



THE BASICS

Eukaryotic and Prokaryotic Cells

- Cells were first named in 1665 with the recent invention of the light microscope.
- All life has cells with certain features in common.
- Cells can have specialised organelles that perform specific roles.
- Some organelles in eukaryotes are membrane-bound.
- Cells also have a cytoskeleton that performs several key roles within the cell.
- Microscopes use light, electrons or lasers to form an image of a cell. Preparing cells for use in a microscope requires several steps.
- Microscopy depends on magnification and resolution.

Exam Tip!

Only use abbreviations such as LSCM, TEM and SEM if you have already fully written the word in your answer.



Magnification

$$\text{Magnification} = \frac{\text{eyepiece lens} \times \text{objective lens}}{\text{Image}}$$

$$\text{Actual} = \frac{\text{Image}}{\text{Magnification}}$$

Eukaryotic Cells

Cell surface membrane – phospholipid bilayer with membrane proteins; controls movement of substances into and out of the cell

Nucleus – surrounded by a nuclear membrane; contains DNA and a nucleolus where RNA and ribosomes are formed

Smooth endoplasmic reticulum – synthesises, stores and transports lipids and carbohydrates

Rough endoplasmic reticulum – coated in ribosomes; provides large surface area for protein synthesis

Cell wall – (plants and fungi) rigid wall with cellulose or chitin; provides protection and support

Protein Synthesis:

Ribosomes: convert mRNA into proteins. They can be attached to rough endoplasmic reticulum.

Nucleus: DNA codes for proteins via mRNA, which leaves through pores.

Lysosomes – secrete harmful substances out of the cell

Golgi apparatus – modifies proteins and packages them into vesicles for transport.

Golgi apparatus: modifies and packages proteins and pinches them into vesicles for transport.

Rough ER: packages proteins and pinches them into vesicles for transport.

Cell membrane: fuses with the vesicle, secreting proteins outside cell.

Chloroplasts – (plants only) contain DNA and chlorophyll to carry out photosynthesis

Mitochondria – have folded inner cristae and own DNA; respire to produce ATP

80S ribosomes – protein and RNA complexes for protein synthesis

Permanent vacuole (plants only)

Other structures include:

Flagella – tails for locomotion

Cilia – membrane projections to increase surface area for absorption

Centrioles – a pair of small, cylindrical organelles outside of the nucleus

Microscopy

Magnification determines how large an object appears; resolution determines how clear an image is.

There are four main types of microscopy.

- Optical microscopy:** uses light to look at living samples, but at low resolution and magnification.
- Laser scanning confocal microscopes:** use light in lasers to achieve a higher resolution than optical microscopy, but cannot achieve the magnification of electron microscopes. LSCMs allow for depth selection and can construct a 3D model using computers.
- Electron microscopes use electrons for greater magnification; however, they need a vacuum, therefore samples must be dead.
- Transmission electron microscopes:** pass electrons through a sample, get a high magnification and resolution of a cell's organelles, but only provide a flat cross-sectional image.
- Scanning electron microscopes:** bounce electrons off the surface for a 3D surface view of cells, but have a lower resolution.

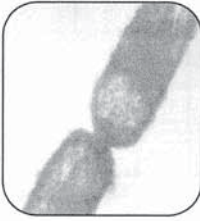
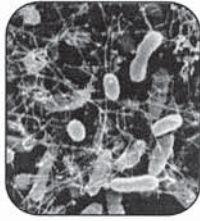


Preparing a Specimen for Microscopy

- Sectioning: Specimens are embedded in wax and a thin section is cut.
- Staining: Stains are added that bind to specific molecules, organelles and cell types. These could be coloured or fluorescent chemicals or metal particles.
- Measuring: An eyepiece graticule and a stage micrometer are used to calibrate light microscopes.

Exam Tip!

Remember: scanning shows surface. The top image is from a scanning electron microscope; the bottom image is from a transmission microscope.



Prokaryotic Cells

Plasmid – small circular DNA

Circular DNA – main DNA

Capsule – mucus layer

Pilus – membrane projections

70S ribosomes

Flagella – locomotion

Cell wall and cell membrane

Prokaryotes have no membrane-bound organelles.

Cytoskeleton

Consists of protein fibres called microtubules.

Microtubule motors use ATP to move organelles along the microtubules.

The cytoskeleton has four main uses:

- keeps cell shape stable
- allows cell movement by extending cytoplasm
- provides mechanical strength
- moves organelles within the cell

Word cloud

Organelle
Magnification
Prokaryotic
Eukaryotic
Golgi apparatus
Endoplasmic reticulum
Lysosomes
Capsule
Vacuole
Pilus
Flagella
Electron microscopy
Cell membrane
Plasmid
Cytoskeleton
Ribosomes
Mitochondria
Chloroplasts
Nucleus

OCR Biology (Oxford): pp. 8–39
OCR AS Biology (Pearson): pp. 26–43