

# Biology



**abdomen** posterior part of an arthropod's body (p. 721)

**abiotic factor** physical, or nonliving, factor that shapes an ecosystem (p. 90)

**abscission layer** layer of cells at the petiole that seals off a leaf from the vascular system (p. 642)

**accessory pigment** compound other than chlorophyll that absorbs light at different wavelengths than chlorophyll (p. 506)

**acellular slime mold** slime mold that passes through a stage in which its cells fuse to form large cells with many nuclei (p. 516)

**acetylcholine** neurotransmitter that diffuses across a synapse and produces an impulse in the cell membrane of a muscle cell (p. 929)

**acid** compound that forms hydrogen ions ( $H^+$ ) in solution (p. 43)

**acid rain** rain containing nitric and sulfuric acids (p. 148)

**acoelomate** animal lacking a coelom, or body cavity (p. 688)

**actin** a protein that mainly makes up the thin filaments in striations in skeletal muscle cells (p. 928)

**action potential** reversal of charges across the cell membrane of a neuron (p. 899)

**activation energy** energy needed to get a reaction started (p. 50)

**active immunity** immunity produced by a vaccine; so-called because the body has the ability to mount an active immune response against the pathogen (p. 1040)

**active transport** energy-requiring process that moves material across a cell membrane against a concentration difference (p. 189)

**adaptation** inherited characteristic that increases an organism's chance of survival (p. 380)

**adaptive radiation** process by which a single species or small group of species evolves into several different forms that live in different ways; rapid growth in the diversity of a group of organisms (pp. 437, 851)

**addiction** uncontrollable craving for more of a drug (p. 911)

**adenosine triphosphate (ATP)** one of the principal chemical compounds that living things use to store energy (p. 202)

**adhesion** attraction between molecules of different substances (p. 41); in plants: attraction between unlike molecules (p. 599)

**aerobic** process that requires oxygen (p. 226)

**age-structure diagram** graph of the numbers of males and females within different age groups of a population (p. 131)

**aggression** threatening behavior that one animal uses to gain control over another (p. 881)

**agriculture** the practice of farming (p. 141)

**air sac** one of several sacs attached to a bird's lungs into which air moves when a bird inhales; allows for the one-way flow of air through the respiratory system (p. 810)

**algal bloom** an immediate increase in the amount of algae and other producers that results from a large input of a limiting nutrient (p. 80)

**allele** one of a number of different forms of a gene (p. 265)

**allergy** overreaction of the immune system that results when antigens bind to mast cells (p. 1041)

**alternation of generations** process in which many algae switch back and forth between haploid and diploid stages of their life cycles (p. 512)

**alveolus** tiny air sac at the end of a bronchiole in the lungs that provides surface area for gas exchange to occur (pp. 959, 958)

**amino acid** compound with an amino group ( $-NH_2$ ) on one end and a carboxyl group ( $-COOH$ ) on the other end (p. 47)

**amniotic egg** egg composed of shell and membranes that create a protected environment in which the embryo can develop out of the water (p. 802)

**amoeboid movement** type of locomotion used by amoebas (p. 498)

**amphibian** vertebrate that, with some exceptions, lives in water as a larva and on land as an adult, breathes with lungs as an adult, has moist skin that contains mucus glands, and lacks scales and claws (p. 782)

**amylase** enzyme in saliva that breaks the chemical bonds between the sugar monomers in starches (p. 979)

**anaerobic** process that does not require oxygen (p. 224)

**anal pore** region of the cell membrane of a ciliate where waste-containing food vacuoles fuse and are then emptied into the environment (p. 500)

**anaphase** the third phase of mitosis, during which the chromosome pairs separate and move toward opposite poles (p. 248)

**angiosperm** flowering plant; bears its seeds within a layer of tissue that protects the seed (p. 564)

**Animalia** kingdom of multicellular eukaryotic heterotrophs whose cells do not have cell walls (p. 461)

**annual** flowering plant that completes a life cycle within one growing season (p. 572)

**anther** flower structure in which haploid male gametophytes are produced (p. 612)

**antheridium** male reproductive structure in some algae and plants (pp. 519, 559)

**anthropoid** humanlike primate (p. 835)

**antibiotic** compound that blocks the growth and reproduction of bacteria (pp. 480, 1033)

**antibody** specialized protein that helps destroy disease-causing organisms (p. 1036)

**anticodon** group of three bases on a tRNA molecule that are complementary to an mRNA codon (p. 304)

**antigen** substance that triggers an immune response (p. 1036)

**anus** opening through which wastes leave the digestive tract (pp. 661, 689)

**aorta** large blood vessel in mammals through which blood travels from the left ventricle to all parts of the body except the lungs (p. 946)

**aphotic zone** permanently dark layer of the oceans below the photic zone (p. 109)

**apical dominance** phenomenon in which the closer a bud is to the stem's tip, the more its growth is inhibited (p. 636)

**apical meristem** group of undifferentiated cells that divide to produce increased length of stems and roots (p. 580)

**appendage** structure, such as a leg or antenna, that extends from the body wall (p. 715)

**aquaculture** farming of aquatic organisms (p. 147)

**Archaea** domain of unicellular prokaryotes that have cell walls that do not contain peptidoglycan (p. 459)

**Archaeobacteria** kingdom of unicellular prokaryotes whose cell walls do not contain peptidoglycan (p. 459)

**archaeocyte** specialized cell in a sponge that makes spicules (p. 665)

**archegonium** female reproductive structure in some plants, including mosses and liverworts (p. 559)

**artery** large blood vessel that carries blood from the heart to the tissues of the body (p. 946)

**artificial selection** selection by humans for breeding of useful traits from the natural variation among different organisms (p. 379)

**ascospore** haploid spore produced within the ascus of ascomycetes (p. 532)

**ascus** structure within the fruiting body of an ascomycete in which two nuclei of different mating types fuse (p. 532)

**asexual reproduction** process by which a single parent reproduces by itself (p. 17)

**asthma** allergic reaction in which smooth muscle contractions reduce the size of air passageways in the lungs and make breathing very difficult (p. 1042)

**atherosclerosis** condition in which fatty deposits called plaque build up on the walls of the arteries (p. 949)

**atom** basic unit of matter (p. 35)

**ATP synthase** large protein that uses energy from  $H^+$  ions to bind ADP and a phosphate group together to produce ATP (p. 210)

**atrium** large muscular upper chamber of the heart that receives and holds blood that is about to enter the ventricle (pp. 776, 944)

**autosome** autosomal chromosome; chromosome that is not a sex chromosome (p. 341)

**autotroph** organism that can capture energy from sunlight or chemicals and use it to produce its own food from inorganic compounds; also called a producer (pp. 67, 201)

**auxin** substance produced in the tip of a seedling that stimulates cell elongation (p. 635)

**axon** long fiber that carries impulses away from the cell body of a neuron (p. 898)

**bacillus** rod-shaped prokaryote (p. 473)

**Bacteria** domain of unicellular prokaryotes that have cell walls containing peptidoglycans (p. 459)

**bacteriophage** virus that infects bacteria (pp. 289, 484)

**bark** tree structure that includes all tissues outside the vascular cambium, including phloem, the cork cambium, and cork (p. 593)

**base** compound that produces hydroxide ions ( $OH^-$ ) in solution (p. 43)

**base-pairing** principle that bonds in DNA can form only between adenine and thymine and between guanine and cytosine (p. 294)

**basidiospore** spore in basidiomycetes that germinates to produce haploid primary mycelia (p. 535)

**basidium** spore-bearing structure of a basidiomycete (p. 534)

**behavior** the way an organism reacts to changes in its internal condition or external environment (p. 871)

**behavioral isolation** form of reproductive isolation in which two populations have differences in courtship rituals or other types of behavior that prevent them from interbreeding (p. 404)

**benthos** organisms that live attached to or near the ocean floor (p. 112)

**biennial** flowering plant that completes its life cycle in two years (p. 572)

**bilateral symmetry** body plan in which only a single, imaginary line can divide the body into two equal halves; characteristic of worms, arthropods, and chordates (pp. 662, 748)

**binary fission** type of asexual reproduction in which a prokaryote replicates its DNA, and divides in half, producing two identical daughter cells (p. 476)

**binocular vision** ability to merge visual images from both eyes, which provides depth perception and a three-dimensional view of the world (p. 834)

**binomial nomenclature** classification system in which each species is assigned a two-part scientific name (p. 448)

**biodiversity** biological diversity; the sum total of the variety of organisms in the biosphere (p. 150)

**biogeochemical cycle** process in which elements, chemical compounds, and other forms of matter are passed from one organism to another and from one part of the biosphere to another (p. 74)

**biological magnification** increasing concentration of a harmful substance in organisms at higher trophic levels in a food chain or food web (p. 152)

**biology** science that seeks to understand the living world (p. 16)

**biomass** total amount of living tissue within a given trophic level (p. 72)

**biome** group of ecosystems that have the same climate and similar dominant communities (pp. 64, 98)

**biosphere** part of Earth in which life exists including land, water, and air or atmosphere (p. 63)

**biotic factor** biological influence on organisms within an ecosystem (p. 90)

**bipedal** term used to refer to two-footed locomotion (p. 835)

**bird** endothermic animal that has an outer covering of feathers, two legs covered with scales that are used for walking or perching, and front limbs modified into wings (p. 806)

**blade** thin, flattened section of a plant leaf that collects sunlight (p. 595)

**blastula** hollow ball of cells formed when a zygote undergoes a series of divisions (p. 661)

**bone marrow** soft tissue inside cavities within bones; two types are yellow marrow and red marrow (p. 922)

**book lung** organ that has layers of respiratory tissue stacked like the pages of a book; used by some terrestrial arthropods to exchange gases (p. 717)

**Bowman's capsule** cup-shaped structure in the upper end of a nephron that encases the glomerulus (p. 987)

**brain stem** structure that connects the brain and spinal cord; includes the medulla oblongata and the pons (p. 902)


**bronchus** passageway leading from the trachea to a lung (p. 958)

**bryophyte** nonvascular plant; examples are mosses and their relatives (p. 556)

**bud** plant structure containing undeveloped tissue that can produce new stems and leaves (p. 589)

**budding** process of attaching a bud to a plant to produce a new branch (p. 623)

**buffer** weak acid or base that can react with strong acids or bases to help prevent sharp, sudden changes in pH (p. 43)



**calorie** amount of energy required to raise the temperature of 1 gram of water by 1 Celsius degree (p. 221)

**Calorie** term used by scientists to measure the energy stored in foods; 1000 calories (p. 971)

**Calvin cycle** reactions of photosynthesis in which energy from ATP and NADPH is used to build high-energy compounds such as sugars (p. 212)

**cancer** disorder in which some of the body's own cells lose the ability to control growth (p. 252)

**canopy** dense covering formed by the leafy tops of tall rain trees (p. 100)

**capillary** smallest blood vessel; brings nutrients and oxygen to the tissues and absorbs carbon dioxide and waste products (p. 947)

**capillary action** tendency of water to rise in a thin tube (p. 599)

**capsid** outer protein coat of a virus (p. 483)

**carapace** in crustaceans, the part of the exoskeleton that covers the cephalothorax (p. 721); in turtles and tortoises, the dorsal part of the shell (p. 805)

**carbohydrate** compound made up of carbon, hydrogen, and oxygen atoms; major source of energy for the human body (pp. 45, 972)

**carnivore** organism that obtains energy by eating animals (p. 69)

**carpel** innermost part of a flower that produces the female gametophytes (p. 612)

**carrying capacity** largest number of individuals of a population that a given environment can support (p. 122)

**cartilage** strong connective tissue that supports the body and is softer and more flexible than bone (pp. 773, 922)

**Casparian strip** waterproof strip that surrounds plant endodermis cells (p. 587)

**caste** group of individual insects specialized to perform particular tasks, or roles (p. 732)

**catalyst** substance that speeds up the rate of a chemical reaction (p. 51)

**cell** collection of living matter enclosed by a barrier that separates the cell from its surroundings; basic unit of all forms of life (pp. 17, 170)

**cell body** largest part of a typical neuron; contains the nucleus and much of the cytoplasm (p. 897)

**cell culture** group of cells grown in a nutrient solution from a single original cell (p. 27)

**cell cycle** series of events that cells go through as they grow and divide (p. 245)

**cell division** process by which a cell divides into two new daughter cells (p. 243)

**cell fractionation** technique in which cells are broken into pieces and the different cell parts are separated (p. 27)

**cell-mediated immunity** an immune response in which killer T cells attack antigen-bearing cells directly (p. 1038)

- cell membrane** thin, flexible barrier around a cell; regulates what enters and leaves the cell (p. 171)
- cell specialization** separate roles for each type of cell in multicellular organisms (p. 191)
- cell theory** idea that all living things are composed of cells, cells are the basic units of structure and function in living things, and new cells are produced from existing cells (p. 170)
- cellular respiration** process that releases energy by breaking down food molecules in the presence of oxygen; made up of glycolysis, the Krebs cycle, and the electron transport chain (p. 222)
- cellular slime mold** slime mold whose individual cells remain separated during every phase of the mold's life cycle (p. 516)
- cell wall** strong layer around the cell membrane in plants, algae, and some bacteria (p. 171)
- central nervous system** the brain and the spinal cord (p. 901)
- centriole** one of two tiny structures located in the cytoplasm of animal cells near the nuclear envelope (p. 246)
- centromere** area where the chromatids of a chromosome are attached (p. 244)
- cephalization** concentration of sense organs and nerve cells at the front of an animal's body (pp. 663, 748)
- cephalothorax** region of a crustacean formed by the fusion of the head with the thorax (p. 721)
- cerebellum** region of the brain that coordinates body movements (pp. 777, 902)
- cerebral cortex** outer layer of the cerebrum of a mammal's brain; center of thinking and other complex behaviors (p. 825)
- cerebrospinal fluid** fluid in the space between the meninges that acts as a shock absorber that protects the central nervous system (p. 901)
- cerebrum** area of the brain responsible for all voluntary activities of the body (pp. 777, 902)
- chelicerae** pair of mouthparts in chelicerates that contain fangs and are used to stab and paralyze prey (p. 722)
- cheliped** one of the first pair of legs of decapods (p. 721)
- chemical bond** link that holds together atoms in compounds (p. 38)
- chemical reaction** process that changes one set of chemicals into another set of chemicals (p. 49)
- chemoautotroph** prokaryote that obtains energy directly from inorganic molecules using chemical reactions (p. 474)
- chemosynthesis** process by which some organisms use chemical energy to produce carbohydrates (p. 68)
- chemotherapy** drug therapy; the use of a combination of chemicals to destroy cancer cells (p. 1048)
- chitin** complex carbohydrate that makes up the cell walls of fungi; also found in the external skeletons of arthropods (pp. 527, 715)
- chlorophyll** principal pigment of plants and other photosynthetic organisms; captures light energy (p. 207)
- chloroplast** organelle found in cells of plants and some other organisms that uses energy from sunlight to make energy-rich food molecules by photosynthesis (p. 180)
- choanocyte** specialized cell in sponges that uses a flagellum to move a steady current of water through the sponge (p. 665)
- chordate** member of the phylum Chordata; animal that has, for at least some stage of its life, a dorsal, hollow nerve cord; a notochord; pharyngeal pouches; and a muscular tail (p. 767)
- chromatid** one of two identical "sister" parts of a duplicated chromosome (p. 244)
- chromatin** granular material visible within the nucleus; consists of DNA tightly coiled around proteins (pp. 175, 297)
- chromosome** threadlike structure within the nucleus containing the genetic information that is passed from one generation of cells to the next (p. 175)
- chyme** mixture of stomach fluids and food produced in the stomach by contracting stomach muscles (p. 981)
- cilium** short hairlike projection similar to a flagellum; produces movement in many cells (p. 499)
- circadian rhythm** behavioral cycle that occurs in a daily pattern (p. 878)
- cladogram** diagram that shows the evolutionary relationships among a group of organisms (p. 453)
- class** group of similar orders (p. 449)
- classical conditioning** learning process in which an animal makes a mental connection between a stimulus and some kind of reward or punishment (p. 874)
- climate** average, year-after-year conditions of temperature and precipitation in a particular region (p. 87)
- clitellum** band of thickened, specialized segments in annelids that secretes a mucus ring into which eggs and sperm are released (p. 696)
- cloaca** a muscular cavity at the end of the large intestine through which digestive wastes, urine, and eggs or sperm leave the body (p. 748)
- clone** member of a population of genetically identical organisms produced from a single cell (p. 333)
- closed circulatory system** system in which blood is contained within a network of blood vessels (pp. 695, 754)
- cnidocyte** stinging cell located along the tentacles of cnidarians; used for defense and to capture prey (p. 669)
- coastal ocean** marine zone that extends from the low-tide mark to the end of the continental shelf (p. 110)



# GLOSSARY

- coccus** spherical prokaryote (p. 473)
- cochlea** fluid-filled part of the inner ear; sends nerve impulses to the brain through the cochlear nerve (p. 908)
- codominance** situation in which both alleles of a gene contribute to the phenotype of the organism (p. 272)
- codon** three-nucleotide sequence on messenger RNA that codes for a single amino acid (p. 302)
- coelom** fluid-filled body cavity lined with mesoderm (pp. 683, 749)
- coevolution** process by which two species evolve in response to changes in each other (p. 437)
- cohesion** attraction between molecules of the same substance (p. 41)
- collenchyma** type of ground tissue cell with a strong, flexible cell wall; helps support larger plants (p. 583)
- commensalism** symbiotic relationship in which one member of the association benefits and the other is neither helped nor harmed (p. 93)
- common descent** principle that all living things have a common ancestor (p. 382)
- communication** passing of information from one organism to another (p. 881)
- community** assemblage of different populations that live together in a defined area (p. 64)
- companion cell** phloem cell that surrounds sieve tube elements (p. 583)
- competitive exclusion principle** ecological rule that states that no two species can occupy the same exact niche in the same habitat at the same time (p. 92)
- complete metamorphosis** type of insect development in which the larvae look and act nothing like their parents and also feed in completely different ways (p. 729)
- compound** substance formed by the chemical combination of two or more elements in definite proportions (p. 37)
- compound light microscope** microscope that allows light to pass through a specimen and uses two lenses to form an image (p. 26)
- concentration** the mass of solute in a given volume of solution, or mass/volume (p. 185)
- cone** in gymnosperms, a seed-bearing structure (p. 564); in the retina of the eye, a photoreceptor that responds to light of different colors, producing color vision (p. 907)
- conidium** tiny fungal spore that forms at the tips of specialized hyphae in ascomycetes (p. 532)
- coniferous** term used to refer to trees that produce seed-bearing cones and have thin leaves shaped like needles (p. 103)
- conjugation** form of sexual reproduction in which paramecia and some prokaryotes exchange genetic information (pp. 476, 500)
- connective tissue** tissue that holds organs in place and binds different parts of the body together (p. 894)
- conservation** wise management of natural resources, including the preservation of habitats and wildlife (p. 154)
- consumer** organism that relies on other organisms for its energy and food supply; also called a heterotroph (p. 68)
- contractile vacuole** cavity in the cytoplasm of some protists that collects water and discharges it from the cell (p. 500)
- controlled experiment** a test of the effect of a single variable by changing it while keeping all other variables the same (p. 9)
- controlled variable** factor in an experiment that a scientist purposely keeps the same (p. 1056)
- convergent evolution** process by which unrelated organisms independently evolve similarities when adapting to similar environments (p. 437)
- coral reef** diverse and productive environment named for the coral animals that makes up its primary structure (p. 111)
- cork cambium** lateral meristematic tissue that produces the outer covering of stems (p. 591)
- corpus luteum** name given to a follicle after ovulation because of its yellow color (p. 1014)
- cortex** spongy layer of ground tissue just inside the epidermis of a root (p. 585)
- cotyledon** seed leaf in a plant embryo (p. 570)
- courtship** type of behavior in which an animal sends out stimuli—such as sounds, visual displays, or chemicals—in order to attract a member of the opposite sex (p. 879)
- covalent bond** bond formed by the sharing of electrons between atoms (p. 38)
- crop** in earthworms, part of the digestive system in which food can be stored (p. 695); in birds, structure at the lower end of the esophagus in which food is stored and moistened (p. 809)
- crossing-over** process in which homologous chromosomes exchange portions of their chromatids during meiosis (p. 277)
- cuticle** in plants, a thick, waxy layer on exposed outer surfaces of cells that protects them against water loss and injury (p. 581)
- cyclin** one of a family of closely related proteins that regulate the cell cycle in eukaryotic cells (p. 251)
- cytokinesis** division of the cytoplasm during cell division (p. 248)
- cytoplasm** material inside the cell membrane—but not including the nucleus (p. 171)
- cytoskeleton** network of protein filaments within some cells that helps the cell maintain its shape and is involved in many forms of cell movement (p. 176)

**data** evidence; information gathered from observations (pp. 4, 1057)

**deciduous** term used to refer to a tree that sheds its leaves during a particular season each year (p. 100)

**decomposer** organism that breaks down and obtains energy from dead organic matter (p. 69)

**deforestation** destruction of forests (p. 146)

**demographic transition** change in a population from high birth and death rates to low birth and death rates (p. 130)

**demography** scientific study of human populations (p. 130)

**dendrite** extension of the cell body of a neuron that carries impulses from the environment or from other neurons toward the cell body (p. 898)

**denitrification** conversion of nitrates into nitrogen gas (p. 78)

**density-dependent limiting factor** limiting factor that depends on population size (p. 125)

**density-independent limiting factor** limiting factor that affects all populations in similar ways, regardless of population size (p. 127)

**deoxyribonucleic acid (DNA)** nucleic acid that contains the sugar deoxyribose (p. 47)

**dependent variable** factor in an experiment that a scientist wants to observe, which may change because of the manipulated variable; also known as a responding variable (p. 1056)

**depressant** drug that decreases the rate of functions regulated by the brain (p. 911)

**derived character** characteristic that appears in recent parts of a lineage, but not in its older members (p. 453)

**dermis** innermost layer of the skin (p. 935)

**descent with modification** principle that each living species has descended, with changes, from other species over time (p. 381)

**desertification** in areas with dry climates, a process caused by a combination of poor farming practices, overgrazing, and drought that turns productive land into desert (p. 145)

**detritivore** organism that feeds on plant and animal remains and other dead matter (p. 69)

**detritus** particles of organic material that provide food for organisms at the base of an estuary's food web (p. 108)

**deuterostome** animal whose anus is formed from the blastopore of a blastula (p. 661)

**diabetes mellitus** condition that occurs when the pancreas produces too little insulin, resulting in an increase in the amount of glucose in the blood (p. 1008)

**diaphragm** large, flat muscle at the bottom of the chest cavity that contracts during breathing, pulling the bottom of the chest cavity down and increasing its volume (pp. 824, 959)

**dicot** angiosperm whose seeds have two cotyledons (p. 570)

**diffusion** process by which molecules tend to move from an area where they are more concentrated to an area where they are less concentrated (p. 185)

**diploid** term used to refer to a cell that contains both sets of homologous chromosomes (p. 275)

**directional selection** form of natural selection in which the entire curve moves; occurs when individuals at one end of a distribution curve have higher fitness than individuals in the middle or at the other end of the curve (p. 398)

**disease** any change, other than an injury, that disrupts the normal functions of the body (p. 1029)

**disruptive selection** form of natural selection in which a single curve splits into two; occurs when individuals at the upper and lower ends of a distribution curve have higher fitness than individuals near the middle (p. 399)

**DNA fingerprinting** analysis of sections of DNA that have little or no known function, but vary widely from one individual to another, in order to identify individuals (p. 357)

**DNA polymerase** enzyme that "proofreads" new DNA strands, helping to ensure that each molecule is a nearly perfect copy of the original DNA (p. 299)

**domain** most inclusive taxonomic category; larger than a kingdom (p. 458)

**dormancy** period of time during which a plant embryo is alive but not growing (pp. 620, 641)

**double fertilization** fertilization in angiosperms, in which two distinct fertilization events take place between the male and female gametophytes (p. 616)

**drug** any substance, other than food, that causes a change in the structure or function of the body (p. 910)

**drug abuse** use of any drug in a way that most doctors would not approve (p. 914)

**ecological pyramid** diagram that shows the relative amounts of energy or matter within each trophic level in a food chain or food web (p. 72)

**ecological succession** gradual change in living communities that follows a disturbance (p. 94)

**ecology** scientific study of interactions among organisms and between organisms and their environment (p. 63)

**ecosystem** collection of all the organisms that live in a particular place, together with their nonliving environment (p. 64)

# GLOSSARY

- ecosystem diversity** variety of habitats, living communities, and ecological processes in the living world (p. 150)
- ectoderm** outermost germ layer of most animals; gives rise to outer layer of the skin, sense organs, and nerves (p. 661)
- ectotherm** animal that relies on interactions with the environment to help it control body temperature (pp. 800, 855)
- electron** negatively charged particle; located outside the atomic nucleus (p. 35)
- electron microscope** microscope that forms an image by focusing beams of electrons onto a specimen (p. 26)
- electron transport chain** a series of proteins in which the high-energy electrons from the Krebs cycle are used to convert ADP into ATP (p. 228)
- element** substance consisting entirely of one type of atom (p. 36)
- embryo** early developmental stage of a sporophyte plant (p. 565)
- embryo sac** female gametophyte within the ovule of a flowering plant (p. 615)
- emigration** movement of individuals out of a population (p. 120)
- emphysema** disease in which the tissues of the lungs lose elasticity, making breathing very difficult (p. 962)
- endangered species** species whose population size is rapidly declining and will become extinct if the trend continues (p. 151)
- endocrine gland** gland that releases its secretions directly into the bloodstream (p. 998)
- endocytosis** process by which a cell takes material into the cell by infolding of the cell membrane (p. 189)
- endoderm** innermost germ layer of most animals; develops into the linings of the digestive tract and much of the respiratory system (p. 661)
- endodermis** layer of cells that completely encloses vascular tissue (p. 585)
- endoplasmic reticulum** internal membrane system in cells in which components of the cell membrane are assembled and some proteins are modified (p. 177)
- endoskeleton** structural support located inside the body of an animal (pp. 734, 757)
- endosperm** food-rich tissue that nourishes a seedling as it grows (p. 616)
- endospore** type of spore formed when a bacterium produces a thick internal wall that encloses its DNA and a portion of its cytoplasm (p. 476)
- endosymbiotic theory** theory that eukaryotic cells formed from a symbiosis among several different prokaryotic organisms (p. 427)
- endotherm** animal that generates its own body heat and controls its body temperature from within (pp. 808, 855)
- enzyme** protein that acts as a biological catalyst (p. 51)
- epidermal cell** cell that makes up the dermal tissue, which is the outer covering of a plant (p. 581)
- epidermis** outer layer of the skin (p. 934)
- epididymis** structure in the male reproductive system in which sperm fully mature and are stored (p. 1010)
- epiphyte** plant that grows directly on the body of another plant (p. 645)
- epithelial tissue** tissue that covers the surface of the body and lines internal organs (p. 894)
- era** one of several subdivisions of the time between the Precambrian and the present (p. 421)
- esophagus** food tube connecting the mouth to the stomach (p. 980)
- estuary** wetlands formed where rivers meet the ocean (p. 108)
- ethylene** plant hormone that stimulates fruits to ripen (p. 638)
- Eubacteria** kingdom of unicellular prokaryotes whose cell walls are made up of peptidoglycan (p. 459)
- Eukarya** domain of all organisms whose cells have nuclei, including protists, plants, fungi, and animals (p. 460)
- eukaryote** organism whose cells contain nuclei (p. 172)
- evaporation** process by which water changes from a liquid into an atmospheric gas (p. 75)
- evolution** change in a kind of organism over time; process by which modern organisms have descended from ancient organisms (pp. 20, 369)
- evolutionary classification** method of grouping organisms together according to their evolutionary history (p. 452)
- exocrine gland** gland that releases its secretions through tubelike structures called ducts (p. 998)
- exocytosis** process by which a cell releases large amounts of material (p. 189)
- exon** expressed sequence of DNA; codes for a protein (p. 302)
- exoskeleton** external skeleton; tough external covering that protects and supports the body of many invertebrates (pp. 715, 757)
- exponential growth** growth pattern in which the individuals in a population reproduce at a constant rate (p. 121)
- external fertilization** process in which eggs are fertilized outside the female's body (pp. 672, 758)
- extinct** term used to refer to a species that has died out (p. 417)
- extinction** disappearance of a species from all parts of its geographical range (p. 151)
- extracellular digestion** process in which food is broken down outside the cells in a digestive tract (p. 751)



**eyespot** group of cells that can detect changes in the amount of light in the environment (pp. 506, 685)

**facilitated diffusion** movement of specific molecules across cell membranes through protein channels (p. 188)

**Fallopian tube** one of two fluid-filled tubes in human females through which an egg passes after its release from an ovary (p. 1013)

**family** group of genera that share many characteristics (p. 449)

**fat** lipid; made up of fatty acids and glycerol (p. 972)

**feather** structure made mostly of protein that develops from a pit in a bird's skin (p. 806)

**feedback inhibition** process by which the product of a system shuts down the system or limits its operation (p. 895)

**fermentation** process by which cells release energy in the absence of oxygen (p. 224)

**fetal alcohol syndrome** group of birth defects caused by the effects of alcohol on a fetus (p. 913)

**fetus** name given to a human embryo after eight weeks of development (p. 1019)

**fever** elevated body temperature that occurs in response to infection (p. 1035)

**fibrous root** part of a root system in which roots branch to such an extent that no single root grows larger than the rest (p. 584)

**filament** in algae, a long threadlike colony formed by many green algae (p. 512); in plants, a long, thin structure that supports an anther (p. 612)

**filtration** process by which fluid from the blood filters into Bowman's capsule in the kidneys (p. 987)

**fish** aquatic vertebrate characterized by paired fins, scales, and gills (p. 771)

**fission** form of asexual reproduction in which an organism splits into two, and each half grows new parts to become a complete organism (p. 686)

**fitness** ability of an organism to survive and reproduce in its environment (p. 380)

**flagellum** whiplike structure on some cells that is used for movement (p. 473)

**flame cell** specialized cell that filters and removes excess water from the body of a flatworm (p. 684)

**flower** seed-bearing structure of an angiosperm (p. 564)

**follicle** cluster of cells surrounding a single egg in the human female reproductive system (p. 1012)

**food chain** series of steps in an ecosystem in which organisms transfer energy by eating and being eaten (p. 69)

**food vacuole** small cavity in the cytoplasm of protists that temporarily stores food (p. 498)

**food web** network of complex interactions formed by the feeding relationships among the various organisms in an ecosystem (p. 70)

**foot** muscular part of a mollusk (p. 702)

**fossil** preserved remains or evidence of an ancient organism (p. 371)

**fossil record** information about past life, including the structure of organisms, what they ate, what ate them, in what environment they lived, and the order in which they lived (p. 417)

**founder effect** change in allele frequencies as a result of the migration of a small subgroup of a population (p. 400)

**frameshift mutation** mutation that shifts the "reading" frame of the genetic message by inserting or deleting a nucleotide (p. 307)

**frond** large leaf of a fern (p. 562)

**fruit** thick wall of tissue surrounding an angiosperm seed (p. 569)

**fruiting body** reproductive structure of fungus that develops from a mycelium (p. 528)

**Fungi** kingdom composed of heterotrophs; many obtain energy and nutrients from dead organic matter (p. 460)

**gametangium** gamete-forming structure produced when the hyphae of opposing mating types of fungi meet (p. 529)

**gamete** specialized cell involved in sexual reproduction (p. 266)

**gametophyte** haploid, or gamete-producing, phase of an organism (pp. 514, 552)

**ganglion** group of nerve cells (p. 685)

**gastrovascular cavity** digestive chamber with a single opening, in which cnidarians, flatworms, and echinoderms digest food (p. 671)

**gastrulation** process of cell migration by which a third layer of cells is formed within the cavity of a blastocyst (p. 1017)

**gel electrophoresis** procedure used to separate and analyze DNA fragments by placing a mixture of DNA fragments at one end of a porous gel and applying an electrical voltage to the gel (p. 323)

**gemma** small cup-shaped structure in liverworts that contains many haploid cells; used for asexual reproduction (p. 557)

**gemmule** group of archaeocytes surrounded by a tough layer of spicules; produced by some sponges (p. 667)

**gene** sequence of DNA that codes for a protein and thus determines a trait (p. 265)

**gene map** diagram showing the relative locations of each known gene on a particular chromosome (p. 280)

# GLOSSARY

**gene pool** combined genetic information of all the members of a particular population (p. 394)

**genetic diversity** sum total of all the different forms of genetic information carried by all organisms living on Earth today (p. 150)

**genetic drift** random change in allele frequencies that occurs in small populations (p. 400)

**genetic engineering** process of making changes in the DNA code of living organisms (p. 322)

**genetic equilibrium** situation in which allele frequencies remain constant (p. 401)

**genetic marker** gene that makes it possible to distinguish bacteria that carry a plasmid with foreign DNA from those that don't (p. 328)

**genetics** scientific study of heredity (p. 263)

**genotype** genetic makeup of an organism (p. 268)

**genus** group of closely related species, first part of the scientific name in binomial nomenclature (p. 448)

**geographic isolation** form of reproductive isolation in which two populations are separated physically by geographic barriers such as rivers, mountains, or stretches of water (p. 405)

**geologic time scale** scale used by paleontologists to represent evolutionary time (p. 421)

**germ theory of disease** idea that infectious diseases are caused by microorganisms, or germs (p. 1029)

**germination** early growth stage of a plant embryo (p. 621)

**gibberellin** growth-promoting substance produced by plants (p. 637)

**gill** filamentous organ in aquatic animals specialized for the exchange of gases with water (p. 696)

**gizzard** in earthworms, part of the digestive system in which food is ground into smaller pieces (p. 695); in birds, a muscular organ that helps in the mechanical breakdown of food (p. 809)

**global warming** increase in the average temperatures on Earth (p. 159)

**glomerulus** small network of capillaries encased in the upper end of a nephron (p. 987)

**glycolysis** first step in releasing the energy of glucose, in which a molecule of glucose is broken into two molecules of pyruvic acid (p. 221)

**Golgi apparatus** stack of membranes in the cell in which enzymes attach carbohydrates and lipids to proteins (p. 178)

**grafting** use of a stem as a scion (p. 623)

**gravitropism** tendency of a plant to grow in a direction in response to the force of gravity (p. 635)

**green revolution** introduction of intensive farming practices that lead to a substantial increase in crop yields (p. 142)

**greenhouse effect** natural situation in which heat is retained in Earth's atmosphere by carbon dioxide, methane, water vapor, and other gases (p. 87)

**guard cell** specialized cell in the epidermis of plants that controls the opening and closing of stomata by responding to changes in water pressure (p. 596)

**gullet** indentation in one side of a ciliate that allows food to enter the cell (p. 500)

**gymnosperm** seed plant that bears its seeds directly on the surfaces of cones (p. 564)



**habitat** the area where an organism lives, including the biotic and abiotic factors that affect the organism (p. 90)

**habitat fragmentation** splitting of ecosystems into small fragments (p. 151)

**habituation** learning process by which an animal decreases or stops its response to a repetitive stimulus that neither rewards nor harms it (p. 874)

**hair follicle** tubelike pocket of epidermal cells that extends into the dermis; cells at the base of hair follicles produce hair (p. 936)

**half-life** length of time required for half of the radioactive atoms in a sample to decay (p. 420)

**haploid** term used to refer to a cell that contains only a single set of chromosomes and therefore only a single set of genes (p. 275)

**Hardy-Weinberg principle** principle that allele frequencies in a population will remain constant unless one or more factors cause the frequencies to change (p. 401)

**Haversian canal** one of a network of tubes running through compact bone that contains blood vessels and nerves (p. 922)

**heartwood** older xylem near the center of a woody stem that no longer conducts water (p. 592)

**hemoglobin** iron-containing protein in red blood cells that transports oxygen from the lungs to the tissues of the body (p. 952)

**herbicide** compound that is toxic to plants (p. 636)

**herbivore** organism that obtains energy by eating only plants (p. 69)

**hermaphrodite** individual that has both male and female reproductive organs (p. 686)

**heterotroph** organism that obtains energy from the foods it consumes; also called a consumer (pp. 68, 201)

**heterozygous** term used to refer to an organism that has two different alleles for the same trait (p. 268)

**histamine** chemical released by activated mast cells that increases the flow of blood and fluids to the surrounding area (p. 1041)

**histone** globular protein molecule around which DNA is tightly coiled in chromatin (p. 297)

**homeostasis** process by which organisms maintain a relatively stable internal environment (p. 19)

**hominid** primate that walks upright, has opposable thumbs, and possesses a large brain; only living members are humans (p. 835)

**hominoid** member of a group of primates that includes apes and humans (p. 835)

**homologous** term used to refer to chromosomes that each have a corresponding chromosome from the opposite-sex parent (p. 275)

**homologous structures** structures that have different mature forms in different organisms but develop from the same embryonic tissues (p. 384)

**homozygous** term used to refer to an organism that has two identical alleles for a particular trait (p. 268)

**hormone** substance produced in one part of an organism that affects another part of the same individual (pp. 634, 997)

**host** organism that provides a source of nutritional needs for a parasite (p. 658)

**hox genes** series of genes that controls the organs and tissues that develop in various parts of an embryo (p. 312)

**humoral immunity** immunity against pathogens in the body fluids (p. 1036)

**humus** material formed from decaying leaves and other organic matter (p. 103)

**hybrid** offspring of crosses between parents with different traits (p. 264)

**hybridization** breeding technique that involves crossing dissimilar individuals to bring together the best traits of both organisms (p. 319)

**hydrostatic skeleton** layers of circular and longitudinal muscles, together with the water in the gastrovascular cavity, that enable movement (p. 671)

**hypha** tiny filament that makes up a multicellular fungus or a water mold (pp. 518, 527)

**hypothalamus** brain structure that acts as a control center for recognition and analysis of hunger, thirst, fatigue, anger, and body temperature (p. 903)

**hypothesis** possible explanation for a set of observations or possible answer to a scientific question (pp. 5, 1056)

**immigration** movement of individuals into an area occupied by an existing population (p. 120)

**immune response** the body's specific defenses that attack a disease-causing agent (p. 1036)

**implantation** process in which a blastocyst attaches itself to the wall of the uterus (p. 1017)

**imprinting** learning based on early experience; once imprinting has occurred, the behavior cannot be changed (p. 876)

**inbreeding** continued breeding of individuals with similar characteristics (p. 320)

**incomplete dominance** situation in which one allele is not completely dominant over another (p. 272)

**incomplete metamorphosis** type of insect development characterized by a similar appearance throughout all stages of the life cycle (p. 729)

**independent assortment** independent segregation of genes during the formation of gametes (p. 271)

**independent variable** factor in an experiment that a scientist purposely changes; also known as a responding variable (p. 1056)

**index fossil** distinctive fossil used to compare the relative ages of fossils (p. 419)

**inference** logical interpretation based on prior knowledge and experience (p. 4)

**inflammatory response** nonspecific defense reaction to tissue damage caused by injury or infection (p. 1035)

**innate behavior** instinct, or inborn behavior; behavior that appears in a fully functional form the first time it is performed (p. 873)

**insight learning** also called reasoning; learning process in which an animal applies something it has already learned to a new situation without a period of trial and error (p. 875)

**interferon** one of a group of proteins that help cells resist viral infection (p. 1035)

**internal fertilization** process in which eggs are fertilized inside the female's body (pp. 666, 690, 758)

**internode** region between nodes on plant stems (p. 589)

**interphase** period of the cell cycle between cell divisions (p. 245)

**intracellular digestion** process in which food is digested inside cells (p. 751)

**intron** intervening sequence of DNA; does not code for a protein (p. 302)

**invasive species** plants and animals that have migrated to places where they are not native (p. 153)

**invertebrate** animal that does not have a backbone or vertebral column (p. 657)

**ion** atom that has a positive or negative charge (p. 38)

**ionic bond** bond formed when one or more electrons are transferred from one atom to another (p. 38)

**isotope** atom of an element that has a number of neutrons different from that of other atoms of the same element (p. 36)

**joint** place where one bone attaches to another (p. 924)

**karyotype** set of photographs of chromosomes grouped in order in pairs (p. 341)

**kelp forest** coastal ocean community named for its dominant organism—kelp (p. 110)

**keratin** tough, fibrous protein found in skin (p. 934)

# GLOSSARY

- kidney** organ that removes urea, excess water, and other waste products from the blood and passes them to the ureter (p. 985)
- kingdom** largest taxonomic group, consisting of closely related phyla (p. 449)
- Koch's postulates** series of guidelines used to identify the microorganism that causes a specific disease (p. 1030)
- Krebs cycle** second stage of cellular respiration, in which pyruvic acid is broken down into carbon dioxide in a series of energy-extracting reactions (p. 226)
- language** system of communication that combines sounds, symbols, or gestures according to a set of rules about word order and meaning (p. 882)
- large intestine** colon; organ that removes water from the undigested materials that pass through it (p. 984)
- larva** immature stage of an organism that looks different from the adult form (p. 666)
- larynx** structure in the throat containing the vocal cords (p. 958)
- lateral bud** meristematic area on the side of a stem that gives rise to side branches (p. 636)
- lateral line system** sensitive receptor system that enables fish to detect gentle currents and vibrations in the water (p. 777)
- leaf** photosynthetic organ that contains one or more bundles of vascular tissue (p. 561)
- learning** alterations in behavior as a result of experience (p. 873)
- lens** transparent object behind the iris that changes shape to help adjust the eye's focus to see near or distant objects (p. 907)
- lichen** symbiotic association between a fungus and a photosynthetic organism (p. 540)
- ligament** strip of tough connective tissue in a joint that holds bones together (p. 925)
- light-dependent reactions** reactions of photosynthesis that use energy from light to produce ATP and NADPH (p. 210)
- lignin** substance in vascular plants that makes cell walls rigid (p. 560)
- limiting factor** factor that causes the growth of a population to decrease (p. 124)
- limiting nutrient** single nutrient that either is scarce or cycles very slowly, limiting the growth of organisms in an ecosystem (p. 80)
- lipid** macromolecule made mainly from carbon and hydrogen atoms; includes fats, oils, and waxes (p. 46)
- lipid bilayer** double-layered sheet that forms the core of nearly all cell membranes (p. 184)
- liver** large organ just above the stomach that produces bile, a fluid loaded with lipids and salts (p. 982)
- logistic growth** growth pattern in which a population's growth rate slows or stops following a period of exponential growth (p. 122)
- long-day plant** plant that flowers when days are long (p. 641)
- loop of Henle** section of the nephron tubule that conserves water and minimizes the volume of urine (p. 988)
- lymph** fluid lost by the blood into surrounding tissue (p. 954)
- lysogenic infection** process by which a virus embeds its DNA into the DNA of the host cell and is replicated along with the host cell's DNA (p. 485)
- lysosome** cell organelle filled with enzymes needed to break down certain materials in the cell (p. 178)
- lytic infection** process in which a virus enters a cell, makes a copy of itself, and causes the cell to burst (p. 485)
- macroevolution** large-scale evolutionary changes that take place over long periods of time (p. 435)
- macronucleus** the larger of a ciliate's two nuclei, contains multiple copies of most of the genes that the cell needs in its day-to-day existence (p. 499)
- madreporite** sievelike structure through which the water vascular system of an echinoderm opens to the outside (p. 735)
- malignant** term used to describe cancerous tumors, which can invade and destroy surrounding healthy tissue (p. 1046)
- Malpighian tubule** saclike organ in most terrestrial arthropods that extracts wastes from the blood and adds them to feces that move through the gut (p. 717)
- mammary gland** gland in mammals that produces milk to nourish the young (p. 821)
- mandible** mouthpart adapted for biting and grinding food (p. 721)
- mangrove swamp** coastal wetland dominated by mangroves, salt-tolerant woody plants (p. 108)
- manipulated variable** factor in an experiment that a scientist purposely changes; also known as independent variable (pp. 9, 1056)
- mantle** thin layer of tissue that covers most of a mollusk's body (p. 702)
- marsupial** mammal which bears live young that complete their development in an external pouch (p. 829)
- mass extinction** event in which many types of living things become extinct at the same time (p. 431)
- medulla oblongata** area of the brain that controls the functioning of many internal organs (p. 777)

- medusa** motile stage of the life cycle of a cnidarian that has a bell-shaped body (p. 670)
- meiosis** process by which the number of chromosomes per cell is cut in half through the separation of homologous chromosomes in a diploid cell (p. 276)
- melanin** dark-brown pigment found in skin (p. 934)
- meninges** three layers of connective tissue in which the brain and spinal cord are wrapped (p. 901)
- menstrual cycle** cycle during which an egg develops and is released from an ovary and the uterus is prepared to receive a fertilized egg (p. 1013)
- menstruation** last phase of the menstrual cycle, during which the lining of the uterus, along with blood and the unfertilized egg, is discharged through the vagina (p. 1015)
- meristematic tissue** plant tissue found only in the tips of shoots and roots; responsible for plant growth (p. 580)
- mesoderm** middle germ layer of most animals; gives rise to muscles and much of the circulatory, reproductive, and excretory systems (p. 661)
- mesophyll** specialized ground tissue that makes up the bulk of most leaves; performs most of a plant's photosynthesis (p. 596)
- messenger RNA (mRNA)** RNA molecule that carries copies of instructions for the assembly of amino acids into proteins from DNA to the rest of the cell (p. 301)
- metabolism** set of chemical reactions through which an organism builds up or breaks down materials as it carries out its life processes (p. 18)
- metaphase** second phase of mitosis, during which the chromosomes line up across the center of the cell (p. 248)
- metastasis** spread of a cancerous tumor beyond its original site (p. 1046)
- metric system** decimal system of measurement based on certain physical standards and scaled on multiples of 10 (p. 24)
- microclimate** climate within a small area that differs significantly from the climate of the surrounding area (p. 98)
- microfilament** long, thin fiber that functions in the movement and support of the cell (p. 176)
- microfossil** microscopic fossil (p. 426)
- miconucleus** the smaller of a ciliate's two nuclei; contains a "reserve copy" of all of the cell's genes (p. 499)
- microscope** device that produces magnified images of structures that are too small to see with the unaided eye (p. 25)
- microtubule** hollow tube of protein that maintains cell shape and can also serve as a "track" along which organelles are moved (p. 176)
- migration** periodic movement and return of animals from one place to another (p. 878)
- mineral** inorganic nutrient the body needs, usually in small amounts (p. 975)
- mitochondrion** cell organelle that releases energy from stored food molecules (p. 180)
- mitosis** part of eukaryotic cell division during which the cell nucleus divides (p. 245)
- mixture** material composed of two or more elements or compounds that are physically mixed together but not chemically combined (p. 41)
- molecular clock** model that uses DNA comparisons to estimate the length of time that two species have been evolving independently (p. 455)
- molecule** smallest unit of most compounds (p. 38)
- molting** process in which an arthropod sheds its exoskeleton and manufactures a larger one to take its place (p. 719)
- monocot** angiosperm whose seeds have one cotyledon (p. 569)
- monoculture** farming strategy in which large fields are cleared, plowed, and planted with a single, highly productive crop year after year (p. 142)
- monomer** small unit that can join together with other small units to form polymers (p. 45)
- monosaccharide** single sugar molecule (p. 46)
- monotreme** egg-laying mammal (p. 828)
- multiple alleles** three or more alleles of the same gene (p. 273)
- muscle tissue** tissue that controls the internal movement of materials in the body, as well as external movement of the entire body or body parts (p. 894)
- mutation** change in a DNA sequence that affects genetic information (p. 307)
- mutualism** symbiotic relationship in which both species benefit from the relationship (p. 93)
- mycelium** many hyphae tangled together into a thick mass; comprises the bodies of multicellular fungi (p. 528)
- mycorrhiza** symbiotic association of plant roots and fungi (p. 541)
- myelin sheath** insulating membrane surrounding the axon in some neurons (p. 898)
- myocardium** thick middle muscle layer of the heart; pumps blood through the circulatory system (p. 944)
- myosin** protein that makes up the thick filaments in striations in skeletal muscle cells (p. 928)
- NAD<sup>+</sup> (nicotinamide adenine dinucleotide)** electron carrier involved in glycolysis (p. 223)
- NADP<sup>+</sup> (nicotinamide adenine dinucleotide phosphate)** one of the carrier molecules that transfers high-energy electrons from chlorophyll to other molecules (p. 209)



# GLOSSARY

- natural selection** process by which individuals that are better suited to their environment survive and reproduce most successfully; also called survival of the fittest (p. 381)
- natural variation** differences among individuals of a species (p. 379)
- nematocyst** stinging structure within each cnidocyte of a cnidarian that is used to poison or kill prey (p. 669)
- nephridium** excretory organ of an annelid that filters fluid in the coelom (p. 696)
- nephron** small independent blood-filtering unit in the renal cortex of the kidney (p. 986)
- nerve net** loosely organized network of nerve cells that together allow cnidarians to detect stimuli (p. 671)
- nervous tissue** tissue that receives messages from the body's external and internal environment, analyzes the data, and directs the response (p. 894)
- neuromuscular junction** point of contact between a motor neuron and a skeletal muscle cell (p. 929)
- neuron** cell that carries messages throughout the nervous system (p. 897)
- neurotransmitter** chemical used by a neuron to transmit an impulse across a synapse to another cell (p. 900)
- niche** full range of physical and biological conditions in which an organism lives and the way in which the organism uses those conditions (p. 91)
- nicotine** stimulant drug in tobacco that increases heart rate and blood pressure (p. 961)
- nictitating membrane** movable transparent membrane in amphibians located inside the regular eyelid; protects the surface of the eye from damage under water and keeps it moist on land (p. 787)
- nitrogen fixation** process of converting nitrogen gas into ammonia (pp. 78, 478)
- node** point on a stem where a leaf is attached (p. 589)
- nondisjunction** error in meiosis in which homologous chromosomes fail to separate (p. 352)
- nonrenewable resource** resource that cannot be replenished by natural processes (p. 144)
- notochord** long supporting rod that runs through a chordate's body just below the nerve cord (pp. 767, 849)
- nuclear envelope** double-membrane layer that surrounds the nucleus of a cell (p. 176)
- nucleic acid** macromolecule containing hydrogen, oxygen, nitrogen, carbon, and phosphorus (p. 47)
- nucleolus** small, dense region within most nuclei in which the assembly of ribosomes begins (p. 176)
- nucleotide** monomer of nucleic acids made up of a 5-carbon sugar, a phosphate group, and a nitrogenous base (pp. 47, 291)
- nucleus** the center of the atom which contains the protons and neutrons (p. 35); in cells, large structure inside some cells that contains the cell's genetic material (DNA) and controls the cell's activities (p. 171)
- nutrient** chemical substance that an organism requires to live (p. 76)
- nymph** immature form that lacks functional sex organs and other adult structures (p. 729)
- observation** use of one or more of the senses—sight, hearing, touch, smell, and sometimes taste—to gather information (p. 4)
- omnivore** organism that obtains energy by eating both plants and animals (p. 69)
- oogonium** specialized structure formed by hyphae that produces female nuclei (p. 519)
- open circulatory system** system in which blood is not always contained within a network of blood vessels (pp. 703, 754)
- operant conditioning** learning process in which an animal learns to behave in a certain way through repeated practice, in order to receive a reward or avoid punishment; also called trial-and-error learning (p. 875)
- operational definition** description of how a particular variable is to be measured or how a term is to be defined (p. 1057)
- operator** region of chromosome in an operon to which the repressor binds when the operon is "turned off" (p. 310)
- operon** group of genes operating together (p. 309)
- opposable thumb** thumb that enables grasping objects and using tools (p. 835)
- order** group of similar families (p. 449)
- organ** group of tissues that work together to perform closely related functions (p. 193)
- organ system** group of organs that work together to perform a specific function (p. 193)
- organelle** specialized structure that performs important cellular functions within a eukaryotic cell (p. 172)
- osmosis** diffusion of water through a selectively permeable membrane (p. 186)
- ossification** process of bone formation, during which cartilage is replaced by bone (p. 922)
- ovary** in plants, a flower structure that contains one or more ovules from which female gametophytes are produced (p. 612); in animals, the female gonad that produces eggs (p. 1008)
- oviparous** term used to refer to animals whose eggs hatch outside the mother's body (p. 778)

**ovoviviparous** term used to refer to animals whose young are born alive after developing in eggs inside the mother's body (p. 778)

**ovulation** process in which an egg is released from the ovary (p. 1013)

**ovule** structure in seed cones in which female gametophytes develop (p. 610)

**ozone layer** band of ozone, a gas made up of three oxygen atoms (p. 157)

**pacemaker** small group of cardiac muscle cells in the right atrium that "set the pace" for the heart as a whole; also known as the sinoatrial node (p. 946)

**paleontologist** scientist who studies fossils (p. 417)

**palisade mesophyll** layer of tall, column-shaped mesophyll cells just under the upper epidermis of a leaf (p. 596)

**pancreas** gland that produces hormones that regulate blood sugar; enzymes that break down carbohydrates, proteins, lipids, and nucleic acids; and sodium bicarbonate, a base that neutralizes stomach acid (p. 982)

**parasite** organism that lives within or on another organism and harms that organism by feeding on it (p. 658)

**parasitism** symbiotic relationship in which one organism lives in or on another organism and harms it (p. 93)

**parenchyma** type of ground-tissue cell with a thin cell wall and large central vacuole (p. 583)

**pathogen** disease-causing agent, such as a bacterium or fungus (pp. 479, 1029)

**pedigree** chart that shows the relationships within a family (p. 342)

**pedipalps** pair of mouthparts in chelicerates that are usually modified to grab prey (p. 722)

**pellicle** cell membrane in euglenas (p. 506)

**penis** external male reproductive organ that connects the urethra to the outside of the body (p. 1011)

**peptic ulcer** hole in the stomach wall (p. 981)

**perennial** flowering plant that lives for more than two years (p. 572)

**period** unit of time into which eras are subdivided (p. 422)

**periosteum** tough layer of connective tissue surrounding a bone (p. 922)

**peristalsis** rhythmic muscular contractions that squeeze food through the esophagus into the stomach (p. 980)

**permafrost** layer of permanently frozen subsoil in the tundra (p. 104)

**permanent immunity** condition in which people who have survived exposure to a disease never develop it again (p. 1038)

**petal** brightly-colored structure just inside the sepals; attracts insects and other pollinators to a flower (p. 612)

**petiole** thin stalk by which a leaf blade is attached to a stem (p. 595)

**pH scale** measurement system used to indicate the concentration of hydrogen ions ( $H^+$ ) in solution; ranges from 0 to 14 (p. 43)

**phagocyte** white blood cell that engulfs and digests foreign cells (p. 952)

**phagocytosis** process in which extensions of cytoplasm surround and engulf large particles and take them into the cell (p. 189)

**pharyngeal pouch** one of a pair of structures in the throat (pharynx) region of a chordate (p. 767)

**pharynx** muscular tube at the end of the gastrointestinal cavity, or throat, that connects the mouth with the rest of the digestive tract and serves as a passageway for air and food (pp. 684, 956)

**phenotype** physical characteristics of an organism (p. 268)

**pheromone** specific chemical messenger that affects the behavior or development of other individuals of the same species (p. 731)

**phloem** vascular tissue responsible for the transport of nutrients and the carbohydrates produced by photosynthesis (p. 560)

**photic zone** well-lit upper layer of the oceans (p. 109)

**photoautotroph** prokaryote that carries out photosynthesis in a manner similar to that of plants (p. 474)

**photoheterotroph** prokaryote that is photosynthetic but also needs organic compounds for nutrition (p. 474)

**photoperiodism** response of plants to periods of light and darkness (p. 641)

**photosynthesis** process by which plants and some other organisms use light energy to power chemical reactions that convert water and carbon dioxide into oxygen and high-energy carbohydrates such as sugars and starches (pp. 68, 204)

**phototropism** tendency of plants to grow toward a source of light (p. 634)

**phycobillin** accessory pigment found in red algae that is especially good at absorbing blue light (p. 510)

**phylum** group of closely related classes (p. 449)

**phytochrome** plant pigment responsible for photoperiodism (p. 641)

**phytoplankton** population of algae and other small, photosynthetic organisms found near the surface of the ocean and forming part of plankton (pp. 107, 508)

# GLOSSARY

**pigment** light-absorbing colored molecule (p. 207)

**pioneer species** first species to populate an area during primary succession (p. 94)

**pith** parenchyma cells inside the ring of vascular tissue in dicot stems (p. 590)

**pituitary gland** gland in the base of the skull that secretes nine hormones that directly regulate many body functions and control the actions of several other endocrine glands (p. 1003)

**placenta** organ in placental mammals through which nutrients, oxygen, carbon dioxide, and wastes are exchanged between embryo and mother (pp. 829, 1018)

**plankton** tiny, free-floating, weakly swimming organisms that occur in aquatic environments (p. 107)

**Plantae** kingdom of multicellular photosynthetic autotrophs that have cell walls containing cellulose (p. 461)

**plasma** straw-colored fluid that makes up about 55 percent of blood; consists of about 90 percent water and about 10 percent dissolved gases, salts, nutrients, enzymes, hormones, waste products, and plasma proteins (p. 951)

**plasmid** circular DNA molecule found in bacteria (p. 327)

**plasmodium** structure with many nuclei formed by acellular slime molds (p. 518)

**plastron** ventral part of a turtle's or tortoise's shell (p. 805)

**platelet** cell fragment released by bone marrow (p. 953)

**point mutation** mutation that affects a single nucleotide, usually by substituting one nucleotide for another (p. 307)

**polar zone** cold climate zone where the sun's rays strike Earth at a very low angle (p. 188)

**pollen cone** cone in gymnosperms that produces male gametophytes in the form of pollen grains (p. 610)

**pollen grain** male gametophyte in seed plants (p. 565)

**pollen tube** structure grown by a pollen grain; contains two haploid sperm nuclei (p. 611)

**pollination** transfer of pollen from the male gametophyte to the female gametophyte (p. 565)

**pollutant** harmful material that can enter the biosphere through the land, air, or water (p. 148)

**polygenic trait** trait controlled by two or more genes (pp. 273, 343, 396)

**polymer** large compound formed from combinations of many monomers (p. 45)

**polymerase chain reaction (PCR)** technique that allows molecular biologists to make many copies of a particular gene (p. 325)

**polyp** usually sessile stage of the life cycle of a cnidarian that has a cylindrical body with armlike tentacles (p. 670)

**polyploid** having many sets of chromosomes (p. 321)

**polysaccharide** large macromolecule formed from monosaccharides (p. 46)

**population** group of individuals of the same species that live in the same area (p. 64)

**population density** number of individuals per unit of area (p. 119)

**predation** interaction in which one organism captures and feeds on another organism (p. 93)

**predator-prey relationship** mechanism of population control in which a population is regulated by predation (p. 126)

**prehensile** term used to refer to a long tail that can grasp branches (p. 835)

**pressure-flow hypothesis** hypothesis that considers plants in terms of where they produce and use materials from photosynthesis (p. 602)

**primary growth** type of plant growth that occurs at the tips of roots and shoots (p. 590)

**primary productivity** rate at which organic matter is created by producers in an ecosystem (p. 80)

**primary succession** succession that occurs on surfaces where no soil exists (p. 94)

**prion** infectious particle made up of protein rather than RNA or DNA (p. 487)

**probability** likelihood that a particular event will occur (p. 267)

**producer** organism that can capture energy from sunlight or chemicals and use it to produce food from inorganic compounds; also called an autotroph (p. 67)

**product** element or compound produced by a chemical reaction (p. 49)

**proglottid** one of the segments that make up most of a tapeworm's body (p. 688)

**prokaryote** single-celled microorganism that lacks a nucleus (pp. 172, 471)

**promoter** region of DNA that indicates to an enzyme where to bind to make RNA (p. 301)

**prophase** first and longest phase of mitosis, during which the chromosomes become visible and the centrioles separate and take up positions on the opposite sides of the nucleus (p. 246)

**prosimian** with few exceptions, small, nocturnal primate that has large eyes for seeing in the dark (p. 834)

**prostaglandin** hormonelike modified fatty acid produced by a wide range of cells; generally affects only nearby cells and tissues (p. 1000)

- protein** macromolecule that contains carbon, hydrogen, oxygen, and nitrogen; needed by the body for growth and repair and to make up enzymes (pp. 47, 973)
- proteinoid microsphere** tiny bubble, formed of large organic molecules, that has some characteristics of a cell (p. 425)
- protist** any eukaryote that is not a plant, an animal, or a fungus (p. 495)
- Protista** kingdom composed of eukaryotes that are not classified as plants, animals, or fungi (p. 460)
- protonema** mass of tangled green filaments in mosses that forms during germination (p. 558)
- protostome** animal whose mouth is formed from its blastopore (p. 661)
- pseudocoelom** body cavity between the endoderm and mesoderm tissues that is partially lined with mesoderm tissue (p. 689)
- psuedopod** projection of cytoplasm, or false foot, used by some protists for feeding or movement (p. 498)
- puberty** period of rapid growth and sexual maturation during which the reproductive system becomes fully functional (p. 1009)
- pulmonary circulation** pathway in which the right side of the heart pumps blood to the lungs (p. 944)
- punctuated equilibrium** pattern of evolution in which long stable periods are interrupted by brief periods of more rapid change (p. 439)
- Punnett square** diagram showing the gene combinations that might result from a genetic cross (p. 268)
- pupa** stage of metamorphosis in which an insect changes from a larva into an adult (p. 729)
- pupil** small opening in the middle of the iris through which light enters the eye (p. 906)
- radial symmetry** body plan in which body parts repeat around the center of the body; characteristic of sea anemones and sea stars (pp. 662, 748)
- radioactive dating** technique in which scientists calculate the age of a sample based on the amount of remaining radioactive isotopes it contains (p. 420)
- radula** tongue-shaped structure used for feeding by snails and slugs (p. 702)
- reabsorption** process by which most of the material removed from the blood at Bowman's capsule makes its way back into the blood (p. 987)
- reactant** element or compound that enters into a chemical reaction (p. 49)
- recombinant DNA** DNA produced by combining DNA from different sources (p. 324)
- reflex** quick automatic response to a stimulus (p. 903)
- relative dating** method of determining the age of a fossil by comparing its placement with that of fossils in other layers of rock (p. 419)
- relative frequency** number of times an allele occurs in a gene pool compared with the number of times other alleles occur (p. 394)
- renewable resource** resource that can regenerate quickly and that is replaceable (p. 144)
- replication** copying process by which a cell duplicates its DNA (p. 299)
- reproductive isolation** separation of species or populations so that they cannot interbreed and produce fertile offspring (p. 404)
- reptile** any vertebrate that has dry scaly skin, lungs, and terrestrial eggs with several protective membranes (p. 797)
- resource** any necessity of life, such as water, nutrients, light, food, or space (p. 92)
- responding variable** factor in an experiment that a scientist wants to observe, which may change in response to the manipulated variable; also known as a dependent variable (pp. 9, 1056)
- response** single, specific reaction to a stimulus (p. 871)
- resting potential** difference in electrical charge across the cell membrane of a resting neuron (p. 898)
- restriction enzyme** enzyme that cuts DNA at a specific sequence of nucleotides (p. 323)
- retina** innermost layer of the eye (p. 907)
- retrovirus** virus that contains RNA as its genetic information (p. 487)
- rhizoid** in fungi, a rootlike hypha that penetrates the surface of an object (p. 530); in mosses, a long, thin cell that anchors the moss to the ground and absorbs water and minerals from the surrounding soil (p. 557)
- rhizome** creeping or underground stem in ferns (p. 562)
- ribonucleic acid (RNA)** single-stranded nucleic acid that contains the sugar ribose (p. 47)
- ribosomal RNA (rRNA)** type of RNA that makes up the major part of ribosomes (p. 301)
- ribosome** small particle in the cell on which proteins are assembled; made of RNA and protein (p. 157)
- RNA polymerase** enzyme similar to DNA polymerase that binds to DNA and separates the DNA strands during transcription (p. 301)
- rod** photoreceptor in eye that is extremely sensitive to light (p. 907)
- root** underground organ in plants that absorbs water and minerals (p. 561)
- root cap** tough structure that protects a root as it forces its way through the soil (p. 585)
- root hair** tiny projection from the outer surface, or epidermis, of a root (p. 585)
- rumen** stomach chamber in cows and related animals in which newly swallowed plant food is stored and processed (p. 823)

- salt marsh** temperate-zone estuary dominated by salt-tolerant grasses above the low-tide line and by seagrasses under water (p. 108)
- saprobe** organism that obtains food from decaying organic matter (p. 537)
- sapwood** area in plants that surrounds heartwood and is active in fluid transport (p. 592)
- science** organized way of using evidence to learn about the natural world; also, the body of knowledge that scientists have built up after years of using this process (p. 3)
- sclerenchyma** type of ground-tissue cell with an extremely thick, rigid cell wall that makes ground tissue tough and strong (p. 583)
- scolex** head of an adult tapeworm; can contain suckers or hooks (p. 688)
- scrotum** external sac containing the testes (p. 1010)
- secondary growth** pattern of plant growth in which stems increase in width (p. 95)
- secondary succession** succession following a disturbance that destroys a community without destroying the soil (p. 95)
- seed** embryo of a living plant that is encased in a protective covering and surrounded by a food supply (p. 565)
- seed coat** structure that surrounds and protects a plant embryo and keeps it from drying out (p. 565)
- seed cone** cone that produces female gametophytes (p. 610)
- segregation** separation of alleles during gamete formation (p. 266)
- selective breeding** method of improving a species by allowing only those individual organisms with desired characteristics to produce the next generation (p. 319)
- selective permeability** property of biological membranes that allows only certain substances to pass through them (p. 186)
- semicircular canal** one of three structures within the inner ear that help an organism maintain balance (p. 908)
- seminiferous tubule** one of hundreds of tiny tubules in the testes in which sperm are produced (p. 1010)
- sensory receptor** neuron that reacts directly to light, sound, or other stimuli by sending impulses to other neurons and eventually to the central nervous system (p. 906)
- sepal** outermost circle of flower parts that encloses a bud before it opens and protects the flower while it is developing (p. 612)
- septum** internal wall between the segments of an annelid's body (p. 694)
- seta** bristle attached to the segments of many annelids (p. 694)
- sex chromosome** one of two chromosomes that determine an individual's sex; females have two X chromosomes; males have one X chromosome and one Y chromosome (p. 341)
- sex-linked gene** gene located on the X or Y chromosome (p. 350)
- sexual reproduction** process by which two cells from different parents unite to produce the first cell of a new organism (p. 17)
- shell** structure in mollusks made by glands in the mantle that secrete calcium carbonate (p. 702)
- short-day plant** plant that flowers when daylight is short (p. 641)
- sieve tube element** phloem cell that is joined end-to-end to similar cells to form a continuous sieve tube (p. 582)
- single-gene trait** trait controlled by a single gene (p. 395)
- siphon** tubelike structure through which water enters and leaves a mollusk's body (p. 703)
- small intestine** digestive organ in which most chemical digestion takes place (p. 981)
- smog** gray-brown mixture of chemicals that occurs as a haze in the atmosphere (p. 148)
- society** group of closely related animals of the same species that work together for the benefit of the group (p. 732)
- soil erosion** wearing away of surface soil by water and wind (p. 145)
- solute** substance that is dissolved in a solvent to make a solution (p. 42)
- solution** mixture of two or more substances in which the molecules of the substances are evenly distributed (p. 42)
- solvent** substance in which a solute is dissolved to form a solution (p. 42)
- sorus** cluster of sporangia on the underside of a fern frond (p. 562)
- speciation** formation of new species (p. 404)
- species** group of similar organisms that can breed and produce fertile offspring (p. 64)
- species diversity** number of different species in the biosphere (p. 150)
- spicule** spike-shaped structure that makes up the skeletons of harder sponges; made of either chalklike calcium carbonate or glasslike silica (p. 665)
- spindle** fanlike microtubule structure that helps separate the chromosomes during mitosis (p. 247)
- spinneret** organ in spiders that contains silk glands (p. 723)
- spiracle** small opening located along the side of the body through which air enters and leaves the body of many terrestrial arthropods (p. 717)



**spirillum** spiral or corkscrew-shaped prokaryote (p. 473)

**spongy mesophyll** loose tissue beneath the palisade layer of a leaf; has many air spaces between its cells (p. 596)

**spontaneous generation** hypothesis (disproven) stating that life could arise from nonliving matter (p. 8)

**sporangiophore** specialized hyphae where sporangia are found (p. 528)

**sporangium** structure in ferns and some fungi that contains spores (pp. 528, 562)

**spore** haploid reproductive cell (p. 514)

**sporophyte** diploid, or spore-producing, phase of an organism (pp. 514, 552)

**stabilizing selection** form of natural selection by which the center of the curve remains in its current position; occurs when individuals near the center of a distribution curve have higher fitness than individuals at either end (p. 399)

**stamen** male part of the flower; made up of an anther and a filament (p. 612)

**stem** supporting structure that connects roots and leaves and carries water and nutrients between them (p. 561)

**sterilization** process of destroying bacteria using great heat or chemical action (p. 481)

**stigma** sticky portion at the top of the style where pollen grains frequently land (p. 612)

**stimulant** drug that speeds up the actions regulated by the nervous system (p. 910)

**stimulus** any kind of detectable signal that carries information (p. 871)

**stolon** in fungi, a stemlike hypha that runs along the surface of an object (p. 530); in plants, a long, trailing stem that produces roots when it touches the ground (p. 622)

**stoma** opening in the underside of a leaf that allows carbon dioxide and oxygen to diffuse into and out of the leaf (p. 596)

**stomach** large muscular sac that continues the mechanical digestion of food (p. 980)

**stroma** region outside the thylakoid membranes in chloroplasts (p. 208)

**struggle for existence** competition among members of a species for food, living space, and the other necessities of life (p. 380)

**style** narrow stalk of the carpel in a flower (p. 612)

**subcutaneous fat** layer of fat cells beneath the skin (p. 822)

**subsistence hunting** hunting only to acquire basic necessities for survival; makes relatively few demands on the environment (p. 140)

**substrate** reactant of an enzyme-catalyzed reaction (p. 52)

**survival of the fittest** process by which individuals that are better suited to their environment survive and reproduce most successfully; also called natural selection (p. 381)

**suspension** mixture of water and nondissolved materials (p. 42)

**sustainable use** using natural resources at a rate that does not deplete them (p. 145)

**swim bladder** internal gas-filled organ in many bony fishes that adjusts their buoyancy (p. 777)

**swimmerets** flipperlike appendages used by decapods for swimming (p. 721)

**symbiosis** relationship in which two species live closely together (p. 93)

**synapse** location at which a neuron can transfer an impulse to another cell (p. 900)

**systemic circulation** pathway in which the left side of the heart pumps blood to all of the body except the lungs (p. 944)

**taproot** primary root found in some plants that grows longer and thicker than other roots (p. 584)

**target cell** cell affected by a particular hormone (pp. 634, 997)

**taste bud** sense organ that detects the flavor of a substance (p. 909)

**taxon** group or level of organization into which organisms are classified (p. 449)

**taxonomy** discipline of classifying organisms and assigning each organism a universally accepted name (p. 447)

**telophase** fourth and final phase of mitosis, during which the chromosomes begin to disperse into a tangle of dense material (p. 248)

**temperate zone** moderate climate zone between the polar zones and the tropics (p. 88)

**temporal isolation** form of reproductive isolation in which two populations reproduce at different times (p. 405)

**tendon** tough connective tissue that joins skeletal muscles to bones (p. 930)

**territory** specific area occupied and protected by an animal or group of animals (p. 881)

**testis** male gonad that produces sperm (pp. 688, 1008)

**tetrad** structure containing 4 chromatids that forms during meiosis (p. 276)

**thalamus** brain structure that receives messages from the sense organs and relays the information to the proper region of the cerebrum for further processing (p. 903)

**theory** well-tested explanation that unifies a broad range of observations (pp. 14, 369)

**thigmotropism** response of plants to touch (p. 639)

# GLOSSARY

**thorax** body part of a crustacean that lies just behind the head and houses most of the internal organs (p. 721)

**threshold** minimum level of a stimulus required to activate a neuron (p. 899)

**thylakoid** saclike body in chloroplasts made of photosynthetic membranes that contain photosystems (p. 208)

**tissue** group of similar cells that perform a particular function (p. 192)

**toxin** poison that produces illness by disrupting bodily functions (p. 1031)

**trachea** windpipe; tube through which air moves (p. 956)

**tracheal tube** one of many branching, air-filled tubes that extend throughout the bodies of many terrestrial arthropods (p. 717)

**tracheid** hollow plant cell in xylem tissue with thick cell walls that resist pressure (p. 560)

**trait** specific characteristic that varies from one individual to another (p. 264)

**transcription** process in which part of the nucleotide sequence of DNA is copied into a complementary sequence in RNA (p. 301)

**transfer RNA (tRNA)** type of RNA molecule that transfers amino acids to ribosomes during protein synthesis (p. 301)

**transformation** process in which one strain of bacteria is changed by a gene or genes from another strain of bacteria (p. 288)

**transgenic** term used to refer to an organism that contains genes from other organisms (p. 331)

**translation** decoding of a mRNA message into a polypeptide chain (p. 304)

**transpiration** loss of water from a plant through its leaves (pp. 75, 596)

**trichocyst** small, bottle-shaped structures used for defense by paramecia (p. 499)

**trichome** tiny cellular projection on the surfaces of some leaves that helps protect the leaf and also gives it a fuzzy appearance (p. 581)

**trochophore** free-swimming larval stage of an aquatic mollusk (p. 701)

**trophic level** step in a food chain or food web (p. 70)

**tropical zone** warm climate zone that receives direct or nearly direct sunlight year round (p. 88)

**tropism** response of a plant to an environmental stimulus (p. 639)

**true-breeding** term used to describe organisms that produce offspring identical to themselves if allowed to self-pollinate (p. 263)

**tube foot** suction cup-like structure attached to radial canals of echinoderms; used to walk and to open shells (p. 735)

**tumor** mass of growing tissue that may form when a cell or group of cells begins to grow and divide uncontrollably (p. 1046)

**tympanic membrane** eardrum of amphibians inside the skull; vibrates in response to sound, allowing hearing (p. 787)

**understory** layer in a rain forest formed by shorter trees and vines (p. 100)

**ureter** tube that carries urine from the kidney to the urinary bladder (p. 985)

**urethra** tube through which urine and semen are released from the body (pp. 988, 1011)

**urinary bladder** saclike organ in which urine is stored before being excreted (p. 985)

**uterus** organ of the female reproductive system in which a fertilized egg can develop (p. 1013)

**vaccination** injection of a weakened or mild form of a pathogen to produce immunity (p. 1040)

**vacuole** cell organelle that stores materials such as water, salts, proteins, and carbohydrates (p. 179)

**vagina** canal in the human female reproductive system that leads from the uterus to the outside of the body (p. 1013)

**valve** flap of connective tissue between an atrium and a ventricle, or in a vein, that prevents backflow of blood (p. 945)

**van der Waals forces** a slight attraction that develops between the oppositely charged regions of nearby molecules (p. 39)

**variable** factor in an experiment that can change (p. 1056)

**vas deferens** tube that carries sperm from the epididymis to the urethra (p. 1010)

**vascular bundle** plant stem structure that contains xylem and phloem tissue (p. 590)

**vascular cambium** lateral meristematic tissue that produces vascular tissues and increases the thickness of the stem over time (p. 591)

**vascular cylinder** central region of a root that includes the vascular tissue—xylem and phloem (p. 585)

**vascular tissue** type of plant tissue specialized to conduct water (p. 560)

**vector** animal that carries disease-causing organisms from person to person (p. 1032)

**vegetative reproduction** method of asexual reproduction used by many flowering plants (p. 622)

**vein** in plants, a cluster of vascular tissue in leaves (p. 561); in animals, a blood vessel that returns blood to the heart (p. 947)

**ventricle** thick-walled lower chamber of the heart that pumps blood out of the heart (pp. 776, 944)

**vertebra** individual segment of the backbone; encloses and protects the spinal cord (p. 768)

**vertebrate** animal that has a vertebral column, or backbone (p. 657)

**vessel element** in angiosperms; xylem cell that forms part of a continuous tube through which water can move (p. 582)

**vestigial organ** organ that serves no useful function in an organism (p. 385)

**villus** folded projection that increases the surface area of the walls of the small intestine (p. 983)

**virus** particle made up of nucleic acid, protein, and in some cases lipids that can replicate only by infecting living cells (p. 482)

**visceral mass** area beneath the mantle of a mollusk that contains the internal organs (p. 702)

**vitamin** organic molecule that helps regulate body processes (p. 974)

**viviparous** term used to refer to animals that bear live young that are nourished directly by the mother's body as they develop (p. 778)



**water vascular system** system of internal tubes in echinoderms that carries out essential functions such as feeding, respiration, circulation, and movement (p. 735)

**weather** condition of Earth's atmosphere at a particular time and place (p. 87)

**wetland** ecosystem in which water either covers the soil, or is present at or near the surface of the soil for at least part of the year (p. 107)



**xerophyte** desert plant (p. 644)

**xylem** vascular tissue that carries water upward from the roots to every part of a plant (p. 560)



**zonation** prominent horizontal banding of organisms that live in a particular habitat (p. 110)

**zooplankton** tiny animals that form part of the plankton (p. 107)

**zoosporangium** spore case (p. 518)

**zygospore** resting spore that contains zygotes formed during the sexual phase of a mold's life cycle (p. 530)

**zygote** fertilized egg (p. 1016)

