complex of DNA, histones, and nonhistone proteins found in the nucleus of a eucaryotic cell. The material of which chromosomes are made.

chromosome Structure composed of a very long DNA molecule and associated proteins that carries part (or all) of the hereditary information of an organism. Especially evident in plant and animal cells undergoing mitosis or meiosis, where each chromosome becomes condensed into a compact rodlike structure visible under the light microscope.

circadian clock Internal cyclical process that produces a particular change in a cell or organism with a period of around 24 hours, for example the sleep-wakefulness cycle in humans.

clone 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.

critical concentration Concentration of a protein monomer, such as actin or tubulin, that is in equilibrium with the assembled form of the protein (i.e. assembled into actin filaments or microtubules respectively).

cyclic AMP (cAMP) Nucleotide that is generated from ATP by adenylyl cyclase in response to stimulation of many types of cell-surface receptors. cAMP acts as an intracellular signaling molecule by activating cyclic-AMP-dependent kinase (protein kinase A, PKA). It is hydrolyzed to AMP by a phosphodiesterase.

cytoplasm Contents of a cell that are contained within its plasma membrane but, in the case of eucaryotic cells, outside the nucleus.
cytoskeleton System of protein filaments in the cytoplasm of a eucaryotic cell that gives the cell shape and the capacity for directed movement. Its most abundant components are actin filaments, microtubules, and intermediate filaments.

diploid Containing two sets of homologous chromosomes and hence two copies of each gene or genetic locus.

DNA polymerase Enzyme that synthesizes DNA by joining nucleotides together using a DNA template as a guide.

Drosophila melanogaster Species of small fly, commonly called a fruit fly, much used in genetic studies of development.

enzyme Protein that catalyzes a specific chemical reaction.

Escherichia coli (E. coli) Rodlike bacterium normally found in the colon of humans and other mammals and widely used in biomedical research.

eucaryote (eukaryote) Organism composed of one or more cells with a distinct nucleus and cytoplasm. Includes all forms of life except viruses and procaryotes (bacteria and archa).

exon Segment of a eucaryotic gene that consists of a sequence of nucleotides that will be represented in messenger RNA or the final transfer RNA or ribosomal RNA. In protein-coding genes, exons encode amino acids in the protein. An exon is usually adjacent to a noncoding DNA segment called an intron.

fission yeast Common name often given to the yeast Schizosaccharomyces pombe, a common experimental organism. It divides to give two equal-sized cells.

flagellum (flagella) Long, whiplike protrusion whose undulations drive a cell through a fluid medium. Eucaryotic flagella are longer versions of cilia. Bacterial flagella are smaller and completely different in construction and mechanism of action.

gene activator protein A gene regulatory protein that when bound to its regulatory sequence in DNA activates transcription.

gene regulatory protein General name for any protein that binds to a specific DNA sequence to alter the expression of a gene.

gene repressor protein A gene regulatory protein that prevents the initiation of transcription.

gene Region of DNA that controls a discrete hereditary characteristic, usually corresponding to a single protein or RNA. This definition includes the entire functional unit, encompassing coding DNA sequences, noncoding regulatory DNA sequences, and introns.

G-protein-linked receptor Cell-surface receptor that associates with an intracellular trimeric GTP-binding protein (G protein) after receptor activation by an extracellular ligand. These receptors are seven-pass transmembrane proteins.

green fluorescent protein (GFP) Fluorescent protein isolated from a jellyfish. Widely used as a marker in cell biology.
GTP (guanosine 5′-triphosphate) Nucleoside triphosphate produced by phosphorylating GDP (guanosine diphosphate). Like ATP it releases a large amount of free energy on hydrolysis of its terminal phosphate group. It has a special role in microtubule assembly, protein synthesis, and cell signaling.

haploid Having only one set of chromosomes, as in a sperm cell or a bacterium, as distinct from diploid (having two sets of chromosomes).

heat shock protein (stress-response protein) Protein synthesized in increased amounts in response to an elevated temperature or other stressful treatment, and which usually helps the cell to survive the stress.

housekeeping gene Gene serving a function required in all the cell types of an organism, regardless of their specialized role.

in vitro Term used by biochemists to describe a process taking place in an isolated cell-free extract. Also used by cell biologists to refer to cells growing in culture (in vitro), as opposed to in an organism (in vivo). (Latin for “in glass.”)

in vivo In an intact cell or organism. (Latin for “in life.”)

intron Noncoding region of a eucaryotic gene that is transcribed into an RNA molecule but is then excised by RNA splicing during production of the messenger RNA or other functional structural RNA.

ion channel Transmembrane protein complex that forms a water-filled channel across the lipid bilayer through which specific inorganic ions can diffuse down their electrochemical gradients.

lamellipodium (lamellipodia) Flattened, sheetlike protrusion supported by a meshwork of actin filaments, which is extended at the leading edge of a crawling animal cell.

ligand Any molecule that binds to a specific site on a protein or other molecule. (From Latin ligare, to bind.)

lipid bilayer Thin bimolecular sheet of mainly phospholipid molecules that forms the core structure of all cell membranes. The two layers of lipid molecules are packed with their hydrophobic tails pointing inward and their hydrophilic heads outward, exposed to water.

lysis Rupture of a cell's plasma membrane, leading to the release of cytoplasm and the death of the cell.

lysogeny 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.

meiosis Special type of cell division by which eggs and sperm cells are produced. It comprises two successive nuclear divisions with only one round of DNA replication, which produces four haploid daughter cells from an initial diploid cell.

membrane channel Transmembrane protein complex that allows inorganic ions or other small molecules to diffuse passively across the lipid bilayer.
membrane potential Voltage difference across a membrane due to a slight excess of positive ions on one side and of negative ions on the other. A typical membrane potential for an animal cell plasma membrane is –60 mV (inside negative relative to the surrounding fluid).

messenger RNA (mRNA) RNA molecule that specifies the amino acid sequence of a protein. Produced by RNA splicing (in eucaryotes) from a larger RNA molecule made by RNA polymerase as a complementary copy of DNA. It is translated into protein in a process catalyzed by ribosomes.

microtubule Long hollow cylindrical structure composed of the protein tubulin. It is one of the three major classes of filaments of the cytoskeleton. (See Panel 16–1, p. 909.)

mitosis Division of the nucleus of a eucaryotic cell, involving condensation of the DNA into visible chromosomes, and separation of the duplicated chromosomes to form two identical sets.

monomer Small molecular building block that can serve as a subunit, being linked to others of the same type to form a larger molecule (a polymer).

motor protein Protein that uses energy derived from nucleoside triphosphate hydrolysis to propel itself along a protein filament or another polymeric molecule.

nucleotide Nucleoside with one or more phosphate groups joined in ester linkages to the sugar moiety. DNA and RNA are polymers of nucleotides.

operator Short region of DNA in a bacterial chromosome that controls the transcription of an adjacent gene.

operon In a bacterial chromosome, a group of contiguous genes that are transcribed into a single mRNA molecule.

phenotype The observable character of a cell or an organism.

phosphorylation Reaction in which a phosphate group becomes covalently coupled to another molecule.

plasmid Small circular DNA molecule that replicates independently of the genome. Modified plasmids are used extensively as plasmid vectors for DNA cloning.

point mutation Change of a single nucleotide in DNA, especially in a region of DNA coding for protein.

polymer Large molecule made by covalently linking multiple identical or similar units (monomers) together.

procaryote (prokaryote) Single-celled microorganism whose cells lack a well-defined, membrane-enclosed nucleus. The procaryotes comprise two of the major domains of living organisms—the Bacteria and the Archaea.

promoter Nucleotide sequence in DNA to which RNA polymerase binds to begin transcription.

protease (proteinase, proteolytic enzyme) Enzyme such as trypsin that degrades proteins by hydrolyzing some of their peptide bonds.
protein kinase Enzyme that transfers the terminal phosphate group of ATP to a specific amino acid of a target protein.

reading frame The phase in which nucleotides are read in sets of three to encode a protein. A messenger RNA molecule can be read in any one of three reading frames, only one of which will give the required protein. (See Figure 6–51.)

receptor Protein that binds a specific extracellular signal molecule (ligand) and initiates a response in the cell. Cell-surface receptors, such as the acetylcholine receptor and the insulin receptor, are located in the plasma membrane, with their ligand-binding site exposed to the external medium. Intracellular receptors, such as steroid hormone receptors, bind ligands that diffuse into the cell across the plasma membrane.

regulatory sequence DNA sequence to which a gene regulatory protein binds to control the rate of assembly of the transcriptional complex at the promoter.

repressor Protein that binds to a specific region of DNA to prevent transcription of an adjacent gene.

ribosome Particle composed of ribosomal RNAs and ribosomal proteins that associates with messenger RNA and catalyzes the synthesis of protein.

RNA polymerase Enzyme that catalyzes the synthesis of an RNA molecule on a DNA template from nucleoside triphosphate precursors. (See Figure 6–8.)

scaffold protein Protein that organizes groups of interacting intracellular signaling proteins into signaling complexes.

signal molecule Extracellular or intracellular molecule that cues the response of a cell to the behavior of other cells or objects in the environment.

signal transduction Relaying of a signal by conversion from one physical or chemical form to another. In cell biology, the process by which a cell converts an extracellular signal into a response.

terminator Signal in bacterial DNA that halts transcription.

transcription (DNA transcription) Copying of one strand of DNA into a complementary RNA sequence by the enzyme RNA polymerase.

virus Particle consisting of nucleic acid (RNA or DNA) enclosed in a protein coat and capable of replicating within a host cell and spreading from cell to cell.

wild-type Normal, nonmutant form of an organism; the form found in nature (in the wild).