

Glossary

A

abiotic non-living; refers to non-living things in the environment, such as sunlight, water, soil, air, or minerals (3.1)

ABO system classification system for human blood antigens in which the presence or absence of type A or type B antigens on red blood cells determines blood type as A, B, AB, or O. (8.3)

absorbance spectrum a graph showing the relative amounts of light of different colours (wavelengths) absorbed by various compounds (5.2)

abstinence avoidance of sexual intercourse (15.3)

accessory organ term often used to refer to the pancreas, liver, and gall bladder, because their role in the process of digestion is vital, but they are not physically part of the digestive tract (6.2)

accommodation in the eye, adjustment that the ciliary muscles make to the shape of the lens to focus on objects at varying distances (12.2)

acetylcholine the primary neurotransmitter of both the somatic nervous system and the parasympathetic nervous system (11.1)

acid deposition process by which sulfur and nitrogen emissions undergo chemical change in the atmosphere and are deposited in the environment as dry particles and gases, or as wet acid precipitation, including rain, snow, and fog (2.2)

actin protein that, along with myosin, is the chief component of muscle; makes up the thin filament of a muscle fibre; also a main component of the cellular cytoskeleton; *also see actin myofibril* (10.1)

actin myofibril thin myofibril consisting of two strands of actin molecules wrapped around each other; works with myosin myofibril to produce muscle contractions (10.1)

action potential in an axon, the change in charge that occurs when the gates of the K^+ channels close and the gates of the Na^+ channels open after a wave of depolarization is triggered (11.1)

adaptation a structure, behaviour, or physiological process that helps an organism survive and reproduce in a particular environment. (4.1) In vision, the process by which the iris adjusts the size of the pupil based on the light conditions, thereby controlling the amount of light that enters (12.2)

adaptive radiation diversification of a common ancestral species into a variety of species, all of which are differently adapted (4.3)

Addison's disease condition resulting from a damaged adrenal cortex; body secretes inadequate amounts of mineralocorticoids and glucocorticoids; symptoms include hypoglycemia (low blood sugar), sodium and potassium imbalances, rapid weight loss, and general weakness (13.3)

adhesion molecular attraction between two substances or bodies; for example, the attraction between water and the inner surface of a glass tube (2.1)

adrenal cortex the outer layer of the adrenal glands that produces glucocorticoids and mineralocorticoids, hormones that regulate the long-term stress response; also secretes a small amount of gonadocorticoids, female and male sex hormones that supplement the hormones produced by the gonads (testes and ovaries) (13.3)

adrenal gland one of a pair of organs located on top of the kidneys; composed of two layers: an outer cortex and an inner medulla; each layer produces different hormones and functions as an independent organ (13.3)

adrenal medulla the inner layer of the adrenal glands that produces epinephrine and norepinephrine, hormones that regulate the short-term stress response (13.3)

adrenaline *see epinephrine* (13.2, 13.3)

adrenocorticotropic hormone (ACTH) hormone synthesized by the anterior pituitary gland to target the adrenal cortex and regulate the production of glucocorticoids (13.3)

aerobic involving oxygen; *see also oxic* (5.3)

aerobic cellular respiration respiration carried out using oxygen to produce ATP; compare *anaerobic cellular respiration* (5.3)

afterbirth term for the extra-embryonic membranes, placenta, and umbilical cord when expelled from the uterus after birth (15.1)

age pyramid representation of the age structure of a population to show the proportion of individuals in the population in each age class; used by demographers to assess a population's potential for growth (20.3)

- agglutination** clumping together; for example clumping of red blood cells that occurs when incompatible blood types are mixed (8.3)
- AIDS** Acquired Immunodeficiency Syndrome; a disease that compromises the body's capacity for immunity; caused by a group of related viruses collectively called human immunodeficiency virus, or HIV, which are transmitted through body fluids; results in susceptibility to other diseases, often resulting in death (14.2)
- albedo** percentage of incoming solar radiation reflected by a surface (1.1)
- aldosterone** a type of mineralocorticoid hormone secreted by the adrenal cortex; stimulates the distal tubule and collecting duct of the kidneys to increase the absorption of sodium into the bloodstream, which is followed by the passive absorption of water and chloride (9.3, 13.3)
- algal bloom** rapid overgrowth of algae in a body of water, usually resulting from high concentrations of nitrate and/or phosphate; can result in deoxygenation of water when algae die, causing death of aquatic plants and animals (2.2)
- allantois** extra-embryonic membrane that forms the foundation for the umbilical cord (15.1)
- allele** different form of the same gene occurring on homologous chromosomes (16.1, 17.1, 19.1)
- allele frequency** rate of occurrence of a particular allele in a population, with respect to a particular gene; usually expressed as a decimal (19.1)
- alpha cell** cell of the pancreas which secretes glucagon to increase the level of blood glucose; compare *beta cell* (13.4)
- alternation of generations** term describing the life cycle of a plant that alternates between a diploid sporophyte generation and a haploid gametophyte generation (16.4)
- alveolus (alveoli)** gas exchange structure within mammalian lungs; tiny air pocket with walls made of a membrane that is a single cell thick, allowing for exchange of respiratory gases (7.1)
- amino acid** an organic compound consisting of a carboxylic acid group (COOH), an amino group (NH₂), and any of various side groups, linked together by peptide bonds to form proteins (18.2)
- ammonification** production of ammonia or ammonium products via break down of organic matter by decomposers (2.2)
- amniocentesis** procedure by which a needle is used to withdraw a small sample of amniotic fluid from the uterus in order to perform a genetic analysis; for safety, cannot be performed before the 14th week of pregnancy (18.4)
- amnion** extra-embryonic membrane that forms a transparent sac that encloses and protects the embryo and fetus (15.1)
- amylase** enzyme in saliva that breaks down starch into simpler sugars (6.2)
- anabolic** compound-synthesizing metabolic reaction (5.1)
- anaerobic** absence of oxygen (5.3)
- anaerobic cellular respiration** respiration carried out without using oxygen to produce ATP; compare *aerobic cellular respiration* (5.3)
- analogous structures** body parts in different species that have a similar function but evolved separately; for example insect and bird wings; compare *homologous structures* (4.2)
- anaphase** a late stage of cell division (mitosis) during which the centromere splits apart and chromosomes move to opposite poles of the cell; by the end of the phase, one complete diploid set of chromosomes has been gathered at each pole (16.2)
- androgen** male sex hormone (14.3)
- andropause** in men, a gradual decline in their testosterone level beginning around age 40; symptoms include fatigue, depression, loss of muscle and bone mass, and a drop in sperm production (14.3)
- anemia** a condition in which there is a deficiency of red blood cells or too little hemoglobin inside the red blood cells in the bloodstream; results in a deficiency of oxygen in the body tissues (8.2)
- anorexia nervosa** eating disorder characterized by a morbid fear of gaining weight and a misconception of body image; sufferers starve themselves and typically have a body mass less than 85% of their normal mass (6.3)
- anoxic** non-oxygen containing; compare *oxic* (5.3)
- anterior pituitary** anterior lobe of the pituitary gland; an endocrine gland that synthesizes and secretes six major hormones: human growth hormone (hGH), prolactin (PRL), thyroid-stimulating hormone (TSH), adrenocorticotropic hormone (ACTH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH); compare *posterior pituitary* (13.2)
- antibody** proteins that recognize foreign substances in the body and neutralize or destroy them (8.3)

antibody-mediated immunity component of the immune system that involves the activation of lymphocytes and the secretion of antibodies specific to a specific antigen; also known as *specific defence*; compare *cell-mediated immunity* (8.3)

anticodon specialized base triplet located on one lobe of a transfer RNA (tRNA) molecule that recognizes its complementary codon on a messenger RNA (mRNA) molecule (18.2)

antidiuretic hormone (ADH) hormone regulated by the hypothalamus and released by the pituitary gland that increases the permeability of the distal tubule and the collecting duct in the nephrons of the kidneys, allowing more water to be reabsorbed into the blood from the filtrate (9.3, 13.1)

antigen molecule found on the surface of cells and pathogens; can be recognized by the body's immune system (8.3)

antiparallel describes the property by which the 5' to 3' phosphate bridges run in opposite directions on each strand of nucleotides in a double-stranded DNA molecule (18.1)

anti-sense strand strand of nucleotides in a double-stranded DNA molecule that is complementary to the sense strand and is *not* transcribed; compare *sense strand* (18.2)

aorta major artery that carries oxygenated blood away from the heart to all regions of the body except the lungs (8.1)

aqueous humour clear, watery fluid in the anterior chamber of the eye; maintains the shape of the cornea and provides oxygen and nutrients for the surrounding cells, including those of the lens and cornea (12.2)

arteriosclerosis general term used to describe several conditions in which the walls of the arteries thicken and lose some of their elastic properties, thus becoming harder; the most common type is called atherosclerosis (8.1)

artery blood vessel that carries oxygen-rich blood away from the heart (8.1)

artificial insemination process by which sperm is collected, concentrated, and placed in the female's vagina (15.3)

asexual reproduction reproduction that requires only one parent and does not involve gametes; produces genetically identical offspring (16.4)

asthma chronic, obstructive lung disease that affects the bronchi and bronchioles, making breathing

difficult or impossible because of reduced air flow (7.3)

astigmatism uneven curvature of part of the cornea or lens that results in uneven focus and therefore blurry vision (12.2)

asymmetrical cytokinesis unequal division of the cytoplasm that occurs during cell division to form an egg cell during oogenesis (16.3)

ATP adenosine triphosphate; high-energy phosphate molecule that provides and stores energy required for chemical functions (5.1)

atrioventricular (AV) node bundle of specialized muscle tissue located in the wall of the right atrium; receives electrical stimulus from the sinoatrial node and transmits this impulse over the walls of the ventricles to start their contraction; compare *sinoatrial node* (8.1)

atrium (atria) one of the two upper chambers of the heart that collects blood flowing into the heart; right atrium receives blood from systemic circulation, and the left from pulmonary circulation (8.1)

atrophy reduction in the size, tone, and power of a muscle (10.2)

auditory canal tube that conducts sound waves from the outer ear to the tympanum (eardrum) of the middle ear; amplifies sound waves, effectively making sounds louder (12.3)

autoimmune disorder condition in which T cells or antibodies mistakenly attack the body's own cells as if they had foreign antigens (8.3)

autonomic system in vertebrates, the division of the peripheral nervous system that is under involuntary control; regulates glandular secretions and the function of smooth and cardiac muscle; compare *somatic system* (11.1, 11.3)

autosomal inheritance refers to traits—dominant and recessive—that are coded for by genes on autosomes (non-sex chromosomes) (17.3)

autosome chromosome other than a sex chromosome; human somatic cells have 22 pairs of these (16.1)

autotroph *see producer* (1.1)

axon long, cylindrical extension of a neuron's cell body that can range from 1 mm to 1 m in length; transmits impulses away from the cell body along its length to the next neuron (11.1)

B

B cell lymphocyte that is activated by a specific antigen to produce memory B cells and plasma cells; plasma

cells produce antigen specific antibodies; also known as *B lymphocyte*; compare *T cell* (8.3)

B lymphocyte see *B cell* (8.3)

back mutation mutation that reverses the effects of former mutations (19.2)

Barr body structure formed when the inactive X chromosome condenses tightly (17.2)

basilar membrane one of two parallel membranes that comprise the organ of Corti in the inner ear (the other is the tectorial membrane); lies along the base of the organ of Corti; attached to it are sensory mechanoreceptors known as hair cells (12.3)

Batesian mimicry form of mimicry in which an organism resembles another organism with a defense mechanism, but doesn't itself have the defence mechanism; compare *Müllerian mimicry* (20.2)

beta cell cell of the pancreas which secretes insulin to decrease the level of blood glucose; compare *alpha cell* (13.4)

binary fission asexual reproductive process of cell division in bacteria; produces genetically identical populations (16.4)

binocular vision type of vision in humans (and other primates) with forward-facing eyes; both eyes are used to look at and collect visual information about an object, enabling the brain to perceive depth and three-dimensional images (12.2)

binomial nomenclature a system in which a two-word name (genus plus species) is used to identify an organism (3.2)

bioavailability the amount of a nutrient that a person absorbs from a source, rather than the total amount actually in the source (6.2)

biodiversity the variety of species in an area and their range of behavioural, ecological, physiological, and other adaptations (3.3)

biogeochemical cycle the cyclical route taken by water and other chemical nutrients through all biotic and abiotic components of the biosphere (2.1)

biogeography the study of the past and present geographical distribution of species (4.2)

biological barrier factor such as behaviour that keeps species reproductively isolated even when they exist in the same region (4.3)

biological species see *species* (4.1)

biomass total dry mass of all the living, or once-living, organisms in a given population, area, or other unit being measured (1.2)

biome ecosystem or group of ecosystems in a specific region on Earth that has a particular combination of biotic and abiotic factors; for example, tundra, tropical rainforest, hot desert (3.3)

bioremediation use of living cells to perform environmental clean-up tasks, such as using bacteria to degrade PCBs into harmless compounds (18.4)

biosphere all of the areas on Earth (in the air, land, and water) that are inhabited by and that support life (1.1, 3.1)

biotechnology the use of natural biological systems to create useful new technologies and products (18.4)

biotic living; refers to living things in the environment, such as humans, trees, fish, or bacteria (3.1)

biotic potential (r) highest possible per capita growth rate for a population, given unlimited resources and ideal living conditions (20.1)

blastocyst mammalian embryo at the stage in which it is implanted in the wall of the uterus and consists of a nearly hollow ball of cells; is made up of two groups of cells: the trophoblast and the inner cell mass; this stage follows the morula (15.1)

blind spot region of the retina lacking photoreceptors (rods or cones) where the optic nerve leaves the eye; is incapable of detecting light (12.2)

blood pressure pressure exerted against blood vessel walls as circulating blood passes through the vessels (8.1)

blood transfusion introduction of blood or blood products into an artery or vein (8.3)

blood-brain barrier protective barrier formed by glial cells and blood vessels that separates the blood from the central nervous system; selectively controls the entrance of substances into the brain from the blood (11.2)

bolus smooth, lump-like mass of food rolled by the tongue to aid swallowing (6.2)

bottleneck effect gene pool change that results from a rapid decrease in population size (19.2)

Bowman's capsule in the kidney, cap-like formation at the top of each nephron that serves as a filtration structure; surrounds the glomerulus (9.1)

breathing inspiration and expiration; inspiration moves air from the external environment into the lungs, and expiration moves air from the lungs back to the external environment (7.1)

Broca's area one of two important areas on the left side of the cerebral cortex; coordinates the muscles for speaking and translates thought into speech; damage

to this area results in an inability to speak but does not affect the understanding of language; compare *Wernicke's area* (11.2)

bronchiole in a mammal, the passageway that branches from the bronchi into the separate lobes of the lungs; divides into smaller and smaller passageways that carry air into all portions of the lungs (7.1)

bronchitis inflammation of the bronchi; can be acute or chronic (7.3)

bronchus (bronchi) in a mammal, the passageway that branches from the trachea into the lungs, with one bronchus carrying air into each lung (7.1)

budding asexual form of reproduction whereby a new organism develops as an outgrowth of the body of the parent (16.4)

bundle of His a bundle of specialized fibres through which an electrical signal is transmitted from the atrioventricular (AV) node, initiating the contraction of the right and left ventricles (8.1)

C

calcitonin hormone that regulates calcium levels in the blood; stimulates the uptake of calcium into bones when the concentration of calcium in the blood rises too high (13.2)

Calvin-Benson cycle the light-independent process in which photosynthetic organisms fix carbon from atmospheric carbon dioxide to produce carbohydrates (5.2)

cancer group of diseases associated with uncontrolled, rapid cell division (16.2)

capillary the smallest blood vessel; gases and other substances are exchanged between the circulatory system and body tissues across the capillary wall, which is only a single cell thick (8.1)

carbohydrase enzyme that catalyses the hydrolysis of carbohydrates (6.2)

carbohydrate organic macromolecule that contains carbon, hydrogen, and oxygen in a 1:2:1 ratio; examples include monosaccharides, disaccharides, and polysaccharides (6.1)

carbon dioxide fixation the first stage in the synthesis of carbohydrates through the Calvin-Benson cycle; a carbon atom in carbon dioxide is chemically bonded to a pre-existing 5-carbon compound (ribulose biphosphate or RuBP) in the stroma of a chloroplast (5.2)

carcinogen cancer-causing agent (7.3)

carcinogenic cancer-causing; describes a factor, such as a chemical mutagen, that is associated with one or more forms of cancer (18.3)

carcinoma malignant tumour (7.3)

cardiac muscle striated, involuntary muscle found only in the heart (10.1)

carnivore an animal that eats other animals; compare *herbivore* (1.1)

carrying capacity (K) theoretical maximum population size that the environment can sustain over an extended period of time; may change over time as the habitat changes (20.1)

catabolic compound-decomposing metabolic reaction (5.1)

catalyst chemical that speeds up a chemical reaction but is not used up in the reaction (6.1)

cataract cloudy, or opaque, grey-white area on the lens of the eye caused by the degeneration of the protein structure of the lens; prevents the passing of light; increases in size over time and can lead to blindness if not medically treated (12.2)

CCK cholecystokinin; one of three enzymes (including secretin and GIP) secreted into the bloodstream by the duodenum, causing inhibition of stomach movement and secretions, and enabling fatty meals to remain in the stomach longer than non-fatty meals; also stimulates increased pancreatic secretions of digestive enzymes and gall bladder contractions (6.2)

cell body the main part of a neuron, containing the nucleus and other organelles and serving as the site of the cell's metabolic reactions; processes input from the dendrites and, if the input received is large enough, relays it to the axon, where an impulse is initiated (11.1)

cell cycle a continuous sequence of cell growth and division; the life cycle of a cell (16.1)

cell plate structure across a dividing plant cell that signals the location of new plasma membranes and cell walls (16.2)

cell-mediated immunity non-specific component of the immune system that involves the activation of white blood cells, specifically macrophages, neutrophils and monocytes, rather than the production of antibodies; also known as *non-specific defence*; compare *antibody-mediated immunity* (8.3)

cellular respiration process in which, mitochondria in the cells of plants, animals, and other multicellular organisms break down carbohydrates and other

- energy-rich products derived from them, such as fats, to generate molecules of ATP (1.1, 5.1)
- central nervous system** network of nerves that includes the brain and spinal cord; integrates and processes information sent by nerves (11.1)
- centriole** one of a pair of cylindrical organelles that moves to opposite poles of the cell during prophase of mitosis; provides an attachment for the spindle apparatus (16.2)
- centromere** the point at which two sister chromatids of a chromosome are joined and to which the spindle fibres are attached during mitosis (16.1)
- cerebellum** the part of the hindbrain involved in the unconscious coordination of posture, reflexes, and body movements, as well as fine, voluntary motor skills (11.2)
- cerebral cortex** thin outer covering of grey matter that covers each cerebral hemisphere of the brain; responsible for language, memory, personality, conscious thought, and other activities that are associated with thinking and feeling (11.2)
- cerebrospinal fluid** dense, clear liquid derived from blood plasma, found in the ventricles of the brain, in the central canal of the spinal cord, and in association with the meninges; transports hormones, white blood cells, and nutrients across the blood-brain barrier to the cells of the brain and spinal cord; acts as a shock absorber to cushion the brain (11.2)
- cerebrum** the largest part of the brain, divided into right and left cerebral hemispheres, which contains the centres for intellect, memory, consciousness, and language; interprets and controls the response to sensory information (11.2)
- cervix** in females, the narrow opening of the uterus that connects to the vagina (14.1)
- Chargaff's rule** in any sample of DNA, a constant relationship in which the amount of adenine is always approximately equal to the amount of thymine, and the amount of cytosine is always approximately equal to the amount of guanine (18.1)
- chemical mutagen** molecule that can enter the cell nucleus and induce a permanent change in the genetic material of the cell by reacting chemically with DNA; e.g., nitrites (18.3)
- chemiosmosis** process through which ATP is generated across the inner membrane of mitochondria and the thylakoid membrane of chloroplasts; couples the movement of hydrogen ions down a concentration gradient to the synthesis of ATP from ADP and phosphate (5.2, 5.3)
- chemoreceptor** sensory receptor that is sensitive to chemical stimulation; e.g., taste, smell, and blood pH (12.1)
- chemosynthesis** the process by which certain fungi and bacteria use the energy from chemical nutrients to chemically convert carbon (inorganic) into carbohydrates (organic) such as sugars and starches in the absence of sunlight (1.1)
- chlamydia** a sexually transmitted infection caused by the bacterium *Chlamydia trachomatis*; symptoms may include discharge from the penis or vagina, burning pain while urinating, or fever; left untreated, the disease can lead to pelvic inflammatory disease (PID) (14.2)
- chlorophyll** photosynthetic pigment located in the thylakoid membranes within chloroplasts (5.1)
- chloroplast** organelle within photosynthetic plants, algae, and some bacteria that uses the Sun's light energy to chemically convert carbon (inorganic) into carbohydrates (organic) such as sugars and starches; contains the photosynthetic pigment chlorophyll (5.1)
- cholinesterase** enzyme that breaks down the neurotransmitter acetylcholine in a synapse (11.1)
- chorion** in humans, membrane developed from the trophoblast layer of the blastocyst; develops into the fetal part of the placenta; is the outermost of the extra-embryonic membranes which encloses all the other membranes, as well as the embryo (15.1)
- chorionic villi sampling** procedure where fetal cells are removed from the chorion (a tissue that surrounds the amniotic sac and makes up the fetal placenta) to perform a genetic analysis; can be performed around the 9th week of pregnancy (18.4)
- choroid** vascular membrane of the eye that lies between the retina and the sclera; absorbs stray light rays that are not detected by the photoreceptors in the retina (12.2)
- chromatin** long fibres that form chromosomes and contain DNA, a small amount of RNA, and various proteins; non-condensed form of genetic material that predominates for most of the cell cycle (16.1)
- chromosomal sex** genetic sex of an individual, as determined by the type of sex chromosomes within the gametes at fertilization (14.3)
- chromosome** a length of DNA and its associated proteins (16.1)

- chromosome mapping** process for determining the relative position of genes on a chromosome (17.2)
- chromosome theory of inheritance** theory proposed by Walter Sutton that genes are carried on chromosomes (17.1)
- chyme** thick liquid formed by mixing food with gastric juice in the stomach (6.2)
- circadian rhythm** internal signal or 'clock' that tells your body when to sleep and wake (13.1)
- circulatory system** in animals, the system of vessels that transports blood, and the cells and substances suspended and dissolved in blood, throughout the body (8.1)
- circumcision** surgical removal of the foreskin of the penis (14.1)
- cirrhosis** a disorder of the liver in which scar tissue replaces healthy liver tissue and prevents the liver from functioning properly (6.3)
- cleavage** the process of cell division without cell growth; after fertilization, the zygote undergoes repeated cleavage without increasing in overall size (15.1)
- climate** average weather conditions in a particular region over a period of time, usually 30 years or more (3.3)
- climax community** the last or final stage of succession in an area; may remain relatively stable if there are no major environmental changes (20.2)
- clone** one of a pair of organisms (or more) that are genetically identical (18.4)
- clumped distribution** distribution of individuals in close proximity to each other throughout a suitable habitat; occurs when individuals tend to congregate where food, water, or shelter is most abundant (20.1)
- cochlea** one of the three components of the inner ear (cochlea, vestibule, and semicircular canals); involved in hearing; within the cochlea, the mechanical energy of sound is converted into electrochemical impulses that are transmitted to the brain (12.3)
- co-dominance** describes a situation in which two alleles may be expressed equally; occurs when two different alleles for a trait are both dominant (17.1)
- codon** in a gene, each set of three bases (for example, ACC or GAA) that code for an amino acid or a termination signal (18.2)
- coenzyme** chemical needed to make enzymes function (6.1)
- co-evolve** to evolve (change in traits over time) together, as occurs with two species that are closely associated with one another (20.2)
- cohesion** intermolecular force that holds molecules of a liquid or a solid together; for example, the attraction of water molecules to each other, resulting in surface tension (2.1)
- collecting duct** in the kidneys, large, pipe-like channel arising from the tubule connected to the Bowman's capsule in the nephron; functions as a water-conservation device, reabsorbing water from the filtrate in the nephron (9.1)
- colour blindness** inability to distinguish between or recognize some colours, typically shades of red and green; an inherited condition that occurs more frequently in males than in females; caused by a lack of particular cones, usually red and green (12.2)
- commensalism** a type of symbiotic relationship in which one individual lives close to or on another and benefits, and the host neither benefits, nor is harmed; compare *mutualism* and *parasitism* (20.2)
- community** all of the organisms in all the interacting populations in a given area (3.1)
- competitive inhibitor** *molecule that is able to bind with the active site of an enzyme, thus competing with the substrate to occupy this active site*; if the inhibitor is plentiful, it will occupy the active site, blocking the substrate from binding and stopping enzyme activity; compare *non-competitive inhibitor* (6.1)
- complementary base pairs** refers to the hydrogen-bonded, nitrogenous base pairs of adenosine and thymine, and of cytosine and guanine in the DNA double helix, or to the base pairs of adenosine and uracil, and of cytosine and guanine in hybrid molecules that link complementary strands of RNA and DNA (18.1)
- complete dominance** a condition in which the dominant allele of a gene completely conceals the presence of the recessive allele of a gene; an individual with one recessive and one dominant allele has the same observable physical characteristic as an individual with two dominant alleles; compare *incomplete dominance* (17.1)
- cone** a type of photoreceptor in the eye that is sensitive to different colours; compare *rod* (12.2)
- conjugation** in micro-organisms, a process of reproduction that involves the transfer of genetic material from one cell to another by cell-to-cell

- contact through a bridging structure; creates cells with new genetic combinations (16.4)
- consumer** an organism that cannot synthesize its own food through photosynthesis or chemosynthesis, and must derive some of its nutrients from organic molecules formed by producers (autotrophs); also known as a *heterotroph* (1.1)
- continuous trait** a trait for which the phenotypes vary smoothly from one extreme to another (17.2)
- contraceptive technology** any technology that reduces reproductive potential (15.3)
- copy DNA (cDNA)** artificial form of DNA synthesized from the mRNA of cell samples during a DNA microarray experiment (18.4)
- cornea** the transparent part of the sclera at the front of the eye, through which light enters (12.2)
- corona radiata** several jelly-like layers of follicle cells that loosely adhere to one another and surround the egg (15.1)
- coronary pathway** in animals, the circulatory pathway that supplies oxygen-rich blood to and carries deoxygenated blood from the muscle tissue of the heart (8.1)
- corpus callosum** bundle of white matter that joins the two cerebral hemispheres of the cerebrum of the brain; sends messages from one cerebral hemisphere to the other, telling each half of the brain what the other half is doing (11.2)
- corpus luteum** yellowish, gland-like structure that develops from a follicle that has matured and released its egg (ovum); it produces progesterone and some estrogen; if pregnancy doesn't occur, it degenerates (14.3)
- cortisol** a type of glucocorticoid hormone released by the adrenal cortex of the adrenal gland in a long-term stress response; triggers an increase in blood glucose levels and reduces inflammation (13.3)
- Cowper's gland** gland in human males that secretes mucus-like fluids into the urethra (14.1)
- creatine phosphate** a high-energy compound that regenerates ATP in muscle cells (10.1)
- cretinism** condition in which the thyroid fails to develop properly during childhood; individual has severe hyperthyroidism; characterized by a short, stocky figure, as well as developmental delays if not treated early in life (13.2)
- crista (cristae)** short, fingerlike projection formed by the folding of the inner membrane of a mitochondrion; provides a large surface area for the production of ATP (5.1)
- crossing over** the process by which non-sister chromatids exchange genes during prophase I of meiosis, allowing for the recombination of genes (16.3, 17.2)
- cryptic coloration** type of camouflage that makes potential prey difficult to spot (20.2)
- cystic fibrosis** a genetic condition that disrupts the function of the cells lining the passageways of the lungs; causes the usually thin mucus and liquid coating on the insides of the lungs to become very thick and sticky, leading to breathing problems (7.3)
- cytokinesis** one of the two main processes in cell division; consists of separation of cytoplasm and organelles and the formation of two daughter cells; *see also asymmetrical cytokinesis* (16.1)
- D**
- daughter cell** any one of two cells produced from the division of a parent cell (16.1)
- decomposer** organism, usually a bacterium, fungus, earthworm, or insect, that obtains energy by consuming dead plant and animal matter, or waste (1.1)
- dehydration synthesis** chemical reaction that results in the formation of a covalent bond between two subunit molecules by the removal of an -OH (hydroxyl) group from one subunit and a hydrogen atom from the other subunit; essentially, a molecule of water (H₂O) is removed; compare *hydrolysis* (6.1)
- denature** to alter the natural structural state of molecules such as nucleic acids and proteins, thereby disrupting their biological activity (6.1)
- dendrite** short, branching terminal on a nerve cell (neuron) that receives signals from other neurons or sensory receptors and relays the impulse to the cell body; numerous and highly branched (11.1)
- denitrification** conversion of nitrate or nitrite to nitrogen gas by bacteria in soil (2.2)
- density** in population dynamics, the number of individuals per unit of area or volume in a population (3.3)
- density-dependent factor** biotic factor that limits a habitat's carrying capacity (e.g., parasites, disease); the impact increases with the density of the population; compare *density-independent factor* (20.1)

density-independent factor abiotic factor that limits a habitat's carrying capacity (e.g., fire, flood); the impact is not affected by the density of the population; compare *density-dependent factor* (20.1)

deoxyribonucleic acid (DNA) a double-stranded nucleic acid molecule that governs the processes of heredity in the cells of organisms; composed of nucleotides containing a phosphate group, a nitrogenous base (adenine, guanine, cytosine, or thymine), and deoxyribose (16.1, 18.1)

depolarization in a neuronal membrane, reducing a membrane potential to less than the resting potential of -70 mV (11.1)

diabetes insipidus a disorder characterized by excessive thirst, weakness, and heavy and frequent urination due to insufficient levels of anti-diuretic hormone (ADH) (9.3)

diabetes mellitus a serious chronic condition that results when the pancreas does not make enough insulin or the body does not respond properly to insulin; levels of blood glucose tend to rise sharply after meals (hyperglycemia) and remain at significantly elevated levels (13.4)

dialysis procedure that removes wastes and excess fluid from the blood when kidney function is lost due to renal failure; based on the principle of diffusion of dissolved substances along a concentration gradient through a semipermeable membrane (9.3)

diaphragm in mammals, a muscle layer that separates the region of the lungs (thoracic cavity) from the region of the stomach and liver (abdominal cavity); contraction contributes to inspiration by increasing the volume of the thoracic cavity (7.2)

diastolic pressure the lowest blood pressure exerted before the ventricles contract; compare *systolic pressure* (8.1)

dichotomous key identification key that uses a series of paired comparisons to sort organisms into smaller and smaller groups (3.2)

differentiation cellular process that enables a cell to develop a particular shape and to perform specific functions that are different from the functions of other cells (15.1)

digestive system in animals, the system into which food is taken and broken down so that useful substances can be absorbed into and transported by the circulatory (blood) system to individual cells (6.2)

digestive tract in animals, a long tube that extends from the mouth to the anus, through which food

moves and is broken down into simpler compounds that are used for energy, growth, and cell repair (6.2)

dihybrid cross cross of two individuals that differ in two traits (17.1)

diploid describing a cell that contains two pairs of every chromosome, designated as $2n$; e.g., somatic cells; compare *haploid* (16.1)

disaccharide sugar that can be hydrolyzed into two monosaccharide subunits; examples include maltose and sucrose (6.1)

distal tubule in the kidney, tubular portion of the nephron that lies between the loop of Henle and the proximal tubule; main function is reabsorption of water and solutes, and secretion of various substances (9.2)

distribution pattern pattern in which a population is distributed or spread in an area; three types are uniform, random, and clumped (20.1)

divergence the development of one or more new species from a parent species as a result of mutation and adaptation to changing environmental conditions; the parent species continues to exist; compare *transformation* (4.3)

DNA fingerprint the pattern of bands into which DNA fragments sort during gel electrophoresis (18.3)

DNA ligase enzyme that splices together Okazaki fragments during DNA replication on the lagging strand or sticky ends that have been cut by a restriction endonuclease; catalyzes the formation of phosphate bonds between nucleotides (18.1, 18.3)

DNA microarray a chip (usually a glass microscope slide or polymer membrane) that contains a grid of thousands of microscopic cells; each cell contains a nucleic acid sequence that can bind with one of the mRNA molecules transcribed during gene expression; allows scientists to analyze the activity of thousands of genes at once (18.4)

DNA polymerase during DNA replication, an enzyme that slips into the space between two strands, uses the parent strands as a template, and adds nucleotides to make complementary strands (18.1)

DNA probe molecule of DNA with a nucleic acid sequence that is labelled with a radioactive or fluorescent chemical tag; binds to a complementary DNA sequence and can be used to locate a specific genetic marker (18.4)

DNA sequencing the process of identifying the precise nucleotide sequence of a DNA fragment (18.1)

DNA vector in gene therapy, something (commonly, a modified form of virus) that carries recombinant DNA containing a desired gene into a host cell in order to incorporate the gene into a patient's genome (18.4)

domain highest level of classification of living things (above kingdom); the three domains are Bacteria, Archaea, and Eukarya (3.2)

dominant describes a trait which always appears (is expressed) in an individual that is either heterozygous (*Aa*) or homozygous (*AA*) for that trait (17.1)

double helix spiral shape most commonly associated with DNA, made up of two long strands of nucleotides bound together and twisted (18.1)

ductus deferens (ductus deferentia) a storage duct from the epididymis leading to the penis via the ejaculatory duct; formerly known as *vas deferens* (14.1)

duodenum the first 25 cm of the small intestine; important site of chemical digestion of chyme from the stomach (6.2)

E

ecological community an association of interacting populations that inhabit a defined area (20.2)

ecological disturbance event that changes the structure of a community, sometimes destroying all actively growing organisms (20.2)

ecological niche the role that members of a population play in a community, including the resources that members need and the way in which members interact with other members of the population and the community (3.3)

ecological pyramid a pyramid-shaped model depicting patterns in distribution of energy, biomass and/or numbers of organisms among trophic levels (1.2)

ecology the study of the relationships between living things (organisms) and their non-living surroundings, the environment (1.1)

ecosystem a community of populations, together with the abiotic factors that surround and affect it (1.2, 3.1)

ecotourism form of tourism which incorporates the practice of sustainability (20.3)

ectoderm outermost germ layer formed during animal embryogenesis (15.1)

ejaculation release of semen from the penis (14.1)

ejaculatory duct tube connecting the ductus deferens to the penis (14.1)

electron transport system in mitochondria and chloroplasts, a system of electron-carrying molecules that transfer electrons to generate a hydrogen ion

gradient across a thylakoid or inner mitochondrial membrane to produce ATP (5.2, 5.3)

elongation the process of joining nucleotides to extend a new strand of DNA; relies on the action of DNA polymerase (18.1)

embryonic disk flattened, disk-shaped structure formed from the inner cell mass of the blastocyst during the second week after fertilization (15.1)

embryonic period of development the first of two main periods of prenatal development, taking place over the first eight weeks of the first trimester; during this time, cells divide and become redistributed, and tissues and organs form, as do structures that support and nourish the developing embryo; compare *fetal period of development* (15.1)

emigration migration of individuals out of a population; compare *immigration* (20.1)

emphysema obstructive respiratory disorder in which the walls of the alveoli break down and lose their elasticity; reduces the surface area for gas exchange and causes oxygen shortages in the tissues (7.3)

endocrine glands ductless glands that secrete hormones directly into the bloodstream (13.1)

endocrine system in vertebrates, system that works in parallel with the nervous system to maintain homeostasis by releasing chemical hormones from various glands; composed of the hormone-producing glands and tissues of the body (13.1)

endoderm the innermost germ layer formed during animal embryogenesis (15.1)

endometrium the mucous membrane that lines the uterus and increases in thickness in the latter part of the menstrual cycle; is richly supplied with blood vessels to provide nutrients for the fetus (14.1)

endosymbiont theory theory proposing that eukaryotic cells arose through a process in which one species of prokaryote was engulfed by another, thereby creating organelles (18.3)

environmental resistance combined effects of various interacting factors that limit population growth; prevents a population from growing at its biotic potential and determines the carrying capacity of the habitat (20.1)

enzyme protein molecule that acts as a catalyst to increase the rate of a reaction (6.1)

epididymis (epididymides) in human males, a narrow, tightly coiled tube connecting the seminiferous tubules to the ductus deferens; within, the sperm mature and become motile (14.1)

epiglottis in mammals, flap of cartilage located over the entrance to the trachea (called the glottis); closes during swallowing to prevent food from entering the respiratory tract (7.1)

epinephrine hormone produced by the adrenal cortex hormones that helps regulate the short-term stress response; also known as *adrenaline* (13.2, 13.3)

equilibrium state of balance in a system in which there is no net change over time (2.3)

erythrocyte blood cell that contains the respiratory protein hemoglobin and is specialized for oxygen transport; also known as *red blood cell* (8.2)

esophageal sphincter a muscular ring between the esophagus and the stomach that controls the movement of food into and out of the stomach (6.2)

esophagus muscular portion of the digestive tract that directs food from the mouth to the stomach (6.2)

essential amino acid refers to the any of the nine of twenty amino acids that must come from the diet because the human body cannot synthesize them (6.1)

estrogen female sex hormone produced in the ovary; helps maintain sexual organs and secondary sexual characteristics (14.3)

ethanol fermentation type of fermentation in which yeasts and some kinds of bacteria convert pyruvate to ethanol and carbon dioxide when low oxygen conditions inhibit aerobic respiration; compare *lactate fermentation* (5.3)

eukaryote organism characterized by cells that contain membrane-bound, structurally distinct nuclei and other membrane-bound organelles; compare *prokaryote* (3.2)

Eustachian tube bony passage extending from the middle ear to the throat; plays a role in equalizing air pressure on both sides of the eardrum (12.3)

evapotranspiration combined evaporation and transpiration of plants from a terrestrial area (2.1)

excretion process of separating wastes from body fluids and eliminating them from the body; performed by several body systems, including respiratory (excretes carbon dioxide and small amounts of other gases, including water vapour), skin (excretes water, salts, and some urea in perspiration), digestive (excretes water, salts, lipids, and a variety of pigments and other cellular chemicals), and excretory (excretes metabolic wastes that are dissolved or suspended in solution) systems (9.1)

excretory system in animals, the system that regulates the volume and composition of body fluids by

excreting metabolic wastes and recycling some substances for reuse; main organs include the kidneys, ureters, bladder, and urethra; also known as the *urinary system* (9.1)

exhalation movement of air out of the lungs during breathing; also known as *expiration* (7.2)

exocrine gland gland which secretes hormones via ducts (13.4)

expiratory reserve volume additional volume of air that can be forced out of the lungs, beyond a regular, or tidal, exhalation (7.2)

exponential growth growth, particularly of a population, in which the increase occurs by a repeated doubling in number (16.4)

exponential growth pattern pattern exhibited by a population which is increasing exponentially (i.e., doubles repeatedly); results in a J-shaped curve showing a brief lag phase, followed by a steep increase in the growth curve (20.1)

exponential growth phase stage in the growth of a population at which birth rate is much higher than death rate because competition for resources is not yet a limiting factor; compare *lag phase* and *stationary phase* (20.1)

external respiration exchange of oxygen and carbon dioxide between the air and the blood; takes place in the lungs; compare *internal respiration* (7.2)

extra-embryonic membrane any in an intricate system of membranes external to the embryo; responsible for the protection, nutrition, respiration, and excretion of the embryo and fetus (15.1)

F

FAD flavin adenine dinucleotide; coenzyme that functions as a carrier of electrons and hydrogen ions; important coenzyme in electron transport in the Krebs cycle (5.3)

FADH₂ reduced form of FAD that can act as an electron donor; important coenzyme in electron transport in the Krebs cycle (5.3)

Fallopian tube see *oviduct* (14.1)

fast-twitch fibre muscle fibre that produces most of its energy anaerobically; adapted for the rapid generation of power, but dependence on anaerobically produced energy results in vulnerability to accumulation of lactate, causing rapid fatigue; also called *Type II fibre*; compare *slow-twitch fibre* (10.2)

- fat** lipid that is usually of animal origin and solid at room temperature (6.1)
- fermentation** energy-yielding metabolic pathway in which carbohydrates are anaerobically broken down into simpler components; includes glycolysis and is widely occurring in yeast and bacteria (5.3)
- fertilization** in humans, the joining of male and female gametes (sperm and egg) to form a single cell that contains 23 chromosomes from each parent, for a total of 46 chromosomes (15.1)
- fetal alcohol spectrum disorder (FASD)** term used to describe all the disorders related to alcohol consumption during pregnancy; includes the more commonly known clinical disorder called fetal alcohol syndrome (FAS) (15.2)
- fetal period of development** the second of two main periods of prenatal development, taking place from the start of the ninth week through to birth; during this time, the fetus grows rapidly and organs begin to function and coordinate to form organ systems; compare *embryonic period of development* (15.1)
- fight-or-flight response** see *short-term stress response* (13.3)
- filial generation** in breeding, the offspring of a cross; first filial (F_1) generation is the offspring of a cross of the parental generation, second filial (F_2) generation is the offspring of a cross between two organisms in the F_1 generation, and so forth (17.1)
- filtrate** in the kidney, filtered fluid that proceeds from the glomerulus into the Bowman's capsule of the nephron (9.1)
- fimbria (fimbriae)** thread-like projections that sweep the released ovum from the ovary into the cilia-lined oviduct (14.1)
- first law of thermodynamics** law stating that energy cannot be created or destroyed but can only change form (1.1)
- first polar body** cell that receives the smaller portion of cytoplasm when a primary oocyte undergoes asymmetrical cytokinesis during meiosis I; is not functional and soon degenerates; compare *secondary oocyte* (16.3)
- fixation (carbon dioxide)** see *carbon dioxide fixation* (5.2)
- follicle** in the female reproductive system, specialized cell structure within the ovaries; each one contains an ovum (egg) that will be released (14.1)
- follicle-stimulating hormone (FSH)** reproductive hormone produced by the anterior pituitary gland; stimulates the development of the sex organs and gamete production in males and females (14.3)
- follicular stage** the first stage of the ovarian cycle (part of the menstrual cycle), during which increased levels of FSH stimulate the follicles to release increased quantities of estrogen and some progesterone into the bloodstream, leading to the release of an egg (ovum) from the follicle (14.3)
- food chain** model showing the linear pathways through which food (energy) is transferred from producers to primary consumers and to higher trophic levels (1.2)
- food web** model of food (energy) transfer in an ecosystem that shows the connections among food chains (1.2)
- formed portion** solid portion of the blood consisting of red blood cells, white blood cells, and platelets (8.2)
- fossil record** remains and traces of past life found in sedimentary rock, which reveals the history of life on Earth and the kinds of organisms that were alive in the past (4.2)
- founder effect** gene pool change that occurs when a few individuals start a new, isolated population; for example, on islands (19.2)
- founders** individuals forming a new population (19.2)
- fovea centralis** concentration of cones on the retina; located directly behind the centre of the lens (12.2)
- fragmentation** form of asexual reproduction in which a new organism is created from a fragment (portion) of a parent organism (16.4)
- frameshift mutation** permanent change in the genetic material of a cell caused by the insertion or deletion of one or two nucleotides so that the entire reading frame of the gene is altered; usually results in a nonsense mutation (18.3)
- fraternal twins** twins resulting from the simultaneous fertilization and implantation of two eggs; no more genetically alike than other siblings; compare *identical twins* (16.3)
- frontal lobe** one of four lobes into which each hemisphere of the cerebral cortex is divided; integrates information from other parts of the brain and controls reasoning, critical thinking, memory, and personality; the Broca's area of the frontal lobes is associated with language use; as well, contains motor areas control various aspects of precise, voluntary movement (11.2)

G

G1 phase the first part of interphase, a somatic cell's growth stage, during which cells carry out rapid growth and metabolic activity; also known as *Growth 1* or *Gap 1* (16.1)

G2 phase the last part of interphase, a somatic cell's growth stage, during which the cell rebuilds its reserves of energy and manufactures proteins and other molecules to prepare for division; also known as *Growth 2* or *Gap 2* (16.1)

gall bladder organ that stores bile produced by the liver (6.2)

gallstone small, hard mass that forms in the gall bladder when cholesterol precipitates out of the bile and forms crystals that grow in size (6.3)

gamete male or female haploid reproductive cell; e.g., egg (ovum) and sperm (14.1, 16.1)

gametophyte haploid generation of a plant; produces male and female gametes that fuse at fertilization to form a diploid sporophyte; also see *alternation of generations* (16.4)

gastrin stomach hormone that stimulates the secretion of hydrochloric acid and the inactive precursor molecule of pepsin from glands in the stomach (6.2)

gastrula term used for the developing embryo after the formation of the three primary germ layers (15.1)

gastrulation the formation of the three primary germ layers in embryogenesis (15.1)

gel electrophoresis tool used to separate molecules according to their mass and charge; can be used to separate fragments of DNA (18.3)

gene the basic unit of heredity; a specific sequence of DNA that encodes a protein, tRNA, rRNA molecule, or regulates the transcription of such a sequence; governs the expression of a particular trait and can be passed to an offspring (16.1, 18.1, 19.1)

gene expression the transfer of genetic information from DNA to RNA to protein (18.2)

gene flow net movement of alleles from one population to another due to the migration of individuals and subsequent interbreeding (19.2)

gene pool total of all the alleles for all the genes of all the individuals in a population (19.1)

gene therapy the process of changing the function of genes to treat or prevent genetic disorders (18.4)

gene-chromosome theory theory stating that genes exist at specific sites arranged in a linear manner

along chromosomes; an amendment to the chromosome theory of inheritance (17.2)

genetic code the order of base pairs in a DNA molecule (18.2)

genetic counsellor person who uses an understanding of genetics to predict and explain traits in children (17.3)

genetic diversity degree of genetic variation within a species or population (19.2)

genetic drift change in allele frequencies due to chance events in a small breeding population; see also *founder effect* and *bottleneck effect* (19.2)

genetic engineering manipulation of genetic material to alter genes and blend plant, animal, and bacterial DNA (18.3)

genetic equilibrium condition of a gene pool in which allele frequencies remain constant over time; a population at genetic equilibrium is not changing or evolving; also known as *Hardy-Weinberg equilibrium* (19.1)

genetic marker a characteristic that provides information about the genotype of an individual (18.4)

genetic screening any of several methods of identifying people who are at risk of developing particular genetic conditions or of passing these conditions on to their children (17.3)

genital herpes a sexually transmitted infection caused by one of two herpes viruses: herpes simplex 1 (HSV 1) or herpes simplex 2 (HSV 2); symptoms include painful, fluid-filled blisters on the genitalia that may be accompanied by flu-like symptoms (14.2)

genital wart flat or raised warts around the genital area, caused by human papilloma virus (HPV) (14.2)

genome the sum of all the DNA carried in an organism's cells (18.1)

genomics the study of genomes as opposed to individual genes (18.2)

genotype the combination of alleles for any given trait; compare *phenotype* (17.1)

genotype frequency proportion of members of a population with a particular genotype; usually expressed as a decimal (19.1)

geographical barrier feature such as a river or mountain that prohibits interbreeding and results in speciation by physically separating populations (4.3)

germ cell gamete-producing cell in the male and female gonads (16.3)

germ layers see *primary germ layers* (15.1)

- germ line mutation** permanent change in the genetic material of a reproductive cell during the lifetime of an organism that is passed on to future generations; compare *somatic cell mutation* (18.3)
- germ-line therapy** gene therapy used to modify the genetic information carried in egg and sperm cells; see also *gene therapy* (18.4)
- GIP** gastric inhibitory peptide; one of three enzymes (including secretin and CCK) secreted into the bloodstream by the duodenum, causing inhibition of stomach movement and secretions, and enabling fatty meals to remain in the stomach longer than non-fatty meals (6.2)
- glaucoma** condition caused when ducts that drain the aqueous humour in the eye are blocked; resulting pressure ruptures delicate blood vessels in the eye and causes deterioration of the cells due to a lack of oxygen and nutrients; can lead to blindness if untreated (12.2)
- glial cell** support cell of the nervous system that nourishes neurons (nerve-impulse conducting cells), removes their wastes, defends against infection, and provides a supporting framework for all the nervous system tissue (11.1)
- glomerular filtration** in the kidney, process that results in the movement of water and solutes, except proteins, from the blood plasma into the nephron down a pressure gradient (9.2)
- glomerulus** in the kidney, a fine network of capillaries within the Bowman's capsule of the nephron; arising from the renal artery, the walls of the glomerulus act as a filtration device (9.1)
- glottis** in mammals, the opening of the trachea through which air enters the larynx (7.1)
- glucagon** hormone produced by the alpha cells of the islets of Langerhans in the pancreas to stimulate the liver to convert glycogen back into glucose, which is released into the blood (13.4)
- glucocorticoid** hormone produced by the adrenal cortex to stimulate tissues to raise blood glucose; e.g., cortisol (13.3)
- glycolysis** energy-yielding metabolic pathway in which one glucose molecule (with six carbons) is broken down to form two pyruvate molecules (with three carbons each), as well as a small amount of ATP; the first step in both aerobic and anaerobic respiration (5.3)
- goitre** enlargement of the thyroid gland characterized by a large swelling in the throat, often associated with a deficiency of iodine; occurs when the thyroid gland is constantly stimulated by thyroxine-stimulating hormone (TSH), but is unable to synthesize thyroxine to create a negative feedback loop (13.2)
- gonad** organ that produces reproductive cells (gametes); the ovary produces eggs (ova), and the testis produces sperm (14.1)
- gonadocorticoid** hormone produced by the adrenal cortex which supplements the sex hormones produced by the gonads (testes and ovaries) (13.3)
- gonadotropin releasing hormone (GnRH)** hormone produced by the hypothalamus; acts on the anterior pituitary gland to cause it to release two different sex hormones: luteinizing hormone (LH) and follicle-stimulating hormone (FSH) (14.3)
- gonorrhoea** a sexually transmitted infection caused by the bacterium *Neisseria gonorrhoeae*; can result in infection of the urethra, cervix, rectum, and throat; left untreated, the disease can lead to PID and may spread through the bloodstream to the joints, heart, or brain (14.2)
- gradualism** in evolution, the theory that change occurs slowly and steadily in a linear fashion, and that large changes occur through the accumulation of many small changes (4.3)
- granulocyte** a type of white blood cell containing granules in its cytoplasm; the three types of granulocytes are neutrophils, basophils, and eosinophils (8.2)
- granum (grana)** stack of chlorophyll-containing thylakoids within a chloroplast (5.1)
- Graves' disease** a severe state of hyperthyroidism that results when the body's immune system attacks the thyroid; antibodies attach to TSH receptors on thyroid cells, causing the thyroid gland to produce too much thyroxine (13.2)
- gravitational equilibrium** balance required while moving the head forward and backward (12.3)
- grey matter** part of the nervous system that contains mostly cell bodies, dendrites, and short, unmyelinated nerve fibres; brownish-grey in colour; forms the outer areas of the brain and the H-shaped core of the spinal cord; compare *white matter* (11.1, 11.2)
- growth rate (gr)** change in population size (N) over a specific time frame (t); N is equivalent to the number of births plus immigration *minus* the number of deaths plus emigration; expressed as $gr = \frac{N}{t}$ (20.1)

H

- habitat** place or area with a particular set of characteristics, both biotic and abiotic, in which an organism lives and is able to survive and reproduce because of particular physical, physiological, and behavioural adaptations (3.3)
- hair cell** sensory mechanoreceptor attached to the basilar membrane in the organ of Corti within the inner ear (12.3)
- haploid** describing a cell containing half the number of chromosomes (n) that the diploid ($2n$) parent cell contains; condition occurring in gametes, either egg (ovum) or sperm; compare *diploid* (16.1)
- Hardy-Weinberg equation** mathematical description of the Hardy-Weinberg principle; used to predict allele and genotype frequencies in a population; usually stated: if the frequency of allele A is p and the frequency of allele a is q , then the genotype frequencies after one generation of random mating will always be $p^2 + 2pq + q^2 = 1.00$ (19.1)
- Hardy-Weinberg principle** principle that states that allele and genotype frequencies remain constant from one generation to the next, as long as five conditions are met: (1) the population is large enough that chance events will not alter allele frequencies, (2) mates are chosen on a random basis, (3) there are no net mutations, (4) there is no migration, and (5) there is no natural selection against any of the phenotypes (19.1)
- heat capacity** a measure of the amount of heat a substance can absorb or release for a given change in temperature (2.1)
- helicase** set of enzymes that cleave and unravel short segments of DNA just ahead of the replicating fork during DNA replication (18.1)
- helper T cell** lymphocyte that, upon recognizing an antigen, gives off chemical signals that stimulate certain immune cells (macrophages, B cells, and other T cells) to perform their respective functions (8.3)
- hemodialysis** type of renal (kidney) dialysis that utilizes an artificial membrane in an external device and is connected to an artery and a vein in a person's arm to remove waste and excess fluid from the blood when kidney function is lost due to renal failure (9.3)
- hemoglobin** iron-containing respiratory pigment found in red blood cells that transports oxygen from the lungs to body tissues (8.2)
- hemolysis** the bursting of red blood cells (8.3)

- hemophilia** inherited, life-threatening disorder resulting from insufficient clotting proteins in the blood (8.2)
- hepatitis** inflammation of the liver tissue; the three types are hepatitis A, B, and C (6.3, 14.2)
- herbivore** organism that eats plants; compare *carnivore* (1.1)
- heterotroph** see *consumer* (1.1)
- heterozygote advantage** a survival benefit for those individuals who inherit two different alleles for the same trait (Aa), compared to those who are homozygous dominant or homozygous recessive; for example, the allele for cystic fibrosis may help carriers better resist diarrheal diseases such as cholera (17.1, 19.2)
- heterozygous** describes an individual with two different alleles for a trait (Aa); compare *homozygous* (17.1)
- histone** protein found in chromosomes; acts as scaffold around which DNA winds, enabling it to fit within the small space of the nucleus (16.1)
- HIV** human immunodeficiency virus; a group of related viruses that destroy the body's capacity for immunity, and so cause AIDS (14.2)
- homeostasis** the tendency of the body to maintain a relatively constant internal environment (6.0, 11.1)
- homologous chromosome** chromosome that contains the same gene sequence as another, but that may not be made up of the same alleles; human somatic cells have 22 pairs of these, known as autosomes, and females also have a homologous pair of X sex chromosomes; males have an X and a Y sex chromosome which are not homologous (16.1)
- homologous structures** body parts in different species that have the same evolutionary origin and structural elements but may have a different function (e.g., bat wing, human arm, dolphin flipper); compare *analogous structures* (4.2)
- homozygous** describes an individual with two identical alleles for a trait (AA or aa); compare *heterozygous* (17.1)
- hormone** chemical messenger sent to many parts of the body to produce a specific effect on a target cell or organ; examples are epinephrine and norepinephrine released from the neurons of the adrenal gland (13.1)
- hormone replacement therapy** administration of low levels of estrogen and/or progesterone to alleviate symptoms of menopause in females (14.3)

human chorionic gonadotropin (hCG) hormone secreted by the trophoblast at the time of implantation of the embryo; prevents degeneration of the corpus luteum (15.1)

Human Genome Project joint effort of thousands of researchers from laboratories worldwide that determined the sequence of the three billion base pairs making up the human genome (18.1)

human growth hormone (hGH) hormone that ultimately affects almost every body tissue, by direct stimulation or via tropic effects; stimulates the liver to secrete hormones called growth factors, which, along with hGH, influence many physiological processes, such as protein synthesis, cell division and growth, and metabolic breakdown and release of fats (13.2)

human papilloma virus (HPV) virus responsible for a condition known as genital warts; transmitted by skin-to-skin contact (14.2)

hybrid offspring of a cross between two parent organisms with different inheritable traits (17.1)

hydrogen bond weak bond that involves sharing an electron between a slightly positive hydrogen atom and a slightly negative atom, such as oxygen or nitrogen, typically in another molecule (2.1)

hydrologic cycle cycle of evaporation and condensation of water that determines the circulation of water through the atmosphere and biosphere; also known as the *water cycle* (2.1)

hydrolysis chemical reaction in which the addition of a water molecule cleaves a macromolecule into subunits; one hydrogen atom from water is attached to one subunit and a hydroxyl group is bonded to the other subunit, breaking a covalent bond in the macromolecule; compare *dehydration synthesis* (6.1)

hyperglycemia condition resulting from high levels of blood glucose; occurs in individuals with diabetes mellitus (13.4)

hyperopia fair-sightedness, or difficulty seeing things that are nearby; caused by weak ciliary muscles or an eyeball that is too short; compare *myopia* (12.2)

hyperthyroidism condition resulting when the thyroid produces extremely high levels of thyroxine (13.2)

hypertrophy exercise-induced increase in muscle mass due to an increase in the size, not number, of individual skeletal muscle fibres (10.2)

hypothalamus region of the forebrain just below the cerebral hemispheres, under the thalamus; a centre of the autonomic nervous system responsible for the integration and correlation of many neural and

endocrine functions; helps to regulate the body's internal environment, as well as certain aspects of behaviour; coordinates the actions of the pituitary gland by producing and regulating the release of certain hormones (11.2)

hypothesis statement that provides one possible answer to a question, or one possible explanation for an observation; also known as *scientific hypothesis* (4.2)

hypothyroidism condition resulting when the thyroid produces extremely low levels of thyroxine (13.2)

I

identical twins twins resulting when a single zygote divides into two separate cell masses during embryonic development; are genetically identical; compare *fraternal twins* (16.3)

immigration migration of individuals into a population; compare *emigration* (20.1)

immunity ability of the body to protect itself from foreign, disease-causing agents through a specific defence mechanism that uses antibody proteins to recognize, neutralize, and destroy foreign substances (8.3)

implantation the process of attachment of the embryo to the endometrium; occurs within the first week after fertilization in humans (15.1)

in vitro fertilization (IVF) technique in which egg cells are fertilized outside the female's body (15.3)

incomplete dominance a condition in which neither of two alleles for the same gene can completely conceal the presence of the other; compare *complete dominance* (17.1)

induced mutation permanent change in genetic material caused by a mutagen outside the cell (18.3)

infertile condition in which a man or a woman has been trying to conceive children for a year or more unsuccessfully; compare *sterile* (15.3)

inflammatory bowel disease general name for a disease that causes inflammation in the intestines (bowels); examples are Crohn's disease and colitis (6.3)

inhalation movement of air into the lungs during breathing; also known as *inspiration* (7.2)

inheritance of acquired characteristics theory that characteristics acquired during an organism's lifetime could be passed to its offspring (4.2)

inhibin hormone released from the seminiferous tubules; acts on the anterior pituitary to inhibit the production of follicle-stimulating hormone (FSH);

produces a negative feedback loop that controls the rate of sperm formation (14.3)

inhibitor molecule that attaches to an enzyme and reduces its ability to bind substrate; two classes are competitive and non-competitive inhibitors (6.1)

inner cell mass the inner cells of the blastocyst; will develop into the embryo; also known as *embryoblast*; compare *trophoblast* (15.1)

inner ear one of the three separate segments of the ear (outer ear, middle ear, and inner ear); consists of three components: semicircular canals, vestibule (utricle and saccule), and cochlea (12.3)

inspiratory reserve volume additional volume of air that can be taken in by the lungs, beyond a regular, or tidal, inhalation (7.2)

insulin a hormone secreted by the alpha cells of the islets of Langerhans in the pancreas to make target cells more permeable to glucose; enables the body to use sugar and other carbohydrates (13.4)

internal respiration exchange of oxygen and carbon dioxide between the body's tissue cells and the blood (7.2)

interphase growth stage of a somatic cell; there are 3 phases: G1, S, and G2; ends when the cell begins the process of nuclear division (mitosis) (16.1)

interspecific competition competition for limited resources among members of different species; compare *intraspecific competition* (20.2)

interstitial fluid fluid that surrounds all cells in the body; also known as *extracellular fluid* or *tissue fluid* (8.2)

intraspecific competition competition between members of the same population (species) for a limited resource (3.3)

intraspecific competition competition for limited resources among members of the same species; compare *interspecific competition* (20.2)

iris the doughnut-shaped, coloured muscle formed from the choroid at the front of the eye; adjusts the central dark pupil to regulate the amount of light that enters the eye (12.2)

islet of Langerhans cluster of endocrine cells found throughout the pancreas, consisting of glucagon-producing alpha cells and insulin-producing beta cells (13.4)

K

karyotype the particular set of chromosomes that an individual possesses (16.1)

kidney in vertebrates, one of a pair of organs that filters waste from the blood (which is excreted in urine) and adjusts the concentrations of salts in the blood (9.1)

killer T cell cytotoxic lymphocyte that binds with infected cells and destroys them by puncturing a hole in their membrane; may be activated indirectly by chemical signals from a helper T cell or directly by the presence of the invading pathogen and associated antigens (8.3)

kingdom the second highest taxonomic classification of all living things (below domain); the six kingdoms recognized in biology are Archaea, Bacteria, Protista, Fungi, Plantae, and Animalia. (3.2)

Krebs cycle in cellular respiration, a metabolic pathway consisting of a series of reactions that break down the end products of glycolysis, producing carbon dioxide and generating a large amount of ATP; also known as *citric acid cycle* or *tricarboxylic acid (TCA) cycle* (5.3)

K-selected strategy a life strategy designed to take advantage of stable environmental conditions; characterized by the production of a few offspring with much attention given to offspring survival; organisms that exhibit this strategy include mammals and species that live close to the carrying capacity (K) of their habitats, also known as *K-selection*; compare *r-selected strategy* (20.1)

L

labia majora along with the labia minora, one of two pairs of external skin folds that protect the vaginal opening (14.1)

labia minora along with the labia majora, one of two pairs of external skin folds that protect the vaginal opening (14.1)

labour all the events associated with parturition (the birthing process) (15.2)

lactation the secretion and formation of breast milk by the mammary glands (15.2)

lactate fermentation type of fermentation in which NADH is used to convert pyruvate to lactate (lactic acid); the resulting NAD⁺ is recycled to continue the process; carried out by some bacteria, as well as animal muscle cells when demand for energy exceeds aerobic production; compare *ethanol fermentation* (5.3)

lag phase stage at the beginning of growth in a small population in which the rate of growth is slow, since there are only a few individuals to reproduce;

- compare *exponential growth phase* and *stationary phase* (20.1)
- lagging strand** in DNA replication, the strand that is replicated in short segments rather than continuously; compare *leading strand* (18.1)
- large intestine** final portion of the digestive system; about 1.5 m long, and wider in diameter than the small intestine; comprised of the caecum, colon, rectum, and anal canal; main function is to concentrate and eliminate waste materials (6.2)
- laryngitis** inflammation of the larynx (7.3)
- larynx** in mammals, a structure within the upper respiratory tract that contains the vocal cords; also commonly known as *voice box* (7.1)
- law of independent assortment** Mendel's second law of inheritance, stating that the two alleles for one gene segregate (assort) independently of the alleles for other genes during gamete formation (17.1)
- law of segregation** Mendel's first law of inheritance, stating that all individuals have two copies of each factor (gene); these copies segregate (separate) randomly during gamete formation, and each gamete receives one copy of every factor (gene) (17.1)
- leading strand** in DNA replication, the strand that is replicated continuously; compare *lagging strand* (18.1)
- lens** clear, flexible part of the eye that focusses images on the retina (12.2)
- leucocyte** see *white blood cell* (8.2)
- leukemia** cancer of the white blood cells; two main types are myeloid and lymphoid (8.2)
- life strategies** strategies for reproduction exhibited by organisms; bacteria and species that reproduce close to their biotic potential (r) are considered to have r -selected strategies, and mammals, birds, and species that live close to the carrying capacity (K) of their habitat are considered to have K -selected strategies (20.1)
- light-dependent reactions** the part of the process of photosynthesis in which reactions dependent on the presence of light convert solar energy into chemical energy, generating two high-energy compounds: ATP and NADPH; compare *light-independent reaction* (5.2)
- light-independent reactions** the part of the process of photosynthesis in which reactions not dependent on the presence of light use the products of the light-dependent reactions (ATP and NADPH) to reduce carbon dioxide to a carbohydrate; compare *light-dependent reaction* (5.2)
- limiting factor** any abiotic or biotic condition that limits the number of individuals in a population (3.3)
- linked genes** genes found on the same chromosome (17.2)
- lipase** enzyme that catalyzes the hydrolysis of triglycerides into glycerol and fatty acids (6.2)
- lipid** group of organic macromolecules, including fats, oils, phospholipids, and steroids, that is insoluble in water, but soluble in a non-polar, organic substance (6.1)
- liver** organ found in the abdomen that performs hundreds of functions as an accessory organ of the digestive system, including the secretion of bile to digest fats; other functions include plasma protein production, blood detoxification, and glycogen storage (6.2)
- locus** specific location on a chromosome (16.1)
- logistic growth pattern** population increase that results in an S-shaped curve; growth is slow at first, steepens in an exponential pattern, and then levels off due to environmental resistance such as competition (20.1)
- long-term stress response** sustained physiological response to stressors, characterized by increases in blood glucose and blood pressure, and decrease in inflammatory response; regulated by hormones produced by the adrenal cortex (13.3)
- loop of Henle** in the kidney, tubular portion of the nephron that lies between the proximal tubule and the distal tubule; main function is reabsorption of water and ions (9.2)
- lung cancer** uncontrolled and invasive growth of abnormal cells in the lungs (7.3)
- luteal stage** the second stage of the ovarian cycle (part of the menstrual cycle), beginning with ovulation; during this stage, luteinizing hormone (LH) stimulates the formation of the corpus luteum, which secretes progesterone and some estrogen, which stimulate in the thickening of the endometrium for implantation of the embryo (14.3)
- luteinizing hormone (LH)** reproductive hormone produced by the anterior pituitary; in the ovaries, triggers ovulation, stimulates the formation of the corpus luteum, and (with follicle-stimulating hormone) stimulates estrogen production; in the testes, stimulates the release of testosterone (14.3)
- lymph** interstitial fluid carried throughout the body in the lymphatic circulatory system; is either colourless

or pale yellow, with a composition much like the plasma of blood (8.3)

lymphatic circulatory system network of glands and vessels that carry lymph throughout the mammalian body; helps to maintain the balance of fluids in the body (8.3)

lymphocyte type of white blood cell involved in both cell-mediated and antibody-mediated immunity; types include B and T cells (8.2)

M

macromolecule a large, complex assembly of organic molecules; four categories of macromolecules are carbohydrates, lipids, proteins, and nucleic acids (6.1)

macrophage phagocytic white blood cell that develops from a monocyte; acts as a scavenger, ingesting dead cells and foreign material, and killing microorganisms; macrophages also stimulate other cells in the immune system (8.3)

map distance distance between genes on a single chromosome (17.2)

map unit distance between points on a chromosome where a crossover is likely to occur in 1% of all meiotic events (17.2)

matrix fluid-filled space within the inner membrane of a mitochondrion; contains proteins and other chemicals needed to break down carbohydrates and other high energy molecules (5.1)

mechanoreceptor sensory receptor that responds to mechanical stimuli, such as that from pressure, sound waves, and gravity; e.g., proprioceptor (12.1)

medulla oblongata part of the hindbrain attached to the spinal cord at the base of the brainstem; controls automatic, involuntary responses, such as heart rate, constriction or dilation of blood vessels to control blood pressure, and the rate and depth of breathing, swallowing, and coughing (11.2)

medusa free-swimming adult form of organisms in the phylum Cnidaria; is an example in animals that exhibit alternation between asexually reproducing and sexually reproducing phases; compare *polyp* (16.4)

meiosis the cellular process that produces haploid gametes from diploid cells in the ovaries and testes (16.3)

meiosis I the first of two sequences in meiotic cell division in which the chromosomes are reduced from diploid to haploid ($2n$ to n) (16.3)

meiosis II the second of two sequences in meiotic cell division in which each of the haploid cells created

during meiosis I undergoes mitosis (without an interphase) (16.3)

membrane potential electrical charge separation across a cell membrane; a form of potential energy (11.1)

memory T cell lymphocyte that carries receptors for a specific foreign antigen that was encountered in an earlier infection or through vaccination; memory T cells quickly promote an immune response if the same antigen is re-encountered in a subsequent infection (8.3)

meninges three layers of tough, elastic tissue within the skull and spinal column which directly enclose the brain and spinal cord (11.2)

menopause period in a woman's life during which a decrease in estrogen and progesterone results in an end of menstrual cycles, usually occurring around age 50 (14.3)

menstrual cycle in a human female, period of 20–45 days during which hormones stimulate the development of the uterine lining, and an egg (ovum) is developed and released from an ovary; if the egg is not fertilized, the uterine lining is shed as the cycle begins again; can be divided into the ovarian cycle and the uterine cycle (14.3)

menstruation initial phase in the menstrual cycle, in which the endometrium disintegrates and is expelled from the uterus of females who are not pregnant (14.1)

mesoderm the middle germ layer formed during animal embryogenesis (15.1)

messenger RNA (mRNA) strand of RNA that carries genetic information from DNA to the protein synthesis machinery of the cell during transcription (18.2)

metabolic pathway a controlled, step-by-step sequence of reactions that is catalyzed by enzymes in living cells to support and sustain life functions (5.1)

metabolism refers to all the chemical reactions that occur within a cell to support and sustain its life functions (5.1)

metaphase the second stage of cell division (mitosis) during which chromosomes line up at the cell's equator in preparation for separation (16.2)

microevolution gradual change in allele frequencies in a population over time (19.1)

microvillus (microvilli) microscopic projection found along exposed cell surfaces that greatly increases the surface area of the cell; found on the villi of the small intestine and on the membranes of certain cells (6.2)

midbrain part of the brain found above the pons in the brainstem; relays visual and auditory

- information between areas of the hindbrain and forebrain, and plays an important role in eye movement and control of skeletal muscles (11.2)
- middle ear** one of the three separate segments of the ear (outer ear, middle ear, and inner ear); begins at the tympanum (eardrum) and ends at two small openings in the wall of the inner ear called the round window and the oval window (12.3)
- mineral** inorganic compound required in trace amounts for normal metabolism (6.1)
- mineralocorticoid** hormone produced by the adrenal cortex that regulates the balance of electrolytes, such as sodium and potassium, and water in the body; e.g., aldosterone (13.3)
- mis-sense mutation** permanent change in the genetic material of a cell that results in a slightly altered but still functional protein (18.3)
- mitochondrial DNA (mtDNA)** DNA within the mitochondria; is genetically identical to that of the female parent because the cytoplasm of offspring is derived from the egg (ovum) (18.3)
- mitochondrion (mitochondria)** organelle that breaks down organic molecules, usually carbohydrates, to release energy (5.1)
- mitosis** one of the two main processes in cell division: division of the genetic material and the contents of the cell's nucleus into two complete and separate sets; results in a daughter cell receiving the exact number of chromosomes and genetic make-up as the parent cell; see also *cytokinesis* (16.1, 16.2)
- monocyte** type of white blood cell that leaves the bloodstream and become further specialized as a macrophage (8.2)
- monohybrid cross** cross of two individuals that differ in one trait (17.1)
- monosaccharide** simple sugar that cannot be hydrolyzed into simpler sugars; for example glucose, fructose, and galactose (6.1)
- monosomy** loss of a chromosome as a result of nondisjunction (16.3)
- morphogenesis** the series of events that form distinct structures of a developing organism; gastrulation marks the beginning of the process (15.1)
- morphology** physical structure and form of an organism (3.1)
- morula** term used to describe a zygote when it becomes a 16-cell sphere (15.1)
- mouth** opening through which an animal takes in food and water (6.2)
- Müllerian mimicry** form of mimicry where an organism resembles another organism with a defence mechanism, and also has the defence mechanism; believed to be a form of co-evolution; compare *Batesian mimicry* (20.2)
- multiple alleles** pattern of inheritance in which a gene has more than two alleles for any given trait (17.2)
- muscle fibre** skeletal muscle cell (10.1)
- muscle twitch** muscular contraction that lasts a fraction of a second (10.2)
- muscular system** in animals, system made up of tissues specialized for movement (10.1)
- mutagen** substance or event that increases the rate of mutation in an organism; may be physical or chemical (18.3)
- mutation** a permanent change in a cell's DNA; includes changes in nucleotide sequence, alteration of gene position, gene loss, or duplication and insertion of foreign sequences; an inheritable mutation has the potential to affect an entire gene pool (4.1, 18.3, 19.2)
- mutualism** a type of symbiotic relationship in which both partners benefit from the relationship, or depend on it in order to survive; compare *commensalism* and *parasitism* (20.2)
- myelin sheath** the fatty, insulating layer around the axon of a nerve cell, composed of Schwann cells; protects myelinated neurons and speeds the rate of nerve impulse transmission (11.1)
- myofibril** one of hundreds of thousands of cylindrical subunits that make up a skeletal muscle cell (fibre) (10.1)
- myofilament** one of many microscopic, string-like structures, composed of actin and myosin, that make up myofibrils; responsible for muscle contraction (10.1)
- myoglobin** protein in muscle tissue that stores and transports oxygen (10.1)
- myopia** near-sightedness, or difficulty seeing things that are far away; caused by ciliary muscles that are too strong or an eyeball that is too long; compare *hyperopia* (12.2)
- myosin** protein that, along with actin, is the chief component of muscle; makes up the thick filament of a muscle fibre; also see *myosin myofilament* (10.1)
- myosin myofilament** thick myofilament consisting of two strands of myosin molecules wound around each other; one end consists of a long rod, while the other end consists of a double-headed globular region; works with actin myofilament to produce muscle contractions (10.1)

N

NAD⁺ nicotinamide adenine dinucleotide; coenzyme that functions as a carrier of electrons and hydrogen ions; important coenzyme in electron transport in the Krebs cycle (5.2)

NADH reduced form of the coenzyme nicotinamide adenine dinucleotide (NAD⁺) that can act as an electron donor; important coenzyme in electron transport in the Krebs cycle (5.2)

nasal passage passage from the nostrils to the back of the throat through which air enters the body; serves to warm, moisten, and clean incoming air; lined with ciliated cells and mucus-secreting cells; also called the *nasal cavity* (7.2)

natural selection process whereby the characteristics of a population of organisms change over time because individuals with certain heritable traits survive specific local environmental conditions and, through reproduction, pass on their traits to their offspring (4.1, 19.2)

negative feedback mechanism mechanism of homeostatic response by which the output of a system suppresses or inhibits activity of the system; e.g., when a certain blood concentration of a hormone is reached, the endocrine gland releasing the hormone is inhibited by the presence of the hormone (13.1)

nephron microscopic tube-like filtration unit found in the kidneys that filters and reabsorbs various substances from the blood; produces urine (9.1)

nerve message pathway of the nervous system; made up of many neurons grouped into bundles and surrounded by protective connective tissue (11.1)

nervous system in animals, system made up of cells and organs that let an animal detect changes and respond to them; made up of the brain and spinal cord, as well as the nerves that emerge from them and connect them to the rest of the body (11.1)

neuromuscular junction synapse between a motor neuron and a muscle cell (11.1)

neuron nerve cell; the structural and functional unit of the nervous system, consisting of a nucleus, cell body, dendrites, axons, and a myelin sheath; specialized to respond to physical and chemical stimuli, to conduct electrochemical signals, and to release chemicals that regulate various body processes (11.1)

neurotransmitter chemical messenger secreted by neurons to carry a neural signal from one neuron to

another, or from a neuron to an effector, such as a gland or muscle fibre (11.1)

neurulation in embryogenesis, process of forming the neural tube, which develops into the brain and spinal cord (15.1)

nitrogen fixation process whereby free atmospheric nitrogen (nitrogen gas) is converted, usually by bacteria, into compounds such as ammonium and nitrates that can be used by other organisms (2.2)

nociceptor pain receptor found throughout the skin and internal organs (12.3)

node of Ranvier gap in the myelin sheath insulating the axon of a myelinated nerve cell; the membrane of the axon is exposed and action potentials occur only at these nodes; nerve impulses jump from one node of Ranvier to the next (11.1)

non-competitive inhibitor a molecule that, upon binding with an enzyme, prevents the enzyme from binding to a substrate by changing the three-dimensional structure of the enzyme and its active site; does not bind with the active site directly; compare *competitive inhibitor* (6.1)

nondisjunction failure of homologous chromosomes pairs or sister chromatids to separate during meiosis I and meiosis II, respectively (16.3)

non-random mating mating among individuals on the basis of mate selection for a particular phenotype or due to inbreeding, rather than mating on a random basis (19.2)

nonsense mutation permanent change in the genetic material of a cell that renders a gene unable to code for a functional protein (18.3)

non-sister chromatids in a tetrad, those chromatids that do not belong to the same chromosome; undergo crossing over during prophase I of meiosis (16.3)

non-specific defence see *cell-mediated immunity* (8.3)

noradrenaline see *norepinephrine* (11.3, 13.3)

norepinephrine neurotransmitter released by sympathetic neurons of the autonomic system to produce an excitatory effect on target muscles; also a hormone produced by the adrenal medulla along with epinephrine to function in the short-term stress response; also known as *noradrenaline* (11.3, 13.3)

nuclease enzyme that hydrolyses the bonds between nucleotides in nucleic acids (6.2)

nucleic acid macromolecule formed from a long chain of nucleotide subunits, each consisting of a five-carbon simple sugar, a nitrogen-containing base, and a

phosphate group; two types include DNA and RNA (6.1)

nucleotide units making up nucleic acids (e.g., DNA, RNA), composed of a five-carbon sugar, a phosphate group, and one of five nitrogen-containing bases (adenine, cytosine, guanine, and either thymine or uracil) (18.1)

O

obesity condition in which body mass is 20 percent or more above what is considered to be an ideal body mass for a person's height (6.3)

occipital lobe one of four lobes into which each hemisphere of the cerebral cortex is divided; receives and analyzes visual information, and is needed for recognition of what is being seen (11.2)

Okazaki fragments short nucleotide fragments synthesized during DNA replication of the lagging strand (18.1)

olfactory bulb region of forebrain where ends of sensory nerve fibres from nose terminate and transmit olfactory information to other areas of the brain (12.3)

olfactory cell chemoreceptor for the sense of smell; lines the upper nasal cavity (12.3)

oogenesis the process of female gamete (ova or egg) production in animals (14.1, 16.3)

oogonium the diploid germ cell from which eggs are produced in the ovaries (16.3)

optic nerve a nerve that carries messages from the photoreceptors in the retina to the brain (12.2)

order of dominance sequence indicating which alleles are dominant to other alleles (17.2)

organ of Corti organ of hearing found within the cochlea of the inner ear; contains hair cells that detect vibrations in the inner ear and transmit this information to auditory nerves (12.3)

osmoreceptor cell that is sensitive to osmotic pressure; most are located in the hypothalamus of the brain (9.3)

ossicles the group of three small bones (malleus, incus, and stapes) between the tympanum (eardrum) and the oval window of the middle ear; transmit sound waves from the eardrum to the inner ear (12.3)

otolith calcium carbonate granule associated with sensory receptors for detecting movement of the head; in vertebrates, located in the utricle and saccule in the vestibule of the inner ear (12.3)

outer ear one of the three separate segments of the ear (outer ear, middle ear, and inner ear); consists of the pinna and the auditory canal (12.3)

oval window membrane-covered opening in the wall of the inner ear; receives vibrations from the stapes (one of the ossicles) (12.3)

ovarian cycle the part of the menstrual cycle that takes place in the ovaries (14.3)

ovary in mammals, one of a pair of female reproductive organs (gonads); is suspended in the abdominal cavity and produces eggs (ova) (14.1)

oviduct one of a pair of cilia-lined tubes in the body that transport an egg (ovum) from the ovary to the uterus; also known as Fallopian tube (14.1)

ovulation in females, the process by which a single follicle in an ovary matures and then ruptures, releasing the ovum (egg) into the oviduct; usually occurs at the midpoint (day 14) of a 28-day menstrual cycle (14.1)

ovum (ova) female reproductive cell (gamete) (14.1)

oxic oxygen-containing; compare *anoxic* (5.3)

oxidation process by which an atom or molecule loses an electron (5.1)

P

paleontology the study of ancient life through the examination of fossils (4.2)

pancreas small gland in the abdomen that secretes digestive enzymes into the small intestine, as well as bicarbonate to neutralize hydrochloric acid from the stomach; also secretes the hormone insulin (6.2, 13.4)

pangenes theory of inheritance proposed by Aristotle that egg and sperm consist of particles, called pangenes, that come from all parts of the body; upon fertilization of the egg by a sperm, the pangenes develop into the parts of the body from which they were derived (17.1)

parasitism a type of symbiotic relationship in which an organism benefits by living on or in an organism of a different species that is harmed by the association; compare *mutualism* and *commensalism* (20.2)

parasympathetic nervous system division of the autonomic system that regulates involuntary processes in the body; works in opposition to the sympathetic nervous system; typically activated when the body is calm and at rest (11.1, 11.3)

parathyroid hormone hormone produced by the parathyroid glands in response to falling concentrations of calcium in the blood; stimulates

bone cells to break down bone material (calcium phosphate) and reabsorb calcium into the blood; stimulates the kidneys to reabsorb calcium from the urine; activates vitamin D, which stimulates the absorption of calcium from food in the intestine (13.2)

parent cell original cell that divides to produce two new daughter cells during cell division (16.1)

parental (P) generation in breeding, the organisms that are being crossed; compare *filial generation* (17.1)

parental type describes offspring that have chromosomes that are identical to those of their parents; compare *recombinant type* (17.2)

parietal lobe one of four lobes into which each hemisphere of the cerebral cortex is divided; receives and processes sensory information from the skin, and helps to process information about the body's position and orientation (11.2)

parthenogenesis form of asexual reproduction in which an unfertilized egg develops into an adult (16.4)

parturition the act or process of giving birth to young (15.2)

pedigree diagram that uses symbols to illustrate the patterns of relationships and traits among a family over many generations (17.3)

pelvic inflammatory disease (PID) infection of the female uterus, oviducts, and/or ovaries; can result in a build-up of scar tissue causing infertility; may occur as a result of undetected chlamydia or gonorrhoea infection (14.2)

penis male copulatory organ; in humans, the male organ of sexual intercourse; its primary reproductive function is to transfer sperm from the male to the female reproductive tract (14.1)

pepsin protein-digesting enzyme secreted in the stomach; remains inactive until hydrochloric acid is present (6.2)

peptide bond bond between the amino group of one amino acid and the carboxyl group of another in a protein (6.1)

per capita growth rate (cgr) change in population size per individual over a given time frame; expressed as $cgr = \frac{N}{N}$ or $cgr = \frac{N_{\text{final}} - N}{N}$ (20.1)

perception interpretation of sensory information by the cerebral cortex (12.1)

peripheral nervous system network of nerves that carry sensory messages to the central nervous system (CNS) and send information from the CNS to the muscles and glands; consists of the autonomic and somatic system (11.1)

peristalsis wave-like series of muscular contractions and relaxations of the circular and longitudinal muscles that surround the various parts of the digestive tract; aids the movement of food through the digestive tract (6.2)

peritoneal dialysis type of renal (kidney) dialysis that utilizes the lining of the intestines, called the peritoneum, as the dialysis membrane to remove waste and excess fluid from the blood when kidney function is lost due to renal failure (9.3)

phagocytosis process by which a cell ingests another cell, bacterium, or particle of organic matter (8.3)

pharynx structure located just behind the mouth that connects the mouth and nasal cavity to the larynx and esophagus; serves as the passageway for air into the respiratory system and for food and water into the digestive system; also known as *throat* (7.1)

phenotype the visible physical and physiological traits of an organism; compare *genotype* (17.1)

phenotype frequency proportion of members of a population with a particular phenotype; usually expressed as a decimal (19.1)

photoreceptor sensory receptor that responds to light stimuli and allows us to sense different levels of light and shades of colour (12.1)

photosynthesis the process by which plants, algae, and some kinds of bacteria use the Sun's light energy to chemically convert carbon (inorganic) into carbohydrates (organic) such as sugars and starches (1.1, 5.1)

photosynthetic pigment compound that traps light energy and passes it on to other chemicals that use the energy to synthesize high-energy compounds; the main photosynthetic pigment is chlorophyll (5.2)

photosystem cluster of light-absorbing pigment molecules within thylakoid membranes in chloroplasts (5.2)

physical mutagen agent that can forcibly break a nucleotide sequence, causing random changes in one or both strands of a DNA molecule; (e.g., X rays) (18.3)

pigment compound that absorbs specific wavelengths of visible light and therefore has colour; see also *photosynthetic pigment* (5.2)

pilus (pili) extensions of a bacterial cell enabling it to transfer genetic materials from one individual to another through the process of conjugation (16.4)

pinna the outside flap of the ear; made of skin and cartilage and shaped in a way that enhances sound vibrations and focusses them into the ear (12.3)

- pioneer community** first species to colonize a barren or disturbed habitat and initiate primary succession (20.2)
- pituitary gland** small gland that lies just inferior to the hypothalamus; consists of the anterior and posterior pituitary, both of which produce hormones that influence metabolism, growth, development, reproduction, and other critical life functions (13.2)
- placenta** in most pregnant mammals, a disk-shaped organ within the uterus that is rich in blood vessels; attaches the embryo or fetus to the uterine wall and facilitates metabolic exchange (15.1)
- plasma** fluid portion of the blood, made up of water plus dissolved gases, proteins, sugars, vitamins, minerals, hormones, and waste products (8.2)
- plasmid** small self-duplication loop of DNA in a prokaryotic cell that is separate from the main chromosome and contains from one to a few genes (18.3)
- platelet** component of the formed portion of the blood, consisting of fragments of cells that are created when larger cells in the bone marrow break apart; contains no nucleus and plays a key role in blood clotting (8.2)
- pleural membrane** double-layered membrane that encloses the lungs; also referred to as *pleura* (7.1)
- pleurisy** inflammation of the pleural membranes that surround the lungs (7.3)
- pneumonia** inflammation of the alveoli (air sacs) in the lungs (7.3)
- point mutation** permanent change in the genetic material of a cell that affects one or just a few nucleotides; may involve the substitution of one nucleotide for another, or the insertion or deletion of one or more nucleotides (18.3)
- polar** refers to a molecule with uneven charge distribution (2.1)
- polarization** lowering the membrane potential of the cell below its equilibrium value; in nerves, the process of generating a resting membrane potential of -70 mV (11.1)
- polygene** group of genes that all contribute to the same trait (17.2)
- polygenic trait** trait that is controlled by many genes (17.2)
- polyp** non-motile adult form of organisms in the phylum Cnidaria; is an example in animals exhibiting alternation between asexually reproducing and sexually reproducing phases; compare *medusa* (16.4)
- polyploid** describing a cell which contains sets of more than two homologous chromosomes (16.1)
- polysaccharide** complex carbohydrate consisting of many simple sugars linked together; examples include starch, cellulose, and glycogen (6.1)
- pons** part of the hindbrain found above and in front of the medulla oblongata in the brainstem; serves as a relay centre between the neurons of the right and left halves of the cerebrum, the cerebellum, and the rest of the brain (11.2)
- population** any group of individuals of the same species living in the same geographical area at the same time (3.1, 19.1)
- population crash** a dramatic decrease in the size of a population over a short period of time; compare *population explosion* (20.1)
- population density (D_p)** the number of individual organisms (N) in a given area (A) or volume (V); expressed as $D_p = \frac{N}{A}$ or $D_p = \frac{N}{V}$ (20.1)
- population explosion** a dramatic increase in the size of a population over a short period of time; compare *population crash* (20.1)
- posterior pituitary** posterior lobe of the pituitary gland; an endocrine gland that stores and releases antidiuretic hormone (ADH) and oxytocin, which are produced in the hypothalamus and transferred to the posterior pituitary by neuronal axons; compare *anterior pituitary* (13.2)
- potential difference** the difference in the potential energy per unit of charge of an object due to its position or condition; potential difference is like an ‘electrical pressure’ that pushes charges along a circuit; also referred to as *voltage* (11.1)
- precautionary principle** the principle stating that governments should act in advance, as a precaution, to prevent potential harm from new technologies, and should act even when neither the danger nor the effectiveness of the preventive measures have been demonstrated scientifically (18.4)
- predator** organism that kills and consumes other organisms (20.2)
- prey** organism that is killed and consumed by another organism (20.2)
- primary consumer** organism that obtains energy by eating plants; also known as a *herbivore* (1.1)
- primary germ layers** first layers of cells formed during animal embryogenesis, mainly in the vertebrates; consist of ectoderm (outer layer), mesoderm (middle layer), and endoderm (inner layer) (15.1)

primary oocyte each of two cells formed when an oogonium undergoes mitosis (16.3)

primary sex characteristic any structure (organ, duct, or gland) that plays a direct role in reproduction; compare *secondary sex characteristic* (14.1)

primary spermatocyte one of two daughter cells formed by division of the spermatogonia; the other daughter cell replenishes the spermatogonia population (16.3)

primary succession the development of a new community in a previously barren area where there is no soil present, such as on a hardened lava bed, or on a bare rock mountaintop; compare *secondary succession* (20.2)

primase in DNA replication, enzyme that forms a primer used as a starting point for the attachment of new nucleotides (18.1)

primer in DNA replication, short strand of RNA that is complementary to a DNA template and serves as a starting point for the attachment of new nucleotides (18.1)

producer organism that synthesizes its own food from inorganic molecules by using light or chemical energy; also known as *autotroph* (1.1)

productivity the rate at which organisms produce new biomass (2.3)

progesterone female sex hormone produced first by the corpus luteum of the ovary to prepare the uterus for the fertilized egg (ovum), and later by the placenta to maintain pregnancy (14.3)

prokaryote organism characterized by cells that do not contain membrane-bound, structurally distinct nuclei or other membrane-bound organelles; compare eukaryote (3.2)

promoter during transcription, a sequence of nucleotides on the DNA molecule that tells the RNA polymerase complex where to bind (18.2)

prophase the first of the four phases in cell division (mitosis), when chromatin condenses and can be seen as tightly packed chromosomes; the nuclear membrane breaks down, centrioles move to opposite poles of the cell, and the spindle apparatus forms (16.2)

proprioceptor type of mechanoreceptor found in muscles, tendons, and joints; senses the body's position and movements to send information about body position to the brain (12.1, 12.3)

prostate gland in male mammals, a mass of glandular tissue at the base of the urethra that secretes mucus-

like, alkaline fluid that neutralizes the acids from urine in the urethra (14.1)

protease enzyme that hydrolyzes the peptide bonds that link amino acids in proteins and peptides (6.2)

protective coloration adaptation that helps individuals avoid predation; includes camouflage, mimicry, and using body colours as a warning signal (20.2)

protein organic macromolecule assembled from subunits of amino acids (6.1)

proteomics the study of all proteins that are produced by a given genome (18.2)

proximal tubule in the kidney, tubular portion of the nephron that lies between the Bowman's capsule and the loop of Henle; main function is reabsorption of water and solutes, as well as secretion of hydrogen ions (9.2)

puberty period in which the reproductive system completes its development and becomes fully functional, and reproductive hormones begin to be formed (14.3)

pulmonary artery blood vessel that carries blood from the heart to the lungs (8.1)

pulmonary pathway in animals, the circulatory pathway that carries oxygen-poor blood from the heart to the lungs and oxygen-rich blood from the lungs to the heart (8.1)

pulmonary vein blood vessel that carries blood from the lungs to the heart (8.1)

punctuated equilibrium model that suggests that evolutionary history consists of long periods of stasis (stable equilibrium), punctuated by periods of divergence (4.3)

Punnett square simple grid used to illustrate all possible combinations of simple genetic crosses (17.1)

pupil aperture in the middle of the iris of the eye, the size of which can be adjusted to control the amount of light entering the eye (12.2)

purines nitrogenous compounds that have a double-ring structure; the nucleotide bases adenine and guanine are derived from purines and always bond with pyrimidines in DNA (18.1)

Purkinje fibre in the heart, a fast-conducting muscle fibre that initiates the almost simultaneous contraction of all cells of the right and left ventricles; signal for this contraction is initiated by the sinoatrial (SA) node and is relayed through the atrioventricular (AV) node and the bundle of His (8.1)

pyloric sphincter muscular ring that acts as a valve between the stomach and the first part of the small

intestine (duodenum), controlling the passage of food out of the stomach (6.2)

pyramid of biomass schematic representation of the relative amount of biomass at each trophic level (1.2)

pyramid of energy schematic representation of the relative amount of energy at each trophic level (1.2)

pyramid of numbers schematic representation of the relative numbers of organisms at each trophic level (1.2)

pyrimidines nitrogenous compounds that have a single-ring structure; the nucleotide bases thymine, cytosine, and uracil are derived from pyrimidines and always bond with purines in DNA (18.1)

Q

quadrat area of determined size that is marked out for the purpose of sampling a population; often used to sample plants and other organisms that tend to stay in one spot all their lives (3.3)

R

random distribution distribution of individuals throughout a suitable habitat with no identifiable pattern; occurs when resources are very abundant and population members do not have to compete with one another or group together for survival (20.1)

random sample sample in which all of the individuals in the population have an equal chance of being represented (3.3)

range geographical area in which a population or species is found (3.3)

rapid cycling (of nutrients) relatively quick movement of nutrients through nutrient reservoirs, such as organisms, soil, air, and water (2.2)

reaction centre a specialized, electron-accepting chlorophyll *a* molecule that receives light energy of various wavelengths from pigment molecules found in the photosystems of chloroplasts; transfers electrons to an electron acceptor during the light-independent reactions of photosynthesis (5.2)

receptor protein protein within the membrane of a target cell; circulating hormones bind to specific receptor proteins to produce an effect on the target cell (13.1)

recessive refers to a type of trait which does not appear (is not expressed) in an individual that is heterozygous (*Aa*) for that trait (17.1)

recombinant DNA a molecule of DNA that includes genetic material from different sources (18.3)

recombinant type describes offspring that have a different combination of alleles than the chromosomes of their parents; also known as *recombinants*; compare *parental type* (17.2)

recombination one of the outcomes of meiosis: cell division that produces daughter cells with different combinations of genes than the parent cells; gives rise to offspring that are genetically distinct from one another and from their parents; see also *reduction division* (16.3)

recombination frequency percentage of times that a crossover occurs as gametes are formed (17.1)

red blood cell see *erythrocyte* (8.2)

reducing power the chemical potential energy available in molecules that are in their reduced form (5.1)

reduction process by which an atom or molecule gains an electron (5.1)

reduction division one of the outcomes of meiosis: cell division that produces daughter cells with fewer chromosomes than the parent cells; see also *recombination* (16.3)

reflex arc simple connection of neurons that results in a reflex action in response to a stimulus (11.1)

refractory period the brief time (a few milliseconds) between the triggering of an impulse along an axon and the axon's readiness for the next impulse; during this time, the axon cannot transmit an impulse (11.1)

regulatory sequence strand of DNA that helps determine when various genetic processes are activated (18.3)

renal artery blood vessel that originates from the aorta and delivers blood to the kidneys; splits into a fine network of capillaries (the glomerulus) within the Bowman's capsule of the nephron (9.1)

renal insufficiency general term used to describe the state in which the kidneys cannot maintain homeostasis due to nephron damage (9.3)

renal vein blood vessel that drains from the kidney; returns to the body the solutes and water reabsorbed by the kidney (9.1)

replicate in biology, refers to the reproduction of an exact copy of genetic material, a cell, or an organism (16.1)

replication in genetics, process of creating an exact copy of a molecule of DNA (18.1)

replication bubble oval-shaped unwound area within a DNA molecule that is being replicated (18.1)

replication fork during DNA replication, Y-shaped points at which the DNA helix is unwound and new strands develop (18.1)

replication machine complex involving dozens of different enzymes and other proteins that work closely together in the process of DNA replication and interact at the replication fork (18.1)

replication origin specific nucleotide sequence where replication begins; ranges from a single replication origin in prokaryotes to thousands in eukaryotes (18.1)

repolarization return of a nerve to its resting potential following depolarization (11.1)

reproductive technology any technology that enhances or reduces reproductive potential (15.3)

residual volume amount of gas that remains in the lungs and the passageways of the respiratory system even after a full exhalation (7.2)

respiratory system in animals, system responsible for gas exchange (bringing oxygen into the body and removing carbon dioxide from the body) (7.1)

resting membrane potential potential difference across the membrane in a resting neuron (11.1)

restriction endonuclease type of restriction enzyme that recognizes a specific short sequence of nucleotides within, rather than at the ends of, a strand of DNA and cuts the strand at that particular point within the sequence (18.3)

restriction enzyme enzyme in prokaryotes that catalyzes the cleavage of DNA at specific nucleotide sequences (18.3)

restriction fragment small segments of DNA cut from a DNA molecule by a restriction endonuclease (18.3)

restriction site specific location within a short sequence of nucleotides in a strand of DNA at which a restriction endonuclease will cut (18.3)

retina the innermost layer of the eye, containing the photoreceptors (rods and cones) (12.2)

revolution term used by Georges Cuvier to describe the idea that Earth experienced many destructive natural events, such as floods and volcanic eruptions, in the past that were violent enough to have killed numerous species each time they occurred (4.2)

Rh factor group of antigens found in most red blood cells; people with the Rh factor on their red blood cells are termed Rh positive (Rh⁺) and people without it are Rh negative (Rh⁻) (8.3)

rib muscle one of several muscles found between and along the inside surface of the ribs, extending down to the diaphragm; as a group, work with the

diaphragm to move air in and out of the lungs; also known as *intercostal muscle* (7.2)

ribonucleic acid (RNA) a nucleic acid molecule that plays a role in gene expression and protein synthesis, composed of a phosphate group, a nitrogenous base (adenine, guanine, cytosine, or uracil), and the five-carbon sugar ribose; structure is similar to DNA (18.1)

ribosomal RNA (rRNA) linear strand of RNA that remains associated with the ribosomes (18.2)

ribosome organelle involved in protein synthesis; brings together the mRNA strand, the tRNA molecules carrying amino acids, and the enzymes involved in building polypeptides (18.2)

RNA polymerase main enzyme that catalyzes the formation of RNA from the DNA template (18.2)

rod type of photoreceptor in the eye that is more sensitive to light intensity (level of brightness) than is a cone, but is unable to distinguish colour (12.2)

rotational equilibrium balance required while rotating the head and body (12.3)

r-selected strategy a life strategy designed to take advantage of favourable conditions; characterized by a high reproductive rate with little or no attention given to offspring survival; organisms that exhibit this strategy include bacteria and species that reproduce close to their biotic potential (*r*); also known as *r-selection*; compare *K-selected strategy* (20.1)

S

S phase the middle part of interphase, a somatic cell's growth stage, during which the cell's DNA is replicated (16.1)

sacculle saclike cavity in the vestibule of the inner ear; contains sensory receptors for gravitational equilibrium (12.3)

saliva watery secretion of the salivary glands; in addition to containing a starch-digesting enzyme, helps lubricate food for easier swallowing (6.2)

saltatory conduction refers to the 'jumping' of action potentials from one node of Ranvier to the next due to the myelin sheath (11.1)

sample small portion of an entire population; samples are counted or estimated and the results are averaged and then applied, or extrapolated, to the entire area occupied by the population (3.3)

Schwann cell a type of insulating glial cell that wraps around the axon of a neuron, creating a myelin sheath (11.1)

- scientific hypothesis** see *hypothesis* (4.2)
- scientific theory** general statement that explains and makes successful predictions about a broad range of observations; usually based on hypotheses that consistently lead to successful predictions and explanations (4.2)
- sclera** the white, tough, fibrous protective outer layer that gives the eye its shape (12.2)
- scrotum** pouch that contains the testes in most mammals (14.1)
- second law of thermodynamics** law stating that all energy transformations are inefficient because some usable energy is always dissipated to the environment as unusable heat (1.1)
- second polar body** one of a pair of cells that results when a secondary oocyte undergoes asymmetrical cytokinesis during meiosis II; is not a viable gamete; also used to refer to the products of a second division that may occur in the first polar body (16.3)
- secondary consumer** organism that eats primary consumers (herbivores) (1.1)
- secondary oocyte** cell that receives the larger portion of cytoplasm when a primary oocyte undergoes asymmetrical cytokinesis during meiosis I; becomes the egg; compare *first polar body* (16.3)
- secondary sex characteristic** any of the physical manifestations that distinguish male from female but are not required for reproduction, such as distribution of body fat, female breasts, change of voice pitch in adolescent males, differences in muscularity, etc.; compare *primary sex characteristic* (14.1)
- secondary spermatocyte** each of two cells produced as a result of a primary spermatocyte undergoing meiosis I (16.3)
- secondary succession** the regrowth of a previously existing community after an ecological disturbance, such as a forest fire, flood, or agricultural activity; differs from primary succession in the presence of soil, which is not usually destroyed in an ecological disturbance (20.2)
- secretin** one of three enzymes (including CCK and GIP) secreted into the bloodstream by the duodenum, causing inhibition of stomach movement and secretions, and enabling fatty meals to remain in the stomach longer than non-fatty meals; also stimulates the pancreas to release more bicarbonate to neutralize acidic chyme (6.2)
- segmentation** a process by which some physical digestion occurs in the small intestine; chyme sloshes back and forth between segments of the small intestine that form when bands of circular muscle briefly contract (6.2)
- selective advantage** characteristic that improves an organism's chance of survival, usually in a changing environment; the result of mutations (4.1, 19.2)
- selective breeding** process of choosing and breeding specific organisms for particular physical features or behaviours (17.1)
- selective pressure** environmental condition or conditions that select for certain characteristics of individuals, and select against others (4.1)
- semen** fluid released from the penis during ejaculation; combination of sperm and glandular secretions (14.1)
- semicircular canal** one of the three components of the inner ear (cochlea, vestibule, and semicircular canals); consists of three fluid-filled loops, arranged in three different planes; contains mechanoreceptors that detect head and body rotation (rotational equilibrium) (12.3)
- semi-conservative** term used to describe replication: each new molecule of DNA contains one strand of the original complementary DNA and one new strand, thus conserving half of the original molecule (18.1)
- seminal vesicle** in human males, gland behind the bladder that is connected to the ductus deferens; produces a mucus-like fluid containing the sugar fructose, which provides energy for the sperm (14.1)
- seminiferous tubule** long, coiled tube inside the testes in which sperm are produced (14.1)
- sensation** receiving and processing by the brain of neural impulses from the sensory receptors; e.g., sensory receptors on the skin detect heat, and when the brain processes the impulses, the sensation of warmth is felt on that part of the skin (12.1)
- sense strand** the one strand of nucleotides from the double-stranded DNA molecule that is transcribed; compare *anti-sense strand* (18.2)
- sensory adaptation** the filtering by the brain of redundant, insignificant sensory information (12.1)
- sensory receptor** cell or group of cells scattered throughout the body that works continually to receive information about the body's external conditions (through sight, hearing, taste, smell, and touch) and internal conditions (such as temperature, pH, glucose levels, and blood pressure), and then initiates neural impulses in response (12.1)
- septum** in the heart, the muscular wall that separates the two ventricles and the two atria (8.1)

Sertoli cells cells within the seminiferous tubules that support and nourish developing sperm (14.1)

sessile does not move (3.2)

sex chromosome X or Y chromosome that carries the genes involved in determining the genetic sex of an individual (16.1)

sex hormone one of several chemical compounds that control the development and function of the reproductive system or secondary sex characteristics (14.1)

sex-linked trait trait controlled by genes on either the X or Y chromosome (17.2)

sexual reproduction reproduction involving meiosis, gamete formation, and fertilization; produces genetically distinct offspring (16.4)

sexual selection a type of natural selection that results from non-random mating; e.g., if a male organism can attract more mates as a result of physical traits, his phenotype gives him a reproductive advantage over the other males in his population (19.2)

sexually transmitted infection (STI) infection such as AIDS, chlamydia, or genital herpes that is normally passed from one person to another through sexual activity; also known as *sexually transmitted disease (STD)* (14.2)

short-term stress response the body's acute reaction to stress in which the sympathetic nervous system is stimulated; also known as *flight-or-flight response* (13.3)

silent mutation permanent change in the genetic material of a cell that has no effect on the function of the cell (18.3)

sinoatrial (SA) node bundle of specialized muscle tissue located in the wall of the right atrium of the mammalian heart; generates an electrical impulse that stimulates cardiac muscle fibres to contract and relax rhythmically, producing a regular heartbeat; also known as *pacemaker*; compare *atrioventricular node* (8.1)

sister chromatids two chromatids in a chromosome that are genetically identical and are held together by a centromere (16.1)

skeletal muscle striated, voluntary muscle tissue that comprises skeletal muscles; also called *striated muscle* (10.1)

sliding filament model an explanation for muscle contraction based on the movement (sliding) of actin filaments in relation to myosin filaments (10.1)

slow cycling (of nutrients) long-term storage of nutrients in nutrient reservoirs, such as fossil fuel

deposits; nutrients stored in these reservoirs are unavailable for long periods of time (2.2)

slow-twitch fibre muscle fibre that produces most of its energy aerobically; contracts slowly, but can maintain a steady, prolonged production of ATP when oxygen is available; also called *Type I fibre*; compare *fast-twitch fibre* (10.2)

small intestine length of the digestive tract between the stomach and the large intestine; narrower in diameter than the large intestine, it is comprised of the duodenum, jejunum, and ileum; main function is to complete the digestion of macromolecules and to absorb their component subunits (6.2)

smooth muscle nonstriated, involuntary muscle tissue found in the walls of internal organs (10.1)

sodium-potassium exchange pump system involving a carrier protein in the plasma membrane that uses the energy of ATP to transport sodium ions out of and potassium ions into animal cells; important in nerve and muscle cells (11.1)

somatic cell any of the cells of a multicellular organism except those that form gametes (16.1)

somatic cell mutation permanent change in the genetic material of a body cell, *not* including germ cells, during the lifetime of an organism; is copied during DNA replication and passed on to daughter cells, but not passed on to future generations; compare *germ line mutation* (18.3)

somatic gene therapy therapy that is aimed at correcting genetic disorders in somatic (body) cells; see also *gene therapy* (18.4)

somatic system in vertebrates, division of the peripheral nervous system that controls voluntary movement of skeletal muscle; conducts signals from the central nervous system to the skeletal muscles and signals from the sensory receptors in the body to the central nervous system; compare *autonomic system* (11.1, 11.3)

sound wave small fluctuation in air pressure resulting from sound, which causes particles around the source to vibrate and move; the auditory system (sense of hearing) detects these movements and the brain perceives them as sound (12.3)

speciation the formation of new species (4.3)

species population of organisms capable of interbreeding and producing fertile offspring (3.1)

specific defence see *antibody-mediated immunity* (8.3)

sperm cell male reproductive cell (gamete) (14.1)

- spermatid** each of four haploid cells that result when a secondary spermatocyte undergoes meiosis II; each spermatid differentiates into a sperm cell (16.3)
- spermatogenesis** the process of male gamete (sperm) production in animals (14.1, 16.3)
- spermatogonium** the diploid germ cell from which sperm are produced in the testes (16.3)
- spindle apparatus** assembly that carries out the separation of chromosomes during cell division (mitosis); composed of spindle fibres and assembled during prophase (16.2)
- spindle fibre** one of a network of fibres that forms the spindle apparatus during cell division (mitosis); made of microtubules, hollow tubes of protein that facilitate movement of chromosomes within a cell (16.2)
- spiograph** graph representing the amount of air that moves into and out of the lungs with each breath (7.2)
- spontaneous generation** a theory, accepted until the mid-1800s, stating that living organisms could arise from nonliving matter (16.1)
- spontaneous mutation** permanent change in the genetic material of a cell as a result of the molecular interactions that occur naturally within the cell (18.3)
- spore** reproductive cell capable of developing into a new organism without fusion with another cell, in contrast to a gamete; contains genetic material and cytoplasm surrounded by a protective sheath or wall (16.4)
- sporophyte** diploid generation of a plant that produces haploid spores (through the process of meiosis) that develop without fertilization into a gametophyte; also see *alternation of generations* (16.4)
- stable equilibrium** maintenance of population size around carrying capacity, with only slight fluctuations above and below this capacity (20.1)
- stationary phase** stage in the growth of a population at which birth rate and death rate are equivalent as competition for resources and other limiting factors slow the rate of growth; compare *exponential growth phase* and *lag phase* (20.1)
- sterile** condition in which a man or a woman is unable to have children; compare *infertile* (15.3)
- sticky end** short sequence of unpaired nucleotides remaining on a single strand of DNA at each end of a restriction fragment, after an endonuclease makes a staggered cut at the restriction site (18.3)
- stomach** “J”-shaped sac lying between the esophagus and the small intestine whose muscles and secretions work to physically and chemically break down food and push it into the small intestine; also stores food (6.2)
- striated muscle** see *skeletal muscle* (10.1)
- stroma** fluid in the inner space of a chloroplast, which contains a concentrated mixture of proteins and other chemicals that are used in the synthesis of carbohydrates during photosynthesis (5.1)
- stromatolite** fossilized sedimentary structure formed from ancient bacteria; iron bands present in some stromatolites provide evidence of oxygen formation in Earth’s past (2.3)
- substrate** substance upon which an enzyme acts (6.1)
- succession** sequence of invasion and replacement of species in an ecosystem over time (20.2)
- superovulation** production of multiple eggs as a result of hormone treatment (15.3)
- suppressor T cell** lymphocyte that slows and suppresses the cell-mediated immune response to an antigen to ensure that healthy tissues are not destroyed (8.3)
- surrogate mother** woman who becomes impregnated and carries a baby for another; baby may be conceived through artificial insemination or *in vitro* fertilization (15.3)
- sustainability** concept of living in a way that meets our needs without compromising the health of future generations or of the planet (20.3)
- symbiosis** direct or close relationship between individuals of different species that live together; usually involves an organism that lives or feeds in or on another organism (host); three forms are *mutualism*, *commensalism*, and *parasitism* (20.2)
- sympathetic nervous system** division of the autonomic system that regulates involuntary processes in the body; works in opposition to the parasympathetic nervous system; typically activated in stress related situations; compare *parasympathetic nervous system* (11.1, 11.3)
- synapse** junction between two neurons or between a neuron and an effector (muscle or gland) (11.1)
- synapsis** aligning of homologous chromosomes side-by-side during prophase I in meiosis (16.3)
- syphilis** a sexually transmitted infection caused by the bacterium *Treponema pallidum*; if untreated, can cause bones, muscles, and nerve tissue to degenerate (14.2)
- systemic pathway** in animals, the circulatory pathway that carries oxygen-rich blood from the heart to the body tissues, and oxygen-poor blood from the tissues back to the heart (8.1)

systolic pressure maximum blood pressure exerted during ventricular contraction; compare *diastolic pressure* (8.1)

T

T cell lymphocyte that is primarily responsible for cell-mediated immunity; roles include activation of certain immune cells, destruction of invading pathogens, suppression of cellular immunity, and promotion of immune response upon reinfection; types include helper, killer, suppressor, and memory T cells; compare *B cell* (8.3)

T lymphocyte see *T cell* (8.3)

target sequence in DNA replication, short sequence of nucleotides within a strand of DNA recognized and cut by restriction endonucleases (18.3)

taste bud sensory receptor in the bumps (papillae) on the tongue (12.3)

taxonomy practice of classifying organisms based on common fundamental characteristics (3.2)

tectorial membrane one of two parallel membranes that comprise the organ of Corti in the inner ear (the other is the basilar membrane); during the transmission of sound waves, the basilar membrane vibrates, causing the sensory hairs to flex against the tectorial membrane (12.3)

telophase the final stage of cell division (mitosis) in which a nucleolus forms around chromosomes at opposite ends of the dividing parent cell; this stage is followed by cytokinesis to form two daughter cells (16.2)

temporal lobe one of four lobes into which each hemisphere of the cerebral cortex is divided; shares in the processing of visual information but its main function is auditory reception; also linked to understanding speech and retrieving visual and verbal memories (11.2)

tendon fibrous connective tissue that connects skeletal muscle to bone (10.1)

teratogen any agent that causes a structural abnormality of the developing fetus due to exposure during pregnancy; e.g., smoking (15.2)

termination in DNA replication, the completion of the new DNA strands and the dismantling of the replication machine (18.1)

tertiary consumer organism that eats secondary consumers (1.1)

test cross cross of an individual of unknown genotype with a homozygous recessive individual; used as a method to determine the unknown genotype (17.1)

testis (testes) in mammals, one of a pair of male reproductive organs (gonads) that produces sperm (14.1)

testis-determining factor gene carried on the Y chromosome that triggers the production of male sex hormones (14.3)

testosterone reproductive hormone produced in the testes; stimulates the development of the male reproductive tract and secondary sex characteristics; only minor effects in females (14.3)

tetrad a homologous pair formed during prophase I of meiosis, so named because it contains four chromatids (16.3)

thalamus sensory relay centre at the base of the forebrain that governs the flow of information from all other parts of the nervous system, mainly between the forebrain and hindbrain, and between areas of the sensory system (except for the sense of smell) and cerebellum (11.2)

theory of evolution by natural selection a well-supported, widely accepted explanation of how species have changed, and continue to change, during Earth's history as a result of natural selection (4.2)

thermoreceptor sensory receptor that detects heat and cold (12.1)

threshold potential in a neuronal membrane, the minimum change in the membrane potential required to generate an action potential; usually -55 mV (11.1)

thylakoid interconnected flattened sac within the stroma of a chloroplast; membranes contain chlorophyll; may occur in a stack called a granum (5.1)

thylakoid space in chloroplasts, the area inside a thylakoid that is completely sealed off from the surrounding stroma (5.2)

thyroid gland butterfly-shaped gland located below the larynx in the neck; produces the hormone thyroxine; helps regulate metabolism and growth (13.2)

thyroid-stimulating hormone (TSH) a hormone released by the anterior pituitary which causes the thyroid gland to secrete thyroxine; controlled by a negative feedback mechanism: rising thyroxine levels in the blood detected by the hypothalamus and anterior pituitary suppress the secretion of TSH and, therefore, thyroxine (13.2)

thyroxine (T_4) hormone produced by the thyroid and released into the bloodstream; controls the rate at which the body metabolizes fats, proteins, and carbohydrates for energy (13.2)

tidal volume volume of air that is inhaled and exhaled in a normal breathing movement when the body is at rest (7.2)

tonsillitis infection of the tonsils, which are located in the pharynx (7.3)

trachea (tracheae) in vertebrates, tube that carries air from the nasal passages or mouth to the lungs; also known as *windpipe* (7.1)

transcription the first stage of gene expression, in which a strand of messenger RNA (mRNA) is produced that is complementary to a segment of DNA (18.2)

transect a long, relatively narrow rectangular area marked out in a study area for the purpose of sampling a population (3.3)

transfer RNA (tRNA) type of RNA that works with messenger RNA (mRNA) to direct the synthesis of a polypeptide in a process known as translation (18.2)

transformation the evolution of one species into another as a result of mutation and adaptation to changing environmental conditions, resulting in the replacement of the old species; compare *divergence* (4.3)

transforming principle ability of dead pathogenic bacteria to pass on their disease-causing properties to live, non-pathogenic bacteria; phenomenon described by Frederick Griffith in 1928 (18.1)

transgenic genetically engineered; a transgenic organism is produced by incorporating the DNA from one organism into another to create a new genetic combination (18.4)

transitional fossil the remains or impression of a prehistoric organism that shows intermediary links between groups of organisms and shares characteristics common to these groups (4.2)

translation the second stage of gene expression, in which the mRNA nucleotide sequence directs the synthesis of a polypeptide (a chain of amino acids) with the aid of another RNA molecule, transfer RNA (tRNA) (18.2)

transposon short strand of DNA capable of moving randomly from one chromosome to another; also called *transposable element* or *jumping gene* (18.3)

triglyceride high-energy organic molecule composed of one glycerol molecule and three fatty acid molecules; main component of fats and oils (6.1)

trimester one of the three three-month periods into which pregnancy is divided (15.1)

trisomy gain of an extra chromosome as a result of nondisjunction (16.3)

trophic level in an ecosystem, a feeding level through which energy and matter are transferred; indicates an organism's position in the food chain and is determined by the number of energy transfer steps required to reach each level (1.2)

trophoblast the outer cell layer of the blastocyst; will develop into the chorion membrane; compare *inner cell mass* (15.1)

tropic hormone hormone that targets endocrine glands and stimulates them to release other hormones (13.1)

true breeding organisms that are homozygous for a particular trait or set of traits and produce offspring that exhibit the same characteristics generation after generation (17.1)

tubal ligation a surgical sterilization procedure in women that involves cutting the oviducts and tying off the cut ends to ensure that the ovum does not encounter sperm or reach the uterus (15.3)

tubular reabsorption in the kidney, process in which water and useful solutes are reabsorbed from the filtrate in the nephron and transported into capillaries for reuse by the body (9.2)

tubular secretion in the kidney, process that moves additional wastes and excess substances from the blood into the filtrate in the nephron; uses mainly active transport (9.2)

tympanum round, elastic structure within the middle ear that vibrates in response to sound waves; also known as *eardrum* or *tympanic membrane* (12.3)

type 1 diabetes a condition in which the immune system produces antibodies that attack and destroy the beta cells of the pancreas so they are unable to produce insulin; is usually diagnosed in childhood, and patients require daily insulin injections; also known as *juvenile diabetes* and *insulin-dependent diabetes* (13.4)

type 2 diabetes a condition that develops slowly over time either because the insulin receptors on the body's cells stop responding to insulin or because the beta cells of the pancreas produce less and less insulin over time; condition often appears in overweight adults; also known as *adult-onset diabetes* and *non-insulin-dependent diabetes* (13.4)

U

ulcer slow-healing sore that forms when the thick layer of mucus that protects the lining of the stomach from the acids in digestive juices is eroded (6.3)

ultrasound sound with a frequency greater than the upper limit of human hearing; used in a procedure by which sound waves sent through the body provide information about internal structures, such as a developing fetus (18.4)

umbilical cord flexible, often spirally twisted, tube that connects the abdomen of a fetus to the mother's placenta in the uterus, and through which nutrients are delivered and waste is expelled (15.1)

uniform distribution distribution of individuals in an evenly spaced pattern over a defined area; seen in artificial populations, such as an orchard, or in birds of prey and other territorial organisms (20.1)

ureter in mammals, a pair of muscular tubes that carry urine from the kidneys to the bladder (9.1)

urethra the tube through which urine exits the bladder and the body (9.1, 14.1)

urinary bladder organ where urine is stored before being discharged by way of the urethra (9.1)

urine in the kidneys, filtrate of the nephron upon leaving the collecting duct; exits the body through the urethra (9.2)

uterine cycle the part of the menstrual cycle that takes place in the uterus (14.3)

uterus in mammals, expanded muscular organ in the female reproductive tract through which eggs pass to the environment or in which an embryo develops and is nourished before birth (14.1)

utricle saclike cavity in the vestibule of the inner ear; contains sensory receptors for gravitational equilibrium (12.3)

V

vagina a muscular tube that leads from outside the female's body to the uterus; serves as an entrance for the erect penis to deposit sperm during sexual intercourse and as an exit for the fetus during childbirth (14.1)

valve membranous extension of a vessel or the heart wall that opens and closes, ensuring one-way fluid flow (8.1)

variation a visible or invisible difference between one individual and other members of a population (4.1)

vas deferens (vasa deferentia) former name for the storage duct from the epididymis leading to the penis via the ejaculatory duct; now known as *ductus deferens* (14.1)

vasectomy a sterilization procedure in men; involves cutting and tying the ductus deferens (15.3)

vasoconstriction decrease in the diameter of blood vessels; vasoconstriction near the skin conserves body heat (8.2)

vasodilation expansion in the diameter of blood vessels; vasodilation near the skin brings more blood to the surface to help reduce body temperature (8.2)

vegetative reproduction a form of asexual reproduction in which a new plant grows from a modified stem (16.4)

vein blood vessel that carries oxygen-poor blood to the heart (8.1)

vena cava (vena cavae) one of two large vessels, the superior and inferior vena cavae, that open into the right atrium of the heart (8.1)

ventricle one of the two lower chambers of the heart; each ventricle receives blood from one of the atria and pumps it into systemic or pulmonary circulation (8.1)

villus (villi) finger-like projection along the ridges of the small intestine; increases surface area to aid in the absorption of nutrients (6.2)

vital capacity the total volume of gas that can be moved in or out of the lungs; equal to tidal volume + inspiratory reserve volume + expiratory reserve volume; also known as *total lung volume capacity* (7.2)

vitamin organic compound required in trace amounts for normal metabolism (6.1)

vitreous humour a clear, jelly-like fluid inside the posterior chamber of the eye; helps to maintain the shape of the eyeball and support the surrounding cells (12.2)

vulva the external parts of the genital organs of female mammals; includes the labia majora and labia minora, as well as the glans clitoris (14.1)

W

water reabsorption in the kidney, process which removes water from the filtrate in the nephron and returns it to the blood for reuse by body systems (9.2)

Wernicke's area one of two important areas on the left side of the cerebral cortex; stores the information involved in language comprehension; the ability to utter words is not affected if this area is damaged, but the words make little sense; compare *Broca's area* (11.2)

white blood cell colourless blood cell that protects the body from infection by way of the immune response, and also plays a role in allergic reactions and inflammation; three types include granulocytes, monocytes, and lymphocytes; also known as *leucocyte* (8.2)

white matter part of the nervous system that made up of tracts of myelinated nerve fibres; whitish in colour; forms the inner region of some areas of the brain, and the outer area of the spinal cord; compare *grey matter* (11.1, 11.2)

Y

yolk sac one of the extra-embryonic membranes suspended from the abdominal area of the embryo; in humans, serves no nutritive function, but contributes to the formation of the digestive tract and produces the first blood cells and the future egg (ova) or sperm cells (15.1)

Z

zona pellucida thin, clear layer of protein and carbohydrates surrounding the plasma membrane of the egg (ovum) (15.1)

zygote cell formed by the union of two gametes; the product of fertilization; has 23 pairs of chromosomes for a total of 46 chromosomes (diploid) (15.1)