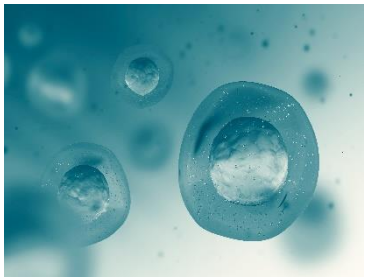
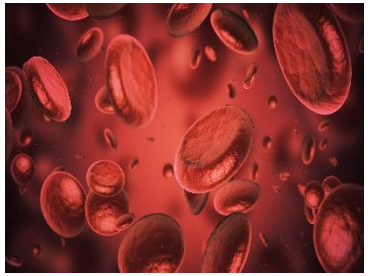
# Chapter 7 - Cell Structure

## Learning objectives

- To be familiar with the parts of the light microscope and its use.
- To be aware of the transmission electron microscope.
- To recognise the components of plant cells and animals' cells, as seen under a microscope, and describe their function.
- To define & understand the terms 'prokaryotic' and 'eukaryotic'.
- To prepare one plant cell and one animal cell (stained and unstained) and examine them using a light microscope.





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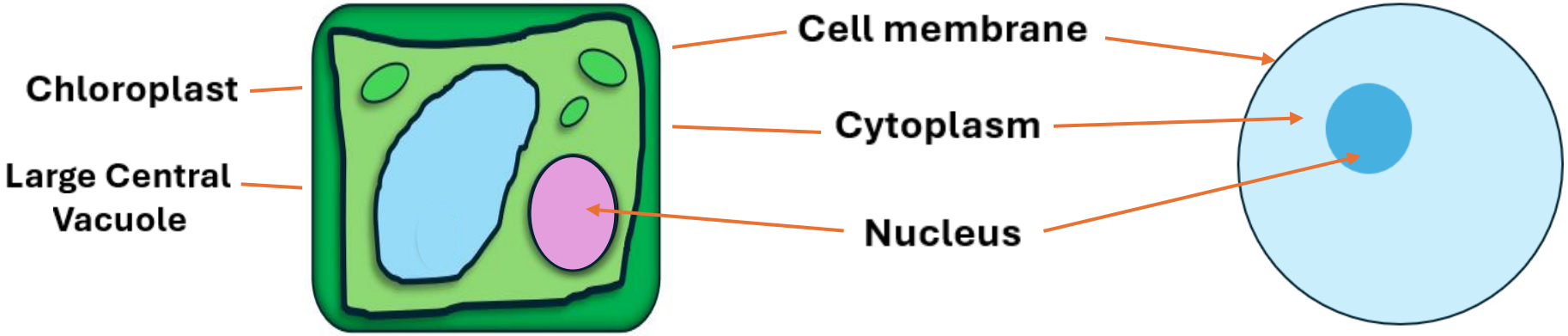
# All living things are made of cells.

**Cell Membrane** – Controls what enters and leaves the cell.

**Cytoplasm** - Watery substance that has proteins and sugar.

**Nucleus** - the control centre of the cell. It contains DNA.




| Plant Cell | Animal Cell |
|---|---|
| Cell Wall - Protection | No Cell Wall |
| Chloroplasts - make food | No Chloroplasts |
| Large Vacuole - store food/waste | Small Vacuoles |

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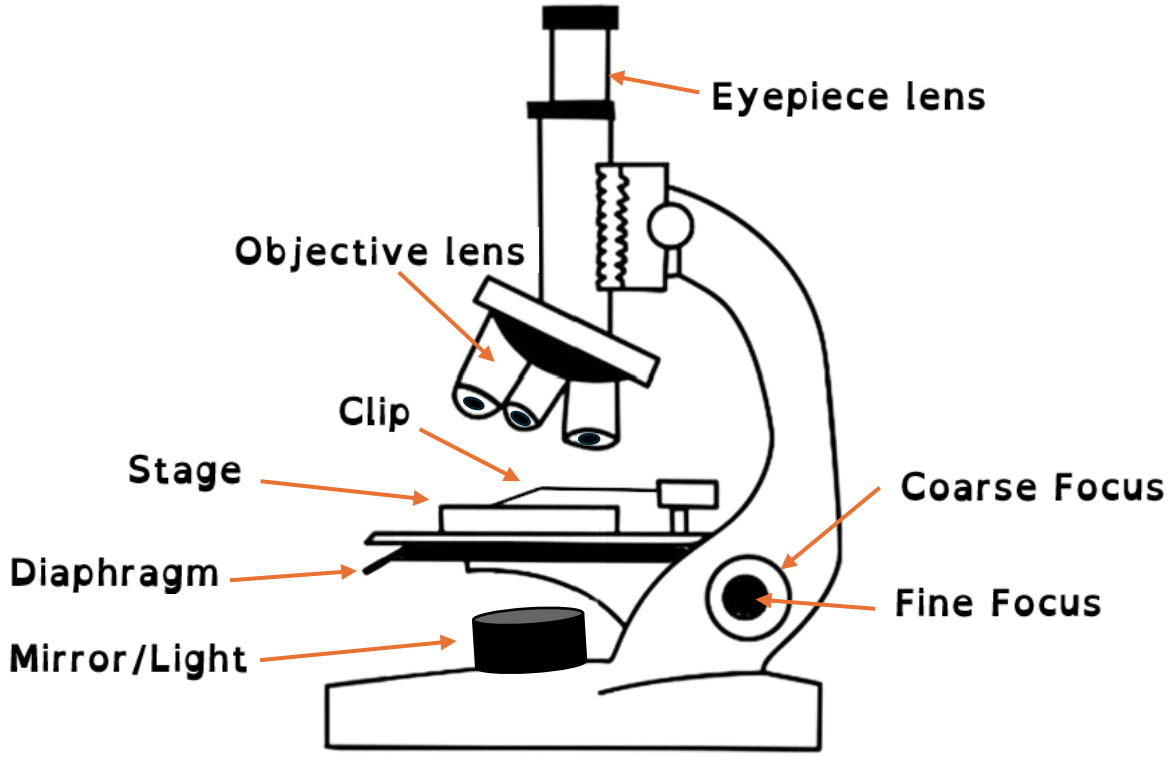
# Compound light Microscope

In 1665 Robert Hooke used the word 'Cell', as they reminded him of monk's cells or bedrooms. A **compound** microscope uses an **eyepiece** lens and **objective** lens. Their strengths are **multiplied** to give a total magnification. e.g. 10 x 40 = 400 times bigger.

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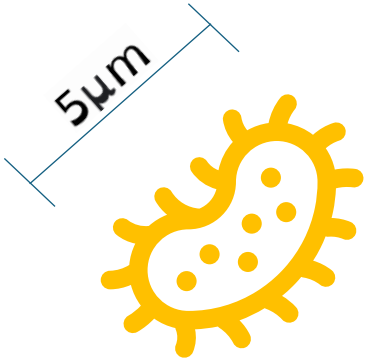
Cells are measured in **micrometres**.

The symbol **µm** is used for micrometres.

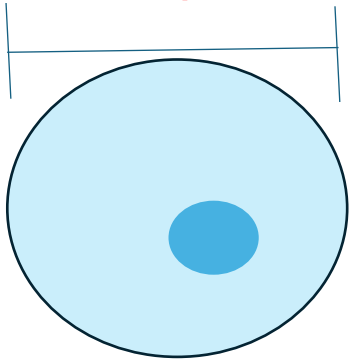
**There are 1000 micrometres in 1mm!**


A bacterial cell can be a few micrometres across.

A virus can be 50 times smaller than this!

An animal cell is about 25µm in size.



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# Mandatory Experiment

## To prepare a slide from plant tissue and sketch the cells

1. Cut out a small piece of onion with **scalpel** or backed blade.
2. Use **forceps** or your fingernail to peel off the inner skin - as thin as possible.
3. Place onion skin on drop of **water** on a slid - to keep cell shape.
4. Gently lower the **coverslip at 45°** onto the slide using a mounted needle – this is to **avoid trapping air** bubbles and confusing them as cells.
5. Place slide under clips - to avoid movement.

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6. Use **lowest power objective lens first** – to find cells on slide, to focus on them clearly and to avoid damage to the lens.
7. **Increase magnification** to see more details - usually x100 mag.
8. Draw what you see – if you can see anything!
9. Repeat the steps above again but before adding the coverslip place the **stain Iodine** at edge of slide and tissue on opposite side to draw stain through the sample.
10. Add coverslip and follow previous instructions.
11. Note the shapes and colours in the cell and draw a diagram.

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# Results

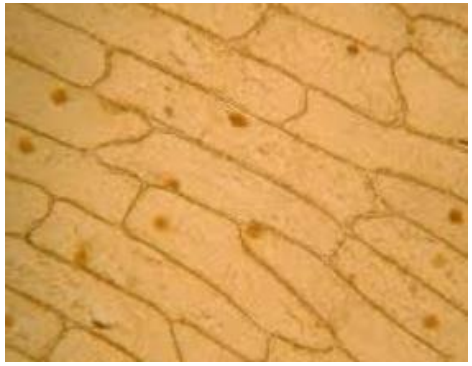
With no stain it is difficult to see the cells.

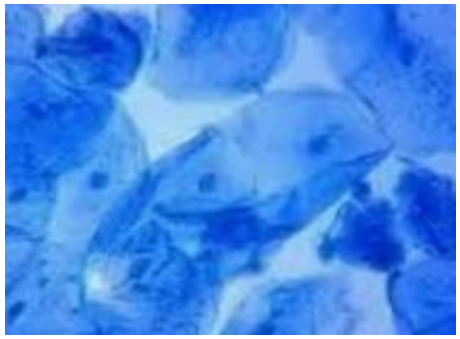
## Onion Cell

The onion cell is stained with **Iodine**.

The cell wall and the nucleus are visible and are a yellow/brown colour.

No chloroplasts or vacuoles are seen.





## Animal Cell

The cheek cell is stained with **Methylene Blue**.

The nucleus is dark blue, and the cytoplasm is light blue. Nothing else is seen.

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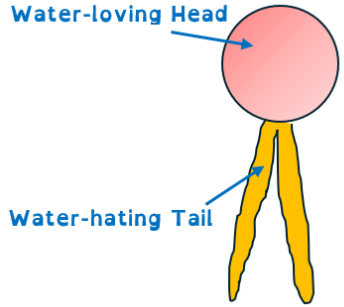
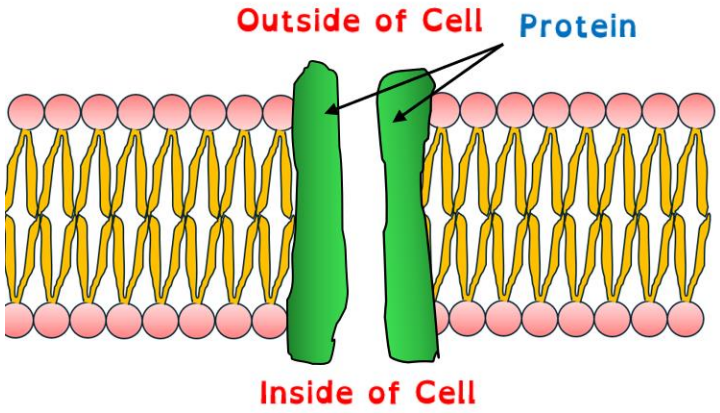
# Cell Ultrastructure

This is the fine detail of the cell seen by an Electron Microscope.

The membrane is made of phospholipids and proteins.

Two layers of these lipids make the **lipid-bilayer**.




## Functions of Cell Membrane:

1. Membranes **retain** the cell contents.
2. Membranes control what **enters** and **exits** the cell.
3. Membranes **recognise molecules** that touch them.

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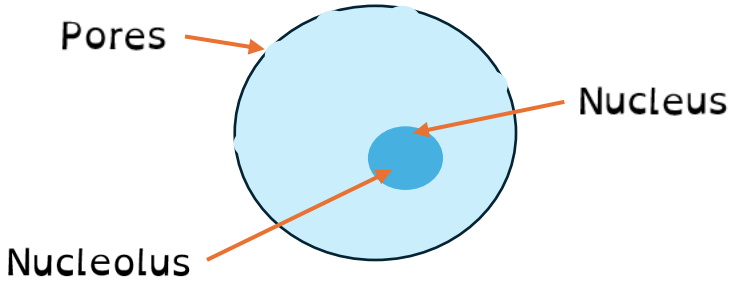
# Nucleus

Contains strands of **DNA** (**D**eoxyribo**n**ucleic **A**cid).

Humans have 46 **chromosomes** with about 25,000 genes.

Genes code for proteins, which control a function in the body.

**Nuclear pores** (holes) allow **RNA** to travel out into the cytoplasm to carry the code from the DNA.

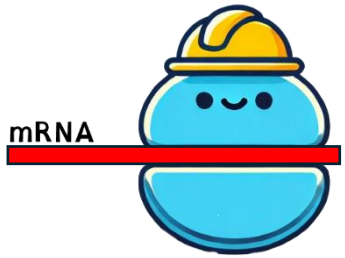



## Nucleolus

The Nucleolus is where **ribosomes** are made.

Ribosomes make proteins for the cell.

This is described in another chapter.

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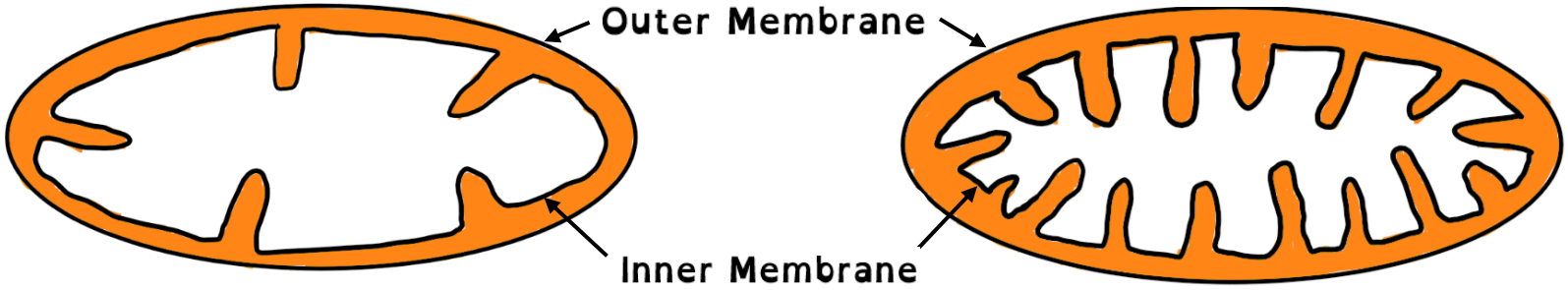
# Mitochondria

These are the **energy factories** for the cell and entire organism. They have their own DNA as they were once a separate living entity. **Respiration** happens in the mitochondria. The more infoldings a mitochondrion has, the more **energy** it makes. When you are sick your mitochondria have less infoldings, so you feel weak. As you get better, you develop more infoldings and have more energy.

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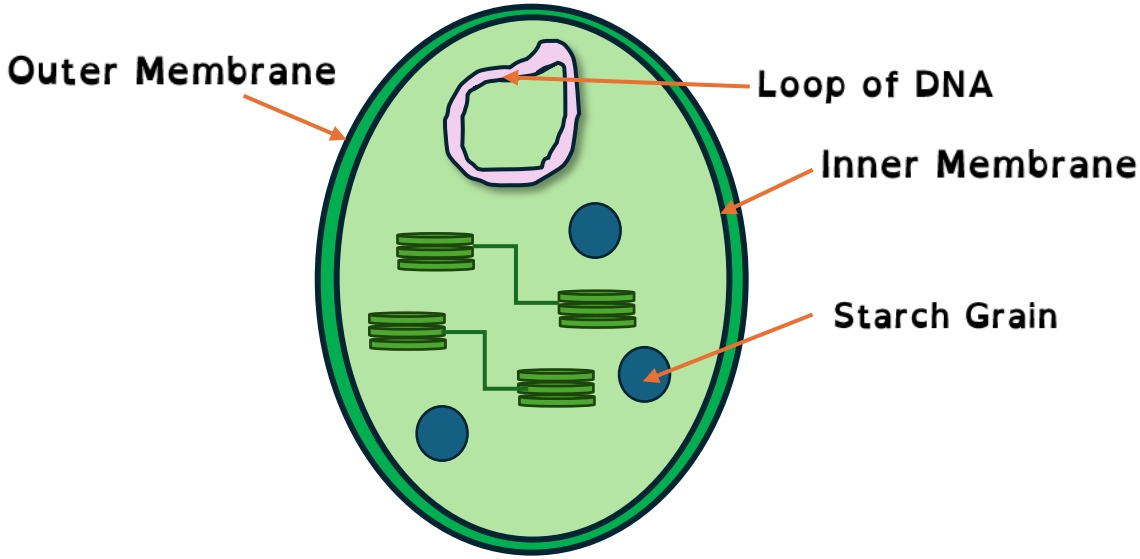
## Chloroplasts

Chloroplasts make **Glucose**. They do this by catching sunlight in a green pigment called **Chlorophyll**. The energy from the sunlight is mixed with $CO_2$ and $H_2O$ to make Glucose ($C_6H_{12}O_6$), which is stored as **Starch** (storage polysaccharide).

**Chloroplasts** have their own DNA, which means they were once a separate living thing from plants.

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# Prokaryotes and Eukaryotes

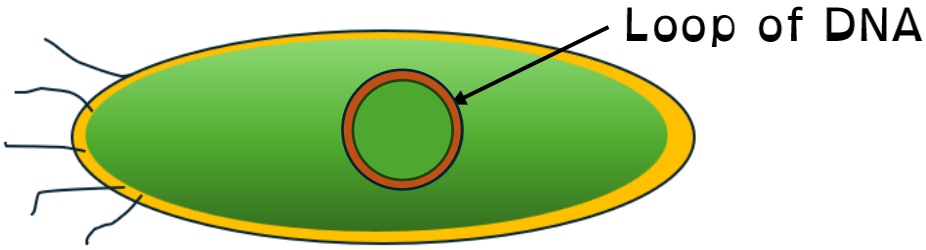
Eukaryotes evolved from prokaryotes around **3 billion** years ago

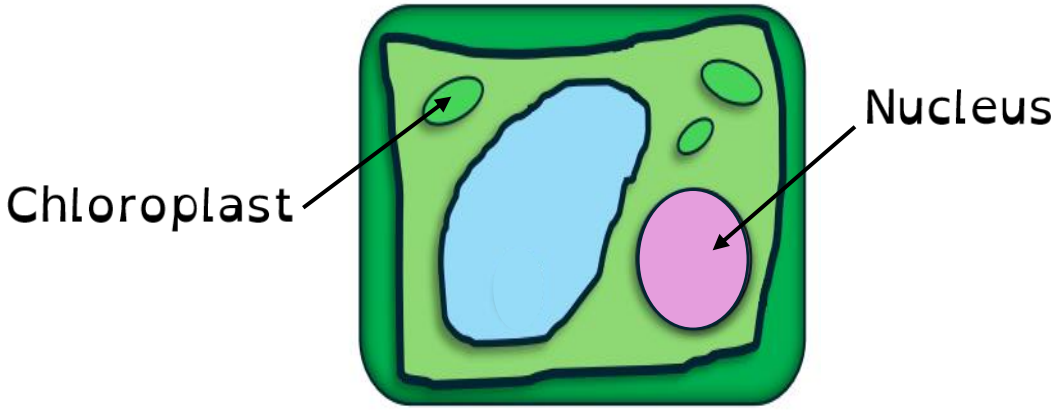
## Prokaryotic cells have:

- No nucleus
- No membrane-enclosed organelles.
- They are single celled.
- DNA is found in a loop.

## Eukaryotic cells have:

- A true Nucleus.
- Membrane-enclosed organelles.
- Are usually multi-celled.

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