

Cell structure Cell theory: three statements	Cell structure How is cell theory used to make predictions?
Cell structure Three structures common to all cells	Cell structure Magnification formula
Cell structure How is an eyepiece graticule calibrated?	Cell structure Coarse or fine adjustment at high power?
Cell structure Stains for temporary mounts	Cell structure Main advantage of electron microscopes

By deduction: a newly discovered organism is predicted to consist of one or more cells.

All organisms consist of one or more cells; cells are the basic structural unit of life; cells only arise from pre-existing cells.

magnification = image size $\div$ actual size, so
actual size = image size $\div$ magnification
(both in the same units).

DNA as genetic material, a cytoplasm composed mainly of water, and a plasma membrane composed of lipids.

Fine adjustment only. The coarse adjustment is used first, at low power.

Line it up against a stage micrometer for each objective lens, then calculate the length of one eyepiece unit.

Much higher resolution, because electrons have a shorter wavelength than light, so ultrastructure is visible.

Iodine for plant cells (starch, nuclei); methylene blue for animal cells (nuclei).

Cell structure

Freeze fracture

Cell structure

Cryogenic electron microscopy

Cell structure

Immunofluorescence

Cell structure

Five components of a Gram-positive bacterium

Cell structure

Two examples of Gram-positive eubacteria

Cell structure

Structure of the eukaryotic nucleus

Cell structure

What makes up the eukaryotic cytoskeleton?

Cell structure

The eight functions of life

Rapid freezing in glass-like ice; many images combined by computer give 3D protein structures at near-atomic resolution.

A rapidly frozen sample is split along membranes; a replica viewed by electron microscopy shows proteins spanning the bilayer.

Cell wall, plasma membrane, cytoplasm, naked DNA in a loop and 70S ribosomes.

Antibodies tagged with fluorescent markers bind specific proteins, showing where they are in the cell under a light microscope.

Chromosomes of DNA bound to histones, enclosed in a double membrane with pores.

Bacillus and *Staphylococcus*.

Homeostasis, metabolism, nutrition, movement, excretion, growth, response to stimuli and reproduction.

Microtubules and microfilaments.

Cell structure

How does Paramecium carry out homeostasis?

Cell structure

How does Chlamydomonas respond to light?

Cell structure

Cell wall composition in plants and fungi

Cell structure

Vacuoles in plant and animal cells

Cell structure

Which eukaryotic cells have centrioles?

Cell structure

Atypical cells with many nuclei

Cell structure

Atypical cells with no nucleus

Cell structure

How do you identify a mitochondrion in an electron micrograph?

An eyespot detects light, and two flagella move the cell towards it.

Contractile vacuoles collect and expel excess water that enters by osmosis.

Plants: a large permanent central vacuole of cell sap. Animals: small, temporary vacuoles.

Plants: cellulose. Fungi: chitin. Animal cells have no cell wall.

Aseptate fungal hyphae (no cross walls) and skeletal muscle fibres (formed by fusion of cells).

Animal cells. Centrioles are absent from flowering plants and most fungi.

Oval, with a double membrane; the inner membrane is folded into cristae.

Mature mammalian red blood cells and phloem sieve tube elements.

Cell structure

**Rough versus smooth ER in an
electron micrograph**

Cell structure

Annotation for the Golgi apparatus

Cell structure

Label versus annotation

Processes proteins and packages them into vesicles, for example for secretion.

Rough ER: flattened sacs studded with ribosomes. Smooth ER: tubular membranes without ribosomes.

A label names a structure; an annotation adds a brief note, such as its function.