

Concepts of Biology – Key Terms

Chapter 1: Introduction to Biology

applied science: a form of science that solves real-world problems;

atom: a basic unit of matter that cannot be broken down by normal chemical reactions

basic science: science that seeks to expand knowledge regardless of the short-term application of that knowledge

biology: the study of living organisms and their interactions with one another and their environments

biosphere: a collection of all ecosystems on Earth

cell: the smallest fundamental unit of structure and function in living things

community: a set of populations inhabiting a particular area

control: a part of an experiment that does not change during the experiment

deductive reasoning: a form of logical thinking that uses a general statement to forecast specific results

descriptive science: a form of science that aims to observe, explore, and find things out

ecosystem: all living things in a particular area together with the abiotic, nonliving parts of that environment

eukaryote: an organism with cells that have nuclei and membrane-bound organelles **evolution** the process of gradual change in a population that can also lead to new species arising from older species

falsifiable: able to be disproven by experimental results

homeostasis: the ability of an organism to maintain constant internal conditions

hypothesis-based science: a form of science that begins with a specific explanation that is then tested

hypothesis: a suggested explanation for an event, which can be tested

inductive reasoning: a form of logical thinking that uses related observations to arrive at a general conclusion

life science: a field of science, such as biology, that studies living things

macromolecule: a large molecule typically formed by the joining of smaller molecules **molecule** a chemical structure consisting of at least two atoms held together by a chemical bond

natural science: a field of science that studies the physical world, its phenomena, and processes

organ system: the higher level of organization that consists of functionally related organs

organelle: a membrane-bound compartment or sac within a cell

organism: an individual living entity

organ: a structure formed of tissues operating together to perform a common function

peer-reviewed article: a scientific report that is reviewed by a scientist's colleagues before publication

phylogenetic tree: a diagram showing the evolutionary relationships among biological species based on similarities and differences in genetic or physical traits or both

physical science: a field of science, such as astronomy, physics, and chemistry, that studies nonliving matter

population: all individuals within a species living within a specific area

prokaryote: a unicellular organism that lacks a nucleus or any other membrane-bound organelle

science: knowledge that covers general truths or the operation of general laws, especially when acquired and tested by the scientific method

scientific law: a description, often in the form of a mathematical formula, for the behavior of some aspect of nature under certain specific conditions

scientific method: a method of research with defined steps that include experiments and careful observation

scientific theory: a thoroughly tested and confirmed explanation for observations or phenomena

tissue: a group of similar cells carrying out the same function

variable: a part of an experiment that can vary or change

Chapter 2: Chemistry of Life

trans-fat: a form of unsaturated fat with the hydrogen atoms neighboring the double bond across from each other rather than on the same side of the double bond

acid: a substance that donates hydrogen ions and therefore lowers pH

adhesion: the attraction between water molecules and molecules of a different substance

amino acid: a monomer of a protein

anion: a negative ion formed by gaining electrons

atomic number: the number of protons in an atom

base: a substance that absorbs hydrogen ions and therefore raises pH

buffer: a solution that resists a change in pH by absorbing or releasing hydrogen or hydroxide ions

carbohydrate: a biological macromolecule in which the ratio of carbon to hydrogen to oxygen is 1:2:1; carbohydrates serve as energy sources and structural support in cells

cation: a positive ion formed by losing electrons

cellulose: a polysaccharide that makes up the cell walls of plants and provides structural support to the cell

chemical bond: an interaction between two or more of the same or different elements that results in the formation of molecules

chitin: a type of carbohydrate that forms the outer skeleton of arthropods, such as insects and crustaceans, and the cell walls of fungi

cohesion: the intermolecular forces between water molecules caused by the polar nature of water; creates surface tension

covalent bond: a type of strong bond between two or more of the same or different elements; forms when electrons are shared between elements

denaturation: the loss of shape in a protein as a result of changes in temperature, pH, or exposure to chemicals

deoxyribonucleic acid (DNA): a double-stranded polymer of nucleotides that carries the hereditary information of the cell

disaccharide: two sugar monomers that are linked together by a peptide bond

electron transfer: the movement of electrons from one element to another

electron: a negatively charged particle that resides outside of the nucleus in the electron orbital; lacks functional mass and has a charge of -1

element: one of 118 unique substances that cannot be broken down into smaller substances and retain the characteristic of that substance; each element has a specified number of protons and unique properties

enzyme: a catalyst in a biochemical reaction that is usually a complex or conjugated protein

evaporation: the release of water molecules from liquid water to form water vapor

fat: a lipid molecule composed of three fatty acids and a glycerol (triglyceride) that typically exists in a solid form at room temperature

glycogen: a storage carbohydrate in animals

hormone: a chemical signaling molecule, usually a protein or steroid, secreted by an endocrine gland or group of endocrine cells; acts to control or regulate specific physiological processes

hydrogen bond: a weak bond between partially positively charged hydrogen atoms and partially negatively charged elements or molecules

hydrophilic: describes a substance that dissolves in water; water-loving

hydrophobic: describes a substance that does not dissolve in water; water-fearing

ionic bond: a chemical bond that forms between ions of opposite charges

ion: an atom or compound that does not contain equal numbers of protons and electrons, and therefore has a net charge

isotope: one or more forms of an element that have different numbers of neutrons

lipids: a class of macromolecules that are nonpolar and insoluble in water

litmus paper: filter paper that has been treated with a natural water-soluble dye so it can be used as a pH indicator

macromolecule: a large molecule, often formed by polymerization of smaller monomers

mass number: the number of protons plus neutrons in an atom

matter: anything that has mass and occupies space

monosaccharide: a single unit or monomer of carbohydrates

neutron: a particle with no charge that resides in the nucleus of an atom; has a mass of 1

nonpolar covalent bond: a type of covalent bond that forms between atoms when electrons are shared equally between atoms, resulting in no regions with partial charges as in polar covalent bonds

nucleic acid: a biological macromolecule that carries the genetic information of a cell and carries instructions for the functioning of the cell

nucleotide: a monomer of nucleic acids; contains a pentose sugar, a phosphate group, and a nitrogenous base

nucleus: (chemistry) the dense center of an atom made up of protons and (except in the case of a hydrogen atom) neutrons

octet rule: states that the outermost shell of an element with a low atomic number can hold eight electrons

oil: an unsaturated fat that is a liquid at room temperature

pH scale: a scale ranging from 0 to 14 that measures the approximate concentration of hydrogen ions of a substance

periodic table of elements: an organizational chart of elements, indicating the atomic number and mass number of each element; also provides key information about the properties of elements

phospholipid: a major constituent of the membranes of cells; composed of two fatty acids and a phosphate group attached to the glycerol backbone

polar covalent bond: a type of covalent bond in which electrons are pulled toward one atom and away from another, resulting in slightly positive and slightly negative charged regions of the molecule

polypeptide: a long chain of amino acids linked by peptide bonds

polysaccharide: a long chain of monosaccharides; may be branched or unbranched

protein: a biological macromolecule composed of one or more chains of amino acids

proton: a positively charged particle that resides in the nucleus of an atom; has a mass of 1 and a charge of +1

radioactive isotope: an isotope that spontaneously emits particles or energy to form a more stable element

ribonucleic acid (RNA): a single-stranded polymer of nucleotides that is involved in protein synthesis

saturated fatty acid: a long-chain hydrocarbon with single covalent bonds in the carbon chain; the number of hydrogen atoms attached to the carbon skeleton is maximized

solvent: a substance capable of dissolving another substance

starch: a storage carbohydrate in plants

steroid: a type of lipid composed of four fused hydrocarbon rings

surface tension: the cohesive force at the surface of a body of liquid that prevents the molecules from separating

temperature: a measure of molecular motion

triglyceride: a fat molecule; consists of three fatty acids linked to a glycerol molecule

unsaturated fatty acid: a long-chain hydrocarbon that has one or more than one double bonds in the hydrocarbon chain

van der Waals interaction: a weak attraction or interaction between molecules caused by slightly positively charged or slightly negatively charged atoms

Chapter 3: Cell Structure and Function

active transport: the method of transporting material that requires energy

cell wall: a rigid cell covering made of cellulose in plants, peptidoglycan in bacteria, non-peptidoglycan compounds in Archaea, and chitin in fungi that protects the cell, provides structural support, and gives shape to the cell

central vacuole: a large plant cell organelle that acts as a storage compartment, water reservoir, and site of macromolecule degradation

chloroplast: a plant cell organelle that carries out photosynthesis

cilium (plural, cilia): a short, hair-like structure that extends from the plasma membrane in large numbers and is used to move an entire cell or move substances along the outer surface of the cell

concentration gradient: an area of high concentration across from an area of low concentration

cytoplasm: the entire region between the plasma membrane and the nuclear envelope, consisting of organelles suspended in the gel-like cytosol, the cytoskeleton, and various chemicals

cytoskeleton: the network of protein fibers that collectively maintains the shape of the cell, secures some organelles in specific positions, allows cytoplasm and vesicles to move within the cell, and enables unicellular organisms to move

cytosol: the gel-like material of the cytoplasm in which cell structures are suspended

desmosome: a linkage between adjacent epithelial cells that forms when cadherins in the plasma membrane attach to intermediate filaments

diffusion: a passive process of transport of low-molecular weight material down its concentration gradient

electrochemical gradient: a gradient produced by the combined forces of the electrical gradient and the chemical gradient

endocytosis: a type of active transport that moves substances, including fluids and particles, into a cell

endomembrane system: the group of organelles and membranes in eukaryotic cells that work together to modify, package, and transport lipids and proteins

endoplasmic reticulum (ER): a series of interconnected membranous structures within eukaryotic cells that collectively modify proteins and synthesize lipids

eukaryotic cell: a cell that has a membrane-bound nucleus and several other membrane-bound compartments or sacs

exocytosis: a process of passing material out of a cell

extracellular matrix: the material, primarily collagen, glycoproteins, and proteoglycans, secreted from animal cells that holds cells together as a tissue, allows cells to communicate with each other, and provides mechanical protection and anchoring for cells in the tissue

facilitated transport: a process by which material moves down a concentration gradient (from high to low concentration) using integral membrane proteins

flagellum (plural, flagella): the long, hair-like structure that extends from the plasma membrane and is used to move the cell

fluid mosaic model: a model of the structure of the plasma membrane as a mosaic of components, including phospholipids, cholesterol, proteins, and glycolipids, resulting in a fluid rather than static character

Golgi apparatus: a eukaryotic organelle made up of a series of stacked membranes that sorts, tags, and packages lipids and proteins for distribution

gap junction: a channel between two adjacent animal cells that allows ions, nutrients, and other low-molecular weight substances to pass between the cells, enabling the cells to communicate

hypertonic: describes a solution in which extracellular fluid has higher osmolarity than the fluid inside the cell

hypotonic: describes a solution in which extracellular fluid has lower osmolarity than the fluid inside the cell

isotonic: describes a solution in which the extracellular fluid has the same osmolarity as the fluid inside the cell

lysosome: an organelle in an animal cell that functions as the cell's digestive component; it breaks down proteins, polysaccharides, lipids, nucleic acids, and even worn-out organelles

microscope: the instrument that magnifies an object

mitochondria: (singular, mitochondrion) the cellular organelles responsible for carrying out cellular respiration, resulting in the production of ATP, the cell's main energy-carrying molecule

nuclear envelope: the double-membrane structure that constitutes the outermost portion of the nucleus

nucleolus: the darkly staining body within the nucleus that is responsible for assembling ribosomal subunits

nucleus: the cell organelle that houses the cell's DNA and directs the synthesis of ribosomes and proteins

organelle: a membrane-bound compartment or sac within a cell

osmolarity: the total amount of substances dissolved in a specific amount of solution

osmosis: the transport of water through a semipermeable membrane from an area of high water concentration to an area of low water concentration across a membrane

passive transport: a method of transporting material that does not require energy

peroxisome: a small, round organelle that contains hydrogen peroxide, oxidizes fatty acids and amino acids, and detoxifies many poisons

phagocytosis: a process that takes macromolecules that the cell needs from the extracellular fluid; a variation of endocytosis

pinocytosis: a process that takes solutes that the cell needs from the extracellular fluid; a variation of endocytosis

plasma membrane: a phospholipid bilayer with embedded (integral) or attached (peripheral) proteins that separates the internal contents of the cell from its surrounding environment

plasmodesma (plural, plasmodesmata): a channel that passes between the cell walls of adjacent plant cells, connects their cytoplasm, and allows materials to be transported from cell to cell

prokaryotic cell: a unicellular organism that lacks a nucleus or any other membrane-bound organelle

receptor-mediated endocytosis: a variant of endocytosis that involves the use of specific binding proteins in the plasma membrane for specific molecules or particles

ribosome: a cellular organelle that carries out protein synthesis

rough endoplasmic reticulum (RER): the region of the endoplasmic reticulum that is studded with ribosomes and engages in protein modification

selectively permeable: the characteristic of a membrane that allows some substances through but not others

smooth endoplasmic reticulum (SER): the region of the endoplasmic reticulum that has few or no ribosomes on its cytoplasmic surface and synthesizes carbohydrates, lipids, and steroid hormones; detoxifies chemicals like pesticides, preservatives, medications, and environmental pollutants, and stores calcium ions

solute: a substance dissolved in another to form a solution

tight junction: a firm seal between two adjacent animal cells created by protein adherence

tonicity: the amount of solute in a solution.

unified cell theory: the biological concept that states that all organisms are composed of one or more cells, the cell is the basic unit of life, and new cells arise from existing cells

vacuole: a membrane-bound sac, somewhat larger than a vesicle, that functions in cellular storage and transport

vesicle: a small, membrane-bound sac that functions in cellular storage and transport; its membrane is capable of fusing with the plasma membrane and the membranes of the endoplasmic reticulum and Golgi apparatus

Chapter 4: How Cells Obtain Energy

ATP synthase: a membrane-embedded protein complex that regenerates ATP from ADP with energy from protons diffusing through it

ATP: the cell's energy currency

adenosine triphosphate: the cell's energy currency

acetyl CoA: the combination of an acetyl group derived from pyruvic acid and coenzyme A which is made from pantothenic acid (a B-group vitamin)

activation energy: the amount of initial energy necessary for reactions to occur

active site: a specific region on the enzyme where the substrate binds

allosteric inhibition: the mechanism for inhibiting enzyme action in which a regulatory molecule binds to a second site (not the active site) and initiates a conformation change in the active site, preventing binding with the substrate

anabolic: describes the pathway that requires a net energy input to synthesize complex molecules from simpler ones

anaerobic cellular respiration: the use of an electron acceptor other than oxygen to complete metabolism using electron transport-based chemiosmosis

bioenergetics: the concept of energy flow through living systems

catabolic: describes the pathway in which complex molecules are broken down into simpler ones, yielding energy as an additional product of the reaction

chemiosmosis: the movement of hydrogen ions down their electrochemical gradient across a membrane through ATP synthase to generate ATP

citric acid cycle: a series of enzyme-catalyzed chemical reactions of central importance in all living cells that harvests the energy in carbon-carbon bonds of sugar molecules to generate ATP; the citric acid cycle is an aerobic metabolic pathway because it requires oxygen in later reactions to proceed

competitive inhibition: a general mechanism of enzyme activity regulation in which a molecule other than the enzyme's substrate is able to bind the active site and prevent the substrate itself from binding, thus inhibiting the overall rate of reaction for the enzyme

electron transport chain: a series of four large, multi-protein complexes embedded in the inner mitochondrial membrane that accepts electrons from donor compounds and harvests energy from a series of chemical reactions to generate a hydrogen ion gradient across the membrane

endergonic: describes a chemical reaction that results in products that store more chemical potential energy than the reactants

enzyme: a molecule that catalyzes a biochemical reaction

exergonic: describes a chemical reaction that results in products with less chemical potential energy than the reactants, plus the release of free energy

feedback inhibition: a mechanism of enzyme activity regulation in which the product of a reaction or the final product of a series of sequential reactions inhibits an enzyme for an earlier step in the reaction series

fermentation: the steps that follow the partial oxidation of glucose via glycolysis to regenerate NAD^+ ; occurs in the absence of oxygen and uses an organic compound as the final electron acceptor

glycolysis: the process of breaking glucose into two three-carbon molecules with the production of ATP and NADH

heat energy: the energy transferred from one system to another that is not work

kinetic energy: the type of energy associated with objects in motion

metabolism: all the chemical reactions that take place inside cells, including those that use energy and those that release energy

noncompetitive inhibition: a general mechanism of enzyme activity regulation in which a regulatory molecule binds to a site other than the active site and prevents the active site from binding the substrate; thus, the inhibitor molecule does not compete with the substrate for the active site; allosteric inhibition is a form of noncompetitive inhibition

oxidative phosphorylation: the production of ATP by the transfer of electrons down the electron transport chain to create a proton gradient that is used by ATP synthase to add phosphate groups to ADP molecules

potential energy: the type of energy that refers to the potential to do work

substrate: a molecule on which the enzyme acts

thermodynamics: the science of the relationships between heat, energy, and work

Chapter 5: Photosynthesis

absorption spectrum: the specific pattern of absorption for a substance that absorbs electromagnetic radiation

autotroph: an organism capable of producing its own food

Calvin cycle: the reactions of photosynthesis that use the energy stored by the light-dependent reactions to form glucose and other carbohydrate molecules

carbon fixation: the process of converting inorganic CO₂ gas into organic compounds

chlorophyll *a*: the form of chlorophyll that absorbs violet-blue and red light

chlorophyll *b*: the form of chlorophyll that absorbs blue and red-orange light

chlorophyll: the green pigment that captures the light energy that drives the reactions of photosynthesis

chloroplast: the organelle where photosynthesis takes place

electromagnetic spectrum: the range of all possible frequencies of radiation

granum: a stack of thylakoids located inside a chloroplast

heterotroph: an organism that consumes other organisms for food

light-dependent reaction: the first stage of photosynthesis where visible light is absorbed to form two energy-carrying molecules (ATP and NADPH)

mesophyll: the middle layer of cells in a leaf

photoautotroph: an organism capable of synthesizing its own food molecules (storing energy), using the energy of light

photon: a distinct quantity or “packet” of light energy

photosystem: a group of proteins, chlorophyll, and other pigments that are used in the light-dependent reactions of photosynthesis to absorb light energy and convert it into chemical energy

pigment: a molecule that is capable of absorbing light energy

stoma: the opening that regulates gas exchange and water regulation between leaves and the environment; plural, stomata

stroma: the fluid-filled space surrounding the grana inside a chloroplast where the Calvin cycle reactions of photosynthesis take place

thylakoid: a disc-shaped membranous structure inside a chloroplast where the light-dependent reactions of photosynthesis take place using chlorophyll embedded in the membranes

wavelength: the distance between consecutive points of a wave

Chapter 6: Reproduction at the Cellular Level

anaphase: the stage of mitosis during which sister chromatids are separated from each other

binary fission: the process of prokaryotic cell division

cell cycle checkpoints: mechanisms that monitor the preparedness of a eukaryotic cell to advance through the various cell cycle stages

cell cycle: the ordered sequence of events that a cell passes through between one cell division and the next

cell plate: a structure formed during plant-cell cytokinesis by Golgi vesicles fusing at the metaphase plate; will ultimately lead to formation of a cell wall to separate the two daughter cells

centriole: a paired rod-like structure constructed of microtubules at the center of each animal cell centrosome

cleavage furrow: a constriction formed by the actin ring during animal-cell cytokinesis that leads to cytoplasmic division

cytokinesis: the division of the cytoplasm following mitosis to form two daughter cells

diploid: describes a cell, nucleus, or organism containing two sets of chromosomes ($2n$)

FtsZ: a tubulin-like protein component of the prokaryotic cytoskeleton that is important in prokaryotic cytokinesis (name origin, Filamenting temperature-sensitive mutant Z)

G₀ phase: a cell-cycle phase distinct from the G₁ phase of interphase; a cell in G₀ is not preparing to divide \

G₁ phase (also, first gap): a cell-cycle phase; first phase of interphase centered on cell growth during mitosis

G₂ phase (also, second gap): a cell-cycle phase; third phase of interphase where the cell undergoes the final preparations for mitosis

gamete: a haploid reproductive cell or sex cell (sperm or egg)

gene: the physical and functional unit of heredity; a sequence of DNA that codes for a specific peptide or RNA molecule

genome: the entire genetic complement (DNA) of an organism

haploid: describes a cell, nucleus, or organism containing one set of chromosomes (n)

homologous chromosomes: chromosomes of the same length with genes in the same location; diploid organisms have pairs of homologous chromosomes, and the members of each pair come from different parents

interphase: the period of the cell cycle leading up to mitosis; includes G₁, S, and G₂ phases; the interim between two consecutive cell divisions

kinetochore: a protein structure in the centromere of each sister chromatid that attracts and binds spindle microtubules during prometaphase

locus: the position of a gene on a chromosome

metaphase plate: the equatorial plane midway between two poles of a cell where the chromosomes align during metaphase

metaphase: the stage of mitosis during which chromosomes are lined up at the metaphase plate

mitosis: the period of the cell cycle at which the duplicated chromosomes are separated into identical nuclei; includes prophase, prometaphase, metaphase, anaphase, and telophase

mitotic phase: the period of the cell cycle when duplicated chromosomes are distributed into two nuclei and the cytoplasmic contents are divided; includes mitosis and cytokinesis

mitotic spindle: the microtubule apparatus that orchestrates the movement of chromosomes during mitosis

oncogene: a mutated version of a proto-oncogene, which allows for uncontrolled progression of the cell cycle, or uncontrolled cell reproduction

origin: the region of the prokaryotic chromosome at which replication begins

prometaphase: the stage of mitosis during which mitotic spindle fibers attach to kinetochores

prophase: the stage of mitosis during which chromosomes condense and the mitotic spindle begins to form

proto-oncogene: a normal gene that controls cell division by regulating the cell cycle that becomes an oncogene if it is mutated

quiescent: describes a cell that is performing normal cell functions and has not initiated preparations for cell division

S phase: the second, or synthesis phase, of interphase during which DNA replication occurs

septum: a wall formed between bacterial daughter cells as a precursor to cell separation

telophase: the stage of mitosis during which chromosomes arrive at opposite poles, de-condense, and are surrounded by new nuclear envelopes

tumor suppressor gene: a gene that codes for regulator proteins that prevent the cell from undergoing uncontrolled division

Chapter 7: The Cellular Basis of Inheritance

alternation of generations: a life-cycle type in which the diploid and haploid stages alternate

aneuploidy: an individual with an error in chromosome number; includes deletions and duplications of chromosome segments

autosome: any of the non-sex chromosomes

chiasmata: (singular = *chiasma*) the structure that forms at the crossover points after genetic material is exchanged

chromosome inversion: the detachment, 180° rotation, and reinsertion of a chromosome arm

crossing-over: the exchange of genetic material between homologous chromosomes resulting in chromosomes that incorporate genes from both parents of the organism forming reproductive cells

recombination: the exchange of genetic material between homologous chromosomes resulting in chromosomes that incorporate genes from both parents of the organism forming reproductive cells

diploid-dominant: a life-cycle type in which the multicellular diploid stage is prevalent

euploid: an individual with the appropriate number of chromosomes for their species

fertilization: the union of two haploid cells typically from two individual organisms

gametophyte: a multicellular haploid life-cycle stage that produces gametes

germ cell: a specialized cell that produces gametes, such as eggs or sperm

haploid-dominant: a life-cycle type in which the multicellular haploid stage is prevalent

interkinesis: a period of rest that may occur between meiosis I and meiosis II; there is no replication of DNA during interkinesis

karyogram: the photographic image of a karyotype

karyotype: the number and appearance of an individual's chromosomes, including the size, banding patterns, and centromere position

life cycle: the sequence of events in the development of an organism and the production of cells that produce offspring

meiosis I: the first round of meiotic cell division; referred to as reduction division because the resulting cells are haploid

meiosis II: the second round of meiotic cell division following meiosis I; sister chromatids are separated from each other, and the result is four unique haploid cells

meiosis: a nuclear division process that results in four haploid cells

monosomy: an otherwise diploid genotype in which one chromosome is missing

nondisjunction: the failure of synapsed homologs to completely separate and migrate to separate poles during the first cell division of meiosis

polyploid: an individual with an incorrect number of chromosome sets

recombinant: describing something composed of genetic material from two sources, such as a chromosome with both maternal and paternal segments of DNA

reduction division: a nuclear division that produces daughter nuclei each having one-half as many chromosome sets as the parental nucleus; meiosis I is a reduction division

somatic cell: all the cells of a multicellular organism except the gamete-forming cells

sporophyte: a multicellular diploid life-cycle stage that produces spores

synapsis: the formation of a close association between homologous chromosomes during prophase I

tetrad: two duplicated homologous chromosomes (four chromatids) bound together by chiasmata during prophase I

translocation: the process by which one segment of a chromosome dissociates and reattaches to a different, non-homologous chromosome

trisomy: an otherwise diploid genotype in which one entire chromosome is duplicated

X inactivation: the condensation of X chromosomes into Barr bodies during embryonic development in females to compensate for the double genetic dose

Chapter 8: Patterns of Inheritance

allele: one of two or more variants of a gene that determines a particular trait for a characteristic

codominance: in a heterozygote, complete and simultaneous expression of both alleles for the same characteristic

continuous variation: a variation in a characteristic in which individuals show a range of traits with small differences between them

dihybrid: the result of a cross between two true-breeding parents that express different traits for two characteristics

discontinuous variation: a variation in a characteristic in which individuals show two, or a few, traits with large differences between them

dominant: describes a trait that masks the expression of another trait when both versions of the gene are present in an individual

epistasis: an interaction between genes such that one gene masks or interferes with the expression of another

F₁: the first filial generation in a cross; the offspring of the parental generation

F₂: the second filial generation produced when F₁ individuals are self-crossed or fertilized with each other

genotype: the underlying genetic makeup, consisting of both physically visible and non-expressed alleles, of an organism

hemizygous: the presence of only one allele for a characteristic, as in X-linkage; hemizyosity makes descriptions of dominance and recessiveness irrelevant

heterozygous: having two different alleles for a given gene on the homologous chromosomes

homozygous: having two identical alleles for a given gene on the homologous chromosomes

hybridization: the process of mating two individuals that differ, with the goal of achieving a certain characteristic in their offspring

incomplete dominance in a heterozygote, expression of two contrasting alleles such that the individual displays an intermediate phenotype

law of dominance: in a heterozygote, one trait will conceal the presence of another trait for the same characteristic

law of independent assortment: genes do not influence each other with regard to sorting of alleles into gametes; every possible combination of alleles is equally likely to occur

law of segregation: paired unit factors (i.e., genes) segregate equally into gametes such that offspring have an equal likelihood of inheriting any combination of factors

linkage: a phenomenon in which alleles that are located in close proximity to each other on the same chromosome are more likely to be inherited together

model system: a species or biological system used to study a specific biological phenomenon to gain understanding that will be applied to other species

monohybrid: the result of a cross between two true-breeding parents that express different traits for only one characteristic

P: the parental generation in a cross

Punnett square: a visual representation of a cross between two individuals in which the gametes of each individual are denoted along the top and side of a grid, respectively, and the possible zygotic genotypes are recombined at each box in the grid

phenotype: the observable traits expressed by an organism

recessive: describes a trait whose expression is masked by another trait when the alleles for both traits are present in an individual

reciprocal cross: a paired cross in which the respective traits of the male and female in one cross become the respective traits of the female and male in the other cross

recombination: the process during meiosis in which homologous chromosomes exchange linear segments of genetic material, thereby dramatically increasing genetic variation in the offspring and separating linked genes

test cross: a cross between a dominant expressing individual with an unknown genotype and a homozygous recessive individual; the offspring phenotypes indicate whether the unknown parent is heterozygous or homozygous for the dominant trait

trait: a variation in an inherited characteristic

wild type: the most commonly occurring genotype or phenotype for a given characteristic found in a population

X-linked: a gene present on the X chromosome, but not the Y chromosome

Chapter 9: Molecular Biology

alternative RNA splicing: a post-transcriptional gene regulation mechanism in eukaryotes in which multiple protein products are produced by a single gene through alternative splicing combinations of the RNA transcript

codon: three consecutive nucleotides in mRNA that specify the addition of a specific amino acid or the release of a polypeptide chain during translation

DNA ligase: the enzyme that catalyzes the joining of DNA fragments together

DNA polymerase: an enzyme that synthesizes a new strand of DNA complementary to a template strand

deoxyribose: a five-carbon sugar molecule with a hydrogen atom rather than a hydroxyl group in the 2' position; the sugar component of DNA nucleotides

double helix: the molecular shape of DNA in which two strands of nucleotides wind around each other in a spiral shape

epigenetic: describing non-genetic regulatory factors, such as changes in modifications to histone proteins and DNA that control accessibility to genes in chromosomes

exon: a sequence present in protein-coding mRNA after completion of pre-mRNA splicing

gene expression: processes that control whether a gene is expressed

genetic code: the amino acids that correspond to three-nucleotide codons of mRNA

helicase: an enzyme that helps to open up the DNA helix during DNA replication by breaking the hydrogen bonds

intron: non-protein-coding intervening sequences that are spliced from mRNA during processing

lagging strand: during replication of the 3' to 5' strand, the strand that is replicated in short fragments and away from the replication fork

leading strand: the strand that is synthesized continuously in the 5' to 3' direction that is synthesized in the direction of the replication fork

mRNA: messenger RNA; a form of RNA that carries the nucleotide sequence code for a protein sequence that is translated into a polypeptide sequence

mismatch repair: a form of DNA repair in which non-complementary nucleotides are recognized, excised, and replaced with correct nucleotides

mutation: a permanent variation in the nucleotide sequence of a genome

nitrogenous base: a nitrogen-containing molecule that acts as a base; often referring to one of the purine or pyrimidine components of nucleic acids

non-template strand: the strand of DNA that is not used to transcribe mRNA; this strand is identical to the mRNA except that T nucleotides in the DNA are replaced by U nucleotides in the mRNA

nucleotide excision repair: a form of DNA repair in which the DNA molecule is unwound and separated in the region of the nucleotide damage, the damaged nucleotides are removed and replaced with new nucleotides using the complementary strand, and the DNA strand is resealed and allowed to rejoin its complement

Okazaki fragments: the DNA fragments that are synthesized in short stretches on the lagging strand

phosphate group: a molecular group consisting of a central phosphorus atom bound to four oxygen atoms

post-transcriptional: control of gene expression after the RNA molecule has been created but before it is translated into protein

post-translational: control of gene expression after a protein has been created

primer: a short stretch of RNA nucleotides that is required to initiate replication and allow DNA polymerase to bind and begin replication

promoter: a sequence on DNA to which RNA polymerase and associated factors bind and initiate transcription

RNA polymerase: an enzyme that synthesizes an RNA strand from a DNA template strand

rRNA: ribosomal RNA; molecules of RNA that combine to form part of the ribosome

replication fork: the Y-shaped structure formed during the initiation of replication

semi-conservative replication: the method used to replicate DNA in which the double-stranded molecule is separated and each strand acts as a template for a new strand to be synthesized, so the resulting DNA molecules are composed of one new strand of nucleotides and one old strand of nucleotides

splicing: the process of removing introns and reconnecting exons in a pre-mRNA

start codon: the AUG (or, rarely GUG) on an mRNA from which translation begins; always specifies methionine

stop codon: one of the three mRNA codons that specifies termination of translation

tRNA: transfer RNA; an RNA molecule that contains a specific three-nucleotide anticodon sequence to pair with the mRNA codon and also binds to a specific amino acid

telomerase: an enzyme that contains a catalytic part and an inbuilt RNA template; it functions to maintain telomeres at chromosome ends

telomere: the DNA at the end of linear chromosomes

template strand: the strand of DNA that specifies the complementary mRNA molecule

transcription bubble: the region of locally unwound DNA that allows for transcription of mRNA

Chapter 10: Biotechnology

anneal: in molecular biology, the process by which two single strands of DNA hydrogen bond at complementary nucleotides to form a double-stranded molecule

biomarker: an individual protein that is uniquely produced in a diseased state

biotechnology: the use of artificial methods to modify the genetic material of living organisms or cells to produce novel compounds or to perform new functions

cloning: the production of an exact copy—specifically, an exact genetic copy—of a gene, cell, or organism

gel electrophoresis: a technique used to separate molecules on the basis of their ability to migrate through a semisolid gel in response to an electric current

gene therapy: the technique used to cure heritable diseases by replacing mutant genes with good genes

genetic engineering: alteration of the genetic makeup of an organism using the molecular methods of biotechnology

genetic map: an outline of genes and their location on a chromosome that is based on recombination frequencies between markers

genetic testing: identifying gene variants in an individual that may lead to a genetic disease in that individual

genetically modified organism (GMO): an organism whose genome has been artificially changed

genomics: the study of entire genomes, including the complete set of genes, their nucleotide sequence and organization, and their interactions within a species and with other species

metagenomics: the study of the collective genomes of multiple species that grow and interact in an environmental niche

model organism: a species that is studied and used as a model to understand the biological processes in other species represented by the model organism

pharmacogenomics: the study of drug interactions with the genome or proteome; also called toxicogenomics

physical map: a representation of the physical distance between genes or genetic markers

plasmid: a small circular molecule of DNA found in bacteria that replicates independently of the main bacterial chromosome; plasmids code for some important traits for bacteria and can be used as vectors to transport DNA into bacteria in genetic engineering applications

polymerase chain reaction (PCR): a technique used to make multiple copies of DNA

protein signature: a set of over- or under-expressed proteins characteristic of cells in a particular diseased tissue

proteomics: study of the function of proteomes

recombinant DNA: a combination of DNA fragments generated by molecular cloning that does not exist in nature

recombinant protein: a protein that is expressed from recombinant DNA molecules

reproductive cloning: cloning of entire organisms

restriction enzyme: an enzyme that recognizes a specific nucleotide sequence in DNA and cuts the DNA double strand at that recognition site, often with a staggered cut leaving short single strands or “sticky” ends

reverse genetics: a form of genetic analysis that manipulates DNA to disrupt or affect the product of a gene to analyze the gene’s function

transgenic: describing an organism that receives DNA from a different species

whole genome sequencing: a process that determines the nucleotide sequence of an entire genome

Chapter 11: Evolution and Its Processes

adaptation: a heritable trait or behavior in an organism that aids in its survival in its present environment

adaptive radiation: a speciation when one species radiates out to form several other species

allopatric speciation: a speciation that occurs via a geographic separation

analogous structure: a structure that is similar because of evolution in response to similar selection pressures resulting in convergent evolution, not similar because of descent from a common ancestor

bottleneck effect: the magnification of genetic drift as a result of natural events or catastrophes

convergent evolution: an evolution that results in similar forms on different species

dispersal: an allopatric speciation that occurs when a few members of a species move to a new geographical area

divergent evolution: an evolution that results in different forms in two species with a common ancestor

founder effect: a magnification of genetic drift in a small population that migrates away from a large parent population carrying with it an unrepresentative set of alleles

gene flow: the flow of alleles in and out of a population due to the migration of individuals or gametes

gene pool: all of the alleles carried by all of the individuals in the population

genetic drift: the effect of chance on a population's gene pool

homologous structure: a structure that is similar because of descent from a common ancestor

inheritance of acquired characteristics: a phrase that describes the mechanism of evolution proposed by Lamarck in which traits acquired by individuals through use or disuse could be passed on to their offspring thus leading to evolutionary change in the population

macroevolution: a broader scale of evolutionary changes seen over paleontological time

microevolution: the changes in a population's genetic structure (i.e., allele frequency)

migration: the movement of individuals of a population to a new location; in population genetics it refers to the movement of individuals and their alleles from one population to another, potentially changing allele frequencies in both the old and the new population

modern synthesis: the overarching evolutionary paradigm that took shape by the 1940s and is generally accepted today

natural selection: the greater relative survival and reproduction of individuals in a population that have favorable heritable traits, leading to evolutionary change

population genetics: the study of how selective forces change the allele frequencies in a population over time

speciation: a formation of a new species

sympatric speciation: a speciation that occurs in the same geographic space

variation: the variety of alleles in a population

vestigial structure: a physical structure present in an organism but that has no apparent function and appears to be from a functional structure in a distant ancestor

vicariance: an allopatric speciation that occurs when something in the environment separates organisms of the same species into separate groups

Chapter 12: Diversity of Life

analogous structure: a character found in two taxa that looks similar because of convergent evolution, not because of descent from a common ancestor

binomial nomenclature: a system of two-part scientific names for an organism, which includes genus and species names

branch point: a point on a phylogenetic tree where a single lineage splits to distinct new ones

clade: a group of taxa with the same set of shared derived characters, including an ancestral species and all its descendants

cladistics: a method used to organize homologous traits to describe phylogenies using common descent as the primary criterion used to classify organisms

class: the category in the taxonomic classification system that falls within phylum and includes orders

domain: the highest level category in the classification system and that includes all taxonomic classifications below it; it is the most inclusive taxon

family: the category in the taxonomic classification system that falls within order and includes genera

genus: the category in the taxonomic classification system that falls within family and includes species; the first part of the scientific name

kingdom: the category in the taxonomic classification system that falls within domain and includes phyla

maximum parsimony: applying the simplest, most obvious way with the least number of steps

molecular systematics: the methods of using molecular evidence to identify phylogenetic relationships

monophyletic group: (also, clade): organisms that share a single ancestor

order: the category in the taxonomic classification system that falls within class and includes families

phylogenetic tree: diagram used to reflect the evolutionary relationships between organisms or groups of organisms

phylogeny: evolutionary history and relationship of an organism or group of organisms

phylum: the category in the taxonomic classification system that falls within kingdom and includes classes

rooted: describing a phylogenetic tree with a single ancestral lineage to which all organisms represented in the diagram relate

shared ancestral character: a character on a phylogenetic branch that is shared by a particular clade

shared derived character: a character on a phylogenetic tree that is shared only by a certain clade of organisms

sister taxa: two lineages that diverged from the same branch point

species: the most specific category of classification

systematics: the science of determining the evolutionary relationships of organisms

taxonomy: the science of classifying organisms

taxon: a single level in the taxonomic classification system

Chapter 13: Diversity of Microbes, Fungi, and Protists

amoebzoa: the eukaryotic super group that contains the amoebas and slime molds

Archaeplastida: the eukaryotic super group that contains land plants, green algae, and red algae

Ascomycota (sac fungi): a division of fungi that store spores in a sac called ascus

anaerobic: refers to organisms that grow without oxygen

anoxic: without oxygen

Black Death: a devastating pandemic that is believed to have been an outbreak of bubonic plague caused by the bacterium *Yersinia pestis*

basidiomycota: (club fungi) a division of fungi that produce club shaped structures, basidia, which contain spores

biofilm: a microbial community that is held together by a gummy-textured matrix

bioremediation: the use of microbial metabolism to remove pollutants

botulism: a disease produce by the toxin of the anaerobic bacterium *Clostridium botulinum*

Chromalveolata: the eukaryotic super group that contains the dinoflagellates, ciliates, the brown algae, diatoms, and water molds

Chytridiomycota (chytrids): a primitive division of fungi that live in water and produce gametes with flagella

capsule: an external structure that enables a prokaryote to attach to surfaces and protects it from dehydration

commensalism: a symbiotic relationship in which one member benefits while the other member is not affected

conjugation: the process by which prokaryotes move DNA from one individual to another using a pilus

cyanobacteria: bacteria that evolved from early phototrophs and oxygenated the atmosphere; also known as blue-green algae

Deuteromycota (imperfect fungi): a division of fungi that do not have a known sexual reproductive cycle

Excavata: the eukaryotic super group that contains flagellated single-celled organisms with a feeding groove

endosymbiosis: the engulfment of one cell by another such that the engulfed cell survives and both cells benefit; the process responsible for the evolution of mitochondria and chloroplasts in eukaryotes

epidemic: a disease that occurs in an unusually high number of individuals in a population at the same time

extremophile: an organism that grows under extreme or harsh conditions

foodborne disease: any illness resulting from the consumption of contaminated food, or of the pathogenic bacteria, viruses, or other parasites that contaminate food

Glomeromycota: a group of fungi that form symbiotic relationships with the roots of trees

Gram-negative: describes a bacterium whose cell wall contains little peptidoglycan but has an outer membrane

Gram-positive: describes a bacterium that contains mainly peptidoglycan in its cell walls

hydrothermal vent: a fissure in Earth's surface that releases geothermally heated water

hypha: a fungal filament composed of one or more cells

lichen: the close association of a fungus with a photosynthetic alga or bacterium that benefits both partners

MRSA (methicillin-resistant *Staphylococcus aureus*): a very dangerous *Staphylococcus aureus* strain resistant to antibiotics

microbial mat: a multi-layered sheet of prokaryotes that may include bacteria and archaea

mold: a tangle of visible mycelia with a fuzzy appearance

mycelium: a mass of fungal hyphae

mycorrhiza: a mutualistic association between fungi and vascular plant roots

mycosis: a fungal infection

Opisthokonta: the eukaryotic super group that contains the fungi, animals, and choanoflagellates

pandemic: a widespread, usually worldwide, epidemic disease

parasite: an organism that lives on or in another organism and feeds on it, often without killing it

pathogen: an organism, or infectious agent, that causes a disease

pellicle: an outer cell covering composed of interlocking protein strips that function like a flexible coat of armor, preventing cells from being torn or pierced without compromising their range of motion

peptidoglycan: a material composed of polysaccharide chains cross-linked to unusual peptides

phototroph: an organism that uses energy from sunlight

plastid: one of a group of related organelles in plant cells that are involved in the storage of starches, fats, proteins, and pigments

pseudopeptidoglycan: a component of some cell walls of Archaea

Rhizaria: the eukaryotic super group that contains organisms that move by amoeboid movement

saprobe: an organism that feeds on dead organic material

septum: the cell wall division between hyphae

stromatolite: a layered sedimentary structure formed by precipitation of minerals by prokaryotes in microbial mats

thallus: a vegetative body of a fungus

transduction: the process by which a bacteriophage moves DNA from one prokaryote to another

transformation: a mechanism of genetic change in prokaryotes in which DNA present in the environment is taken into the cell and incorporated into the genome

yeast: a general term used to describe unicellular fungi

Zygomycota (conjugated fungi): the division of fungi that form a zygote contained in a zygospore

Chapter 14: Diversity of Plants

Anthophyta: the division to which angiosperms belong

anther: a sac-like structure at the tip of the stamen in which pollen grains are produced

apical meristem: the growing point in a vascular plant at the tip of a shoot or root where cell division occurs

basal angiosperms: a group of plants that probably branched off before the separation of monocots and eudicots

calyx: the whorl of sepals

carpel: the female reproductive part of a flower consisting of the stigma, style, and ovary

club moss: the earliest group of seedless vascular plants

cone: the ovulate strobilus on gymnosperms that contains ovules

conifer: the dominant division of gymnosperms with the most variety of species

corolla: the collection of petals

cotyledon: the one (monocot) or two (dicot) primitive leaves present in a seed

cycad: a division of gymnosperms that grow in tropical climates and resemble palm trees

dicot: a group of angiosperms whose embryos possess two cotyledons; also known as eudicot

diplontic: describes a life cycle in which the diploid stage is the dominant stage

eudicots: a group of angiosperms whose embryos possess two cotyledons; also known as dicot

fern: a seedless vascular plant that produces large fronds; the most advanced group of seedless vascular plants

filament: the thin stalk that links the anther to the base of the flower

gametangium (plural, gametangia): the structure within which gametes are produced

gametophyte: the haploid plant that produces gametes

ginkgophyte: a division of gymnosperm with one living species, the *Ginkgo biloba*, a tree with fan-shaped leaves

gnetophyte: a division of gymnosperms with varied morphological features that produce vessel elements in their woody tissues

gymnosperm: a seed plant with naked seeds (seeds exposed on modified leaves or in cones)

gynoecium: the group of structures that constitute the female reproductive organ; also called the pistil

haplodiplontic: describes a life cycle in which the haploid and diploid stages alternate; also known as an alternation of generations life cycle

herbaceous: describes a plant without woody tissue

heterosporous: having two kinds of spores that give rise to male and female gametophytes

homosporous: having one kind of spore that gives rise to gametophytes that give rise to both male and female gametes

hornwort: a group of non-vascular plants in which stomata appear

horsetail: a seedless vascular plant characterized by a jointed stem

liverwort: the most primitive group of non-vascular plants

megasporocyte: a megaspore mother cell; larger spore that germinates into a female gametophyte in a heterosporous plant

microsporocyte: smaller spore that produces a male gametophyte in a heterosporous plant

monocot: a related group of angiosperms that produce embryos with one cotyledon and pollen with a single ridge

moss: a group of plants in which a primitive conductive system appears

nonvascular: plant a plant that lacks vascular tissue formed of specialized cells for the transport of water and nutrients

ovary: the chamber that contains and protects the ovule or female megasporangium

petal: a modified leaf interior to the sepal; colorful petals attract animal pollinator

phloem: the vascular tissue responsible for transport of sugars, proteins, and other solutes

pistil: the group of structures that constitute the female reproductive organ; also called the carpel

sepal: a modified leaf that encloses the bud; outermost structure of a flower

sporangium (plural, sporangia): the organ within which spores are produced

sporophyll: a leaf modified structurally to bear sporangia

sporophyte: the diploid plant that produces spores

stamen: the group of structures that contain the male reproductive organs

stigma: uppermost structure of the carpel where pollen is deposited

strobili: cone-like structures that contain the sporangia

style: the long thin structure that links the stigma to the ovary

syngamy: the union of two gametes in fertilization

vascular plant: a plant in which there is a network of cells that conduct water and solutes through the organism

whisk fern: a seedless vascular plant that lost roots and leaves by evolutionary reduction

Chapter 15: Diversity of Animals

Actinopterygii: ray-finned fishes

Amphibia: frogs, salamanders, and caecilians

Annelida: a phylum of worm-like animals with metamerism

Anura: frogs

Apoda: caecilians

Arthropoda: a phylum of Ecdysozoa with jointed appendages and segmented bodies

acoelomate: without a body cavity

amniote: a clade of animals that possesses an amniotic egg; includes reptiles (including birds) and mammals

amoebocyte: an amoeba-like cell of sponges whose functions include distribution of nutrients to other cells in the sponge

ampulla of Lorenzini: a sensory organ that allows sharks to detect electromagnetic fields produced by living things

anthropoids: a clade consisting of monkeys, apes, and humans

asymmetrical: having no plane of symmetry

bilateral symmetry: a type of symmetry in which there is only one plane of symmetry that creates two mirror-image sides

body plan: the shape and symmetry of an organism

brachiation: swinging through trees

budding: a form of asexual reproduction that occurs through the growth of a new organism as a branch on an adult organism that breaks off and becomes independent; found in plants, sponges, cnidarians, and some other invertebrates

Cephalochordata: a chordate clade whose members possess a notochord, dorsal hollow nerve cord, pharyngeal slits, and a post-anal tail in the adult stage

Chondrichthyes: jawed fishes with paired fins and a skeleton made of cartilage

Chordata: a phylum of animals distinguished by their possession of a notochord, a dorsal hollow nerve cord, pharyngeal slits, and a post-anal tail at some point during their development

Cnidaria: a phylum of animals that are diploblastic and have radial symmetry and stinging cells

Crocodylia: crocodiles and alligators

caecilian: a legless amphibian that belongs to clade Apoda

cephalothorax: a fused head and thorax

chaeta: a chitinous projection from the cuticle found in annelids

chelicerae: a modified first pair of appendages in subphylum Chelicerata

chitin: a tough nitrogen-containing polysaccharide found in the cuticles of arthropods and the cell walls of fungi

choanocyte: a cell type unique to sponges with a flagellum surrounded by a collar used to maintain water flow through the sponge, and capture and digest food particles

clitellum: a specialized band of fused segments in some annelids, which aids in reproduction

cnidocyte: a specialized stinging cell found in Cnidaria

coelom: a lined body cavity derived from mesodermal embryonic tissue

complete digestive system: a digestive system that opens at one end, the mouth, and exits at the other end, the anus, and through which food normally moves in one direction

craniate: a proposed clade of chordates that includes all groups except the tunicates and lancelets

ctenidia: specialized gills in mollusks

cutaneous respiration: gas exchange through the skin

deuterostome: describing an animal in which the blastopore develops into the anus, with the second opening developing into the mouth

dioecious: having separate male and female sexes

diphyodont: refers to the possession of two sets of teeth in a lifetime

diploblast: an animal that develops from two embryonic germ layers

dorsal hollow nerve cord: a hollow, tubular structure derived from ectoderm, which is located dorsal to the notochord in chordates

down feather: feather specialized for insulation

Echinodermata: a phylum of deuterostomes with spiny skin; exclusively marine organisms

epidermis: the layer of cells that lines the outer surface of an animal

eucoelomate: describing animals with a body cavity completely lined with mesodermal tissue

eutherian mammal: a mammal with a complex placenta, which connects a fetus to the mother; sometimes called placental mammals

extracellular digestion: a form of digestion, the breakdown of food, which occurs outside of cells with the aid of enzymes released by cells

fragmentation: a form of asexual reproduction in which a portion of the body of an organism breaks off and develops into a living independent organism; found in plants, sponges, and some other invertebrates

frog: a tail-less amphibian that belongs to clade Anura

gastrovascular: the layer of cells that lines the gastrovascular cavity of Cnidarians

gastrovascular cavity: the central cavity bounded by the gastrodermis in cnidarians

gemmule: a structure produced by asexual reproduction in freshwater sponges that is able to survive harsh conditions

germ layer: a collection of cells formed during embryogenesis that will give rise to future body tissues

gnathostome: a jawed fish

hagfish: an eel-like jawless fish that lives on the ocean floor and is a scavenger

hemocoel: the internal body cavity seen in arthropods

heterodont teeth: different types of teeth modified by different purposes

intracellular digestion: the digestion of matter brought into a cell by phagocytosis

Lophotrochozoa: a clade of invertebrate organisms that is a sister group to the Ecdysozoa

lamprey: a jawless fish characterized by a toothed, funnel-like, sucking mouth

lancelet: a member of Cephalochordata; named for its blade-like shape

lateral line: the sense organ that runs the length of a fish's body, used to detect vibration in the water

Mollusca: a phylum of protostomes with soft bodies and no segmentation

Myxini: hagfishes

madreporite: a pore for regulating entry and exit of water into the water vascular system

mammal: one of the groups of endothermic vertebrates that possess hair and mammary glands

mammary gland: in female mammals, a gland that produces milk for newborns

mantle: a specialized epidermis that encloses all visceral organs and secretes shells in mollusks

marsupial: one of the groups of mammals that includes the kangaroo, koala, bandicoot, Tasmanian devil, and several other species; young develop within a pouch

medusa: a free-floating cnidarian body plan with a mouth on the underside and tentacles hanging down from a bell

mesoglea: the non-living, gel-like matrix present in between ectoderm and endoderm in cnidarians

mesophyl: the collagen-like gel containing suspended cells that perform various functions in sponges

metamerism: having a series of body structures that are similar internally and externally, such as segments

monoecious: having both sexes in one body, hermaphroditic

monotreme: an egg-laying mammal

Nematoda: a phylum of worms in Ecdysozoa commonly called roundworms containing both free-living and parasitic forms

nacre: a calcareous secretion produced by bivalve mollusks to line the inner side of shells as well as to coat foreign particulate matter

nematocyst: the harpoon-like organelle within a cnidocyte with a pointed projectile and poison to stun and entangle prey

notochord: a flexible, rod-shaped structure that is found in the embryonic stage of all chordates and in the adult stage of some chordates

Osteichthyes: bony fishes

osculum: the large opening in a sponge body through which water leaves

ostracoderm: one of the earliest jawless fishes covered in bone

Petromyzontidae: the clade of lampreys

Porifera: a phylum of animals with no true tissues, but a porous body with a rudimentary endoskeleton

Primates: includes lemurs, tarsiers, monkeys, apes, and humans

pharyngeal slit: an opening in the pharynx

pneumatic bone: an air-filled bone

polyp: the stalk-like, sessile life form of a cnidarians with mouth and tentacles facing upward, usually sessile but may be able to glide along a surface

post-anal tail: a muscular, posterior elongation of the body extending beyond the anus in chordates

prosimians: a group of primates that includes bush babies of Africa, lemurs of Madagascar, and lorises, pottos, and tarsiers of southeast Asia

protostome: describing an animal in which the mouth develops first during embryogenesis and a second opening developing into the anus

pseudocoelomate: an animal with a coelom that is not completely lined with tissues derived from the mesoderm as in eucoelomate animals

radial symmetry: a type of symmetry with multiple planes of symmetry all cross at an axis through the center of the organism

radula: a tongue-like scraping organ with chitinous ornamentation found in most mollusks

Sarcopterygii: lobe-finned fishes

Sphenodontia: the reptilian clade that includes the tuataras

Squamata: the reptilian clade of lizards and snakes

salamander: a tailed amphibian that belongs to the clade Urodela

sebaceous gland: in mammals, a skin gland that produce a lipid mixture called sebum

spicule: a short sliver or spike-like structure, in sponges, they are formed of silicon dioxide, calcium carbonate, or protein, and are found in the mesohyl

spiracle: a respiratory openings in insects that allow air into the tracheae

spongocoel: the central cavity within the body of some sponges

stereoscopic vision: two overlapping fields of vision from the eyes that produces depth perception

sudoriferous gland: a gland in mammals that produces sweat and scent molecules

swim bladder: in fishes, a gas filled organ that helps to control the buoyancy of the fish

Testudines: turtles

tadpole: the larval stage of a frog

tetrapod: a four-footed animal; includes amphibians, reptiles, birds, and mammals

trachea: in some arthropods, such as insects, a respiratory tube that conducts air from the spiracles to the tissues

triploblast: an animal that develops from three germ layers

tunicate: a sessile chordate that is a member of Urochordata

Urochordata: the clade composed of the tunicates

Urodela: salamanders

vertebral column: a series of separate bones that surround the spinal cord in vertebrates

Chapter 16: The Body's Systems

action potential: a momentary change in the electrical potential of a neuron (or muscle) membrane

adrenal gland: the endocrine gland associated with the kidneys

air sacs(also alveoli): the terminal structure of the lung passage where gas exchange occurs

alveolus (plural, alveoli): the terminal structure of the lung passage where gas exchange occurs

amygdala: a structure within the limbic system that processes fear

amylase: an enzyme found in saliva and secreted by the pancreas that converts carbohydrates to maltose

anus: the exit point of the digestive system for waste material

aorta: the major artery that takes blood away from the heart to the systemic circulatory system

appendicular skeleton: the skeleton composed of the bones of the upper limbs, which function to grasp and manipulate objects, and the lower limbs, which permit locomotion

artery: a blood vessel that takes blood away from the heart

atrium: (plural, atria) a chamber of the heart that receives blood from the veins

auditory ossicles: (also, middle ear bones) the bones that transduce sounds from the air into vibrations in the fluid-filled cochlea

autonomic nervous system: the part of the peripheral nervous system that controls bodily functions

axial skeleton: skeleton that forms the central axis of the body and includes the bones of the skull, the ossicles of the middle ear, the hyoid bone of the throat, the vertebral column, and the thoracic cage (ribcage)

axon: a tube-like structure that propagates a signal from a neuron's cell body to axon terminals

basal ganglia: an interconnected collections of cells in the brain that are involved in movement and motivation

bicuspid valve: a one-way opening between the atrium and the ventricle in the left side of the heart

bile: a digestive juice produced by the liver; important for digestion of lipids

bolus: a mass of food resulting from chewing action and wetting by saliva

brainstem: a portion of brain that connects with the spinal cord; controls basic nervous system functions like breathing and swallowing

bronchi: (singular, bronchus) smaller branches of cartilaginous tissue that stem off of the trachea; air is funneled through the bronchi to the region where gas exchange occurs in the alveoli

bronchiole: a smaller branch that extends from the main bronchus to the alveoli

capillary: the smallest blood vessel that allows the passage of individual blood cells and the site of diffusion of oxygen and nutrient exchange

cardiac cycle: the filling and emptying the heart of blood caused by electrical signals that cause the heart muscles to contract and relax

cardiac muscle tissue: the muscle tissue found only in the heart; cardiac contractions pump blood throughout the body and maintain blood pressure

cartilaginous joint: a joint in which the bones are connected by cartilage

central nervous system (CNS): the nervous system made up of the brain and spinal cord; covered with three layers of protective meninges

cerebellum: the brain structure involved in posture, motor coordination, and learning new motor actions

cerebral cortex: the outermost sheet of brain tissue; involved in many higher-order functions

cerebrospinal fluid (CSF): a clear liquid that surrounds the brain and fills its ventricles and acts as a shock absorber

chyme: a mixture of partially digested food and stomach juices

closed circulatory system: a system that has the blood separated from the bodily interstitial fluid and contained in blood vessels

colon: the largest portion of the large intestine consisting of the ascending colon, transverse colon, and descending colon

corpus callosum: a thick nerve bundle that connects the cerebral hemispheres

dendrite: a structure that extends away from the cell body to receive messages from other neurons

depolarization: a change in the membrane potential to a less negative value

diaphragm: a skeletal muscle located under lungs that encloses the lungs in the thorax

diastole: the relaxation phase of the cardiac cycle when the heart is relaxed and the ventricles are filling with blood

down-regulation: a decrease in the number of hormone receptors in response to increased hormone levels

ectotherm: an organism that relies primarily on environmental heat sources to maintain its body temperature

electrocardiogram (ECG): a recording of the electrical impulses of the cardiac muscle

endocrine gland: the gland that secretes hormones into the surrounding interstitial fluid, which then diffuse into blood and are carried to various organs and tissues within the body

endotherm: an organism that relies primarily on internal heat sources to maintain its body temperature

esophagus: a tubular organ that connects the mouth to the stomach

essential nutrient: a nutrient that cannot be synthesized by the body; it must be obtained from food

exocrine gland: the gland that secretes chemicals through ducts that lead to skin surfaces, body cavities, and organ cavities.

fibrous joint: a joint held together by fibrous connective tissue

frontal lobe: the part of the cerebral cortex that contains the motor cortex and areas involved in planning, attention, and language

gallbladder: the organ that stores and concentrates bile

glia (also, glial cells): the cells that provide support functions for neurons

hippocampus: the brain structure in the temporal lobe involved in processing memories

hormone: a chemical released by cells in one area of the body that affects cells in other parts of the body

hyoid bone: the bone that lies below the mandible in the front of the neck

hypothalamus: the brain structure that controls hormone release and body homeostasis

inferior vena cava: the major vein of the body returning blood from the lower parts of the body to the right atrium

interstitial fluid: the fluid found between cells in the body, similar in constitution to the fluid component of blood, but without the high concentrations of proteins

intracellular hormone receptor: a hormone receptor in the cytoplasm or nucleus of a cell

joint: the point at which two or more bones meet

kidney: the organ that performs excretory and osmoregulatory functions

large intestine: a digestive system organ that reabsorbs water from undigested material and processes waste matter

larynx: the voice box, located within the throat

limbic system: a connected brain area that processes emotion and motivation

liver: an organ that produces bile for digestion and processes vitamins and lipids

membrane potential: a difference in electrical potential between the inside and outside of a cell

meninges (singular, meninx): the membranes that cover and protect the central nervous system

mineral: an inorganic, elemental molecule that carries out important roles in the body

myelin sheath: a cellular extension containing a fatty substance produced by glia that surrounds and insulates axons

myofibril: the long cylindrical structures that lie parallel to the muscle fiber

myofilament: the small structures that make up myofibrils

nasal cavity: an opening of the respiratory system to the outside environment

nephron: the functional unit of the kidney

neuron: a specialized cell that can receive and transmit electrical and chemical signals

occipital lobe: the part of the cerebral cortex that contains visual cortex and processes visual stimuli

open circulatory system: a circulatory system that has the blood mixed with interstitial fluid in the body cavity and directly bathes the organs

oral cavity: the point of entry of food into the digestive system

osmoregulation: the mechanism by which water and solute concentrations are maintained at desired levels

osmotic balance: the appropriate values of water and solute concentrations for a healthy organism

pancreas: the organ located between the stomach and the small intestine that contains exocrine and endocrine cells and secretes digestive juices

parasympathetic nervous system: the division of autonomic nervous system that regulates visceral functions during relaxation

parathyroid gland: the gland located on the surface of the thyroid that produces parathyroid hormone

parietal lobe: the part of the cerebral cortex involved in processing touch and the sense of the body in space

pectoral girdle: the bones that transmit the force generated by the upper limbs to the axial skeleton

pelvic girdle: the bones that transmit the force generated by the lower limbs to the axial skeleton

pepsin: an enzyme found in the stomach whose main role is protein digestion

peripheral nervous system (PNS): the nervous system that serves as the connection between the central nervous system and the rest of the body; consists of the autonomic nervous system and the sensory-somatic nervous system

peristalsis: wave-like movements of muscle tissue

pharynx: the throat

pituitary gland: the endocrine gland located at the base of the brain composed of an anterior and posterior region; also called hypophysis

primary bronchus (also, main bronchus): a region of the airway within the lung that attaches to the trachea and bifurcates to form the bronchioles

pulmonary circulation: the flow of blood away from the heart through the lungs where oxygenation occurs and then back to the heart

rectum: the area of the body where feces is stored until elimination

renal artery: the artery that delivers blood to the kidney

renal vein: the vein that drains blood from the kidney

salivary gland: one of three pairs of exocrine glands in the mammalian mouth that secretes saliva, a mix of watery mucus and enzymes

sarcolemma: the plasma membrane of a skeletal muscle fiber

sarcomere: the functional unit of skeletal muscle

sensory-somatic nervous system: the system of sensory and motor nerves

set point: the target value of a physiological state in homeostasis

skeletal muscle tissue: forms skeletal muscles, which attach to bones and control locomotion and any movement that can be consciously controlled

skull: the bone that supports the structures of the face and protects the brain

small intestine: the organ where digestion of protein, fats, and carbohydrates is completed

smooth muscle tissue: the muscle that occurs in the walls of hollow organs such as the intestines, stomach, and urinary bladder, and around passages such as the respiratory tract and blood vessels

spinal cord: a thick fiber bundle that connects the brain with peripheral nerves; transmits sensory and motor information; contains neurons that control motor reflexes

stomach: a saclike organ containing acidic digestive juices

superior vena cava: the major vein of the body returning blood from the upper part of the body to the right atrium

sympathetic nervous system: the division of autonomic nervous system activated during stressful "fight-or-flight" situations

synapse: a junction between two neurons where neuronal signals are communicated

synaptic cleft: a space between the presynaptic and postsynaptic membranes

synovial joints: the only joints that have a space between the adjoining bones

systemic circulation: the flow of blood away from the heart to the brain, liver, kidneys, stomach, and other organs, the limbs, and the muscles of the body, and then back to the heart

systole: the contraction phase of cardiac cycle when the ventricles are pumping blood into the arteries

temporal lobe: the part of the cerebral cortex that processes auditory input; parts of the temporal lobe are involved in speech, memory, and emotion processing

thalamus: the brain area that relays sensory information to the cortex

thoracic cage: (also, ribcage) the skeleton of the chest, which consists of the ribs, thoracic vertebrae, sternum, and costal cartilages

threshold of excitation: the level of depolarization needed for an action potential to fire

thymus: the gland located behind the sternum that produces thymosin hormones that contribute to the development of the immune system

thyroid gland: an endocrine gland located in the neck that produces thyroid hormones thyroxine and triiodothyronine

trachea: the cartilaginous tube that transports air from the throat to the lungs

tricuspid valve: a one-way opening between the atrium and the ventricle in the right side of the heart

up-regulation: an increase in the number of hormone receptors in response to increased hormone levels

ureter: the urine-bearing tubes coming out of the kidney

urethra: the tube that conducts urine from the urinary bladder to the external environment

urinary bladder: the structure that the ureters empty the urine into

vein: a blood vessel that brings blood back to the heart

ventricle: (of the heart) a large chamber of the heart that pumps blood into arteries

vertebral column: (also, spine) the column that surrounds and protects the spinal cord, supports the head, and acts as an attachment point for ribs and muscles of the back and neck

vitamin: an organic substance necessary in small amounts to sustain life

Chapter 17: The Immune System and Disease

acellular: lacking cells

active immunity: an immunity that occurs as a result of the activity of the body's own cells rather than from antibodies acquired from an external source

adaptive immunity: a specific immune response that occurs after exposure to an antigen either from a pathogen or a vaccination

allergy: an immune reaction that results from immediate hypersensitivities in which an antibody-mediated immune response occurs within minutes of exposure to a harmless antigen

antibody: a protein that is produced by plasma cells after stimulation by an antigen; also known as an immunoglobulin

antigen-presenting cell (APC): an immune cell that detects, engulfs, and informs the adaptive immune response about an infection by presenting the processed antigen on its cell surface

antigen: a macromolecule that reacts with cells of the immune system and which may or may not have a stimulatory effect

apoptosis: the cell death caused by induction of a cell's own internal mechanisms either as a natural step in the development of a multicellular organism or by other environmental factors such as signals from cells of the immune system

attenuation: the weakening of a virus during vaccine development

autoantibody: an antibody that incorrectly marks "self" components as foreign and stimulates the immune response

autoimmunity: a type of hypersensitivity to self-antigens

B cell: a lymphocyte that matures in the bone marrow

capsid: the protein coating of the viral core

cell-mediated immune response: an adaptive immune response that is controlled by T cells

complement system: an array of approximately 20 soluble proteins of the innate immune system that enhance phagocytosis, bore holes in pathogens, and recruit lymphocytes

cytokine: a chemical messenger that regulates cell differentiation, proliferation, and gene expression to effect immune responses

cytopathic: causing cell damage

cytotoxic T lymphocyte (TC): an adaptive immune cell that directly kills infected cells via enzymes, and that releases cytokines to enhance the immune response

dendritic cell: an immune cell that processes antigen material and presents it on the surface of its cell in MHC class II molecules and induces an immune response in other cells

effector cell: a lymphocyte that has differentiated, such as a B cell, plasma cell, or cytotoxic T cell

glycoprotein: a protein molecule with attached carbohydrate molecules

helper T lymphocyte (TH): a cell of the adaptive immune system that binds APCs via MHC class II molecules and stimulates B cells or secretes cytokines to initiate the immune response

humoral immune response: the adaptive immune response that is controlled by activated B cells and antibodies

hypersensitivity: a spectrum of inappropriate immune responses toward harmless foreign particles or self-antigens; occurs after tissue sensitization and includes immediate-type (allergy), delayed-type, and autoimmunity

immune tolerance: an acquired ability to prevent an unnecessary or harmful immune response to a detected foreign body known not to cause disease

immunodeficiency: a failure, insufficiency, or delay at any level of the immune system, which may be acquired or inherited

inflammation: the localized redness, swelling, heat, and pain that results from the movement of leukocytes through opened capillaries to a site of infection

innate immunity: an immunity that occurs naturally because of genetic factors or physiology, and is not caused by infection or vaccination

interferon: a cytokine that inhibits viral replication

lymph: the watery fluid present in the lymphatic circulatory system that bathes tissues and organs with protective white blood cells and does not contain erythrocytes

lymphocyte: a type of white blood cell that includes natural killer cells of the innate immune system and B and T cells of the adaptive immune system

macrophage: a large phagocytic cell that engulfs foreign particles and pathogens

MHC I: major histocompatibility class I; a group of proteins found on the surface of all nucleated cells that signals to immune cells whether the cell is normal or is infected or cancerous; it also provides the appropriate sites into which antigens can be loaded for recognition by lymphocytes

MHC II: major histocompatibility class II; a protein found on the surface of antigen-presenting cells that signals to immune cells whether the cell is normal or is infected or cancerous; it provides the appropriate template into which antigens can be loaded for recognition by lymphocytes

mast cell: a leukocyte that produces inflammatory molecules, such as histamine, in response to large pathogens

memory cell: an antigen-specific B or T lymphocyte that does not differentiate into an effector cell during the primary immune response but that can immediately become an effector cell on re-exposure to the same pathogen

monocyte: a type of white blood cell that circulates in the blood and lymph and differentiates into a macrophage after it moves into infected tissue

natural killer (NK) cell: a lymphocyte that can kill cells infected with viruses or tumor cells

neutrophil: a phagocytic leukocyte that engulfs and digests pathogens

passive immunity: an immunity that does not result from the activity of the body's own immune cells but by transfer of antibodies from one individual to another

primary immune response: the response of the adaptive immune system to the first exposure to an antigen

secondary immune response: the response of the adaptive immune system to a second or later exposure to an antigen mediated by memory cells

T cell: a lymphocyte that matures in the thymus gland

vaccine: a weakened solution of virus components, viruses, or other agents that produce an immune response

viral envelope: a lipid bilayer that envelops some viruses

virion: an individual virus particle outside a host cell

Chapter 18: Animal Reproduction and Development

asexual reproduction: a mechanism that produces offspring that are genetically identical to the parent

blastocyst: the structure formed when cells in the mammalian blastula separate into an inner and outer layer

budding: a form of asexual reproduction that results from the outgrowth of a part of an organism leading to a separation from the original animal into two individuals

bulbourethral gland: the paired glands in the human male that produce a secretion that cleanses the urethra prior to ejaculation (Cowper's Gland)

clitoris: a sensory and erectile structure in female mammals, homologous to the male penis, stimulated during sexual arousal

corpus luteum: the endocrine tissue that develops from an ovarian follicle after ovulation; secretes progesterone and estrogen during pregnancy

estrogen: a reproductive hormone in females that assists in endometrial regrowth, ovulation, and calcium absorption

external fertilization: the fertilization of eggs by sperm outside an animal's body, often during spawning

fission (also, binary fission): a form of asexual reproduction in which an organism splits into two separate organisms or two parts that regenerate the missing portions of the body

follicle stimulating hormone (FSH): a reproductive hormone that causes sperm production in men and follicle development in women

fragmentation: the breaking of an organism into parts and the growth of a separate individual from each part

gastrulation: the process in which the blastula folds over itself to form the three germ layers

gestation period: the length of time of development, from conception to birth, of the young of a viviparous animal

gestation: the development before birth of a viviparous animal

gonadotropin-releasing hormone (GnRH): a hormone from the hypothalamus that causes the release of FSH and LH from the anterior pituitary

hermaphroditism: the state of having both male and female reproductive structures within the same individual

human beta chorionic gonadotropin (β -HCG): a hormone produced by the chorion of the zygote that helps to maintain the corpus luteum and elevated levels of progesterone

inhibin: a hormone made by Sertoli cells, provides negative feedback to hypothalamus in control of FSH and GnRH release

inner cell mass: the inner layer of cells in the blastocyst, which becomes the embryo

internal fertilization: the fertilization of eggs by sperm inside the body of the female

interstitial cell of Leydig: a cell type found next to the seminiferous tubules that makes testosterone

labia majora: the large folds of tissue covering inguinal area

labia minora: the smaller folds of tissue within labia majora

luteinizing hormone (LH): a reproductive hormone in both men and women, causes testosterone production in men and ovulation and lactation in women

menstrual cycle: the cycle of the degradation and re-growth of the endometrium

oogenesis: the process of producing haploid eggs

organogenesis: the process of organ formation during development

ovarian cycle: the cycle of preparation of egg for ovulation and the conversion of the follicle to the corpus luteum

oviduct: (also, fallopian tube) the muscular tube connecting uterus with ovary area

oviparity: a process by which fertilized eggs are laid outside the female's body and develop there, receiving nourishment from the yolk that is a part of the egg

ovoviparity: a process by which fertilized eggs are retained within the female; the embryo obtains its nourishment from the egg's yolk, and the young are fully developed when they are hatched

ovulation: the release of an oocyte from a mature follicle in the ovary of a vertebrate

parthenogenesis: a form of asexual reproduction in which an egg develops into a complete individual without being fertilized

penis: the male reproductive structure for urine elimination and copulation

placenta: the organ that supports the transport of nutrients and waste between the mothers and fetus' blood in eutherian mammals

progesterone: a reproductive hormone in women; assists in endometrial regrowth and inhibition of FSH and LH release

prostate gland: a structure that is a mixture of smooth muscle and glandular material and that contributes to semen

Sertoli cell: a cell in the walls of the seminiferous tubules that assists developing sperm and secretes inhibin

scrotum: a sac containing testes, exterior to body

semen: a fluid mixture of sperm and supporting materials

seminal vesicle: a secretory accessory gland in male; contributes to semen

seminiferous tubule: the structures within which sperm production occurs in the testes

sex determination: the mechanism by which the sex of individuals in sexually reproducing organisms is initially established

sexual reproduction: a form of reproduction in which cells containing genetic material from two individuals combine to produce genetically unique offspring

spermatogenesis: the process of producing haploid sperm

testes: a pair of male reproductive organs

testosterone: a reproductive hormone in men that assists in sperm production and promoting secondary sexual characteristics

trophoblast: the outer layer of cells in the blastocyst, which gives rise to the embryo's contribution to the placenta

uterus: a female reproductive structure in which an embryo develops

vagina: a muscular tube for the passage of menstrual flow, copulation, and birth of offspring

viviparity: a process in which the young develop within the female and are born in a non-embryonic state

zona pellucida: the protective layer around the mammalian egg

Chapter 19: Population and Community Ecology

age structure: the distribution of the proportion of population members in each age class

birth rate: the number of births within a population at a specific point in time

carrying capacity: the maximum number of individuals of a population that can be supported by the limited resources of a habitat

climax community: the final stage of succession, where a stable community is formed by a characteristic assortment of plant and animal species

competitive exclusion principle: no two species within a habitat can coexist indefinitely when they compete for the same resources at the same time and place

death rate: the number of deaths within a population at a specific point in time

demography: the statistical study of changes in populations over time

density-dependent regulation: the regulation of population in which birth and death rates are dependent on population size

density-independent regulation: the regulation of population in which the death rate is independent of the population size

environmental disturbance: a change in the environment caused by natural disasters or human activities

exponential growth: an accelerating growth pattern seen in populations where resources are not limiting

foundation species: a species which often forms the major structural portion of the habitat **host** an organism a parasite lives on

intraspecific competition: the competition among members of the same species

island biogeography: the study of life on island chains and how their geography interacts with the diversity of species found there

J-shaped growth curve: the shape of an exponential growth curve

keystone species: a species whose presence is key to maintaining biodiversity in an ecosystem and to upholding an ecological community's structure

K-selected species: a species suited to stable environments that produce a few, relatively large offspring and provide parental care

r-selected species: a species suited to changing environments that produce many offspring and provide little or no parental care

life table: a table showing the life expectancy of a population member based on its age

logistic growth: the leveling off of exponential growth due to limiting resources

mark and recapture: a method used to determine population size in mobile organisms

mimicry: an adaptation in which an organism looks like another organism that is dangerous, toxic, or distasteful to its predators

mortality rate: the proportion of population surviving to the beginning of an age interval that dies during that age interval

mutualism: a symbiotic relationship between two species where both species benefit

one-child policy: a policy in China to limit population growth by limiting urban couples to have only one child or face a penalty of a fine

parasite: an organism that uses resources from another species, the host

pioneer species: the first species to appear in primary and secondary succession

population density: the number of population members divided by the area being measured

population size: the number of individuals in a population

primary succession: the succession on land that previously has had no life

quadrat: a square within which a count of individuals is made that is combined with other such counts to determine population size and density in slow moving or stationary organisms

relative species abundance: the absolute population size of a particular species relative to the population size of other species within the community

S-shaped growth curve: the shape of a logistic growth curve

secondary succession: the succession in response to environmental disturbances that move a community away from its equilibrium

species distribution pattern: the distribution of individuals within a habitat at a given point in time

species richness: the number of different species in a community

survivorship curve: a graph of the number of surviving population members versus the relative age of the member

zero population growth: the steady population size where birth rates and death rates are equal

Chapter 20: Ecosystems and the Biosphere

abyssal zone: the deepest part of the ocean at depths of 4000 m or greater

acid rain: a corrosive rain caused by rainwater mixing with sulfur dioxide gas as it falls through the atmosphere, turning it into weak sulfuric acid, causing damage to aquatic ecosystems

algal bloom: a rapid increase of algae in an aquatic system

apex consumer: an organism at the top of the food chain

aphotic zone: the part of the ocean where photosynthesis cannot occur

arctic tundra: a biome characterized by low average temperatures, brief growing seasons, the presence of permafrost, and limited precipitation largely in the form of snow in which the dominant vegetation are low shrubs, lichens, mosses, and small herbaceous plants

autotroph: an organism capable of synthesizing its own food molecules from smaller inorganic molecules

benthic realm (also, benthic zone): the part of the ocean that extends along the ocean bottom from the shoreline to the deepest parts of the ocean floor

biogeochemical cycle: the cycling of minerals and nutrients through the biotic and abiotic world

biomagnification: an increasing concentration of persistent, toxic substances in organisms at each trophic level, from the producers to the apex consumers

biome: a large-scale community of organisms, primarily defined on land by the dominant plant types that exist in geographic regions of the planet with similar climatic conditions

boreal forest: a biome found in temperate and subarctic regions characterized by short growing seasons and dominated structurally by coniferous trees

canopy: the branches and foliage of trees that form a layer of overhead coverage in a forest

channel: the bed and banks of a river or stream

chaparral: a biome found in temperate coastal regions characterized by low trees and dry-adapted shrubs and forbs

chemoautotroph: an organism capable of synthesizing its own food using energy from inorganic molecules

coral reef: an ocean ridge formed by marine invertebrates living in warm shallow waters within the photic zone

cryptofauna: the invertebrates found within the calcium carbonate substrate of coral reefs

dead zone: an area in a lake and ocean near the mouths of rivers where large areas are depleted of their normal flora and fauna; these zones can be caused by eutrophication, oil spills, dumping of toxic chemicals, and other human activities

detrital food web: a type of food web that is supported by dead or decaying organisms rather than by living autotrophs; these are often associated with grazing food webs within the same ecosystem

ecosystem services: the human benefits provided by natural ecosystems

ecosystem: a community of living organisms and their interactions with their abiotic environment

emergent vegetation: the plants living in bodies of water that are rooted in the soil but have portions of leaves, stems, and flowers extending above the water's surface

equilibrium: the steady state of a system in which the relationships between elements of the system do not change

estuary: a region where fresh water and salt water mix where a river discharges into an ocean or sea

eutrophication: the process whereby nutrient runoff causes the excess growth of microorganisms and plants in aquatic systems

fallout: the direct deposition of solid minerals on land or in the ocean from the atmosphere

food chain: a linear sequence of trophic (feeding) relationships of producers, primary consumers, and higher level consumers

food web: a web of trophic (feeding) relationships among producers, primary consumers, and higher level consumers in an ecosystem

grazing food web: a type of food web in which the producers are either plants on land or phytoplankton in the water; often associated with a detrital food web within the same ecosystem

gross primary productivity: the rate at which photosynthetic producers incorporate energy from the Sun

hydrosphere: the region of the planet in which water exists, including the atmosphere that contains water vapor and the region beneath the ground that contains groundwater

intertidal zone: the part of the ocean that is closest to land; parts extend above the water at low tide

neritic zone: the part of the ocean that extends from low tide to the edge of the continental shelf

net primary productivity: the energy that remains in the producers after accounting for the organisms' respiration and heat loss

non-renewable resource: a resource, such as a fossil fuel, that is either regenerated very slowly or not at all

oceanic zone: the part of the ocean that begins offshore where the water measures 200 m deep or deeper

pelagic realm: (also, pelagic zone) the open ocean waters that are not close to the bottom or near the shore

permafrost: a perennially frozen portion of the Arctic tundra soil

photic zone: the upper layer of ocean water in which photosynthesis is able to take place

photoautotroph: an organism that uses sunlight as an energy source to synthesize its own food molecules

planktivore: an animal that eats plankton

primary consumer: the trophic level that obtains its energy from the producers of an ecosystem

producer: the trophic level that obtains its energy from sunlight, inorganic chemicals, or dead or decaying organic material

resilience (ecological): the speed at which an ecosystem recovers equilibrium after being disturbed

resistance (ecological): the ability of an ecosystem to remain at equilibrium in spite of disturbances

savanna: a biome located in the tropics with an extended dry season and characterized by a grassland with sparsely distributed trees

secondary consumer: a trophic level in an ecosystem, usually a carnivore that eats a primary consumer

source water: the point of origin of a river or stream

subduction: the movement of one tectonic plate beneath another

subtropical desert: a biome found in the subtropics with hot daily temperatures, very low and unpredictable precipitation, and characterized by a limited dry-adapted vegetation

temperate forest: a biome found in temperate regions with moderate rainfall and dominated structurally by deciduous trees

temperate grassland: a biome dominated by grasses and herbaceous plants due to low precipitation, periodic fires, and grazing

tertiary consumer: a trophic level in an ecosystem, usually carnivores that eat other carnivores

trophic level: the position of a species or group of species in a food chain or a food web

tropical rainforest: a biome found near the equator characterized by stable temperatures with abundant and seasonal rainfall in which trees form the structurally important vegetation

wetland: environment in which the soil is either permanently or periodically saturated with water

Chapter 21: Conservation and Biodiversity

biodiversity hotspot: a concept originated by Norman Myers to describe a geographical region with a large number of endemic species and a large percentage of degraded habitat

biodiversity: the variety of a biological system, typically conceived as the number of species, but also applying to genes, biochemistry, and ecosystems

bush meat: a wild-caught animal used as food (typically mammals, birds, and reptiles); usually referring to hunting in the tropics of sub-Saharan Africa, Asia, and the Americas

chemical diversity: the variety of metabolic compounds in an ecosystem

chytridiomycosis: a disease of amphibians caused by the fungus *Batrachochytrium dendrobatidis*; thought to be a major cause of the global amphibian decline

ecosystem diversity: the variety of ecosystems

endemic species: a species native to one place

exotic species (also, invasive species): a species that has been introduced to an ecosystem in which it did not evolve

extinction rate: the number of species becoming extinct over time, sometimes defined as extinctions per million species–years to make numbers manageable (E/MSY)

extinction: the disappearance of a species from Earth; local extinction is the disappearance of a species from a region

genetic diversity: the variety of genes and alleles in a species or other taxonomic group or ecosystem; the term can refer to allelic diversity or genome-wide diversity

habitat heterogeneity: the number of ecological niches

secondary plant compound: a compound produced as a byproduct of plant metabolic processes that is typically toxic, but is sequestered by the plant to defend against herbivores

species-area relationship: the relationship between area surveyed and number of species encountered; typically measured by incrementally increasing the area of a survey and determining the cumulative numbers of species

tragedy of the commons: an economic principle that resources held in common will inevitably be over-exploited

white-nose syndrome: a disease of cave-hibernating bats in the eastern United States and Canada associated with the fungus *Geomyces destructans*