

CIE Biology GCSE

2: Organisation of the organism

Notes

Cells can be viewed using a **microscope** to study their structure. Plant and animal cells are known as **eukaryotic** cells as they contain a nucleus and membrane bound **organelles** such as ribosomes and mitochondria. Bacteria are known as **prokaryotes** as they do not contain these. They also do not contain a **rough endoplasmic reticulum**.

To calculate the size of a specimen under a microscope:

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

Where the image size is the size the specimen appears when viewed through the microscope.

Functions of eukaryotic cell structures:

- **Cytoplasm** - A jelly-like material within the cell in which reactions occur. The cytoplasm contains structures such as ribosomes and vesicles.
- **Cell membrane** - a thin membrane that surrounds the cell, controls entry and exit of substances.
- **Nucleus and DNA** - the nucleus contains genetic material in the form of DNA which codes for proteins. DNA replication also occurs in the nucleus.
- **Ribosomes and rough endoplasmic reticulum (RER)** - The RER surrounds the nucleus and ribosomes are attached to it. Ribosomes are the site of protein synthesis.
- **Mitochondria** - site of respiration. Provides energy for the cell to function.
- **Vesicles** - used to transport materials in the cell.

In addition to these, plant cells also contain a **vacuole, chloroplasts** and are surrounded by a **cell wall**.

- **Vacuole** - is a fluid-filled sac containing mineral salts, sugars, amino acids, waste substances and **pigments** which colour the cell and **attract pollinating insects**.
- **Chloroplasts** - are the site of **photosynthesis**, which allows plants to **convert light energy to glucose**.
- **Cell wall** - gives the cell **structure** and **prevents bursting**. It also **controls what enters and exits** the cell.

Levels of organisation

Key terms:

- **Tissue** - a group of similar cells working together to carry out a particular process
- **Organ** - a group of tissues working together to carry out a specific function
- **Organ system** - a group of related organs working together to carry out functions in the body

Specialised cells:

Cells and tissues are **specialised** to carry out their particular function. Examples of specialised cells are:

- **Ciliated cells** - ciliated cells are found lining the **trachea**. They have hair-like projections called **cilia** which move together to **transport mucus, dust and bacteria upwards** to the throat.
- **Root hair cells** - are adapted to have a **large surface area**. This speeds up the rate of osmosis and mineral ion uptake in plants.
- **Xylem vessels** - used to transport water through plants in **transpiration**. The xylem is made from **hollowed-out dead cells** that have the ends removed to make a tube for water to pass through. They have a **thick cell wall** to provide structural strength and are **thin** to allow **capillary action**.
- **Palisade mesophyll cells** - this is where photosynthesis occurs. Mesophyll cells are **tall and closely packed** to efficiently absorb light and **contain lots of chloroplasts** for photosynthesis. They are also placed at the top of the leaf where most of the light hits enabling them to absorb much light energy as possible.
- **Nerve cells** - nerve cells are adapted to rapidly transmit electrical impulses. Nerve cells are **myelinated**, which **insulates** the cell and prevents the impulse weakening and slowing down. They also contain **lots of mitochondria** to provide energy. **Dendrites** have a **large surface area and are branched** to receive impulses from many other neurons.
- **Red blood cells** - red blood cells contain **haemoglobin** which allows them to carry oxygen around the body. They have a **biconcave shape** which increases their surface area, allowing for rapid diffusion. They also have **thin cell membranes** to decrease the diffusion distance. They **do not contain a nucleus**, thus have more space for oxygen.

- **Sperm cells** - sperm cells are adapted by containing **lots of mitochondria** so that the cell has enough energy to reach the egg cell. It has a **tail to allow movement** and contains **digestive enzymes** to help penetrate the egg cell membrane.