

Chapter 1: Cells

- A cell is a basic unit of life.
- Two microscopes are used to see cells and their parts: **light microscope and electron microscope**

	Light microscope	Electron microscope
What is used to produce these images of the cells?	Light	Electrons
What type of image is produced?	Coloured image	Black-and-white image that can be artificially coloured
What is the magnification of the microscope?	1,000x	200,000x

- There are two types of sections to cut the cell to view the cell structures in different perspective. They are the **longitudinal section** and **transverse section**.
- **Longitudinal section** is cutting along the length of a cell.
- **Transverse section** is cutting across the length of a cell.
- **Protoplasm**: The protoplasm consists of the cell surface membrane, nucleus, and cytoplasm

Parts and their Description and Function

Part	Description	Function
Cell surface membrane	It is a partially permeable membrane . It is also part of the protoplasm.	The cell surface membrane <u>controls the movement</u> of substances into and out of the cell.
Nucleus	The nucleus consists of the nuclear envelope, nucleoplasm, nucleolus, and chromatin . It is also part of the protoplasm.	The nucleus controls cell activities such as cell growth and the repair of worn-out parts. It is also essential for cell division.
Cytoplasm	It is part of the protoplasm <u>between</u> the cell surface membrane and the nucleus.	It is where most of the cell activities occur. It also contains specialised structures called organelles.

Cell wall	The cell wall is made of cellulose and is fully permeable .	The cell wall protects the plant cell against injuries and gives the plant cell a fixed shape.
Rough endoplasmic reticulum (RER)	The RER is a network of tubules and flattened spaces lined by a membrane that is continuous with the nuclear envelope .	Transports the proteins synthesised by the attached ribosomes to the Golgi apparatus for secretion out of the cell.
Smooth endoplasmic reticulum (SER)	The SER is a network of tubules and flattened spaces lined by a membrane that is continuous with the RER .	The SER synthesises substances such as fats and steroids and conducts detoxification (converting harmful substances into harmless substances).
Ribosome	The ribosomes are either <u>attached</u> to the membrane of the endoplasmic reticulum (ER) or <u>lie freely</u> in the cytoplasm.	The ribosomes attached to the ER make proteins that are usually transported out of the cell. The ribosomes lying freely in the cytoplasm make proteins that are used within the cytoplasm of the cell.
Golgi apparatus	Stack of flattened discs Vesicles can be seen fusing with one side of the Golgi apparatus and pinching off the other side.	The Golgi apparatus chemically modifies substances made by the ER; and stores and packages these substances in vesicles for secretion out of the cell.
Mitochondria	Oval-shaped organelles.	Aerobic respiration occurs in the mitochondria. During aerobic respiration, food substances are oxidised to release energy. This energy may be used by the cell to perform cell activities such as growth and respiration.
Vacuole	A vacuole is a fluid-filled space enclosed by a membrane. Vacuoles store substances within the cell.	<u>Animal cells</u> have many small temporary vacuoles that contain water and food substances . Plant cells have a large central vacuole which contains a liquid called cell sap .

		Cell sap contains dissolved substances such as sugar , mineral salt , and amino acid . This large vacuole is enclosed by a partially permeable membrane called the tonoplast .
Chloroplast (Only in plant cells)	Chloroplasts are oval structures found in plant cells only . Chloroplasts contain a green pigment called chlorophyll .	Chloroplasts contain chlorophyll which are essential for photosynthesis .
Centrioles (Only in animal cells)	It is a small, hollow cylinder that is found in pairs and located near the nucleus .	Centrioles play a part in cell division.

Differences between a Plant cell and an Animal cell

Plant cell	Animal cell
Cell wall present	Cell wall absent
Chloroplasts present	Chloroplasts absent
Centrioles absent	Centrioles present
A large central vacuole	Small and many vacuoles

Contents in the Nucleus

The nucleus contains of the **nuclear envelope**, **nucleoplasm**, **nucleolus**, and **chromatin**.

- **Nuclear envelope:** The nuclear envelope separates the contents of the nucleus from the rest of the cytoplasm.
- **Nucleoplasm:** The nucleoplasm is a dense material within the nucleus.
- **Nucleolus:** The nucleolus plays a part in the making of proteins in the cell.
- **Chromatin:** The chromatin is made up of proteins and deoxyribonucleic acid (DNA). Heredity information is stored in the DNA. When the cell is dividing, the chromatin threads condense and become highly-coiled structures called **chromosomes**. Under the light microscope, the chromosomes appear as thick rod-shaped structures.

Movement of Substances out of the Cell

1. Vesicles **transport substances** within the cell. Small vesicles containing substances made by the ER are **pinched off** from the ER.
2. These vesicles then **fuse** with the Golgi apparatus and release their contents into the Golgi apparatus. The substances made by the ER **may be modified** by the Golgi apparatus.
3. **Secretory vessels** containing these **modified** substances are pinched off from the Golgi apparatus. They then move to the cell surface membrane.
4. The secretory vessels fuse with the cell surface membrane and their contents are **released outside** of the cell.

Specialised Cells, Tissues, Organs and Systems

- **Differentiation** is the process by which a cell becomes specialised for a specific function.

Type of cell	Adaption	Adaption to function
Red blood cell	Contains a red pigment called haemoglobin.	Haemoglobin transports oxygen <u>from</u> the lungs <u>to</u> all parts of the body.
	Has no nucleus.	Enables the red blood cell to carry more haemoglobin and hence more oxygen.
	Has circular, biconcave shape with thinner, central portion.	Increases the surface-area-to-volume ratio of the red blood cell, which allows oxygen to diffuse into and out of the cell at a faster rate.
Xylem vessels	Long, hollow tube formed out of xylem cells laid end to end.	Conducts water and mineral salts from the roots up to the stem and leaves.
	Does not have cross-walls or protoplasm.	Enables water to move easily through the central space or lumen.
	Deposition of lignin on its walls.	Strengthens the walls and prevents the ratio of the cell, so as to allow water and mineral salts to be efficiently absorbed from the soil.
Root hair cell	Long and narrow cells, present in large numbers.	Increases the surface-area-to-volume ration of the cell, so as to allow water and mineral salts to be efficiently absorbed from the soil.
	Contains a large number of mitochondria.	Releases huge amounts of energy to help the soil actively absorb mineral salts against a concentration gradient.

	Thin cell wall, selectively permeable cell membrane, absence of waxy cuticle layer, and a more concentrated cytoplasm and cell sap.	Greatly facilitates water transport into the root hair cells.

Cells in a Multicellular Organism

- A **tissue** is a group of cells with similar structures which work together to perform a specific function. There are two types of tissues: simple tissue and complex tissue.
- A **simple tissue** is made up of the **same kind of cells**.
- A **complex tissue** is made up of **more than one type of cell**.

1) Cells

- Cells are the basic unit of life

2) Tissue

- A tissue is a group of cells with similar structures which work together to perform a specific function.

3) Organ

- An organ contains more than one type of tissue, all working together for a specific function.

4) Organ system

- An organ system consists of several organs working together to perform a specific function.

5) Organism

- Various systems working together make up the entire body of an organism.