Cell Structure

A microscope is needed to see animal and plant cells.

7.

There are two types: the **light** microscope and the **electron** microscope.

The **light microscope** sends a beam of **light** through a cell which is then focused by two lenses. The **electron microscope** sends a beam of **electrons** through the cell and the beam is focused with electromagnets. The electron microscope has far greater resolution and magnification than the light microscope. It allows us to see **cell ultrastructure**, i.e. tiny **organelles** present in the cell.

Animal Cells (Using the Light Microscope)

The following parts may be seen using a light microscope:

- Cytoplasm: a watery substance in which the cell organelles are suspended.
- Nucleus: the control centre of the cell, it contains DNA (deoxyribonucleic acid) of which genes are made. The genes are contained on thread-like structures called chromosomes.

Genes contain the instructions for the manufacture of **proteins** in the cell. These proteins determine the functions of the cell.

The nucleus therefore regulates what proteins are made and so determines the structure of the cell and its activities.

A dark staining part of the nucleus, called the nucleolus, makes RNA (ribonucleic acid).

 Cell Membrane: surrounds all cells – both animal and plant cells. It is made of protein and phospholipids. Its function is to allow only certain things in or out of the cell, i.e. it is selectively permeable.

Plant Cells (Using the Light Microscope)

The following structures are seen in plant cells (in addition to those mentioned for animal cells).

Cell Wall: made of strong, fibrous cellulose

 (a structural polysaccharide). The cell wall
 gives strength to the cell and prevents it from
 bursting as it fills with water.
 It is fully permeable and has no control over the
 entry of substances into the cell.



- Vacuole: consists of a membrane bag filled with cell sap. It stores sugars and salts, dissolved in water. When water moves into the vacuole, it pushes the cytoplasm against the cell membrane and cell wall, giving the cell turgor (rigidity).
- **Chloroplast**: a membrane-bound structure that contains the green chemical **chlorophyll**. The chloroplast is used by the plant in photosynthesis.



Protein

Phosphate

Pore

Cell Ultrastructures

These are additional structures that may be seen using the **electron microscope**.

 Mitochondrion: mitochondria are tiny rod-shaped structures with an outer membrane and a folded inner membrane. The inner membrane has enzymes on its surface. The enzymes are used in the process of respiration to produce molecules of ATP – the source of chemical energy for cells. Mitochondria are therefore called 'the powerhouses of the cell'. Cells that need a lot of energy (e.g. muscle, brain Inner folded membrane and liver cells) have large numbers of mitochondria.





- Chloroplast DNA Grana Outer membrane Aa. Chloroplast
- Chloroplast: details of the chloroplast may be seen using an electron microscope.
 On the outside, they have a double membrane, and inside there are a large number of membranes arranged in flattened discs called grana, piled one on top of the other. Chlorophyll is contained in the grana.
- Nucleus: the nuclear membrane has a large number of nuclear pores. These pores control the entry and exit of substances into and out of the nucleus.
- **Ribosomes**: are tiny organelles found in the cytoplasm of the cell. They are made of **RNA and protein**, and are used to make **proteins** within the cell.

Prokaryotic and Eukaryotic Cells

Cells are divided into these two main types.

 Prokaryotic cells: have no true nucleus. They have a ring of DNA called nuclear material, but it is not enclosed in a nuclear membrane. They have no chloroplasts or mitochondria. Prokaryotic cells are a primitive cell type and today are mainly seen in bacteria.



Prokaryotic cells do not have a membrane-bound (true) nucleus, or organelles such as chloroplasts or mitochondria.

 Eukaryotic cells: have a true nucleus, i.e. their DNA is enclosed by a nuclear membrane. They are larger and contain specialised organelles such as chloroplasts and mitochondria. Most organisms (plants, animals and fungi) are eukaryotes. Eukaryotic cells are thought to have evolved from earlier prokaryotic cells.

Eukaryotic cells have a membrane-bound (true) nucleus and contain organelles such as chloroplasts and mitochondria.

ACTIVITY 6: To be familiar with and use the light microscope

- Method: 1. Plug in the light microscope or adjust the mirror so that light is seen through the eyepiece lens.
 - 2. Place the slide on the centre of the stage.
 - 3. Using **low power**, turn the **coarse focus wheel** to lower the objective lens.
 - 4. Looking through the eyepiece lens, turn the coarse focus wheel to raise the objective lens and bring the slide into focus.
 - 5. Move the slide very slightly on the stage to centre the object on the slide perfectly.
 - Change the objective lens to medium or high power and fine focus using only the fine focus wheel.

Total **magnification** is the eyepiece lens power (e.g. x10) **multiplied** by the objective lens power (e.g. x40). This combination gives a 400 times magnification.



ACTIVITY 7(A): To view a plant cell using the light microscope

Method: 1. Cut a small square of onion and peel off a thin layer of epidermis.

- 2. Place the epidermal layer on the slide.
- 3. Add 2 drops of **iodine** (stains the **nuclei** and **cell walls a brown** colour).
- 4. Blot off excess stain with filter paper and add 2 drops of water.
- 5. Lower a cover slip slowly at 45° to avoid trapping air bubbles.
- 6. Examine and draw under low and high powers.



ACTIVITY 7(B): To view an animal cell using the light microscope

Method:

- 1. Scrape the **inside** of your **cheek** with a cotton bud.
- 2. Transfer and smear the cells onto a glass slide.
- 3. Add a few drops of **methylene blue stain** (stains the **nuclei** a **deep blue** colour).
- 4. Blot off excess stain with filter paper and add 2 drops of water.
- 5. Lower a cover slip slowly at 45° to avoid trapping air bubbles.
- 6. Examine and draw under low and high powers.



Animal cells (high power)