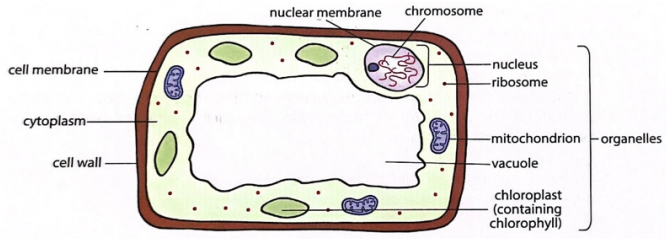
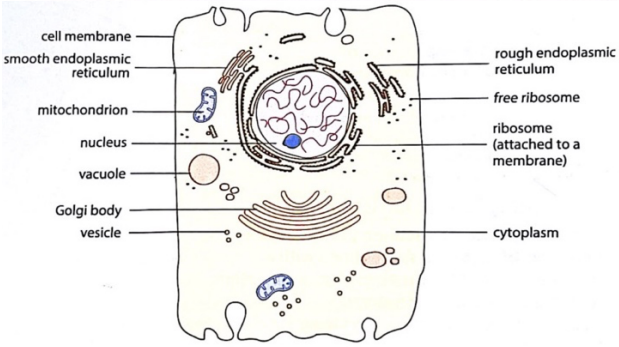
Cell Structure and Organisation

O Level 2024 syllabus

- identify and state the functions of the following cell structures (including organelles) of typical plant and animal cells from diagrams, light micrographs and as seen under the light microscope using prepared slides and fresh material treated with an appropriate temporary staining technique: cell wall, cell membrane, cytoplasm, nucleus, cell vacuoles (large, sap-filled in plant cells, small, temporary in animal cells), chloroplasts
- identify and state the functions of the following membrane systems and organelles from diagrams and electron micrographs: endoplasmic reticulum, Golgi body, mitochondria, ribosomes
- compare the structure of typical animal and plant cells
- explain how the structures of specialised cells are adapted to their functions (e.g. muscle cell – many mitochondria to supply more energy, root hair cell – large surface area of cell membrane for greater absorption, red blood cell – lack of nucleus allowing it to transport more oxygen)

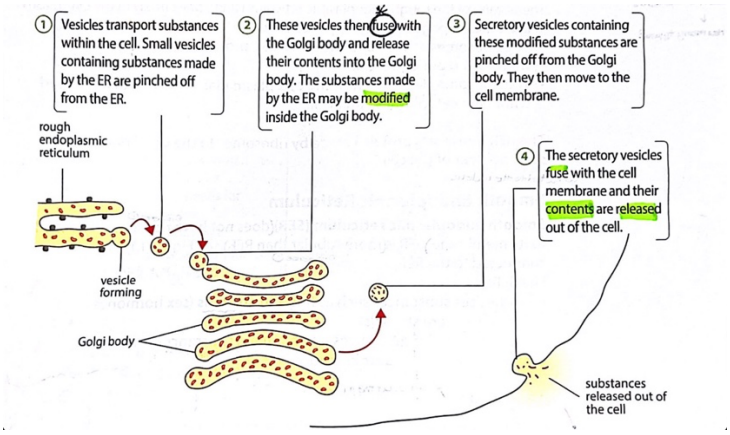
Cells

What is a cell?	A cell is a unit of life. It consists of a mass of living matter called protoplasm.
What does a protoplasm consist of?	The protoplasm consists of the cell membrane, cytoplasm and nucleus
Parts of a cell 'O Level Syllabus'	 **Figure 1.5** A generalised plant cell  **Figure 1.6** Organelles in an animal cell seen under an electron microscope *Cell membranes* - Partially permeable membrane that controls substances entering or leaving the cell *Cell Wall* - Fully permeable - Protects the cell from injury, gives the plant cell a fixed shape *Cytoplasm* - Contains organelles - Site where cell activities occur *Nucleus* - Controls cell activities such as cell growth and repair of worn-out parts - Essential for cell division - Contains DNA (in the form of chromatin) *Rough Endoplasmic Reticulum* - Studded with ribosomes - Synthesises proteins and transports them to the Golgi Body for secretion out of the cell

Ribosomes
- Attached to RER: Synthesises proteins that are transported out of the cell
- In cytoplasm: Synthesises proteins that are to be used within the cell

Smooth Endoplasmic Reticulum
- Synthesises fats and steroids
- Converts harmful substances into harmless substances via detoxification

Golgi Body
- Chemically modifies substances made by the RER
- Stores and packages these substances into vesicles for secretion out of the cell



Mitochondria (plural) / Mitochondrion (Singular)
- Site of aerobic respiration, where food substances like glucose is broken down to release energy for cell activities (growth and reproduction)

Chloroplasts
- Found in plant cells
- Contains chlorophyll which converts light energy to chemical energy for the formation of glucose during photosynthesis

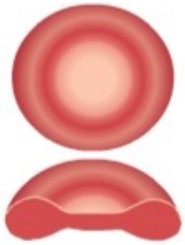
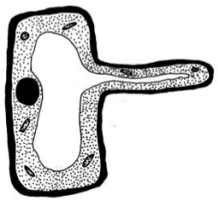
Vacuoles
- Store substances within the cell
- Plants: Large, contains sugars, mineral salts and amino acids
- Animals: Many small, contains water and food

Plant cell V.S. Animal cell

'O Level Syllabus'

Organelle	Plant	Animal
Cell wall	Present	Absent
Chloroplast	Present	Absent
Vacuole	One large central vacuole	Many small vacuoles
Centrioles	Absent	Present

Specialised cells → 'O Level Syllabus'

Red Blood Cell 	- Contains haemoglobin which binds to oxygen and transport it round the body. - Circular and biconcave shape to increase surface area to volume ratio so that oxygen can diffuse in and out at a faster rate. - No nucleus to enable cell to store more haemoglobin for oxygen transport - Is flexible and can squeeze through capillaries easily
Muscle Cell	- Is elongated and cylindrical in shape, contains many nuclei and mitochondria - Many mitochondria to supply energy for contraction of muscles.
Root Hair Cell 	- Long and narrow protrusion increases surface area to volume ratio for faster absorption of water by osmosis and mineral salts by diffusion and active transport from the soil solution. - Cell contains many mitochondria which release energy during respiration needed to transport mineral salts from the soil solution into the root hair cell by active transport.
Xylem Vessel 	- The xylem vessel has an empty lumen without protoplasm or cross-walls. This reduces resistance to water flowing through the xylem. It allows water and dissolved mineral salts to be conducted from the roots to the stems and leaves at a faster rate. - The xylem walls are thickened with lignin, which prevents the collapse of the vessel as it is hard and rigid. This provides mechanical support to the plant.