Knowledge Organiser: Animal Cells

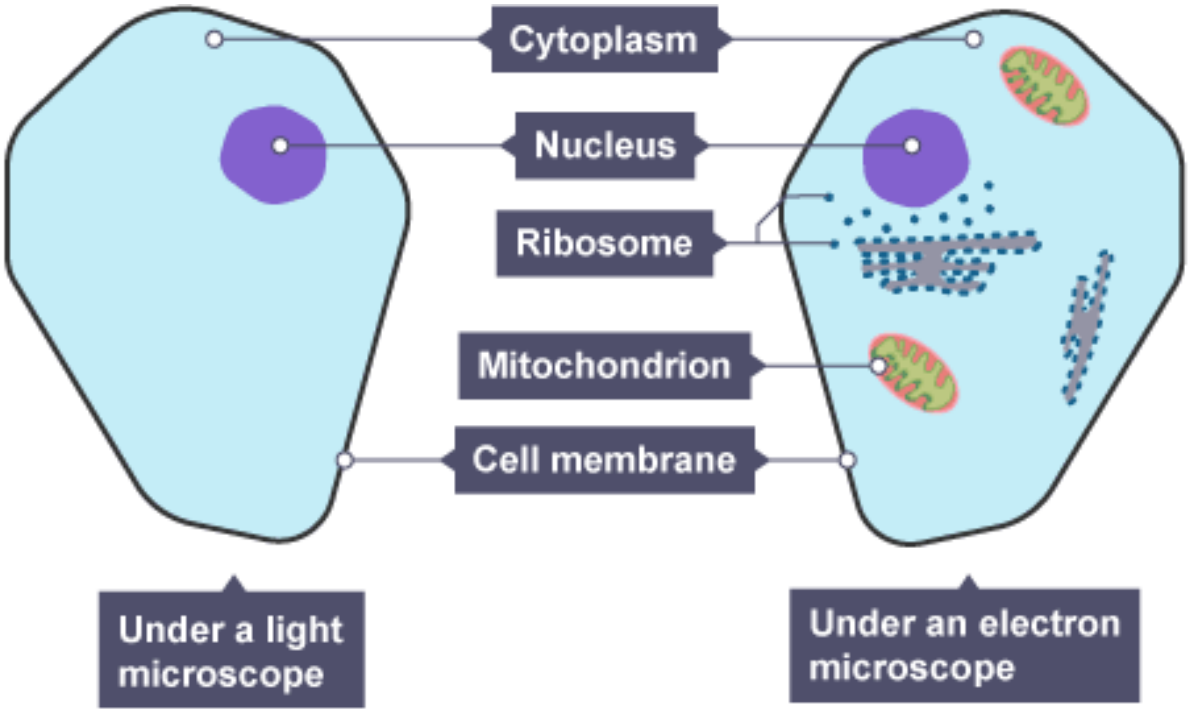
Life processes

Living organisms have certain life processes in common. There are seven things that they need to do to count as being alive. The phrase **MRS GREN** is one way to remember them:

- **M**ovement - all living things move, even plants
- **R**espiration - getting energy from food
- **S**ensitivity - detecting changes in the surroundings
- **G**rowth - all living things grow
- **R**eproduction - making more living things of the same type
- **E**xcretion - getting rid of waste
- **N**utrition - taking in and using food

Animal Cells

Animals are made up of cells. These cells are **eukaryotic**. This means they have a nucleus and other structures which are surrounded by membranes.

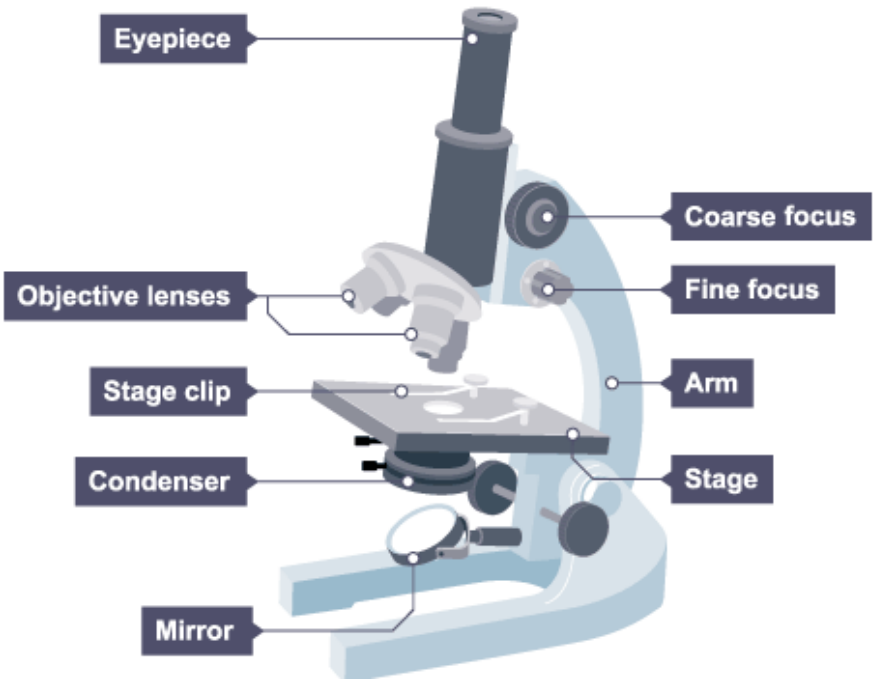


Cell structure	How it is related to its function
Cytoplasm	A jelly-like material **where many of the chemical reactions happen.** It contains dissolved nutrients and salts and structures called organelles.
Nucleus	Contains genetic material, including DNA, which controls the cell's activities.
Cell membrane	It controls the movement of substances in and out of the cell.
Mitochondria	Where most energy is released in respiration.
Ribosomes	Tiny structures where protein synthesis (how proteins are made) occurs.

Most cells are **specialised** and are adapted for their function. Animals therefore consist of <u>many different types of cell working together</u>.

Light Microscopes

We need microscopes to study most cells as they are so small. Microscopes are used to produce magnified images.



Using a light microscope:

1. The object is placed on a rectangular glass slide.
2. The slide is placed on the stage with a light source below.
3. Light shines through the object and into the objective lens.
4. Microscopes often have three or four objective lenses that you can turn. It is wise to observe an object using the lowest magnification lens first. You may need to adjust the focus and the amount of light as you move to higher magnifications.
5. The light passes through the eyepiece lens and from there into your eye.
6. You can focus the image using one or more focusing knobs. It is safest to focus by using the knobs to move the stage downwards, rather than upwards. There is a chance of the objective lens and slide colliding if you focus upwards.

Total magnification

The magnification of each lens is shown next to the lens:

total magnification = eyepiece lens magnification × objective lens magnification

For example, if the eyepiece magnification is ×10 and the objective lens magnification is ×40:

total magnification = 10 x 40 = ×400 (400 times)

Observing cells

When you observe cells, it is usual to make a drawing of what you see. Very often there is so much to see that you can only aim to draw part of it:

- use pencil rather than pen or colours
- outline the features as accurately as you can
- use as little shading as possible
- label your drawing with the name of the sample and the total magnification you used

Practical: how to prepare and stain animal cells for examination with a light microscope.

With cheek cells the stain **methylene blue** can be used. This stains the nucleus blue.

Risks

- Care must be taken when looking down the microscope if the illumination is too bright.
- Care when using microscope stains.
- Care when handling coverslips and microscope slides.

Specialised Cells

Humans are multicellular. That means we are made of lots of cells, not just one cell. The cells in many multicellular animals and plants are specialised.

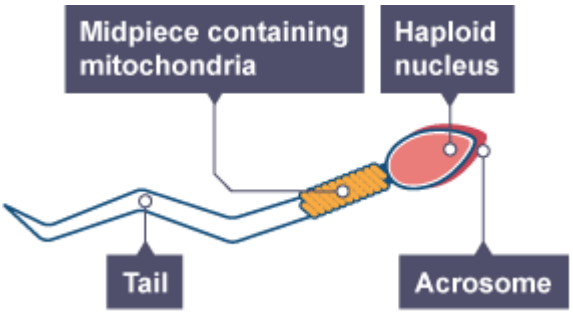
Most cells share features such as having a nucleus, a cell membrane, cytoplasm and mitochondria.

There are differences between cells, too. Each type of cell, has its own job to do. These cells have special features that allow them to perform their functions effectively.

Here are some examples of specialised cells and the features they have to help them with their role:

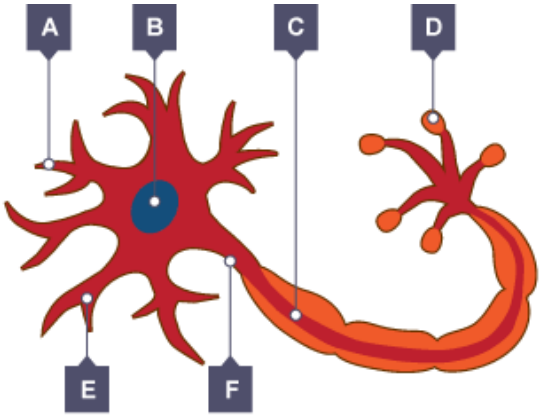
Sperm Cell

- The head of the sperm contains the genetic material for fertilisation.
- The acrosome in the head contains enzymes so that the sperm can penetrate an egg.
- The middle piece is packed with mitochondria to release energy needed to swim and fertilise the egg.
- The tail enables the sperm to swim.



Nerve Cell

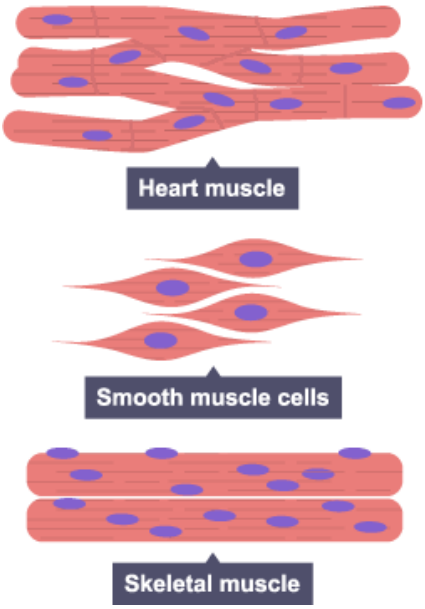
- The nerve cell is extended, so that nerves can run to and from different parts of the body to the central nervous system.
- The cell has extensions and branches, so that it can communicate with other nerve cells, muscles and glands.
- The nerve cell is covered with a fatty sheath, which insulates the nerve cell and speeds up the nerve impulse.



A Dendrite
B Nucleus
C Axon
D Nerve ending
E Cytoplasm
F Cell membrane

Muscle Cell

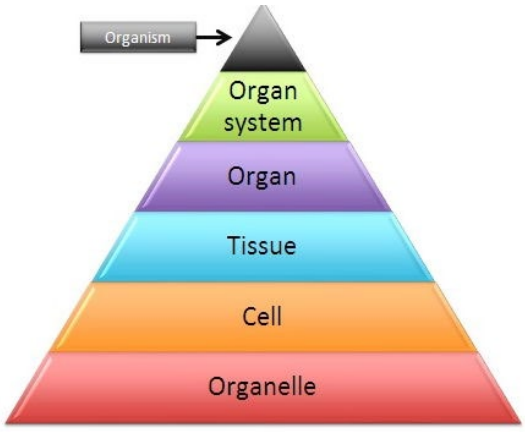
- Muscle cells contain filaments of protein that slide over each other to cause muscle contraction.
- The arrangement of these filaments causes the banded appearance of heart muscle and skeletal muscle.
- They contain many well-developed mitochondria to provide the energy for muscle contraction.
- In skeletal muscle, the cells merge so that the muscle fibres contract in unison.



Cells, tissues, organs and systems

Multicellular organisms are organised into increasingly complex parts. In order, from least complex to most complex:

- organelles
- cells
- tissues
- organs
- organ systems
- organism



Structure	Description
Organelle	Cell structure that is specialised to carry out a particular function or job
Cell	Basic structural and functional unit of a living organism
Tissue	Group of cells with similar structures, working together to perform a shared function
Organ	Structure made up of a group of tissues, working together to perform specific functions
Organ system	Group of organs with related functions, working together to perform body functions