**BIOLOGY GLOSSARY**

**A**

**abdomen** a posterior segment of an animal that usually houses the organs of digestion and excretion

**abiotic factor** any nonliving component of an ecosystem

**abscisic acid** a hormone in plants that helps regulate the growth of buds and the germination of seeds

**abscission zone** the area at the base of a leaf petiole where the leaf breaks off from the stem

**absorption** in digestion, the movement of nutrients to the circulatory system

**acclimation** the process of an organism’s adjustment to an abiotic factor

**acid** any substance that increases the concentration of hydrogen (H+) ions when added to a water solution

**acoelomate** an animal with no coelom, or body cavity

**acquired immune deficiency syndrome (AIDS)** a group of diseases resulting from a viral disruption of the immune system

**actin** one of the two protein filaments in a muscle cell that function in contraction

**activation energy** amount of energy required for a chemical reaction to start and to continue on its own (36)

**active transpor**t the movement of a substance across a cell membrane against a concentration gradient; requires the cell to expend energy (101)

**adapt** in populations, to change genetically over generations to become more suited to the environment (288)

**adaptation** an inherited trait that increases an organism’s chance of survival in a particular environment (288)

**adaptive radiation** an evolutionary pattern in which many species evolve from a single ancestral species (292)

**adductor muscle** the muscle with which a bivalve closes its shell (728)

**adenine** a nitrogen-containing base that is a component of a nucleotide (185)

**adenosine diphosphate (ADP)** a substance involved in energy metabolism formed by the breakdown of adenosine triphosphate (116)

**adenosine triphosphate (ATP)** a molecule present in all living cells and acting as an energy source for metabolic processes (54)

**adhesion** the attractive force between unlike substances (51)

**adrenal gland** an endocrine gland located on the top of a kidney (1034)

**adrenaline** epinephrine; a hormone secreted by the adrenal medulla that raises the level of glucose in the blood, increases the heartbeat, and raises blood pressure (1034)

**aerobic respiration** the process in which cells make ATP by breaking down

organic compounds, with oxygen as the final electron acceptor (133)

**afferent neuron** a neuron that conducts impulses toward the central nervous system (1008)

**aflatoxin** a toxic fungal poison that causes liver cancer; found as contaminants in peanuts and corn; produced by species of *Aspergillus* (551)

**afterbirth** the remains of the placenta and the amnion, expelled from the mother’s body following birth (1058)

**agar** a gel-like base for culturing microbes; extracted from the cell walls of red algae (531)

**age structure** the distribution of individuals among different ages in a population (382)

**alcoholic fermentation** the process by which pyruvic acid is converted to ethyl alcohol; the anaerobic action of yeast on sugars (129)

**alcoholism** the disease of addiction to ethanol (1072)

**aldosterone** a hormone that helps maintain water and salt balance (1035)

**algae** autotrophic protists (5)

**allantois** in amniotic eggs, the membranous sac that contains many blood vessels; in humans, a membrane surrounding the embryo that becomes the umbilical cord (842)

**allele** an alternative form of a gene (169)

**allele frequency** the percentage of an allele in a gene pool (300)

**allergen** a usually harmless antigen in the environment that is capable of inducing an allergic reaction (964)

**allergy** immune reaction to an allergen (964)

**alternation of generations** a sexual life cycle in plants and algae involving two or more phases (581)

**altricial** referring to birds that, at hatching, are immature and in need of parental care (870)

**altruistic behavior** sacrifice by one individual that results in a benefit for another individual (774)

**alveolus** one of the tiny air sacs found in the lungs (945)

**amebic dysentery** a sometimes fatal disease caused by an amoeba that enters the body in contaminated food or water (513)

**amebocyte** in sponges, an amoebalike cell that moves through the body cells, supplying nutrients, removing wastes, and transporting sperm during sexual reproduction

**amino acid** a carboxylic acid with an amino group; one of 20 monomers that form proteins (56)

**amino acid–based hormones** a group of hormones that includes proteins, peptides, amino acids, and other forms derived from amino acids (1029)

**ammonification** in the nitrogen cycle, the formation of ammonia compounds (423)

**amniocentesis** a procedure used in fetal diagnosis in which fetal cells are removed from the amniotic fluid (232)

**amnion** one of four membranes of an amniotic egg; surrounds and protects the embryo (842)

**amniotic egg** the four-membrane egg of a terrestrial vertebrate (842)

**ampulla** a bulblike sac at the base of the tube foot of an echinoderm that functions in movement (786)

**anal pore** in protozoa, an opening from which wastes are eliminated (514)

**analogous structure** in evolution, structures in more than one organism that have similar appearance and function, but different embryological origin (290)

**anaphase** a phase of mitosis and meiosis in which the chromosomes separate (150)

**androgen** a hormone secreted by the testes that controls secondary sex characteristics (1035)

**angiosperm** a flowering plant (581)

**annelid** a bilaterally symmetrical, segmented worm, such as an earthworm or a leech (733)

**annual ring** a yearly growth ring in a woody plant (611)

**antenna** a sensory appendage on the head of an arthropod (748)

**anterior** the front end of a bilaterally symmetrical organism (670)

**anther** the microsporangium of an angiosperm in which pollen grains are produced (166)

**antheridium** in plants, algae, and fungi a reproductive structure that produces gametes by mitosis (625)

**anthropoid primate** one of a subgroup of primates that includes monkeys and apes (320)

**antibiotic** a chemical that can inhibit the growth of some bacteria (472)

**antibody** a protein produced by B cells that binds to antigens (940)

**anticodon** a region of tRNA consisting of three bases complementary to the codon of mRNA (195)

**antidiuretic hormone** a hormone that helps regulate solute concentration in the blood (1033)

**antigen** a substance that stimulates an immune response (960)

**anus** the posterior opening of the digestive tract (809)

**aorta** the largest artery in the human body; carries blood from the left ventricle to systemic circulation (932)

**aortic valve** the semilunar valve on the left side of the heart (932)

**aphotic zone** the ocean layer that receives no light (431)

**apical dominance** a plant growth pattern in which branches near the shoot tip are shorter than branches farther from the shoot tip (649)

**apical meristem** the growing region at the tips of stems and roots in plants (602)

**appendage** any complex part or organ extending from the body (743)

**appendicular skeleton** in vertebrates, the bones that form the limbs (909)

**aqueous solution** a solution in which water is the solvent (40)

**arachnid** an arthropod with four pairs of walking legs; a spider, scorpion, mite, or tick (751)

**arachnoid membrane** the middle layer of the three sacs that surround the brain and spinal cord (1007)

**archaebacterium** a prokaryotic organism distinguished from other prokaryotes by the composition of the cell membranes and walls (467)

**archegonium** in seedless plants, a reproductive structure that produces a single egg by mitosis (625)

**arteriole** a branch of an artery that gives rise to capillaries (934)

**artery** a vessel that carries blood away from the heart to the body’s organs (934)

**arthropod** segmented animal with jointed appendages and an exoskeleton (742)

**artificial selection** breeding of organisms by humans for specific phenotypic characteristics (292)

**ascocarp** the fruiting body of an ascomycete (548)

**ascogonium** a gamete-producing structure in ascomycetes (548)

**ascospore** one of eight haploid cells in an ascus (548)

**ascus** a spore sac that forms on the surface of an ascocarp (548)

**asexual reproduction** the production of offspring that does not involve the union of gametes (156)

**asteroid-impact hypothesis** the hypothesis that the extinction of the dinosaurs was caused by the impact of a huge asteroid (840)

**asthma** a chronic respiratory condition characterized by recurring attacks of wheezing, coughing, and labored breathing (1066)

**atherosclerosis** a disease characterized by the buildup of fatty materials on the interior walls of the arteries (936)

**atom** the simplest particle of an element that retains all the properties of that element (32)

**atomic number** the number of protons in an atom (32)

**ATP synthase** an enzyme that catalyzes the synthesis of ATP from ADP and phosphate (116)

**atrioventricular node** a group of nerves in the heart that functions in the heartbeat (933)

**atrioventricular valve** a one-way valve separating each atrium from the ventricle beneath it (931)

**atrium** an anterior chamber of the heart (931)

**attenuated strain** refers to a preparation of a virus for a vaccine in which the virus is incapable of causing disease under normal circumstances (497)

**auditory canal** the tube through which air enters the ear (1018)

**australopithecine** early hominid from the genus *Australopithecus* (325)

**autoimmune disease** a disorder in which the immune system attacks the organism’s own cells (965)

**autonomic nervous system** a division of the peripheral nervous system that controls the involuntary actions that regulate the body’s internal environment (1010)

**autosome** a chromosome that is not a sex chromosome (146)

**autotomy** the ability of an organism to deliberately drop a body part, most often to escape a predator (852)

**autotroph** an organism that uses energy to synthesize organic molecules from inorganic substances (10)

**auxin** a plant hormone that regulates cell elongation (647)

**axial skeleton** the backbone, skull, and associated bones of vertebrates (909)

**axon** in a neuron, an elongated extension that carries impulses away from the cell body (1003)

**azidothymidine (AZT)** an antiviral drug that inhibits the reverse transcriptase of retroviruses, such as HIV (498)

**B**

**B cell** a lymphocyte that produces antibodies in response to antigens (959)

**bacillus** a rod-shaped bacterium (470)

**bacteriophage** a virus that infects bacteria (491)

**baleen** one of the keratinous plates that function to filter food from water in some whales (886)

**ball-and-socket joint** allows movement in all directions, as in the shoulder (913)

**barb** a branch of a vane in the feather of a bird (864)

**barbule** a branch of a barb in the feather of a bird (864)

**base** any substance that increases the concentration of hydroxide (OH – ) ions when added to a water solution (42)

**base unit** one of seven fundamental units of SI measurement that describe length, mass, time, and other quantities (23)

**base-pairing rule** the rule stating that in DNA, cytosine pairs with guanine and adenine pairs with thymine and in RNA, adenine pairs with uracil (187)

**basidiocarp** the fruiting body of a basidiomycete (547)

**basidium** a specialized club-shaped reproductive structure that forms on the gills of mushrooms (547)

**benign tumor** an abnormal but nonthreatening cell mass (211)

**benthic zone** the ocean bottom (431)

**biennial** a plant having a two-year life cycle (658)

**bilateral symmetry** in animals, a body plan in which the left and right sides mirror each other (670)

**bile** a yellowish fluid secreted by the liver that functions as a fat emulsifier in digestion (809)

**binary fission** an asexual cell division of prokaryotes that produces identical offspring (148)

**binomial nomenclature** a system of naming organisms that uses the genus name and a species identifier (339)

**biochemical pathway** a series of chemical reactions in which the product of one reaction is consumed in the next reaction (111)

**biodiversity** the number and variety of organisms in a given area during a specific period of time (448)

**biogenesis** the theory that living organisms come only from other living organisms (261)

**biogeochemical cycle** the process by which materials necessary for organisms are circulated through the environment (420)

**biogeography** study of the geographical distribution of fossils and living organisms (281)

**biological species concept** the principle that defines a species as those organisms that can produce offspring together (310)

**bioluminescence** the production of light by means of a chemical reaction in an organism (702)

**biomass** the dry weight of organic material in an ecosystem (415)

**biome** a geographic area characterized by specific kinds of plants and animals (424)

**biosphere** the area on and around Earth where life exists (363)

**biotic factor** a living component of an ecosystem (368)

**bipedalism** the ability to walk upright on two legs (319)

**bipinnaria** the larva of echinoderms (787)

**birth rate** the number of births occurring in a period of time (381)

**bivalve** an aquatic mollusk with a shell divided into two halves connected by a hinge, such as a clam, oyster, or scallop (728)

**blade** the broad, flat portion of a typical leaf (616)

**blastocoel** the central cavity of a blastula (683)

**blastopore** a depression formed when cells of the blastula move inward

**blastula** a hollow ball of cells formed when a zygote undergoes repeated cycles of cell division

**blight** a disease of plants characterized by quickly developing decay and discoloring of leaves, stems, and flowers

**blood alcohol concentration (BAC)** a measurement of the amount of alcohol in a person’s blood (1071)

**blood pressure** the force that blood exerts against the walls of a blood vessel

**blood type** a specific characteristic of the blood of an individual; A, B, AB, or O, depending on the type of antigen present on the surface of the red blood cell (941)

**bolting** the rapid lengthening of internodes caused by gibberellic acid (658)

**bone marrow** the soft tissue in the center and ends of long bones where blood cells are produced (911)

**book lung** in the abdomen of an arachnid, an organ for gas exchange with parallel folds that resembles the pages of a book (752)

**botany** the scientific study of plants (561)

**Bowman’s capsule** cup-shaped structure of the nephron of a kidney which encloses the glomerulus and in which filtration takes place **brain stem** the region of the brain that lies posterior to the cerebrum and that connects the cerebrum to the spinal cord (1007)

**broad-spectrum antibiotic** an antibiotic that is able to affect a wide variety of organisms (479)

**bronchiole** a small tube that branches from the bronchi within the lungs (945)

**bronchus** one of the two branches of the trachea that enter the lungs (945)

**bryophyte** a plant that has no vascular tissue and does not form true roots, stems, and leaves (583)

**bud** a structure that develops on the stem at the point of attachment of each leaf (609)

**bud scale** a modified leaf that forms a protective covering for a bud until it opens (609)

**budding** in fungi, a form of asexual reproduction in which a part of a cell pinches off to produce an offspring cell (544)

**buffer** chemical that neutralizes small amounts of acids or bases added to a solution (42)

**C**

**calcitonin** a hormone that stimulates removal of calcium from the blood (1036)

**Calvin cycle** a biochemical pathway of photosynthesis in which CO2 is converted into carbohydrate (117)

**CAM** crassulacean acid metabolism; a biochemical pathway in certain plants in which CO2 is incorporated into organic acids at night and released for fixation in the Calvin cycle during the day (119)

**cancer** the uncontrolled growth of cells (211)

**canopy** layers of treetops that shade the forest floor (429)

**capillarity** the reaction of a liquid surface with a solid; capillarity allows water

to creep up the interior of a narrow vessel (51)

**capillary** the smallest vessel in the blood vessel network (810)

**capsid** the protein covering a virus (488)

**capsule** in mosses, a sporangium that produces spores; in bacteria, a protective layer of polysaccharides around the cell wall (475)

**carageenan** a substance found in the cell walls of red algae that is used commercially as a smoothing agent (531)

**carapace** a tough covering over the cephalothorax of some crustaceans; the dorsal part of a turtle’s shell (748, 850)

**carbohydrate** an organic compound present in the cells of all living things containing carbon, hydrogen, and oxygen and a major organic nutrient that contains sugars and starches

**carbon cycle** process in which carbon is cycled through the biosphere (421)

**carbon fixation** the incorporation of carbon dioxide into organic compounds (117)

**carcinogen** a cancer-causing substance (212)

**carcinoma** a malignant tumor that grows in body tissues (211)

**cardiac muscle** the involuntary muscle of the heart (905)

**cardiac sphincter** a circular muscle located between the esophagus and the stomach (986)

**cardiac stomach** in an echinoderm, the stomach closer to the mouth (786)

**cardiovascular system** the blood, the heart, and the blood vessels (931)

**carnivore** a consumer that eats other consumers (416)

**carotenoid** a light-absorbing compound that functions as an accessory pigment in photosynthesis (113)

**carrier protein** a protein that transports specific substances across a biological membrane (99)

**carrying capacity** the number of individuals of a species that an ecosystem is capable of supporting (385)

**cartilage** a strong, flexible connective tissue (804)

**cast** a type of fossil formed when sediments fill in the cavity left by a decomposing organism (279)

**catalyst** a chemical that reduces the amount of activation energy needed for a reaction but is not a reactant (36)

**caudal fin** in fishes, a fin extending from the tail that moves from side to side and amplifies the swimming motions (808)

**cause and effect** a relationship between two variables in which a change in one variable leads to a change in the other (444)

**cecum** a sac usually found at the beginning of the large intestine (887)

**cell** a membrane-bound structure that is the basic unit of life (11)

**cell cycle** the events of cell division; includes interphase, mitosis, and cytokinesis

**cell differentiation** the change in morphology, physiology, or function of a cell in relation to its neighboring cells

**cell junction** connection between cells that holds them together as a unit (667)

**cell-mediated response** part of an immune response involving a T-cell attack on an antigen (961)

**cell membrane** the lipid bilayer that forms the outer boundary of a cell (59)

**cell plate** a membrane that divides newly forming plant cells following mitosis (151)

**cell theory** the theory that all living things are made up of cells, that cells are the basic units of organisms, and that cells come only from existing cells (69)

**cell wall** a rigid structure that surrounds the cells of plants, fungi, many protists, and most bacteria (82, 468, 543)

**cellular respiration** the process in which cells make ATP by breaking down organic compounds (127)

**cellular slime mold** individual haploid cells that move about like amoebas; member of the phylum Acrasiomycota (534)

**central nervous system** the brain and the spinal cord (1003)

**centriole** a structure that appears during mitosis in animal cells (150)

**centromere** a region of the chromosome where the two sister chromatids are held together and which is the site of attachment of the chromosome to the spindle fibers during mitosis (146)

**centrosome** a dark body containing a centriole in animal cells but not in plant cells; spindle fibers radiate from the centrosome in preparation for mitosis (150)

**cephalization** concentration of nerve tissue and sensory organs at the anterior end of an organism (670)

**cephalopod** a free-swimming, predatory mollusk with a circle of tentacles extending from the head; an octopus, squid, cuttlefish, or chambered nautilus (730)

**cephalothorax** in arachnids and some crustaceans, a body part formed by the fusion of the head with the thorax (748)

**cerebellum** a posterior portion of the brain that controls movement and muscle coordination (1007)

**cerebral cortex** the folded outer layer of the cerebrum that controls motor and sensory activities (1005)

**cerebral ganglion** one of a pair of nerve-cell clusters that serve as a brain at the anterior end of some invertebrates (771)

**cerebrospinal fluid** a watery substance that provides a cushion that protects the brain and spinal cord (1007)

**cerebrum** the anterior portion of the brain where higher brain functions occur

**character displacement** evolution of anatomical differences that reduce competition between similar species (401)

**chelicera** a pincerlike mouthpart of some arthropods (745)

**cheliped** in arthropods, a claw used to capture food and for defense (748)

**chemical bond** a chemical attachment between atoms (33)

**chemical reaction** the process of breaking chemical bonds, forming new bonds, or both (33)

**chemiosmosis** a process in chloroplasts and mitochondria in which the movement of protons down their concentration gradient across a membrane is coupled to the synthesis of ATP (116)

**chemoautotroph** an organism that synthesizes organic compounds using chemicals instead of light (473)

**chemosynthesis** the production of carbohydrates through the use of energy from inorganic molecules instead of light (271)

**chemotropism** plant growth in response to a chemical (654)

**chitin** a carbohydrate that forms part of the arthropod exoskeleton (736)

**chlorofluorocarbons** (**CFCs**) a class of industrial chemicals found to be destroying the ozone layer in the upper atmosphere

**chlorophyll** a class of light-absorbing pigments used in photosynthesis (

**chloroplast** a plastid containing chlorophyll; the site of photosynthesis

**chordate** an animal that, at some stage of its life cycle, has a dorsal nerve cord, a notochord, and pharyngeal pouches, such as mammals, birds, reptiles, amphibians, fish, and some marine lower forms (788)

**chorion** the outer membrane surrounding an embryo (842)

**chorionic villi** fingerlike projections of the chorion that extend into the uterine lining (1056)

**chorionic villi sampling** a procedure involving the analysis of the chorionic villi to diagnose fetal genotypes (232)

**chromatid** one of two identical parts of a chromosome (146)

**chromatin** the DNA and proteins in the nucleus of a nondividing cell (80)

**chromosome** DNA and protein in a coiled, rod-shaped form that occurs during cell division (81)

**chromosome map** a diagram of allele positions on a chromosome (224)

**chronic bronchitis** an inflammation of the bronchi and bronchioles (1069)

**chrysalis** the outer covering of a butterfly pupa (769)

**chyme** the mixture formed in the stomach from digested food particles and gastric fluid (986)

**chytrid** an aquatic protist characterized by gametes and zoospores with a single, posterior flagellum (536)

**cilium** a short, hairlike organelle that extends from a cell and functions in locomotion or in the movement of substances across the cell surface (80)

**circulatory system** the system that distributes oxygen and nutrients to cells in all parts of the body (675)

**cirrhosis** a condition in which normal liver tissues are replaced by scar tissue (1072)

**citric acid** a six-carbon compound formed in the Krebs cycle (134)

**cladistics** a system of phylogenetic classification using shared derived characters and the recency of ancestry is the sole criterion for grouping taxa

**clasper** in fishes, a structure that transfers sperm into the female’s body (806)

**class** in taxonomy, a group of related orders (338)

**cleavage** the divisions of the zygote immediately following fertilization (683)

**cleavage furrow** the area of the cell membrane that pinches in and eventually separates the dividing cell (151)

**clitellum** a noticeable swelling around the sex organs of an earthworm during reproduction (735)

**cloaca** in animals, such as birds, amphibians, and reptiles, a common chamber into which the digestive, reproductive, and excretory systems enter (718)

**clone** an offspring produced by asexual production (639)

**cloning vector** a carrier used to clone a gene and transfer it from one organism to another (240)

**closed circulatory system** a system in which blood is contained within vessels as in the human circulatory system (675)

**cnidarian** a phylum of animals with radially symmetrical bodies, a saclike internal cavity, tentacles, and nematocysts, such as jellyfish, hydras, sea anemones, and corals (696)

**cnidocyte** a stinging cell of a cnidarian (697)

**coacervate** a cell-like droplet formed from dissimilar substances (268)

**coccus** sphere-shaped bacterium (470)

**cochlea** a coiled tube in the inner ear that is filled with fluid and lined with hairlike cells that translates the mechanical energy from sound into nerve impulses (1018)

**cocoon** the outer covering of a moth pupa; a chrysalis (769)

**codominance** an inheritance relationship in which neither of two alleles of the same gene totally masks the other (176)

**codon** a group of three sequential nitrogen bases of an mRNA molecule (193)

**coelom** a body cavity formed within the mesoderm (685)

**coenocytic** referring to filaments without internal cross walls (543)

**coenzyme:** nonprotein, reusable helper molecule that helps enzymes activate chemical reactions

**coevolution** the mutual evolution of two different species interacting with each other (291)

**cohesion** the attraction of like molecules to each other (51)

**cohesion-tension theory** states that water is able to move up the stem xylem due to the strong attraction of water molecules to each other (613)

**collar cell** a cell lining the inside of sponges that circulates water; also called a choanocyte (693)

**collenchyma** plant tissue made up of elongated cells with unevenly thickened, flexible walls (599)

**colloblast** a cell on the tentacles of a ctenophore that secretes a sticky substance that binds to the organism’s prey (702)

**colon** the large intestine (989)

**colonial algae** algae that have a structure that consists of groups of cells behaving in a coordinated manner (526)

**colonial organism** a collection of genetically identical cells that live together in a closely connected group (87)

**columella** a bone that transmits sounds from the eardrum to the inner ear (829)

**commensalism** an ecological relationship in which one organism benefits and the other neither benefits nor is harmed (402)

**community** all the populations in one area (363)

**compact bone** the layer of bone just beneath the periosteum that gives the bone its strength (911)

**companion cell** a specialized plant cell that helps control the movement of sugars through sieve tubes (601)

**competitive exclusion** the local extinction of a species due to competition (400)

**complete dominance** an inheritance relationship in which one allele is completely dominant over the other; both Bb and BB have the same phenotype (176)

**compound:** two or more elements chemically combined

**compound eye** an eye composed of many light detectors, each with its own lens (743)

**compound leaf** a type of leaf in which the blade is divided into leaflets (616)

**compound light microscope** an instrument that magnifies small objects so they can be seen easily using two or more lenses (21)

**concentration** a measurement of the amount of solute dissolved in a fixed amount of solvent (40)

**concentration gradient** the difference in concentration of a substance across space (95)

**condensation reaction** a chemical reaction, also called dehydration synthesis, in which one molecule of water is produced (53)

**cone** a photoreceptor within the retina that can produce sharp images and distinguish colors; in gymnosperms, a seed-bearing structure

**conformer** an organism that does not regulate its internal environment

**conidium** a spore produced during asexual reproduction in ascomycetes

**conjugation** the union of two protists to exchange genetic material

**conjugation bridge** in certain algae and fungi, a passageway for the transfer of the genetic information from one organism to another

**connective tissue** body tissue that supports and holds body structures together (906)

**conservation biology** a branch of biology concerned with preserving biodiversity in natural areas (452)

**constrictor** snake that kills its prey by constriction and suffocation

**consumer** a heterotroph that obtains energy from organic molecules made by other organisms (416)

**contour feather** a feather that provides coloration, insulation, and a streamlined shape to adult birds (864)

**contractile vacuole** an organelle in protists that expels water (97)

**control group** in an experiment, a group or individual that serves as a standard of comparison with another group or individual to which it is identical except for one factor (17)

**controlled experiment** a test of variables using a comparison of a control group with an experimental group (17)

**conus arteriosus** in fishes and frogs, the final chamber of the heart

**convection cell** a regional pattern of rising and falling air (441)

**convergent evolution** the process by which unrelated species become more similar as they adapt to the same kind of environment

**coral reef** a rocklike formation in warm, shallow seas composed of the skeletons of corals

**cork cambium** the lateral meristem of a plant; produces cork (602)

**cornea** protective layer that covers the iris and pupil of the eye (1020)

**coronary circulation** a subsystem of systemic circulation that supplies blood to the heart (936)

**corpus callosum** the structure formed by nerve fibers connecting the cerebral hemispheres of the brain (1004)

**corpus luteum** the structure that forms from the ruptured follicle in the ovary at ovulation (1053)

**cortisol** a hormone that regulates certain phases of carbohydrate and protein metabolism (1035)

**countercurrent flow** in gills of fishes, an arrangement whereby water flows away from the head and blood flows toward the head (811)

**correlation** a relationship between two variables in which both variables change together (444)

**cortex** in plants, a mature ground tissue located just inside the epidermis; in animals, the outermost portion of an organ such as the kidney (605, 991)

**cotyledon** a seed leaf in a plant embryo (592)

**covalent bond**: a bond between elements where electrons are shared

**cranial cavity** the area in which the brain rests (908)

**cranial nerve** one of the 12 nerves of the head that relay information between the brain and the muscular and sensory structures in the head

**cretinism** a form of mental retardation caused by hypothyroidism

**crista** a fold of the inner membrane of mitochondria

**covalent bond** a bond that forms when two atoms share one or more pairs of electrons (33)

**coxal gland** in some arachnids, an organ that removes wastes and discharges them at the base of the legs (752)

**C3 plant** a plant that fixes carbon exclusively through the Calvin cycle, named for the three-carbon compound that is initially formed

**C4 plant** a plant that incorporates CO2 into four-carbon compounds

**crop** in earthworms, a structure that stores soil; in birds, a structure that stores food **crop milk** a nutritious milklike fluid secreted by the crop of pigeons and doves to feed their young (873)

**cross-pollination** a reproductive process in which pollen from one plant is transferred to the stigma of another plant (166)

**crossing-over** the exchange of genes by reciprocal segments of homologous chromosomes during meiosis (153)

**crustacean** an arthropod with mandibles and branched appendages; examples include shrimps, barnacles, crabs, and pill bugs (746)

**crustose** a type of lichen that grows as a layer on rocks and trees (549)

**cultivar** a combination of the words *cultivated* and *variety* for a food plant that has a specific distinguishing characteristic, such as Thompson Seedless grapes (561)

**cutaneous respiration** in some animals, the exchange of gases through the skin (827)

**cuticle** in plants and insects, a waxy covering that prevents desiccation; in parasitic roundworms, a noncellular layer that protects the worm from the host’s digestive and immune systems (600, 715)

**cyanobacteria** photosynthetic unicellular prokaryotes (271)

**cyst** a resistant, thick-walled structure that encloses and protects a dormant organism (714)

**cytokine** a chemical signal between cells of the immune system (957)

**cytokinesis** the division of the cytoplasm of one cell into two new cells

**cytokinins** plant hormones that promote cell division (651)

**cytolysis** the bursting of a cell (99)

**cytoplasm** the region of a cell between the cell membrane and the nucleus (75)

**cytoplasmic streaming** the circular motion of the cytoplasm (512)

**cytosine** a nitrogen-containing base; a pyrimidine of DNA and RNA

**cytoskeleton** a network of long protein strands in the cytosol that helps maintain the shape and size of a eukaryotic cell (79)

**cytosol** the gelatinlike aqueous fluid that bathes the organelles on the inside of the cell membrane (75)

**cytotoxic T cell** a type of T cell that destroys infected body cells

**D**

**day-neutral plant** a plant unaffected by day length (656)

**death rate** or **mortality rate** the number of deaths occurring in a period of time (381)

**debt-for-nature swap** a conservation strategy in which a developing country takes steps to preserve its biodiversity in exchange for a reduction in its foreign debt (450)

**decapod** a crustacean with five pairs of legs, such as shrimps, crayfish, and lobsters (747)

**deciduous** referring to trees that lose their leaves at the end of the growing season

**decomposer** an organism that obtains nutrients from dead plants and

animals (416)

**dehydration** the condition resulting from excessive water loss (982)

**deletion** a mutation in which a segment of DNA breaks off of a

chromosome (225)

**denitrification** a final step in the nitrogen cycle, during which nitrogen gas is returned to the atmosphere (423)

**dental formula** the number, kind, and placement of teeth that are specific for a particular kind of organism (320)

**density-dependent factor** a variable related to the density of a population that affects population size (386)

**density-independent factor** a variable that affects population size regardless of population density (386)

**deoxyribonucleic acid (DNA)** a double-helix-shaped nucleic acid (7)

**dependent variable** the responding variable in an experiment (18)

**depressant** a drug that decreases the activity of the central nervous

system (1070)

**derived character** a feature that evolved only within the group under

consideration, such as the feathers of birds (345)

**dermal tissue system** one type of plant tissue system, which forms the outer covering of plants (600)

**desert** an area where rainfall averages less than 25 cm per year (416)

**determinate cleavage** a process in which each cell develops into a specific part of the gastrula (684)

**detritivore** a consumer that feeds on dead plants and animals (416)

**deuterostome** an organism in which the blastopore develops into the anus and the coelom arises by enterocoely and whose embryo has indeterminate cleavage (684)

**development** the process by which an organism grows (12)

**diabetes mellitus** a disorder of glucose metabolism caused by insufficient insulin (60)

**diaphragm** a sheet of muscle below the rib cage that functions in inspiration and expiration (886)

**diastole** a phase in the heartbeat during which the ventricles relax and the blood flows in from the atria (933)

**diastolic pressure** the pressure maintained in the blood when the ventricles are relaxed (934)

**diatom** an abundant component of phytoplankton; member of phylum

Bacillariophyta (532)

**dicot** an angiosperm with two cotyledons, net venation, and flower parts in fours or fives (580)

**diencephalon** in the brain, an area below the cerebral hemisphere that contains the thalamus and the hypothalamus (1006)

**differentiation** a process in which the cells of a multicellular individual become specialized during development (209)

**diffusion** the process by which molecules move from an area of greater

concentration to an area of lesser concentration (95)

**digestion** breaking down food into usable molecules (983)

**dihybrid cross** a cross between individuals that involves the pairing of

contrasting traits (177)

**dimorphism** the existence of distinct, genetically determined forms of the same species, such as male and female forms (544)

**dinosaur** one of a great variety of terrestrial reptilian forms during the

Mesozoic era 245 million to 65 million years ago (839)

**dipeptide** a formation from two amino acids bonded together by means of a condensation reaction (57)

**diploid** a cell that contains both chromosomes of a homologous pair

**disaccharide** a double sugar formed from two monosaccharides (56)

**dispersion** the spatial distribution of individuals in a population (380)

**disruptive selection** a type of natural selection in which individuals with two extreme forms of a trait have an advantage (307)

**dissociation** the separating of a molecule into simpler molecules, atoms,

radicals, or ions (41)

**divergent evolution** the process of two or more related species becoming more and more dissimilar (292)

**division** in taxonomy, a grouping of similar classes of plants (338)

**DNA** hereditary information in the form of a large molecule called

deoxyribonucleic acid (7)

**DNA fingerprint** a pattern of bands made up of specific fragments from an individual’s DNA (243)

**DNA polymerase** an enzyme that binds to the separated strands of DNA and assembles each strand’s complement in replication (188)

**domain** in the three-domain system of classification, one of three broad groups that all living things fall into on the basis of rRNA analysis (350)

**dominant** referring to an allele that masks the presence of another allele for the same characteristic (168)

**donor gene** a specific gene that is isolated from another organism and spliced into a plasmid (240)

**dormancy** a state of decreased metabolism (370)

**dorsal** the top of a bilaterally symmetrical animal (670)

**dorsal nerve cord** a neural tube dorsal to the notochord (673)

**double fertilization** in plants, the process in which two types of cell fusion take place in the embryo sac (633)

**down feather** one of the soft, fluffy feathers that cover the body of nesting birds and help insulate adult birds (864)

**Down syndrome** a disorder caused by an extra twenty-first chromosome and characterized by a number of physical and mental abnormalities

**drone** a male bee that develops from an unfertilized egg and functions only to fertilize eggs from the queen (772)

**drug** any chemical taken into the body that alters the normal processes of either the mind or the body (1065)

**Duchenne muscular dystrophy** a form of muscular dystrophy that weakens and progressively destroys muscle tissue (229)

**duodenum** the first section of the small intestine (827)

**dura mater** the outermost of the three sacs that enclose the brain and spinal cord (1007)

**E**

**echinoderm** a radially symmetrical marine invertebrate with an endoskeleton, a water-vascular system, and tube feet, such as a sea star, a sea urchin, or a sea cucumber (781)

**echolocation** a method of navigation similar to sonar in which the sound

produced bounces off an object used by bats and cetaceans (887)

**ecology** the study of the relationship between organisms and their

environment (359)

**ecosystem** all the biotic and abiotic components of an environment

**ecotourism** a form of tourism that helps local people make money from an intact ecosystem; tourists pay for nature guides, food, and lodging to tour the ecosystem (451)

**ectoderm** the outermost of the three germ layers of the gastrula that develops into the epidermis and epidermal tissues, the nervous system, external sense organs, and the mucous membranes lining the mouth and anus (683)

**ectoparasite** a parasite that lives on a host but does not enter the host’s

body (399)

**ectoplasm** the region in the cytoplasm located directly inside the cell

membranes (512)

**ectothermic** referring to an animal whose body temperature is determined by

the environment (848)

**efferent neuron** a neuron that conducts impulses away from the central nervous system (1008)

**ejaculation** contractions of the smooth muscles surrounding the urethra by which semen is forcefully expelled (1049)

**elapid** a venomous snake with two small, fixed fangs in the front of the

mouth (853)

**El Niño** a disruption of the normal air and water circulation patterns in the Pacific Ocean, leading to unusual weather in many parts of the world (442)

**electron** a particle with a negative electric charge that orbits the nucleus of an atom

**electron cloud**: space that electrons occupy around the nucleus of the atom.

**electron microscope** an instrument that uses a beam of electrons rather than a beam of light to enlarge the image of an extremely small object so that it can be seen (22)

**electron transport chain** molecules in the thylakoid membrane or inner

mitochondrial membrane that use some of the energy in electrons to pump protons across the membrane (115)

**element** a substance that ordinarily cannot be broken down chemically to form simpler kinds of matter (

**elephantiasis** a condition of swollen lymphatic vessels in the limbs caused by a parasitic filarial worm (718)

**embryo sac** in plants, a megagametophyte containing seven cells and eight nuclei (630)

**emigration** the movement of individuals out of a population (304)

**emphysema** a degenerative lung disease (1069)

**endocrine gland** a ductless gland that secretes hormones into the blood

**endocrine system** a system of glands that transmit chemical messages

throughout the body (1029)

**endocytosis** the process by which a cell surrounds and engulfs substances

**endoderm** the innermost of the three germ layers of the gastrula; develops into the epithelium of the pharynx, respiratory tract, digestive tract, bladder, and urethra (683)

**endodermis** in plants, a specialized layer of cells that regulates substances entering the center of the root (605)

**endoparasite** a parasite that lives inside the host’s body (399)

**endoplasm** the region in the cytoplasm found in the interior of the cell

**endoplasmic reticulum** a system of membranous tubules and sacs in

eukaryotic cells that functions as a path along which molecules move from one part of the cell to another (77)

**endoskeleton** an internal skeleton (909)

**endosperm** a tissue in angiosperms that provides food for the developing embryo (579)

**endospore** a dormant bacterial cell enclosed by a tough coating (475)

**endosymbiosis** a mutually beneficial relationship between one organism and another that lives within it; the hypothesis of endosymbiosis relating to the evolution of eukaryotes that holds that chloroplasts and mitochondria evolved from endosymbiotic bacteria (132)

**endotherm** an animal that generates its own body heat through metabolism

**endotoxin** a substance that causes a poison reaction; a compound that makes up part of the cell wall of Gram-negative bacteria

energy level: the energy of an electron in the electron cloud.

**enhancer** a region adjacent to a eukaryotic gene that must be activated if the gene is to be expressed (208)

**enkephalin** a neurotransmitter that blocks pain messages to the brain

**enteric bacteria** Gram-negative heterotrophic bacteria that inhabit animal intestinal tracts (473)

**enterocoely** the process of mesoderm formation in deuterostomes in which the coelom forms in folded mesoderm (685)

**entomology** the study of insects (762)

**environmental science** a field of study that uses biological principles to look at the relationships between humans and the Earth (440)

**enzyme** a catalyst, usually a protein, in living systems (37)

**ephedrine** a decongestant drug derived from *Ephedra,* a genus of desert shrubs

**epidermis** a layer of cells that forms a continuous sheet over the outer surface of a plant or animal (696)

**epididymis** coiled tube on each testis where sperm complete their development

**epiglottis** a flap of tissue that covers the trachea (945)

**epiphyseal plate** the site of bone elongation at the ends of long bones **epiphyte** a plant that grows on other plants (429)

**epithelial tissue** tissue composed of cells that create a solid sheet that covers a body part (906)

**equilibrium** a state that exists when the concentration of a substance is the same throughout a space (95)

**erosion** the loss of soil that is caused by wind or water (822)

**erythrocyte** a red blood cell (939)

**esophagus** a tube connecting the mouth or pharynx to the stomach or crop

**estrogen** hormone that helps regulate the menstrual cycle (1035)

**estuary** an aquatic biome found where freshwater streams and rivers flow into the sea; where the tides meet a river current (433)

**ethephon** a synthetic chemical that breaks down to release ethylene gas; used to ripen fruit (650)

**ethylene** a gaseous hormone produced by various parts of plants and released into the air (650)

**eubacteria** the lineage of prokaryotes that includes all contemporary bacteria except archaebacteria (348)

**euchromatin** the uncoiled form of chromatin (206)

**euglenoid** flagellated unicellular algae; many are photosynthetic (533)

**eukaryote** a cell that contains a nucleus and membrane-bound organelles (72)

**eustachian tube** a canal that connects the middle ear to the mouth cavity

**eutrophication** the increase of nutrients in an environment (472)

**evenness** the number of individual organisms that belong to each species in a given area (449)

**evolution** all the changes that have formed life on Earth from its earliest

beginnings to the diversity that characterizes it today (8)

**excretion** the process of removing metabolic wastes (991)

**excurrent siphon** a tube through which water exits the mantle cavity of a bivalve (729)

**exergonic reaction** a chemical reaction that involves a net release of free energy

**exocrine gland** a gland that secretes nonhormonal chemicals through a duct

**exocytosis** a process in which a vesicle inside a cell fuses with the cell

membrane and releases its contents to the external environment (104)

**exon** coding region of a eukaryotic gene (206)

**exoskeleton** the hard external covering of some invertebrates that provides protection and support (675)

**exotoxin** a toxic protein secreted by pathogenic bacteria (478)

**expiration** the process in which air is forced out of the lungs (948)

**exponential growth** a model of population growth in which the birth and death rates are constant (384)

**extensor** a muscle that straightens a joint (919)

**external fertilization** the union of gametes outside the bodies of the parents, as in many fishes and amphibians (804)

**external respiration** the exchange of gases between the atmosphere and the blood (948)

**extinction** the dying out of a species (281)

**extreme halophile** an archaebacterium that lives in very high salt

concentrations (468)

**eyespot** a localized region of pigment in some invertebrates and protozoa that detects changes in the quantity and quality of light (508)

**F**

**facilitated diffusion** a process in which substances move down their

concentration gradient across the cell membrane with the assistance of carrier proteins (99)

**facultative anaerobe** an organism that can metabolize with or without oxygen

**FAD** flavin adenine dinucleotide; a compound that accepts electrons during redox reactions (134)

**fallopian tube** a tube through which eggs move from the ovary to the uterus

**family** in taxonomy, a group of related genera (338)

**fascicle** a dense bundle of skeletal muscle fibers (916)

**fatty acid** a monomer that is part of most lipids (58)

**feces** waste materials that pass through the anus or cloacal opening (989)

**feedback mechanism** (positive or negative) a series of events in which the last step controls the first (1038)

**fermentation** a process in which cells make a limited amount of ATP by converting glucose into another organic compound, such as lactic acid or ethyl alcohol, in the absence of oxygen (129)

**fertilizer** a compound that provides plants with essential mineral nutrients like nitrogen and phosphorus (564)

**fetal alcohol syndrome** a condition characterized by growth and developmental defects affecting some children born to women who drink alcohol during pregnancy (1072)

**fetus** referring to a developing human from the end of the eighth week until birth (1057)

**F**1 **generation** the offspring of cross-pollinated P1 generation plants (166)

**F**1 **generation** the offspring of self-pollinated F1 generation plants (166)

**fibrin** the long, sticky threads that function in blood clotting (941)

**fibrous root system** a mat of threadlike roots that spread out below the surface of the soil to maximize exposure to water and minerals and to anchor the plant firmly to the soil (603)

**filament** in flowers, the structure that supports the anther (629)

**filamentous alga** an alga that has a slender, rod-shaped thallus composed of rows of cells joined end to end (526)

**filarial worm** one of a variety of parasitic roundworms that cause elephantiasis in humans and heartworm disease in dogs (717)

**filter feeding** the method by which a sessile organism screens food out of the surrounding water (694)

**filtration** the process in the kidney in which materials from the blood are forced out of the glomerulus into Bowman’s capsule (993)

**first messenger** a hormone that activates a second messenger inside its target cell (1030)

**fission** a type of asexual reproduction in which the organism splits in two and regenerates the parts missing on each new half to produce two whole organisms

**fitness** a measurement of the ability of a species to respond to the pressures of natural selection; the ability of individuals to survive to propagate their genes

**fixed joint** a place where two bones meet but movement does not occur, as in the skull (913)

**flagellum** a hairlike structure made up of microtubules that function in

locomotion (80)

**flame cell** in a flatworm, a cell that collects excess body water and transfers it to the excretory system(710)

**flatworm** the common name for any of the dorso–ventrally flattened worms of the phylum Platyhelminthes, such as a planarian, fluke, and a tapeworm (709)

**flavin adenine dinucleotide** see FAD

**flexor** a muscle that bends a joint (919)

**flight feather** a specialized contour feather on the wing or tail of a bird

**fluid mosaic model** a model of cell membrane structure representing the

dynamic nature of membrane lipids and proteins (75)

**fluke** a leaf-shaped parasitic flatworm (711)

**flyway** the route followed by migratory birds (453)

**foliose lichen** a type of lichen that lives on soil surfaces, where it forms a matlike growth (549)

**follicle** a pit in the skin in which hair or a feather develops; a structure

surrounding an immature egg in an ovary (864)

**follicle stimulating hormone (FSH)** a gonadotropin that stimulates sperm production and causes cells around an immature egg to form a follicle (1035)

**follicular phase** the stage in which an immature egg completes its first meiotic division (1052)

**food chain** pathway beginning with producers along which energy is

transferred from trophic level to trophic level (417)

**food web** the interconnected food chains in an ecosystem (417)

**foraminifera** an ancient group of shelled sarcodines found in oceans

**fossil** the remains or traces of a once-living organism (279)

**fracture** a crack or break in a bone (911)

**fragmentation** in fungi, a form of asexual reproduction in which individual cells are released that act like spores (544)

**frame shift mutation** a mutation that results in the misreading of the code during translation because of a change in the reading frame (226)

**free energy** the energy in a system available for work (35)

**frond** the mature leaf of a fern (588)

**fruit** a mature plant ovary; a modified flower part that encloses a seed or seeds

**fruiting body** spore-bearing structure of a slime mold during reproduction

**fruticose** a shrublike lichen (549)

**fucoxanthin** a carotenoid pigment that is one of the primary pigments found in diatoms and brown algae (531)

**functional group** a structural building block that determines the characteristics of a chemical compound (53)

**fundamental niche** the full range of conditions that a species can tolerate and resources it can use (371)

**fungi imperfecti** or **deuteromycota** a group of fungi whose sexual phase has not been discovered (549)

**furculum** the fused collarbones in a bird’s skeleton; the “wishbone”

**G**

**gallbladder** the saclike organ in vertebrates that is connected to the liver that stores bile (809)

**gametangium** in algae and fungi, a gamete chamber (525)

**gamete** a reproductive cell (153)

**gametocyte** an undifferentiated cell that develops into a gamete (517)

**gametophyte** in plants and algae, a multicellular structure that produces gametes

**ganglion** a mass of nerve cells (726)

**gasohol** an alternative fuel made from alcohol from fermented grains mixed with gasoline (567)

**gastric cecum** a pocket that branches from the digestive tract and secretes enzymes (766)

**gastric fluid** a liquid secreted by gastric glands in the stomach (986)

**gastric pit** the open end of gastric glands through which secretions are released into the stomach (985)

**gastrin** a hormone that stimulates the stomach to secrete digestive enzymes

**gastrodermis** in cnidarians, the layer of cells surrounding the gastrovascular cavity (696)

**gastrointestinal tract** the digestive tract from the mouth to the anus

**gastropod** a mollusk that has one or no shell and moves by gliding on a

muscular foot; examples include snails, slugs, and nudibranchs (727)

**gastrovascular cavity** a digestive chamber with a single opening found in cnidarians, ctenophores, and flatworms (696)

**gastrula** the cup-shaped embryo formed as the blastula folds inward

**gel electrophoresis** technique used to separate nucleic acids or proteins by size and charge (244)

**gemmule** an asexual reproductive structure produced by some freshwater sponges (695)

**gene** a segment of DNA that contains coding for a polypeptide or protein; a unit of hereditary information (7)

**gene clone** an exact copy of a gene (240)

**gene expression** the transcription of DNA into RNA and then into proteins

**gene flow** the movement of genes into or out of a population (305)

**gene pool** all the genes for all of the traits in a population (300)

**gene therapy** treatment of a genetic disorder by introducing a healthy gene into a cell (246)

**generalist** a species with a broad niche that can tolerate a wide range of

conditions and can use a variety of resources (372)

**generative cell** in a pollen grain, the cell that forms two sperm (632)

**genetic code** triplets of nucleotides in mRNA that determine the sequence of amino acids in protein (193)

**genetic counseling** the process of informing a couple about their genetic

makeup, which has the potential to affect their offspring (231)

**genetic disorder** a disease that has a genetic basis (228)

**genetic diversity** the amount of genetic variation within a population or species

**genetic drift** a shift in allele frequencies in a population due to chance

**genetic engineering** a form of applied genetics in which scientists directly manipulate genes (238)

**genetic marker** a short section of DNA that indicates the presence of an allele that codes for a trait (228)

**genetic screening** an examination of a person’s genetic makeup (231)

**genetics** the field of biology devoted to understanding how traits are passed from parents to offspring (164)

**genome** the complete genetic material contained in an individual (203)

**genomic library** a set of thousands of DNA pieces cut by a specific restriction enzyme (241)

**genotype** the genetic makeup of an organism (172)

**genotypic ratio** the probable ratio of genotypes produced by a cross

**genus** in taxonomy, a group of similar species (338)

**geographic isolation** the physical separation of populations (310)

**germ cell mutation** a change in the DNA of a sex cell (224)

**germ layer** a specific layer of cells in an embryo from which specific organ systems are derived (671)

**germinate** in plants, sprout; the seed embryo begins to grow (588)

**gestation** the length of a normal pregnancy (1054)

**giardiasis** an illness characterized by severe diarrhea and intestinal cramps caused by a protozoan parasite (507)

**gibberellin** a plant hormone that, among other actions, stimulates bolting and cessation of dormancy (650)

**gill** in mushrooms, one of the radiating rows on the underside of the cap; in animals, an organ specialized for the exchange of gases with water

**gizzard** a muscular region of the digestive tract in birds that crushes food

**gliding joint** a joint that allows bones to slide over one another, as in foot bones that flex in walking (913)

**glomerulus** a cluster of capillaries that receives blood from the renal artery and that is enclosed in Bowman’s capsule (993)

**glucagon** a hormone that raises the blood glucose level (1036)

**glycolysis** a pathway in which glucose is oxidized to pyruvic acid (127)

**glycoprotein** a molecule of protein with attached sugar chains (489)

**Golgi apparatus** a system of membranes in eukaryotic cells that modifies proteins for export by the cell (78)

**gonad** the organ that produces gametes and some sex hormones (1035)

**G0 phase** a phase of the cell cycle in which the cell is not dividing and its DNA is not replicating (149)

**G1 phase** the first period of interphase, in which the cell doubles in size

**G2 phase** the final period of interphase, in which the cell undergoes rapid growth and prepares for mitosis (149)

**grafting** a technique in which a portion of one plant is inserted into and grows with the root or shoot of another (640)

**Gram-negative bacterium** a bacterium that stains pink with Gram stain and that usually has an outer covering on its cell wall (471)

**Gram-positive bacterium** a bacterium that stains purple with Gram stain and that usually lacks an outer covering on its cell wall (471)

**Gram stain** a series of dyes that stain bacteria either purple or pink according to the chemistry of the bacterial cell wall (471)

**granum** a stack of thylakoids in a chloroplast (112)

**gravitropism** a plant growth response to gravity (654)

**great ape** a gibbon, orangutan, gorilla, or a chimpanzee (320)

**green gland** an excretory organ of some crustaceans that helps regulate the solute concentration of the hemolymph (750)

**greenhouse effect** warming of the Earth due to the insulating effect of gases in the atmosphere, such as carbon dioxide and water vapor (361)

**gross primary productivity** the rate at which energy is produced in an

ecosystem (415)

**ground water** water found in the soil or in underground formations of porous rock (421)

**ground-tissue system** one type of plant-tissue system, made up of

parenchyma, collenchyma, and sclerenchyma (601)

**growth factor** protein that regulates the rate and sequence of the events of cell division (212)

**growth hormone** a hormone secreted by the anterior lobe of the pituitary gland that regulates skeletal and muscular growth (1033)

**growth rate** the amount by which a population’s size changes in a given time

**growth regulator** a hormone that stimulates or inhibits plant growth

**growth retardant** a chemical that retards plant growth (651)

**guanine** a nitrogen-containing base that is a component of a nucleotide

**guard cell** one of two cells bordering a stoma, each of which has flexible cell walls that regulate gas and water exchange (618)

**gullet** the structure that forms food vacuoles that circulate throughout the cytoplasm of the *Paramecium* (514)

**gut** digestive tract (676)

**gymnosperm** a seed plant whose seeds are not enclosed by an ovary

**H**

**habitat** the physical area in which an organism lives (368)

**half-life** the period of time in which half of a radioactive substance decays

**haploid** having only one chromosome of each homologous pair (147)

**hard palate** the bony roof of the mouth (984)

**Hardy-Weinberg principle of genetic equilibrium** the stability of gene frequencies across generations (302)

**Haversian canal** a channel containing nerves and blood vessels making up compact bone (911)

**hay fever** a pollen allergy that results in sneezing, a running nose, and watering eyes (572)

**head-foot** one of the two regions of the mollusk body consisting of the head and the foot

**heartwood** the darker wood in the center of a tree (611)

**heartworm disease** a disease of the heart and large arteries in dogs caused by a filarial worm (718)

**helicase** an enzyme that separates DNA strands before replication (188)

**helper T cell** a type of T cell that coordinates the immune response

**hemocoel** the hemolymph-filled space or body cavity of some invertebrates

**hemoglobin** the oxygen-carrying pigment in red blood cells (939)

**hemolymph** the fluid that is circulated through the body of an animal with an open circulatory system (766)

**hemophilia** a trait in which the blood lacks a protein that is essential for

clotting (229)

**hepatic portal circulation** the system of blood movement through the

digestive tract and liver (936)

**herb** a flowering, vascular seed plant that lacks a woody stem; a plant part used to add flavor to food (563)

**herbaceous plant** an annual plant that is nonwoody (580)

**herbivore** a consumer that eats primary producers (398)

**heredity** the transmission of traits from parents to their offspring (165)

**heterocyst** a cell of cyanophytes that fixes atmospheric nitrogen (472)

**heterospory** a phenomenon in which two types of spores are produced by an individual plant (627)

**heterotroph** an organism that obtains organic food molecules by eating other organisms or their by-products (10)

**heterozygous** referring to a gene pair in which the two alleles do not code for the same trait (173)

**hilum** a scar along the edge of a plant seed marking where the seed was

attached to the ovary wall (636)

**hindgut** the colon and rectum of some invertebrates (766)

**hinge joint** allows movement back and forth like a hinged door, as in the elbow

**histamine** a kind of cytokine that causes an inflammatory response to an injury resulting in redness, swelling, warmth, and pain (957)

**histone** a protein molecule that DNA wraps around during chromosome

formation (145)

**holdfast** the part of an algal thallus that anchors it to a substrate (529)

**homeobox** a specific DNA sequence within a homeotic gene that regulates patterns of development (209)

**homeostasis** the stable internal conditions of a living thing (6)

**homeotic gene** a gene that controls the development of a specific adult structure

**hominid** a subgroup of primates that includes modern humans and their

bipedal ancestors (319)

**homologous chromosome** one of a pair of morphologically similar

chromosomes (146)

**homologous features** similar features that originated in a shared ancestor (289)

**homospory** a phenomenon in which all spores look alike and produce similar gametophytes (626)

**homozygous** referring to a gene pair in which the two alleles code for the same trait (173)

**hookworm** a parasitic roundworm that feeds on its host’s blood by cutting into the intestinal wall (716)

**hormone** a chemical secreted by an endocrine gland that specifically influences the activity of distant cells (1029)

**host** an organism that supports a parasite (399)

**human chorionic gonadotropin (HCG)** a hormone secreted by the placenta

that stimulates the corpus luteum (1056)

**Human Genome Project** worldwide scientific collaboration to determine the nucleotide sequence of the entire human genome (246)

**human immunodeficiency virus (HIV)** the virus that causes AIDS (488)

**humoral immune response** an arm of the immune response that involves mainly B cells and antibodies (961)

**hunter-gatherer lifestyle** a nomadic way of life in which food is found by hunting animals and gathering uncultivated plants, fruits, and shellfish (388)

**Huntington’s disease** a human genetic disorder caused by a dominant allele resulting in involuntary movements, mental deterioration, and eventual death

(228)

**hydrogen bond** a weak chemical bond between the hydrogen atom in one molecule and a negatively-charged region of another molecule (50)

**hydrolysis** the splitting of a molecule through reaction with water (54)

**hydrophilic** referring to the molecular attraction to water (58)

**hydrophobic** referring to the molecular repulsion of water (58)

**hypertension** high blood pressure (934)

**hyperthyroidism** overproduction of thyroid hormones (1034)

**hypertonic** describing a solution whose solute concentration is higher than that inside a cell (96)

**hypha** the vegetative filament of a fungus (543)

**hypocotyl** a stemlike area in plants between the cotyledons and radicle

**hypoglycemia** overproduction of insulin (1036)

**hypothesis** a statement that can be tested experimentally (17)

**hypothyroidism** thyroid hormone deficiency (1034)

**hypotonic** describing a solution whose solute concentration is lower than that inside a cell (96)

**I**

**icosahedron** a polyhedron or a capsid of a virus with 20 triangular faces

**ileum** the middle portion of the small intestine (827)

**immigration** the movement of individuals into a population (366)

**immune response** a reaction of the body against a foreign substance

**immune system** a body system that has the job of fighting off invading

pathogens and preventing the growth and spread of cancers (959)

**immunity** resistance to a specific pathogen (964)

**implantation** the process by which the newly fertilized egg in the blastocyst stage imbeds itself into the lining of the uterus (1055)

**inactivated vaccine** a vaccine that has been treated so that its component microorganisms no longer have the ability to cause disease

**inbreeding** mating with relatives (387)

**incisor** a chisel-like tooth used for biting and cutting (984)

**incomplete dominance** an inheritance relationship that occurs when both alleles influence the phenotype (176)

**incurrent siphon** a tube through which water enters the mantle cavity of a bivalve (729)

**independent assortment** during meiosis, the random distribution of genes from different chromosomes to the gametes (154)

**independent variable** an experimentally manipulated variable (18)

**indeterminate cleavage** a pattern of development in which the functional destiny of each cell is not determined early in the development of the embryo

**indoleacetic acid (IAA)** an auxin produced in actively growing regions of plants (647)

**inducer** in the *lac* operon, the molecule that binds to repressor molecules and

induces gene expression (205)

**infectious disease** a disease caused by a pathogen that can be transmitted from one individual to another (496)

**inferior vena cava** the large vein carrying blood from the lower part of the body (935)

**inflammatory response** a response in which white blood cells engulf foreign substances and body temperature rises (957)

**insertion** the attachment point of a tendon to a moving bone (919)

**inspiration** the process of taking air into the lungs (947)

**insulin** a hormone that lowers the blood glucose level (1036)

**integral protein** a protein imbedded in the bilayer of the cell membrane

**integument** in plants, one or two outer layers of the ovule; in animals, the outer covering (628)

**intercalary meristem** a region of plant tissue that allow grass leaves to quickly regrow (958)

**interferon** a protein produced by the body that inhibits the reproduction of viruses (958)

**intermediate host** the host from which the larvae of a parasite derive their nourishment (713)

**internal fertilization** fertilization in which sperm fuses with an egg inside the female’s body (806)

**internal respiration** the exchange of gases between the blood and the cells of the body (944)

**interneuron** a neuron that connects with another neuron (1008)

**internode** one of the different segments of a stem (609)

**interphase** a period of cell growth and development that precedes eukaryotic cell nuclear division (149)

**intertidal zone** an area along ocean shorelines that is repeatedly covered and uncovered by ocean tides (431)

**intestine** the part of the body where digestion is completed and nutrients are absorbed (809)

**intron** a section of a structural gene that does not code for an amino acid and is excised before translation (206)

**inversion** a mutation that occurs when a chromosome piece breaks off and reattaches in reverse orientation (225)

**invertebrate** an animal without a backbone (667)

**involuntary muscle** a muscle whose movement cannot be consciously

controlled (916)

**ion** an atom or a compound with a net electrical charge (34)

**ion channel** a membrane protein that provides a passageway across the cell membrane through which an ion can diffuse (100)

**ionic bond** a bond formed by electrical attraction between two oppositely charged ions (34)

**islets of Langerhans** specialized cells in the pancreas that secrete two

hormones, insulin and glucagon (1036)

**isomer** one of two or more compounds that differ in structure but not in

molecular composition (55)

**isopod** a crustacean with seven pairs of identical legs; examples include sow bugs and pill bugs (745)

**isotonic** describing a solution whose solute concentration equals that inside a cell (97)

**isotope** one of multiple forms of a chemical element that has a different number of neutrons than other atoms of that element (264)

**J**

**Jacobson’s organ** one of two pits in the mouth of a snake that contain nerves which are extremely sensitive to odors (847)

**jejunum** the middle section of the small intestine (988)

**joint** the place where two bones meet (913)

**K**

**karyotype** a picture of an individual’s chromosomes (147)

**keratin** a protein that forms hair, bird feathers, human fingernails, and the horny scales of reptiles (843)

**kidney** an excretory organ in which wastes are filtered from the blood

**kilocalorie** a unit of energy equal to 1,000 calories; the amount of heat needed to raise the temperature of 1 kg of water by 1° C (130)

**kin selection** a mechanism for increasing the propagation of one’s own genes by helping a closely related individual reproduce (774)

**kinetochore** a disk-shaped protein found in the centromere region of a

chromosome that attaches the chromosomes to the mitotic spindle (150)

**kinetochore fiber** a spindle fiber that extends from the centrosome at one pole of the cell to a chromatid during mitosis (150)

**kingdom** in taxonomy, a group of similar phyla or divisions (338)

**Koch’s postulates** the steps that Robert Koch, a Nobel Prize–winner in 1905 for his work on tuberculosis, formulated for determining the cause of a given disease (955)

**Krebs cycle** a series of biochemical reactions that release carbon dioxide and result in the formation of ATP (133)

**L**

**labium** an insect mouthpart that functions like a lower lip (766)

**labor** the muscular contractions of the uterus and other events that lead to birth

**labrum** an insect mouthpart that functions like an upper lip (766)

***lac* operon** DNA segment that codes for the regulatory enzymes for lactose metabolism in *E. coli* (203)

**lacteal** a tiny lymph vessel (989)

**lactic acid fermentation** the process by which pyruvic acid is converted to lactic acid (129)

**laminarin** a type of polysaccharide with glucose units linked differently from those in starch (531)

**large intestine** an organ of digestion in which water is reabsorbed (989)

**larva** an immature form of an organism that is morphologically distinct from that of an adult (695)

**larynx** the voice box that houses the vocal cords (945)

**lateral line system** a row of sensory structures that run the length of the body of a fish (803)

**lateral meristem** in plants, a growing region that increases the diameter of roots and stems (602)

**law of independent assortmen**t law stating that pairs of genes separate

independently of one another in meiosis (168)

**law of segregation** law stating that pairs of genes separate in meiosis and each gamete receives one gene of a pair (168)

**law of superposition** a law that states that successive layers of rock or soil were deposited on top of one another and the lowest level is oldest

**layering** the process of causing roots to form on a stem (640)

**leaflet** one of the divisions of a blade (616)

**legume** any plant of the family Leguminosae, such as a bean, a pea, or a lentil

**lens** a convex crystalline structure in the eye that focuses light on the retina

**leukemia** a progressive, malignant disease of the blood-forming organs

**leukocyte** a white blood cell (940)

**lichen** a symbiotic association between fungi and green algae (549)

**life expectancy** how long, on average, an individual is expected to live

**ligament** a connective tissue in a joint (913)

**light reactions** the initial reactions in photosynthesis, including the absorption of light by photosystems I and II, the passage of electrons along the electron transport chains, the production of NADPH and O2, and the synthesis of ATP through chemiosmosis (112)

**limbic system** a group of clusters of neurons in the brain that helps regulate the emotions (1006)

**limiting factor** biotic or abiotic factor that restrains the growth of a population

**linkage group** the group of genes, located on the same chromosome, that are usually inherited together (222)

**lipid** a kind of organic compound that is insoluble in water, such as fats and steroids (58)

**liver** organ that performs vital metabolic processes including filtration of blood, secretion of bile, and conversion of sugars into glycogen (986)

**lobe-finned fish** a fish having paddlelike fins with fleshy bases (807)

**logistic growth** a model of population growth in which birth and death rates vary with population size and are equal at the carrying capacity

**long-day plant** a plant that flowers when exposed to day lengths longer than the plant’s critical length (656)

**loop of Henle** in the kidney, the part of the nephron that maintains a high concentration of sodium chloride in the surrounding fluid (993)

**lung** the respiratory organ where gas exchange occurs (678)

**luteal phase** the menstrual stage in which the corpus luteum develops

**luteinizing hormone (LH)** a hormone that stimulates ovulation and androgen secretion by the corpus luteum (1035)

**lymph** the fluid of the lymphatic system (937)

**lymphatic system** a series of one-way vessels that carry intercellular fluid from tissues to the bloodstream (931)

**lymphocyte** a type of white blood cell occurring in two primary forms, T cells and B cells (959)

**lymphoma** a tumor in the tissues that form blood cells (211)

**lysis** the disintegration of a cell by disruption of the plasma membrane

**lysosome** an organelle containing digestive enzymes, existing primarily in animal cells

**lytic cycle** the replication process of viruses that results in the destruction of the host cell (492)

**M**

**macromolecule** a very large organic molecule composed of many smaller molecules (53)

**macronucleus** in *Paramecia,* the larger of the two types of nuclei (514)

**macronutrient** an element used by plant cells in relatively large amounts (606)

**macrophage** a large white blood cell that engulfs pathogens and cellular debris

**madreporite** a sievelike plate on the aboral surface of an echinoderm through which water enters the water-vascular system (786)

**malignant tumor** a cancerous mass of cells (211)

**Malpighian tubule** the main excretory organ of most insects and some

myriapods and arachnids (752)

**mammary gland** one of the milk-secreting glands of mammals (881)

**mandible** a movable mouthpart that usually functions in chewing (745)

**mantle** the epidermal layer of mollusks (726)

**mantle cavity** a space between the mantle and the visceral mass in mollusks

**map unit** a unit in chromosome mapping equal to a 1 percent occurrence of crossing-over (224)

**marsupial** a mammal that carries its young in a pouch (884)

**mass** a fundamental property of an object generally regarded as equivalent to the amount of matter in the object (31)

**mass extinction** one of the brief periods of time during which large numbers of species disappeared (281)

**mass number** the sum of the protons and the neutrons in an atom (265)

**mastax** a muscular organ that breaks up food in rotifers (718)

**matter** anything that occupies space and has mass (10)

**maxilla** a head appendage in arthropods that is used to manipulate food

**maxilliped** a thoracic appendage in arthropods that is used to manipulate food and to detect touch and chemicals

**medulla** the innermost portion of an organ such as the kidney (992)

**medulla oblongata** in fish, the posterior brain lobes that regulate the internal organs; in humans, a part of the brain stem (812, 1007)

**medusa** a free-swimming, bell-shaped stage in the life cycle of a cnidarian (696)

**megagametophyte** female gametophyte (628)

**megasporangium** structure that produces megaspores (628)

**megaspore** a spore produced by meiosis in a megasporangium (627)

**megaspore mother cell** a diploid cell in the ovule that undergoes meiosis to produce four haploid megaspores (630)

**meiosis** the process of nuclear division that reduces the number of

chromosomes in a cell by half (148)

**melatonin** a hormone that probably regulates sleep patterns (1037)

**memory cell** a specialized white blood cell that protects the body from

reinfection by a specific pathogen (963)

**meninges** the three protective membranes that surround the brain and spinal cord (1007)

**menopause** the cessation of the menstrual cycle (1053)

**menstrual cycle** the monthly changes in the female reproductive system

**menstruation** the release of the uterine lining, blood, and an unfertilized egg at the end of the menstrual cycle (1053)

**meristem** the growing region in plants (602)

**merozoite** an asexually produced stage in the life cycle of some parasitic sporozoan protozoans that disperse and infect additional cells

**mesentery** a fanlike membrane that holds the digestive organs in place

**mesoderm** a layer of cells in the gastrula that gives rise to muscles and to interior body linings (683)

**mesoglea** in cnidarians, the jellylike material located between the epidermis and the gastrodermis (696)

**mesophyll** in leaves, the tissue where photosynthesis occurs (616)

**mesothorax** the middle segment of an insect’s thorax (765)

**messenger RNA (mRNA)** the type of RNA that carries genetic information from the nucleus to the ribosomes (191)

**metabolism** the sum of all chemical processes in living things (10)

**metamorphosis** a major change in form that occurs as a larval animal develops into an adult (768)

**metaphase** the second phase of mitosis, during which all the chromosomes move to the cell’s equator (150)

**metastasis** the spread of cancer cells beyond their original site (211)

**metathorax** the most posterior segment of an insect’s thorax (765)

**methanogen** a bacterium that produces methane during anaerobic respiration

**microfilament** a polymer chain of the protein actin; the smallest strand in the cytoskeleton (79)

**micronucleus** in *Paramecia*, the smaller of the two nuclei; involved in sexual reproduction (515)

**micronutrient** an element used by plants in relatively small amounts

**microsphere** a type of microscopic droplet enclosed by a membrane composed of organic molecules (268)

**microsporangium** structure that produces microspores (628)

**microspore** a spore produced by meiosis in a microsporangium (627)

**microspore mother cell** diploid cell in the pollen sac that undergoes meiosis to produce four haploid microspores (631)

**microtubule** a hollow tube of protein that constitutes the largest strand in the cytoskeleton (79)

**microvillus** one of the extensions of membranes covering the villi (688)

**midbrain** the section of the brain stem, which acts as a relay between the cerebrum and cerebellum (709)

**midgut** the stomachlike region of some invertebrates (766)

**migratory bird** a bird that overwinters in the tropics and then travels to

temperate areas to breed and raise its offspring (453)

**mimicry** a defense in which one organism resembles another that is dangerous or poisonous (398)

**mineral** an inorganic solid formed in the Earth (981)

**mitochondrial matrix** the space inside the inner membrane of a

mitochondrion (133)

**mitochondrion** the organelle that is the site of aerobic respiration in eukaryotic cells (76)

**mitosis** eukaryotic nuclear division(148)

**mitotic spindle** the array of spindle fibers that serve to divide the chromatids during nuclear division (150)

**mitral valve** bicuspid valve; the atrioventricular valve on the left side of the heart (932)

**molar** a flattened tooth used to grind and crush (984)

**mold** a type of fossil formed from an impression of the shape or tracks of an organism; in fungi, a mass of tangled filaments of cells, such as the fungus that grows on bread (279)

**molecular genetics** the study of the structure and function of chromosomes and genes (169)

**molecule** a chemical structure composed of one or more atoms (34)

**mollusk** an invertebrate with a soft, unsegmented body often enclosed in a hard shell containing calcium carbonate; examples include snails, clams, and squids

**molting** the process of shedding an exoskeleton or other outer layer on an animal (744)

**monocot** an angiosperm with a single cotyledon, parallel veins, and flower parts in multiples (592)

**monohybrid cross** a cross between individuals that involves one pair of

contrasting traits (174)

**monomer** a repeated, single-molecule unit in a polymer (53)

**monosaccharide** a simple sugar such as fructose or glucose (55)

**monosomy** a condition in a diploid cell in which one chromosome of one pair is missing as a result of nondisjunction during meiosis (231)

**monotreme** egg-laying mammal (884)

**morphogenesis** the change in form of an organism resulting from cell

differentiation (209)

**morphology** the study of the internal and external structure and form of an organism (309)

**morula** a ball of cells produced by cleavage of the zygote (1054)

**motor division** a division of the peripheral nervous system that allows the body to react to the brain’s interpretation of sensory information

**motor neuron** a neuron that carries impulses from the spinal cord to muscle cells (1004)

**mouth pore** the structure at the oral groove into which the *Paramecium* sweeps food (514)

**movable joint** enables the skeleton to move where bones come together to perform a wide range of activities (913)

**M phase** mitosis; the phase of cell division in which the nucleus divides

**mucous membrane** the mucus-secreting epithelial tissue lining of the interior surfaces of the body (956)

**mucus** a thick, slimy fluid produced by the mucous membranes (956)

**multicellular organism** a living thing that consists of more than one cell (6)

**multiple fission** a form of cell division that results in a number of identical individuals (507)

**muscle fatigue** the physiological inability of a muscle to contract (920)

**muscle fiber** a skeletal muscle cell that runs the length of the muscle and contains many nuclei (916)

**muscle tissue** the body tissue that enables movement (905)

**mutagen** an environmental factor that damages DNA (212)

**mutation** a change in DNA (189)

**mutualism** a form of symbiosis in which both organisms benefit from living together (402)

**mycelium** a mat of interwoven hyphae (543)

**mycology** the study of fungi (543)

**mycorrhiza** a symbiotic association between fungi and plant roots (549)

**myofibril** a contracting thread in a skeletal muscle (917)

**myosin** the thick protein filament of a sarcomere (917)

**N**

**NAD+** nicotinamide adenine dinucleotide; an organic molecule that accepts electrons during redox reactions (128)

**NADP+** nicotinamide adenine dinucleotide phosphate; an organic molecule that accepts electrons during redox reactions (115)

**naphthalene acetic acid (NAA)** synthetic auxin used to promote root

formation on stem and leaf cuttings (648)

**narcotic** a drug derived from opium that relieves pain and induces sleep

**nastic movement** a type of plant movement that is independent of the direction of the stimuli (654)

**natural killer cell** a large white blood cell that attacks pathogen-infected cells and cancer cells (958)

**natural selection** the process by which organisms with favorable variations reproduce at higher rates than those without such variations

**nauplius** the free-swimming larva of most crustaceans (746)

**nematocyst** a stinging organelle in the cnidocytes of cnidarians (697)

**nephridium** tubule through which some invertebrates eliminate wastes

**nephron** the functional unit of the kidney (992)

**neritic zone** the ocean subarea over the continental shelf (431)

**nerve** a strand of axons through which impulses travel (1008)

**nerve net** a diffuse web of interconnected nerve cells in the nervous system of cnidarians (697)

**nerve ring** a nerve that encircles the central region of an echinoderm

**nervous tissue** a type of animal tissue that conducts electrical impulses

**net primary productivity** the rate at which biomass accumulates in an

**net venation** in plant leaves, the repeated branching of veins to form a network of smaller veins (592)

**neuron** a cell that transmits electrical signals (668)

**neurosecretory cells** cells of the hypothalamus that produce and secrete

hormones (1032)

**neutron** a subatomic particle with no electric charge (32)

**neutrophil** a large leukocyte containing a lobed nucleus and many cytoplasmic granules (957)

**niche** the way of life of a species (371)

**nicotine** a toxic, addictive alkaloid derived from tobacco and one of the major contributors to the harmful effects of smoking; used as an insecticide (1068)

**nictitating membrane** a third membrane that can cover the eyeball

**nitrification** the process in the nitrogen cycle by which nitrites and nitrates are produced (423)

**nitrogen-containing base** a DNA nucleotide containing nitrogen, a sugar molecule, and a phosphate group (185)

**nitrogen cycle** the pathway that nitrogen follows within an ecosystem

**nitrogen fixation** the process by which gaseous nitrogen in the air is converted into ammonia (251)

**nitrogen-fixing bacteria** bacteria that live in the roots of legumes and convert atmospheric nitrogen into ammonia (423)

**node** the end of the internode where one or more leaves are attached **nondisjunction** the failure of homologous chromosomes to separate during meiosis or the failure of sister chromatids to separate during mitosis (225)

**nonutilitarian value** the intrinsic value of biodiversity apart from any human use or economic value (451)

**nonvascular plant** a plant that lacks vascular tissue and true roots, stems, and leaves (581)

**norepinephrine (noradrenaline)** a chemical that is a hormone in the

endocrine system and is a neurotransmitter in the nervous system (1035)

**notochord** a flexible rod of tissue found in the dorsal part of chordates

**nuclear envelope** a double membrane that surrounds the nucleus of a

eukaryotic cell (80)

**nuclear matrix** the nuclear skeleton, a shape-maintaining protein (80)

**nuclear pore** a small hole in the nuclear envelope through which substances pass between the nucleus and the cytoplasm (81)

**nucleic acid** an organic molecule, DNA or RNA, that stores and carries

important information for cell function

**nucleolus** the structure in which ribosomes are synthesized and partially

assembled; found in most nuclei (81)

**nucleotide** a monomer of DNA and RNA, consisting of a nitrogen base, a sugar, and a phosphate group (59)

**nucleus** in an atom, the core of protons and neutrons; in a eukaryotic cell, the organelle that contains most of the DNA and directs most of the cell’s activities

**nutrient** a chemical substance an organism needs to grow and function

properly (977)

**nyctinastic movement** plant movement in response to the daily cycle of light and temperature (655)

**nymph** an immature form of an insect (768)

**O**

**obligate aerobe** an organism that requires oxygen (476)

**obligate anaerobe** an organism that requires the absence of oxygen

**obligate intracellular parasite** a parasite that requires a host cell in order to reproduce (491)

**oceanic zone** one of two subareas of the pelagic zone (432)

**ocular lens** in a microscope, the lens in the eyepiece (21)

**olfactory lobe** the brain region that interprets smell (812)

**olfactory nerve** the nerve that carries impulses from olfactory receptors in the nasal passage to the brain (721)

**omnivore** an animal that eats both plants and animals (416)

**oncogene** a gene that induces cancer or other uncontrolled cell proliferation; a mutated or activated proto-oncogene that is associated with the development of tumor cells (213)

**oogenesis** the production of mature egg cells (155)

**oogonium** a unicellular gametangium that produces eggs (528)

**open circulatory system** a system in which the circulatory fluid is not

contained entirely within vessels (675)

**operator** a sequence of DNA to which a repressor binds to prevent mRNA synthesis from the adjacent gene; characteristically composed of one or more palindromic sequences (204)

**operculum** in fish, a hard plate attached to each side of the head that covers gills and is open at the rear (808)

**operon** a unit of DNA common in bacteria and phages consisting of clusters of regulated genes

**opportunistic infection** an infection that does not normally cause disease but becomes pathogenic if the patient’s immune system is weakened

**optic nerve** the nerve that transmits signals from the retina of the eye to the brain (1021)

**optic tectum** an area of the fish brain that receives and processes information from the fish’s visual, auditory, and lateral line systems

**oral groove** a funnel-like structure used by ciliates for feeding (514)

**oral surface** the surface of an echinoderm where the mouth is located

**order** in taxonomy, a group of similar families (338)

**organ** several types of body tissues that together perform a function (86)

**organelle** one of several formed bodies with a specialized function that is suspended in the cytoplasm and found in eukaryotic cells (71)

**organ of Corti** in the ear, the middle fluid-filled chamber of the cochlea; the organ of hearing (1019)

**organ system** a group of organs that interact to perform a set of related tasks

**organic compound** a compound that is derived from living things and contains carbon (52)

**origin** attachment point of a tendon to a stationary bone (919)

**osculum** an opening at the top of a sponge through which water leaves the sponge (693)

**osmosis** the diffusion of water across a selectively permeable membrane

**ossicle** one of the small calcium carbonate plates that make up the endoskeleton of an echinoderm (782)

**ossification** process by which cartilage is converted to bone (912)

**osteoarthritis** degenerative joint disease (914)

**osteocyte** a living bone cell (911)

**oval window** the membrane that separates the middle ear from the inner ear

**ovary** an egg-producing gonad of a female (1050)

**oviparity** in which organisms produce eggs that hatch outside the body of the mother (849)

**ovipositor** in many female insects, a structure at the end of the abdomen used for laying eggs (768)

**ovoviviparity** in which organisms produce eggs that hatch inside the body of the mother (849)

**ovulation** menstrual stage in which the ovarian follicle ruptures and releases an egg (1052)

**ovule** the megasporangium of a flowering plant (630)

**ovum** a female gamete or an egg (1050)

**oxaloacetic acid** a four-carbon compound that combines with acetyl CoA in the Krebs cycle to produce citric acid (134)

**oxidation reaction** a chemical reaction in which a reactant loses one or more electrons, becoming more positive in charge (37)

**oxygen debt** a temporary lack of oxygen availability due to exertion

**oxytocin** a hormone that stimulates uterine contractions during childbirth

**ozone** a molecule composed of three atoms of oxygen; ozone in the upper

atmosphere shields the Earth from ultraviolet radiation (271)

**P**

**P1** a strain obtained through self-pollination (166)

**pacemaker** the sinoatrial node that regulates the contraction of the heart

**palisade mesophyll** in plants, a layer of mesophyll directly beneath the upper epidermis where most photosynthesis takes place (616)

**pancreas** the organ that lies behind the stomach and produces and secretes insulin, glucagon, and digestive enzymes (809)

**papilla** bumps of tissue on the tongue, between which are embedded taste buds

**parallel venation** in plants, the arrangement of several main veins parallel to each other (616)

**parapodium** one of the fleshy appendages on each side of most segments in a polychaete annelid (733)

**parasite** an organism that obtains its nutrition at the expense of another

**parathormone** a hormone that regulates the levels of calcium ions and

phosphate ions in the blood (1037)

**parathyroid gland** a gland that secretes hormones that regulate calcium and phosphate ions in the blood (1037)

**parenchyma** in plants, the living tissue of the ground system, consisting of cells with thin cell walls (599)

**passive transport** the movement of substances across a cell membrane without the use of cell energy

**pathogen** an organism that causes disease

**pathology** the scientific study of disease (804)

**pectoral fin** a fin located on the side of a fish body just behind the head

**pedicellaria** one of many pincerlike structures on the surface of certain

echinoderms (785)

**pedigree** a diagram of the genetic history of an individual; can show how a trait is inherited over several generations (227)

**pedipalp** in arachnids, an appendage that aids in chewing (753)

**pellicle** a rigid protein covering of some unicellular organisms (514)

**pelvic fin** in fishes, one of the paired fins positioned in the ventral, posterior portion of the body (808)

**pelvis** the hipbones (319)

**penicillin** antibiotic drug that combats bacteria by interfering with bacterial cellwall synthesis (479)

**pentaradial symmetry** body symmetry in which body parts extend from the center along five spokes (782)

**pepsin** digestive enzyme of the stomach (986)

**peptide bond** a covalent bond between two amino acids (57)

**peptidoglycan** a protein-carbohydrate compound found in the cell walls of bacteria (468)

**pericardium** the tough saclike membrane that surrounds the heart (931)

**pericycle** in plants, the outermost cylinder of cells in the central vascular area

**periosteum** the tough outer membrane of a bone; the point where tendons attach muscles to bones (910)

**peripheral nervous system** the network of nerves that connects the central nervous system with all parts of the body (1004)

**peripheral protein** a protein attached to the interior or exterior surface of the cell membrane (74)

**peristalsis** a series of rhythmic muscular contractions that force food through the digestive system (985)

**permafrost** in the tundra, a permanently frozen layer of ground (425)

**pesticide** a chemical used to control insects (564)

**petal** one of the leaf-shaped parts of the corolla of a flower, usually brightly colored and conspicuous (629)

**petiole** in leaves, the structure that attaches blade and stem (616)

**PGA** phosphoglycerate; a three-carbon molecule formed in the first step of the Calvin cycle (117)

**PGAL** glyceraldehyde phosphate; a three-carbon molecule formed in the second step of the Calvin cycle that can leave the cycle and be used to make other organic compounds (118)

**phagocyte** a cell that engages in phagocytosis (104)

**phagocytosis** a type of endocytosis in which a cell engulfs large particles or whole cells (103)

**pharyngeal pouch** a small outpocket of the anterior gut in a chordate

**pharynx** in flatworms, a muscular tube that leads to the gastrovascular cavity; in animals with a digestive tract, the part of the tract between the mouth and the esophagus (710)

**phenotype** the external appearance of an organism that is determined by the individual’s genotype (172)

**phenotype frequency** a ratio stating the number of times a specific phenotype occurs in a population in a single generation (175)

**phenylketonuria (PKU)** a genetic disorder in which the body cannot

metabolize phenylalanine (232)

**pheromone** a chemical released by an animal that affects the behavior or development of other animals (771)

**phloem** in plants, the specialized tissue in the vascular system that transports dissolved sugars (580)

**phospholipid** a complex lipid having two fatty acids joined by a molecule of glycerol (58)

**photic zone** the layer of the ocean that receives light (431)

**photoautotroph** an organism that uses sunlight as an energy source

**photoperiodism** a plant response to changes in day length (656)

**photosynthesis** the conversion of light energy into chemical energy stored in organic compounds (10, 111)

**photosystem** in plants, a unit of several hundred chlorophyll molecules and carotenoid pigment molecules in the thylakoid membrane (114)

**phototropism** plant growth in response to light (652)

**pH scale** a numeric range that quantifies the relative concentrations of

hydronium ions and hydroxide ions in a solution (42)

**phycobilin** a pigment in red algae capable of absorbing the wavelengths of extremely dim light, allowing red algae to exist in very deep water

**phylogeny** the evolutionary history of a species or taxonomic group

**phylum** in taxonomy, a group of similar classes (338)

**phytochrome** a pigment in plants that monitors changes in day length

**phytoplankton** a photosynthetic, aquatic microorganism (525)

**pia mater** the innermost layer of the three sacs that surround the brain and spinal cord (1007)

**pigment** in plants, a compound that absorbs light and imparts color

**pilus** an appendage that bacteria use to attach to objects (475)

**pineal gland** endocrine gland that secretes melatonin (1037)

**pinocytosis** a type of endocytosis in which a cell engulfs solutes or fluids (103)

**pinworm** roundworm parasite that lives in the lower intestine of humans but causes no serious disease (717)

**pioneer species** the first species to colonize a new habitat (406)

**pistil** a plant structure formed of fused carpels (629)

**pith** the plant tissue located in the center of the stem (606)

**pituitary gland** the endocrine gland suspended directly below the brain that secretes several different regulatory hormones (1032)

**pivot joint** allows movement from side to side and up and down, as in the top two vertebrae of the spine (913)

**placenta** the organ that nourishes unborn young (884)

**placental mammal** an animal that nourishes its young through a placenta inside the mother’s body (884)

**placoid scale** a toothlike spine found on shark skin (804)

**plankton** the abundant small plant and animal organisms that drift or swim weakly near the surface of a body of water (432)

**plant growth regulator** a hormone that affects growth (421)

**planula** a free-swimming, ciliated larva of cnidarians (700)

**plasma** the liquid component of blood (939)

**plasma cell** a differentiated B cell that produces antibodies and secretes them into the blood (962)

**plasmid** a single ring of extrachromosomal DNA in bacteria (240)

**plasmodial slime mold** a member of phylum Myxomycota; a multinucleate mass of cytoplasm that engulfs food by phagocytosis

**plasmodium** the multinucleate cytoplasm of a slime mold surrounded by a membrane that moves as a mass (517)

**plasmolysis** the shrinking or wilting of a walled cell in a hypertonic

environment (98)

**plastid** an organelle of plant cells that contains starch, fats, or pigments

**plastron** the ventral portion of a turtle shell (850)

**platelet** a partial cell needed to form blood clots (941)

**plumule** in plants, the structure composed of the epicotyl plus any embryonic leaves (636)

**point mutation** the change of a single nitrogen-containing base within a codon

**polar body** one of two small cells produced and discarded during each of the two meiotic divisions that yield the haploid egg (156)

**polar compound** a compound with one side having a negative charge and the

other side a positive charge (49)

**polar nucleus** in plants, a nucleus that migrates to the center of the cell during embryo-sac formation (630)

**pollen grain** the microgametophyte of seed plants (628)

**pollen tube** a structure that grows from a pollen grain, down which the sperm travels to the eggs (628)

**pollination** the transfer of pollen from an anther to a stigma of a flower of the same species (166)

**pollinator** an animal that carries pollen, such as insects, birds, or bats

**pollution** an alteration of the natural environment producing a condition that is harmful to living organisms (825)

**polygenic trait** a trait controlled by multiple genes (229)

**polymer** a compound consisting of repeated linked monomers (53)

**polymerase chain reaction (PCR)** technique used to quickly make many copies of selected segments of DNA (245)

**polyp** a sessile, vase-shaped stage in the life cycle of a cnidarian (696)

**polypeptide** a long chain of several amino acids

**polysaccharide** a complex carbohydrate composed of three or more

monosaccharides (56)

**pons** a segment of the brain stem (1007)

**population** all the members of a species that live in the same area and make up a breeding group (363)

**population density** the number of individuals in a population in a given area at a specific time (380)

**population genetics** the study of evolution from a genetic point of view

**posterior** the back or dorsal side of an organism (670)

**postzygotic isolation** a barrier to successful breeding that occurs after

fertilization, such as the production of nonviable or sterile offspring

**power of magnification** in a microscope, the factor of enlargement (22)

**precocial** referring to birds that, when hatched, are physically active and

relatively mature (870)

**preen gland** the oil-secreting gland of a bird (864)

**preening** in birds, the act of grooming their feathers with oil secreted by the preen gland (864)

**prehensile** grasping, as in a primate’s hand, foot, or tail (320)

**premolar** a tooth used to shear, shred, and grind (886)

**pre-mRNA** a form of mRNA that contains introns and exons (207)

**pressure-flow hypothesis** an explanation of the movement of sugars in the phloem of plants (612)

**prezygotic isolation** a barrier to successful breeding that occurs before

fertilization, such as differences in mating time or behavior (311)

**primary electron acceptor** a molecule in the thylakoid membrane that accepts the electrons that chlorophyll *a* loses in the light reactions (115)

**primary growth** the tissue produced by apical meristems in plants (602)

**primary host** the host from which the adults of a parasite derive their

nourishment and in which sexual reproduction occurs (712)

**primary immune response** an immunological response that occurs when an antigen is encountered for the first time (963)

**primary succession** the process of sequential replacement of populations in an area that has not previously supported life (406)

**primate** a member of the order Primates, the mammalian order that includes humans (320)

**primer** an artificially made single-stranded sequence of DNA required for the initiation of replication (245)

**prion** a glycoprotein particle implicated in diseases with long incubation periods

**probability** the number of times an event is expected to happen divided by the number of opportunities for an event to happen (173)

**probe** a radioactive segment of DNA used in DNA fingerprinting (244)

**producer** an autotrophic organism that captures energy to make organic

molecules (415)

**product** a compound formed by a chemical reaction (36)

**progesterone** a steroid hormone secreted by the corpus luteum of the ovary that stimulates the uterine lining to prepare for the implantation of a fertilized egg; produced by the placenta during pregnancy (1035)

**proglottid** one of the many body sections of a tapeworm; contains reproductive organs (713)

**prokaryote** a unicellular organism that lacks a nucleus and membrane-bound organelles (72)

**prolactin** a hormone that stimulates and maintains milk production

**promoter** a nucleotide sequence on a DNA molecule that, when attached to an RNA polymerase molecule, will initiate transcription of a specific structural gene

**prophage** an intracellular bacteriophage that is harmless to the host cell

**prophase** the first stage of mitosis and meiosis, characterized by condensation of chromosomes (150)

**prosimian primate** a suborder of modern primates that includes lemurs,

lorises, and tarsiers (320)

**prostaglandin** a hormonelike chemical messenger that functions as a cell regulator (1031)

**protease inhibitor** an antiviral drug that interferes with the synthesis of viral capsids during viral replication; in combination with AZT has shown some promise in treating patients infected with HIV (498)

**protein** an organic compound composed of one or more chains of polypeptides, which in turn are formed from amino acids (56)

**protein synthesis** the formation of proteins using information coded on DNA and carried by RNA (193)

**prothorax** the most anterior segment of an insect’s thorax (765)

**proton** a subatomic particle with a positive charge (32)

**proto-oncogene** oncogene precursor that controls a cell’s growth and

differentiation (214)

**protostome** an organism in which the blastopore develops into the mouth and the coelom arises by schizocoely and whose embryo has determinate cleavage

**protozoan** a single-celled, eukaryotic protist that is able to move independently

**proventriculus** the first of two chambers in the stomach of a bird (866)

**provirus** a viral DNA molecule produced by reverse transcriptase (495)

**pseudocoelom** in animals, a cavity between the mesoderm and the endoderm

**pseudoplasmodium** a group of cells that act together as a unit to form a

sporangium (534)

**pseudopodium** a retractile, temporary cytoplasmic extension that functions in movement in certain ameboid organisms (512)

**psychoactive drug** a chemical compound that affects the central nervous system (1075)

**puberty** a stage of human life when the sex organs mature and secondary sex characteristics appear (1035)

**pulmonary artery** the artery that carries deoxygenated blood from the heart to the lungs (935)

**pulmonary circulation** the movement of blood between the heart and the lungs (935)

**pulmonary respiration** a type of respiration involving lungs, in which air is inhaled and exhaled by changing the volume and pressure of air in the mouth

**pulmonary vein** the vein that carries oxygenated blood from the lungs to the heart (936)

**punctuated equilibrium** a theory that speciation occurs during brief periods of rapid genetic change (312)

**Punnett square** a model used to establish the probabilities of the results of a genetic cross (l74)

**pupa** a stage in which an insect that goes through complete metamorphosis changes from a larva to an adult (769)

**pupil** the opening in the eye that allows light to enter (1020)

**purine** an organic molecule that has a double ring of carbon and nitrogen atoms

**pyloric sphincter** the valve that separates the stomach from the small intestine

**pyloric stomach** in a sea star, the stomach that is connected to the digestive glands (786)

**pyrenoid** a small protein structure that stores startch; found within the

chloroplasts of certain algae (525)

**pyrimidine** an organic molecule that has a single ring of carbon and nitrogen atoms (186)

**pyruvic acid** a three-carbon molecule that is the end product of glycolysis

**Q**

**quadrupedal** able to walk on four limbs (324)

**queen bee** the only fertile female in a hive of honeybees (772)

**queen factor** a pheromone secreted by a queen bee that prevents other female larvae from developing into fertile females (773)

**quinine** a drug used to treat malaria (399)

**R**

**radial canal** the portion of a sea star’s water-vascular system that runs the length of each arm (786)

**radial cleavage** in deuterostomes, the division of cells parallel to or at right angles to the polar axis of a fertilized egg (684)

**radial nerve** a nerve that runs along the length of each arm of a sea star

**radial symmetry** in animals, an arrangement of body parts around a central axis (670)

**radicle** in plants, the embryonic root (636)

**radioactive dating** a method of determining the age of an object by measuring the amount of a specific radioactive isotope it contains (264)

**radioactive decay** the release of particles or radiant energy by the unstable nuclei of some isotopes (265)

**radioactive isotope** an isotope with an unstable nucleus (265)

**radula** a rough, tonguelike structure used in feeding by many mollusks

**ray-finned fish** a fish with fins supported by several flexible bones rather than a single bony axis (807)

**reabsorption** a process in the kidney by which materials return to the blood from the nephron (994)

**reactant** a compound or atom involved in a chemical reaction (36)

**realized niche** the range of resources and conditions a species actually uses or can tolerate at optimal efficiency; smaller than fundamental niche (372)

**receptacle** the swollen tip of a branch that is the base of a flower (629)

**receptor site** the area of a cell membrane where antigen attachment takes place

**recessive** referring to an allele that is masked by the presence of another allele for the same characteristic (168)

**recombinant DNA** a DNA segment from at least two different organisms

**rectal gland** in fishes, a gland that removes excess sodium and chloride ions from the blood and releases them into the rectum for elimination

**red tide** discoloration of sections of the ocean caused by a population explosion of certain dinoflagellates; contains a poisonous alkaloid produced by the dinoflagellates (528)

**redox reaction** a reduction-oxidation reaction in which electrons are transferred between atoms (37)

**reduction reaction** a chemical reaction in which a reactant gains one or more electrons, becoming more negative in charge (37)

**regeneration** the regrowth of missing body parts (695)

**regulator** an organism that uses energy to control its internal environment (370)

**regulator gene** a genetic unit that regulates or suppresses the activity of one or more structural genes (205)

**releasing hormones** hormones secreted by the hypothalamus that stimulate the anterior pituitary (1033)

**release-inhibiting hormone** hormones secreted by the hypothalamus that inhibit the anterior pituitary (1033)

**renal circulation** a subsystem of the systemic circulation that involves the movement of blood through the kidneys (936)

**renal pelvis** the central structure of the kidney (992)

**renal tubule** a long tube with permeable walls in a nephron (993)

**replication** the process by which DNA copies itself during interphase

**replication fork** the points at which the DNA strands separate during

replication (188)

**repressor** in the *lac* operon, a protein that inhibits an operator and thus stops gene expression (204)

**reproduction** the production of new offspring (7)

**reproductive isolation** the inability of formerly interbreeding organisms to produce offspring (311)

**resolution** the power of a microscope to show detail (21)

**resource partitioning** among similar species, a pattern of resource use in which species reduce their use of shared resources (401)

**restoration biology** the science of reversing major changes in ecosystems and replacing missing ecosystem components (452)

**restriction enzyme** a protein that recognizes specific sequences in a DNA molecule and cuts it into pieces (239)

**reticular formation** a network of nerve fibers running through the brain stem and the thalamus (1007)

**retina** the light-sensitive inner layer of the eye (1020)

**retrovirus** a virus, such as HIV, that contains RNA and reverse transcriptase

**reverse transcriptase** an enzyme that makes DNA from an RNA template

**RFLP analysis** restriction fragment length polymorphism; the method for preparing a DNA fingerprint (244)

**Rh factor** a type of antigen found in the blood that may cause complications during some pregnancies (943)

**rheumatoid arthritis** an immune-system disorder causing painful joints

**rhizoid** a rootlike structure attaching a gametophyte to soil, rock, or tree bark; a rootlike structure that anchors fungal hyphae to a solid substance

**rhizome** the underground stem of a fern sporophyte (588)

**ribonucleic acid (RNA)** a nucleic acid composed of a single strand and

distinguished from DNA by containing ribose and uracil (59)

**ribose** the five-carbon sugar in RNA (190)

**ribosomal RNA (rRNA)** the type of RNA found in a ribosome (191)

**ribosome** an organelle that functions in the synthesis of proteins (77)

**ribozyme** a type of RNA that is able to act as an enzyme (270)

**ring canal** the portion of a sea star’s water-vascular system that encircles the mouth (786)

**RNA polymerase** the primary transcription enzyme (192)

**root cap** a shield covering the apical meristem (604)

**root crop** a plant grown for the nutrients it stores in its roots or modified

underground stems (563)

**root hair** an extension of the epidermal cells (604)

**rotifer** a small, aquatic invertebrate with a crown of cilia surrounding its mouth

**rough endoplasmic reticulum** the portion of the endoplasmic reticulum that contains attached ribosomes (76)

**roundworm** a worm in the phylum Nematoda with a long, slender body that tapers at both ends, such as hookworms and pinworms (715)

**royal jelly** a high-protein substance secreted by worker bees and fed to the queen and the youngest larvae (772)

**RuBP** ribulose bisphosphate; a five-carbon carbohydrate that combines with CO2 to form two molecules of PGA in the first step of the Calvin cycle (117)

**rumen** the storage chamber in the stomach of artiodactyls, such as the antelope and the bison (887)

**S**

**saddle joint** type of joint found at the base of each thumb; allows grasping and rotation (913)

**saliva** a watery fluid secreted into the mouth; moistens food and begins

digestion (984)

**saprophyte** an organism that feeds on dead organic material (476)

**sapwood** lighter-colored wood near the outside of a tree trunk active in

transporting sap; tissue of the secondary xylem system (611)

**sarcoma** a tumor growing in bone or muscle tissue (211)

**sarcomere** the basic contractile unit of skeletal and cardiac muscle that is the portion of the myofibril between two adjacent Z lines (917)

**saturated solution** a solution in which no more solute can dissolve (40)

**savanna** subtropical or tropical grassland with scattered trees and shrubs (428)

**scanning electron microscope** a microscope that produces an enlarged image of the surface of an object with a beam of electrons rather than light (22)

**schistosomiasis** a disease caused by a parasitic blood fluke of the genus

*Schistosoma* (713)

**schizocoely** the method of coelom formation in protostomes that involves splitting the embryonic mesoderm into two layers (685)

**sclerenchyma** the tissue of the ground system that supports and strengthens the plant (600)

**scolex** a knob-shaped organ bearing hooks and suckers; lies at the anterior end of a tapeworm (713)

**scrotum** an external sac of skin that contains the testes (1048)

**second messenger** a chemical signal that relays a message from a cell’s surface to its interior (1030)

**secondary compound** a poisonous, irritating, or bad-tasting substance

synthesized by plants as a defense mechanism (398)

**secondary growth** the tissue produced by lateral meristems of plants

**secondary immune response** the response to a subsequent infection by the same pathogen (963)

**secondary succession** the sequential replacement of populations in a disrupted habitat (406)

**sediment** dust, sand, or mud deposited over time by wind or water (279)

**seed** a plant embryo enclosed in a protective coat (579)

**seed coat** the protective structure of a plant seed (636)

**seed plant** a plant that produces seeds for reproduction (581)

**segmentation** division of a body into units (675)

**selectively permeable membrane** a membrane that keeps out some molecules but allows others to pass through (73)

**self-pollination** pollination involving the same flower, flowers on the same plant, or two genetically identical plants (166)

**semen** a fluid formed from sperm and various exocrine secretions (1048)

**semicircular canal** a structure in the inner ear that helps maintain balance

**semilunar valve** valve that separates the ventricles from the large vessels on each side of the heart (932)

**semimovable joint** a joint that allows limited movement, as in vertebrae

**seminal receptacle** a structure on a female or hermaphrodite invertebrate that

receives sperm (735)

**seminiferous tubules** the location of sperm formation in the testes

**sense organ** an organ that contains sensory neurons which detect external stimuli (1017)

**sensory division** a division of the peripheral nervous system that acquires information from the external and internal environments of the body (1009)

**sensory neuron** a neuron that transmits impulses from sensory receptors to the central nervous system (1004)

**sensory receptor** a neuron that detects a stimulus (1009)

**sepal** a modified leaf that protects a young flower (629)

**septum** a wall dividing hyphae into cells; a thick wall that divides an organ, such as the heart (931)

**sessile** referring to an organism that attaches firmly to a surface and does not move (694)

**seta** one of the external bristles on annelids (733)

**sex chromosome** a chromosome that determines sex (146)

**sex-influenced trait** a trait that is influenced by the presence of male or female sex hormones (229)

**sex-linkage** the presence of a gene on a sex chromosome (222)

**sexual reproduction** the production of offspring from the combination of genetic material from two parent organisms (156)

**sexual selection** the preferential choice of a mate based on a specific

phenotypic trait (308)

**shaft** the center of a bird feather (864)

**short-day plant** a plant that flowers when exposed to day lengths shorter than the plant’s critical length (656)

**sieve plate** a region at the end of a sieve tube member through which

compounds move from cell to cell (601)

**sieve tube** structure formed by stacked sieve tube members (601)

**sieve tube member** the conducting cell of angiosperm phloem (601)

**simple leaf** a leaf with only one blade (616)

**single-allele trait** a trait controlled by a single allele (228)

**sink** the place where a plant stores or uses sugars (613)

**sinoatrial node** the nerve tissue in the right atrium that regulates the contraction rate of the heart (933)

**sinus venosus** in fishes and amphibians, a collecting chamber for deoxygenated blood (810)

**siphon** on a clam, a tube through which water enters or leaves the body

**SI Système International d’Unités** (International System of Measurements) the scientific standard of measurement which employs a set of units that describe length, mass, time and other attributes of matter

**skeletal muscle** voluntary muscle, attached to bones by tendons, that moves parts of the body (905)

**skeleton** the bones of an animal body that form its internal framework

**skin gill** one of many hollow tubes that project from the surface of a sea star, through which gas exchange and excretion take place (785)

**smooth endoplasmic reticulum** the portion of the endoplasmic reticulum that lacks attached ribosomes (76)

**smooth muscle** elongated, spindle-shaped involuntary muscles (except cardiac muscles) (905)

**sodium-potassium pump** a carrier protein that actively transports K+ ions into and Na+ ions out of cells (101)

**soft palate** a soft area made of folded membranes that separates the mouth cavity from the nasal cavity (984)

**solar tracking** the phototropism of leaves or flowers as they follow the sun’s movement across the sky (653)

**solute** a substance dissolved in a solution (40)

**solution** a mixture in which one or more substances are uniformly dissolved in another substance (40)

**solvent** in a solution, the substance in which a solute is dissolved (40)

**somatic mutation** a mutation that occurs in a body cell (224)

**somatic nervous system** the division of the peripheral nervous system that controls skeletal muscles (1009)

**sorus** a cluster of sporangia in ferns (627)

**source** the place where sugars are made in a plant (613)

**spawning** the egg-laying behavior of some bony fishes (812)

**specialist** a species with a narrow niche that can tolerate a narrow range of conditions and can use only a few specific resources (372)

**specialization** the differentiation of a cell for a particular function (667)

**speciation** the formation of a new species (309)

**species** a group of organisms of a single type that are capable of producing fertile offspring in the natural environment (338)

**species-area effect** a pattern of species distribution in which larger areas

contain more species than smaller areas do (404)

**species diversity** an index combining the number and relative abundance of different species in a community (403)

**species identifier** the second part of a species name; humans are known by genus name *Homo* and by species identifier *sapiens*; specific epithet

**species name** the two-part scientific name of a species composed of the genus and the species identifier (339)

**species richness** the number of different species in a community (403)

**spermatid** in meiosis, a haploid cell that develops into a mature sperm cell

**spermatogenesis** the production of sperm cells (155)

**S phase** the second period of interphase during which replication of DNA occurs (132)

**spicule** one of the small, spike-shaped particles of calcium carbonate or silicon dioxide that make up the skeleton of some sponges (693)

**spinal cavity** the area that surrounds and protects the spinal cord (908)

**spinal cord** a column of nerve tissue running through the vertebral column

**spinal nerve** a nerve connection between the spinal cord and an organ or muscle (812)

**spinal reflex** a muscular reaction to a stimulus that is initiated by the neurons of the spinal cord instead of the brain (1009)

**spindle fiber** one of the microtubules that extend across a dividing eukaryotic cell; assists in the movement of chromosomes (150)

**spinneret** the structure through which fluid from the silk gland of spiders passes (752)

**spiracle** an external opening of a trachea in an insect, myriapod, or spider (752)

**spiral cleavage** in protostomes, the division of cells in a spiral arrangement

(684)

**spirillum** spiral-shaped eubacteria (470)

**spirochete** Gram-negative, spiral-shaped, heterotrophic bacterium (472)

**spleen** the largest lymphatic organ in the body; serves as a blood reservoir, disintegrates old red blood cells, and produces lymphocytes and plasmids (959)

**sponge** a sessile, aquatic invertebrate in the phylum Porifera with no true tissues or organs (693)

**spongin** the network of protein fibers making up the simple skeleton of some sponges (693)

**spongy bone** the lacy network of connective tissue in the center of a bone (911)

**spongy mesophyll** a mesophyll of irregularly shaped cells surrounded by air spaces that allow oxygen, carbon dioxide, and water to diffuse into and out of the leaf (616)

**spontaneous generation** an early and now disproved hypothesis that living organisms develop from nonliving material (261)

**sporangiophore** in some fungi, an upright hypha that produces sporangia

**sporangiospore** in fungi, a specialized hypha supporting a sporangium

**sporangium** a spore-bearing sac in plants, algae, and fungi (544)

**spore** a resistant reproductive cell of some organisms, such as certain plants, protists, and fungi (535)

**sporophyte** one of the diploid generation of land plants that produce spores

**sporozoite** a sporozoan that has been released from the oocyst and is ready to penetrate a new host cell (517)

**springwood** in woody plants, secondary xylem with cells that are wide and thin walled; the first wood of a growing season (611)

**stabilizing selection** a type of natural selection in which the average form of a trait causes an organism to have an advantage in reproduction

**stamen** the structure in the flower of plants that produces pollen (629)

**staphylococcus** eubacterium occurring in grapelike clusters (470)

**start codon** the codon AUG which engages a ribosome to start translating an mRNA molecule (194)

**steroid** a lipid in which the molecule is composed of four carbon rings

**steroid hormones** a class of hormones synthesized from cholesterol

**sticky end** the single-stranded end of a double-stranded DNA fragment that can form base pairs with another sticky end of a DNA fragment cut by the same enzyme (240)

**stigma** an expanded apex of a pistil, supported by the style; the part of the pistil that receives pollen (166)

**stimulant** a drug that increases the activity of the central nervous system

**stipe** in some algae, the stemlike region of a thallus (531)

**stolon** the horizontal hypha of some fungi (546)

**stoma** one of many small pores usually located on the underside of a leaf; aids in gas exchange (119)

**stomach** an organ that prepares food for absorption by both physical and

chemical activities (985)

**stone canal** part of the water-vascular system in sea stars that connects the madreporite with the ring canal (786)

**stop codon** causes the ribosome to stop translating mRNA; UAA, UAG, UGA

**stratum** in geology, a layer of soil or rock in a cross section of the Earth

**streptococcus** Gram-positive eubacterium occurring in chains (470)

**strobilus** a conelike structure of sporangia-bearing leaves (587)

**stroma** in plants, the solution that surrounds the thylakoids in a chloroplast

**structural gene** a gene that codes for a product, such as an enzyme, protein, or RNA, rather than serving as a regulator (204)

**style** in plants, a stalklike structure of the ovary (629)

**subspecies** varieties of animal species that occur in different geographical areas

**substitution** a point mutation in which one nucleotide in a codon is replaced with a different nucleotide

**substrate** a part, substance, or element that lies beneath and supports another; the reactant in any enzyme-catalyzed reaction (57)

**succession** the predictable, sequential replacement of populations in an

ecosystem (406)

**sulfa drug** an antibiotic drug that combats bacteria by inhibiting bacterial cell metabolism (479)

**summerwood** in woody plants, secondary xylem cells that are small and thick walled and that are produced in hot, dry summers (611)

**superior vena cava** the large vein carrying blood from the upper part of the body (935)

**suppressor T cell** a type of T cell that shuts down the immune response after the pathogen has been eliminated (961)

**survivorship curve** the graph of a species’ mortality-rate data (382)

**swim bladder** in bony fishes, a gas-filled sac that is used to control bouyancy

**swimmeret** one of 10 bilaterally paired appendages on the abdomen of a

crayfish (748)

**swimmer’s itch** a condition characterized by minor skin irritation and swelling, caused by a small, brown fluke that usually lives in fresh water

**symbiosis** the relationship between different species living in close association with one another (397)

**sympathetic division** the part of the autonomic nervous system that controls internal organs during conditions of high stress or increased activity

**synapsis** the pairing of homologous chromosomes during meiosis (153)

**synovial joint** a joint filled with synovial fluid (914)

**syrinx** the vocal organ of birds (873)

**systematics** systematic taxonomy; taxonomic organization of living things in the context of evolution (342)

**systemic circulation** the movement of blood between the heart and all parts of the body except the lungs (935)

**systole** the phase of the heartbeat in which the ventricles contract and force blood into the arteries (933)

**systolic pressure** pressure of the blood when the ventricles contract

**T**

**tagma** in arthropods, a structure composed of several segments that have fused to perform specific functions (744)

**taiga** forested biome characterized by cone-bearing evergreen trees

**tapeworm** a parasitic flatworm that lives in the vertebrate intestine

**taproot** the organ that results when the primary root grows downward and becomes the largest root (603)

**tar** a sticky mixture of chemicals and particles from tobacco (1068)

**target cell** the specific cell affected by a hormone (1029)

**taste bud** a structure in which chemoreceptors for taste are clustered

**taxonomy** the science of grouping organisms according to their presumed evolutionary relationships (337)

**T cell** a thymus-derived lymphocyte that helps stimulate an immune response against an antigen and can attack certain antigens (499)

**tegument** a continuous sheet of fused cells that covers the external surface of a fluke or tapeworm and protects the worm from the host’s digestive and immune systems (712)

**telophase** the final stage of mitosis during which a nuclear membrane forms around each set of new chromosomes (151)

**telson** a flat, paddlelike projection at the posterior end of many crustaceans

**temperate** referring to a nonvirulent virus, rarely causing disease; moderate, not subject to prolonged extremes of hot or cold (493)

**temperate deciduous forest** a forest characterized by trees that shed their leaves in the fall (426)

**tendon** a tough, solid band of connective tissue that supports and connects body parts (919)

**tendril** a specialized leaf found in many vines that takes on a coiled appearance

**tentacle** a flexible appendage with which an animal feels its environment or grasps objects (696)

**termination signal** a specific sequence of nucleotides that marks the end of a gene in eukaryotes (192)

**test** the shell, or hardened covering, of some invertebrates (783)

**test cross** the crossing of an individual of unknown genotype with a

homozygous recessive individual to determine the unknown genotype

**testis** the gamete-producing gonad of a male (1047)

**testosterone** a hormone that regulates male secondary sex characteristics and the production of sperm cells (1035)

**tetracycline** an antibiotic drug that combats bacteria by interfering with bacterial protein synthesis (479)

**tetrad** a group of two homologous chromosomes during meiosis (153)

**thalamus** the brain structure that directs incoming sensory impulses to the proper region of the cerebral cortex (1006)

**thallus** the body of an alga (525)

**theory** a broad and comprehensive statement of what is believed to be true, supported by considerable experimental evidence resulting from many tests of related hypotheses (19)

**thermoacidophile** an archaebacterium that lives only in hot, acid places

**thermoregulation** control of body temperature (848)

**thigmotropism** a plant’s growth response to touching a solid object, as in the tendrils of vines that coil when they touch an object (653)

**thoracic cavity** the upper ventral cavity of the human body, containing the heart, lungs, and esophagus (908)

**thorax** in insects and some crustaceans, the part of the body between the head and the abdomen; in mammals, the part of the body between the neck and the abdomen (748)

**thylakoid** a flattened, membranous sac inside a chloroplast; contains most of the components involved in the light reactions of photosynthesis

**thymine** a nitrogen-containing base, one component of a nucleotide

**thymosin** a hormone produced in the thymus gland that stimulates the

differentiation of T cells (1037)

**thymus gland** endocrine gland involved in immune-system development

**thyroid gland** the endocrine gland that secretes thyroxine (1034)

**thyroxine** a thyroid hormone that increases metabolism (1034)

**tissue** in most multicellular organisms, a group of similar cells that carry out a common function (86)

**tissue culture** the growing of living cells in a controlled medium (640)

**tolerance** a lessening response to a drug as a result of physical addiction

**tolerance curve** a graph of an organism’s tolerance to a range of an

environmental variable (369)

**topsoil** the uppermost layer of soil (822)

**torpor** a state of stupor (556)

**torsion** a process occurring during the larval development of gastropods in which the visceral mass twists 180° in relation to the head (727)

**toxin** a chemical substance, usually biological in origin, that is harmful to the normal functioning of cells (478)

**toxoplasmosis** a disease caused by a sporozoan that can cause serious harm to fetuses and newborns and can cause flulike symptoms in adults

**trachea** in insects, myriapods, or spiders, one of a network of air tubes; in vertebrates, the tube that connects the pharynx to the lungs (752, 945)

**tracheid** a long, thick wall with tapering ends, forming part of the xylem tissue of plants (601)

**trait** in genetics, a category within which alternate characteristics, such as height and eye color, can be observed (165)

**transcription** the process in which RNA is made from DNA (191)

**transcription factor** one of the additional proteins bound to enhancers and RNA polymerase that regulate transcription (208)

**transduction** in viruses, the process in which genetic material is transferred from one cell to another (477)

**transfer RNA (tRNA)** the type of RNA that carries amino acids from the cytoplasm to the ribosomes (191)

**transformation** a process of direct transfer of nucleic acid from one bacterium to another (477)

**transgenic organism** a host organism that has received recombinant DNA

**translation** the process of converting the genetic code in RNA into the amino acid sequence that makes up a protein (194)

**translocation** a mutation in which a broken piece of chromosome attaches to a nonhomologous chromosome; movement of organic molecules in plant tissues

**transmission electron microscope** a microscope that transmits a beam of electrons rather than light through a thinly sliced specimen (22)

**transpiration** the evaporation of water through stomata (421)

**trichinosis** a disease caused by a parasitic roundworm of the genus

*Trichinella;* characterized by muscle pain and stiffness (717)

**triglyceride** a lipid made of three fatty-acid molecules and one glycerol

molecule (58)

**trimester** one of three divisions of pregnancy (1055)

**trisomy** a chromosomal anomaly in which an individual has an extra

chromosome in any of the chromosome pairs (231)

**trisomy 21** a human congenital disorder caused by trisomy of chromosome 21 due to the failure of the sister chromatids to separate during mitosis or the failure of homologous chromosomes to separate during meiosis (see Down syndrome) (231)

**trochophore** a free-swimming, ciliated larva of most mollusks and some annelids (725)

**trophic level** a feeding level in an ecosystem (417)

**tropical rain forest** a biome near the equator characterized by large amounts of rain and sunlight (429)

**tropism** plant movement toward or away from an environmental stimulus (652)

**trypanosomiasis** any of the forms of sleeping sickness or Chagas’ disease

**tube cell** the cell of a pollen grain that contains the tube nucleus (631)

**tube foot** one of many small, flexible, fluid-filled tubes that project from the body of an echinoderm and are used in locomotion, feeding, gas exchange, and excretion (782)

**tumor** an abnormal mass of cells (211)

**tumor-suppressor gene** a gene that suppresses tumor formation but when mutated causes a loss in cell function, resulting in tumor formation

**tundra** a biome of low-growing vegetation that forms a continuous belt across North America, Europe, and Asia (425)

**turgor pressure** water pressure within a plant cell (98)

**tympanic membrane** the eardrum (1018)

**tympanum** a sound-sensing membrane on each side of the abdomen of an insect (767)

**typhlosole** in an earthworm, an infolding of the intestinal wall (734)

**U**

**umbilical cord** blood vessels that connect the placenta to the fetus (1056)

**ungulate** a hoofed mammal (894)

**unicellular gametangium** a single-celled gamete holder (321)

**unicellular organism** a living thing composed of one cell (6)

**uniformitarianism** a principle that states that the geological structure of Earth resulted from cycles of observable processes and that these processes operate continuously (284)

**upwelling** cold water rising from the ocean floor bringing organic material and nutrients (442)

**uracil** a nitrogen-containing base found in RNA (190)

**urban ecology** a new environmental field wherein people are challenged to increase biodiversity even in the most heavily developed areas (458)

**urea** product of the liver’s conversion of ammonia that is eliminated by the kidneys (992)

**ureter** a narrow tube through which urine flows from the renal pelvis to the urinary bladder (995)

**urethra** the tube through which urine flows from the urinary bladder out of the body (995)

**urinary bladder** a muscular sac that stores urine (995)

**urine** a liquid containing nitrogenous wastes that have been removed from the blood (995)

**uropod** the most posterior appendage on many crustaceans (748)

**uterus** a female reproductive structure where eggs are stored or fertilized or where development of the young occurs (1051)

**utilitarian value** a way of relating the importance of biodiversity in terms of

the economic benefits biodiversity provides to humans (451)

**V**

**vaccine** a solution containing a harmless version of a virus, bacterium, or toxin that causes an immune response when introduced to the body

**vacuole** a fluid-filled organelle that stores enzymes or metabolic wastes in a plant cell (82)

**vane** the projection on either side of a bird’s feather (864)

**variety** a further division or subset of species (339)

**vascular cambium** the lateral meristem in a plant that produces additional vascular tissue (602)

**vascular plant** a plant that has xylem and phloem (581)

**vascular tissue system** the system that includes the xylem and phloem tissues of plants (601)

**vas deferens** a duct through which sperm leave the epididymis (1048)

**vasopressin** a hormone that helps control the amount of water excreted by the kidneys (1033)

**vegetable** food derived from any part of soft plants (563)

**vegetative propagation** asexual reproduction in plants (639)

**vein** a vessel carrying blood to the heart (934)

**venation** the arrangement of veins in a leaf (616)

**vent** in amphibians and reptiles, the opening through which waste and eggs or sperm exit the body (827)

**ventral** the bottom of a bilaterally symmetrical organism (670)

**ventricle** a lower, and the most muscular, chamber of the heart (931)

**venule** a small vessel in the network of veins (935)

**vernalization** the requirement that some seeds or spores be exposed to cold before they can germinate (658)

**vertebra** one of the repeating bony units of the backbone (677)

**vertebrate** an animal with a backbone (667)

**vesicle** a membrane-bound sac in a eukaryotic cell that contains materials involved in endocytosis, exocytosis, or transport within the cell (103)

**vessel** in plants, a structure formed by stacked vessel elements; in animals, a tubular conducting structure for blood or other body fluid

**vessel element** an elongated, water-conducting plant cell wall with slanting ends and holes through which water can pass (601)

**vestigial** referring to a functionless structure that was functional in an ancestral species (290)

**villus** one of the small projections lining the small intestine (988)

**viper** venomous snake with two large, mobile fangs at the front of the mouth

**viroid** a short, single strand of RNA that causes disease in plants (490)

**virology** the study of viruses (487)

**virulent** disease-causing and highly infectious (492)

**virus** a nonliving infectious particle composed of a nucleic acid and a protein coat (486)

**visceral mass** the central region of a mollusk, located between the head-foot and the mantle (726)

**visible spectrum** the portion of sunlight perceived by the human eye as various colors (112)

**vitamin** complex organic molecule that serves as a coenzyme; one of the basic six nutrients (980)

**viviparous** referring to organisms that carry and nourish the young inside the body before birth (849)

**voluntary muscle** a muscle whose movement can be consciously controlled

**vulva** the external part of the female reproductive system (1051)

**W**

**warning coloration** a bold, bright color pattern that makes dangerous, poisonous, or bad-tasting animals clearly recognizable and warns predators away (770)

**water cycle** the movement of water between the ground, the atmosphere, and bodies of water (420)

**water mold** a funguslike organism composed of branching filaments of cells, found in freshwater systems (535)

**water-vascular system** a network of water-filled canals in echinoderms (782)

**wavelength** the distance between crests in a wave (113)

**withdrawal** a reaction to the lack of a drug (1073)

**woody tissue** in plants, tissue that is formed from several layers of xylem, usually concentrated in the center of the stem (580)

**worker bee** a sterile female bee that makes up the majority of the beehive population (772)

**X**

**xylem** the vascular tissue in plants that transfers water and minerals from the roots to the leaves (580)

**X-linked gene** a gene found on the X chromosome (222)

**Y**

**yeast** unicellular fungus whose colonies resemble those of bacteria; known as the microorganisms that make bread rise (543)

**Y-linked gene** a gene found on the Y chromosome (222)

**yolk sac** in amniotic eggs, the membrane that encloses the yolk and supplies the embryo with food (842)

**Z**

**Z line** boundary of a sarcomere; point of anchor for thin actin filaments

**zooplankton** microscopic animal organisms that drift in bodies of water

worldwide; represent a basic level of feeding relationships (507)

**zoospore** a flagellated spore (527)

**zygosporangium** in fungi, fused gametangia in conjugation (547)

**zygospore** the protective structure that results when the wall surrounding a zygote thickens (527)

**zygote** the diploid cell that results form the fusion of gametes.