

Biology Essentials Cheatsheet

A quick reference guide covering essential biology concepts, from cell structure to genetics and ecology. This cheat sheet provides concise summaries and key definitions for students and enthusiasts.



Cell Biology

Cellular Processes

Cell Communication

Cell Membrane	Phospholipid bilayer with embedded proteins; controls the movement of substances in and out of the cell.	Diffusion
Nucleus	Contains DNA, controls cell activities through gene expression.	Osmosis
Mitochondria	Site of cellular respiration; generates ATP.	
Endoplasmic Reticulum (ER)	Rough ER (with ribosomes): protein synthesis; Smooth ER: lipid synthesis and detoxification.	Active Transport
Golgi Apparatus	Processes and packages proteins and lipids.	Endocyto
Lysosomes	Contains enzymes for intracellular digestion.	Exocytosi

Diffusion	Movement of molecules from an area of high concentration to an area of low concentration.
Osmosis	Movement of water across a semipermeable membrane from an area of high water potential to an area of low water potential.
Active Transport	Movement of molecules against a concentration gradient, requiring energy (ATP).
Endocytosis	Cellular uptake of large molecules or particles by engulfing them in vesicles.
Exocytosis	Cellular secretion of large molecules by fusion of vesicles with the plasma membrane.
Cellular Respiration	Process by which cells break down glucose to produce ATP. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$
Photosynthesis	Process by which plants convert light energy into chemical energy. $6CO_2 + 6H_2O$ $\rightarrow C_6H_{12}O_6 + 6O_2$

Cells communicate through chemical signals.

Types of Signals:

- **Autocrine:** Affect the cell that produces them.
- Paracrine: Affect nearby cells.
- **Endocrine:** Travel through the bloodstream to distant target cells.
- **Direct Contact:** Communication through gap junctions.

Signal Transduction: Process by which a cell converts one kind of signal or stimulus into another.

Receptor Proteins: Proteins that bind to specific signaling molecules and initiate a response.

Genetics

Basic Genetic Terms		DNA and RNA		Mendelian Genetics
Gene	A unit of heredity; a sequence of DNA that encodes a protein or RNA molecule.	DNA	Deoxyribonucleic acid; the genetic material containing instructions for cell function.	Law of Segregation: Allele pairs separate during gamete formation.
Allele Genotype	A variant form of a gene. The genetic makeup of an	RNA	Ribonucleic acid; involved in protein synthesis. Types include	Law of Independent Assortment: Genes for different traits assort independently during gamete formation.
Phenotype	organism. The observable characteristics of an organism	Transcription	mRNA, tRNA, and rRNA. Process by which RNA is synthesized from a DNA	Punnett Square: Diagram used to predict the genotypes and phenotypes of offspring.
Homozygous	Having two identical alleles for a gene.	Translation	template. Process by which proteins are synthesized from mRNA.	Example: Monohybrid cross of two heterozygous parents (Aa x Aa) yields: • 1 AA (25%) • 2 Aa (50%)
Heterozygous	Having two different alleles for a gene.	Codon	A sequence of three nucleotides that codes for a specific amino	
Dominant	An allele that masks the effect of another allele.	Control	acid. DNA Dratain DNA Dratain	• 1 aa (25%)
Recessive	An allele whose effect is masked by a dominant allele.	Dogma	DINA → KINA → Protein	

Ecology

Basic Ecological Terms

Ecosystem	A community of living organisms (biotic) and their physical environment (abiotic) interacting as a system.
Habitat	The natural environment where an organism lives.
Niche	The role and position a species has in its environment; how it meets its needs for food and shelter, how it survives, and how it reproduces.
Population	A group of individuals of the same species living in the same area.
Community	An interacting group of various species in a common location.
Biome	A large naturally occurring community of flora and fauna occupying a major habitat, e.g., forest or tundra.

Provide energy and structural

support. Monosaccharides,

disaccharides, and

Store energy, form cell

membranes, and act as

Perform a wide range of functions, including enzymes, structural components, and transport. Amino acids are the

Store and transmit genetic information. DNA and RNA.

hormones. Fats, oils, phospholipids, and steroids.

building blocks.

polysaccharides.

Energy Flow

Producers	Organisms that produce their own food through photosynthesis or chemosynthesis.
Consumers	Organisms that obtain energy by consuming other organisms. (Herbivores, Carnivores, Omnivores).
Decomposers	Organisms that break down dead organic matter.
Food Chain	A linear sequence of organisms through which nutrients and energy pass as one organism eats another.
Food Web	A network of interconnected food chains.
Trophic Level	Each step in a food chain or food web.
Energy Pyramid	Graphical representation of energy flow through trophic levels.

Biogeochemical Cycles

The cycling of essential elements (e.g., carbon, nitrogen, water, phosphorus) through the biotic and abiotic components of ecosystems.

Carbon Cycle: Photosynthesis, respiration, decomposition, and combustion.

Nitrogen Cycle: Nitrogen fixation, nitrification, denitrification, and assimilation.

Water Cycle: Evaporation, transpiration, condensation, precipitation, and runoff.

Biochemistry Macromolecules

Carbohydrates

Lipids

Proteins

Nucleic Acids

Enzymes

A biological catalyst that speeds up chemical reactions by lowering the activation energy.
The reactant on which an enzyme acts.
The region of an enzyme where the substrate binds.
A non-protein chemical compound or metallic ion that is required for an enzyme's activity.
A substance that decreases the activity of an enzyme. (Competitive and Non-competitive).

Important Concepts

pH: A measure of the acidity or alkalinity of a solution.

Buffers: Substances that resist changes in pH.

ATP (Adenosine Triphosphate): The main energy currency of the cell.