

Cell Biology: Structure and Function

What Is a Cell

A cell is the smallest structural and functional unit of life. All known organisms are composed of one or more cells, and every cell arises from a pre-existing cell.

Cells range from about 1 micrometer (bacteria) to over 100 micrometers (large eukaryotic cells).

Prokaryotes vs Eukaryotes

Prokaryotic cells (bacteria and archaea) lack a membrane-bound nucleus. Their DNA sits in a nucleoid region, and they generally lack internal compartments.

Eukaryotic cells contain a true nucleus and a suite of organelles — mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes — that partition function.

Key Organelles

The nucleus houses the genome and coordinates gene expression.

Mitochondria produce ATP through oxidative phosphorylation and originated as endosymbiotic bacteria.

The endoplasmic reticulum and Golgi apparatus synthesize, fold, and traffic proteins destined for membranes or export.

The Cell Cycle

The cell cycle proceeds through G1, S (DNA synthesis), G2, and M (mitosis). Checkpoints ensure DNA integrity before division.

Failures in cell cycle control underlie most cancers, making cycle regulators a major target of cancer therapeutics.

Why It Matters

Understanding cellular mechanisms underpins medicine, biotechnology, and biology education. Nearly every therapeutic advance since 1950 traces back to insights at the cellular scale.