Knowledge Organiser: Classification and Plant Cells

Classification of living organisms

Linnaean system of classification

Living organisms are classified into groups depending on their structure and characteristics. This system was developed in the eighteenth century by **Carl Linnaeus**.

The classification of species allows the subdivision of living organisms into smaller and more specialised groups.

Kingdoms

The first division of living things in the classification system is to put them into one of five **kingdoms**.

The **five kingdoms** are:

1. animals (all multicellular animals)
2. plants (all green plants)
3. fungi (moulds, mushrooms, yeast)
4. protists (Amoeba, Chlorella and Plasmodium)
5. prokaryotes (bacteria, blue-green algae

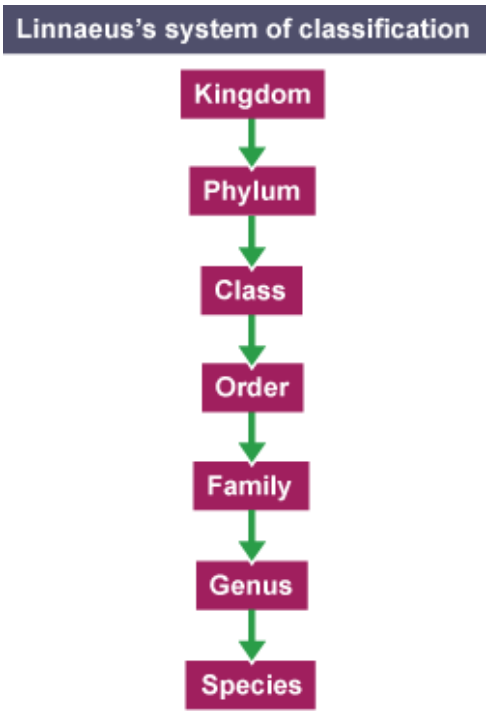
Further divisions

Living things can then be ranked according to:

- **phylum**
- **class**
- **order**
- **family**
- **genus**
- **species**

There are many ways to remember this order, for example using the mnemonic:

Kids **p**refer **c**andy **o**ver **f**resh **g**reen **s**alad



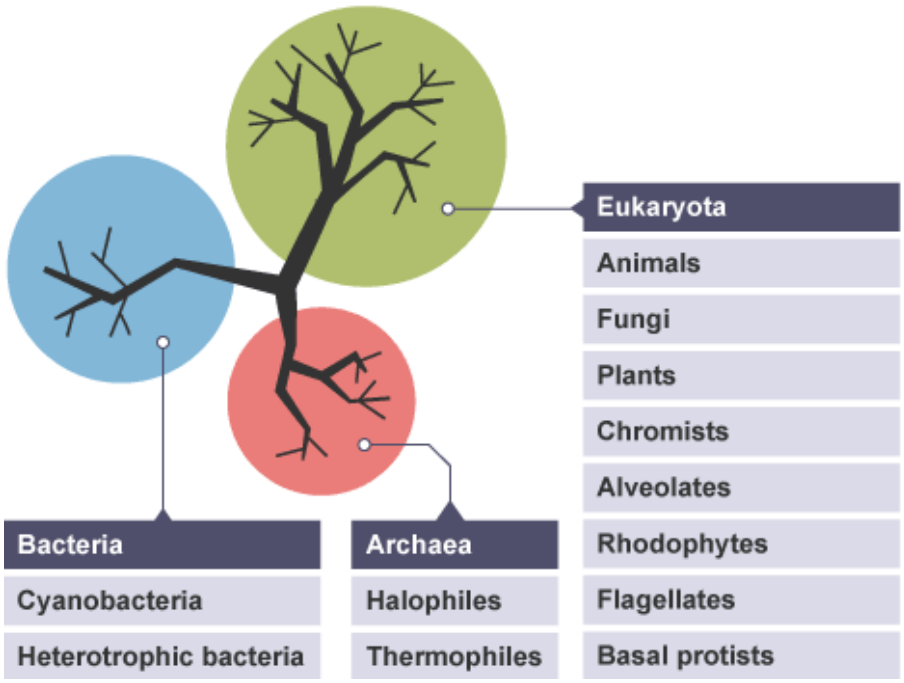
Three-domain system

Technology associated with biology has advanced throughout the years, which has allowed the current classification system to be enhanced by using microscopes, biochemistry and DNA evidence.

Classification systems have continued to be developed by other scientists, such as **Carl Woese** who developed the **three-domain system**. This is based on evidence now available from chemical analysis.

The updated system divides organisms into three domains:

1. **Archaea** (primitive bacteria usually living in extreme environments)
2. **Bacteria** (true bacteria)
3. **Eukaryota** (including protists, fungi, plants and animals)



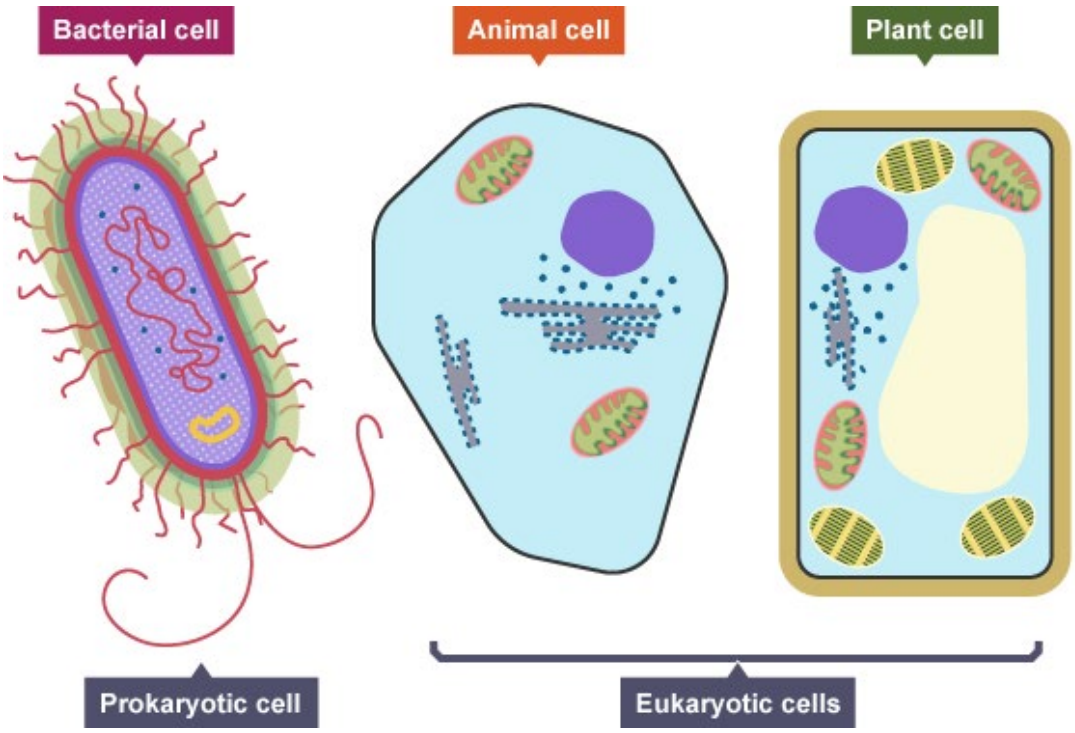
Under this classification system there are now **six kingdoms**.

Organisms that were in the kingdom Prokaryotes (unicellular organisms without a nucleus) are now separated into two domains: the **Archaea** and **Bacteria**.

Organisms from the other four kingdoms (organisms with cells that contain a nucleus) are placed in the third domain: **Eukaryotes** (these include **animals, plants, fungi and protists**).

Prokaryotes and Eukaryotes

- Cells of bacteria (and archaea) are called **prokaryotic cells**.
- Cells of animals, plants and fungi (and protists) are called **eukaryotic cells**.

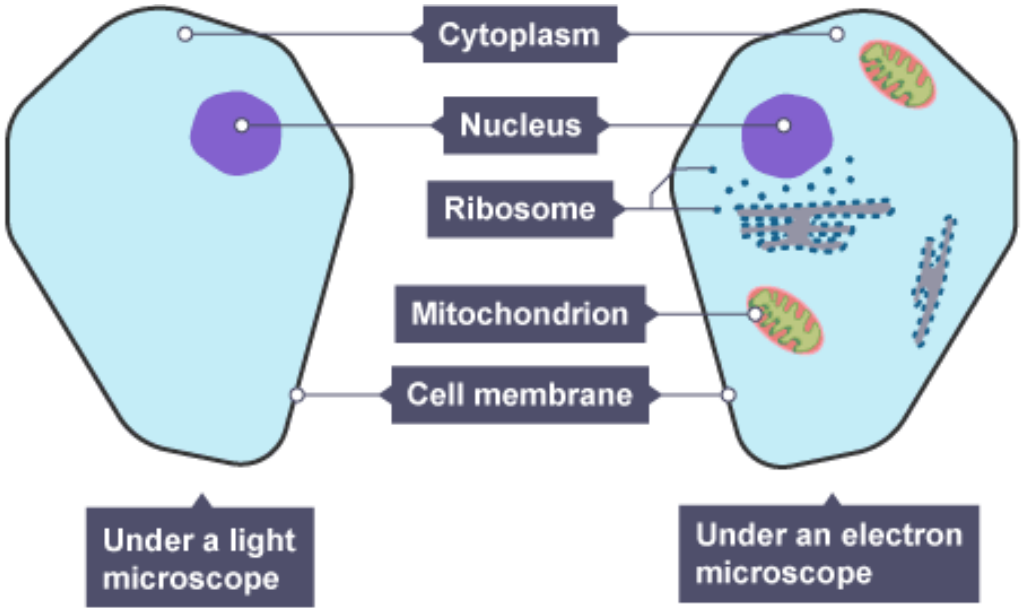


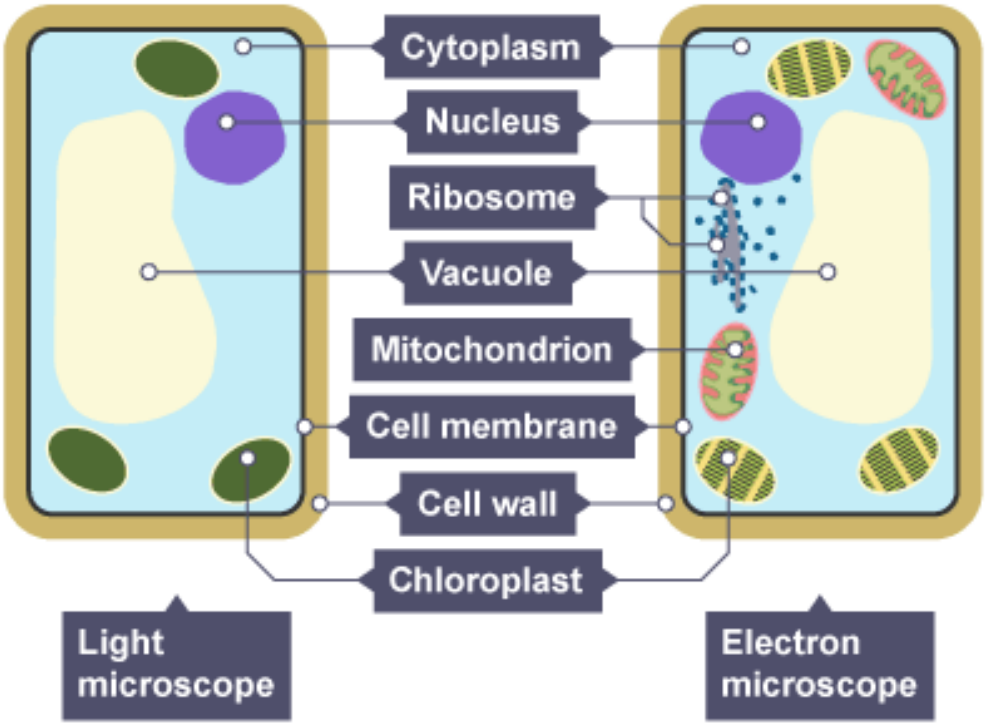
Comparing cell types

	Eukaryotic cell	Prokaryotic cell
Size	Most are 5 μm – 100 μm	Most are 0.2 μm – 2.0 μm
Outer layers of cell	Cell membrane - surrounded by cell wall in plants and fungi	Cell membrane - surrounded by cell wall
Cell contents	Cytoplasm, cell organelles include mitochondria, chloroplasts in plants and ribosomes	Cytoplasm, ribosomes, no mitochondria or chloroplasts
Genetic material	DNA in a nucleus - plasmids are found in a few simple eukaryotic organisms	DNA is a single molecule, found free in the cytoplasm - additional DNA is found on one or more rings called plasmids
Type of cell division	Mitosis	Binary fission

Animal and Plant Cells

Animal and plant cells are BOTH types of **eukaryotic cell**. However, they do have some differences:





Animal and plant cells have certain structures in common.

	Function
Cytoplasm	A jelly-like material that contains dissolved nutrients and salts and structures called organelles. It is where many of the chemical reactions happen.
Nucleus	Contains genetic material, including DNA, which controls the cell's activities.
Cell membrane	Its structure is permeable to some substances but not to others. It therefore controls the movement of substances in and out of the cell.
Mitochondria	Organelles that contain the enzymes for respiration, and where most energy is released in respiration.
Ribosomes	A tiny organelle where protein synthesis occurs.

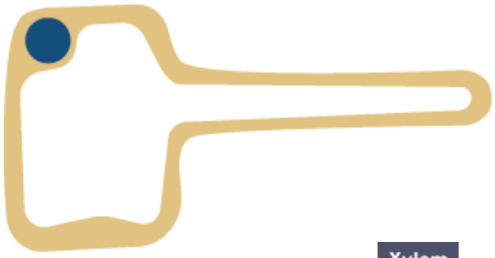
Plant cells also have additional structures:

	Function
Chloroplast	Organelles that contains the green pigment, chlorophyll, which absorbs light energy for photosynthesis. Contains the enzymes needed for photosynthesis.
Cell wall	Made from cellulose fibres and strengthens the cell and supports the plant.
Permanent vacuole	Filled with cell sap to help keep the cell turgid.

Animal cells may also have vacuoles, but these are small and temporary. In animals, they are commonly used to store or transport substances.

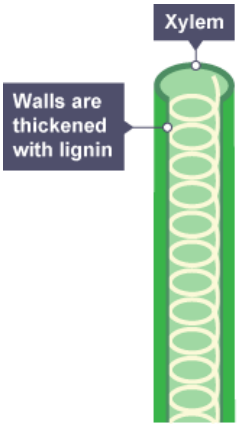
Specialised Plant Cells

Root Hair Cell



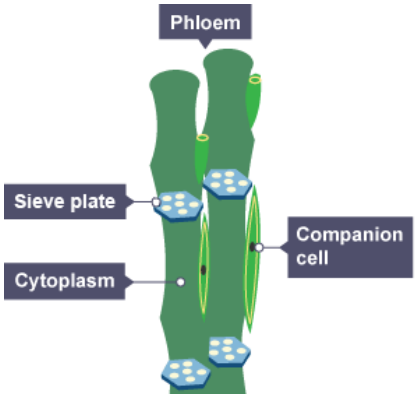
- Absorb water and minerals in the soil.
- Have a **large surface area**, due to their hair-like projections, and **thin walls** which maximises water uptake.

Xylem Cells/Vessels



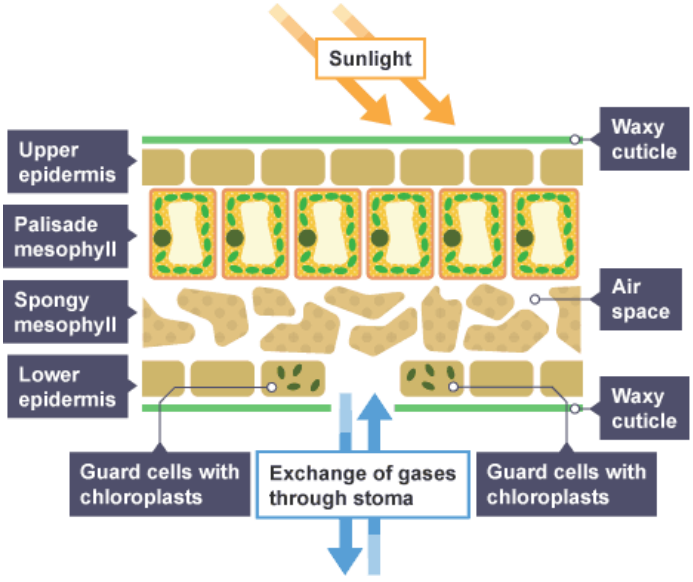
- Carry **dissolved minerals** and **water** from the roots. They also help support the plant.
- No top and bottom walls between xylem vessels, which allows a continuous column of water to run through them.
- Their walls become thickened with a substance called **lignin** to support the plant.

Phloem Cells/Vessels



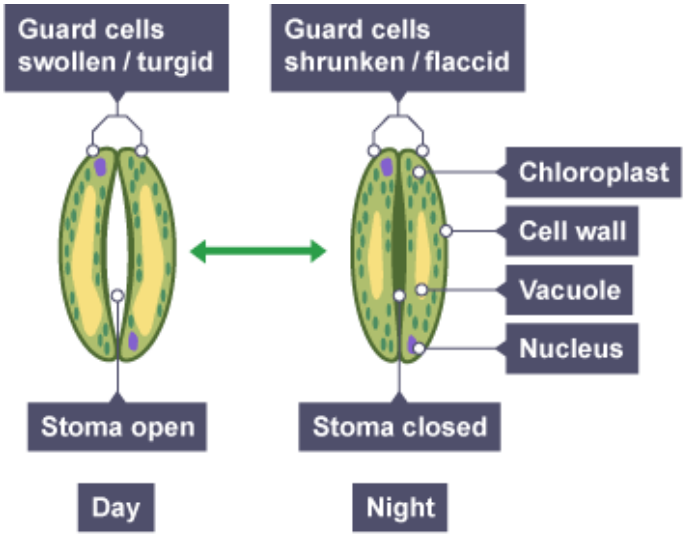
- **Transport nutrients** (dissolved sugars and amino acids) from the source where they are produced (e.g. the leaves) to the sink (e.g. flowers and fruits) where they are used.
- Each **sieve tube** has a perforated end (sieve plate) so **its** cytoplasm connects one cell to the next. **Companion cells** provide energy required to transport substances in the phloem.

Palisade Cell



- **Palisade cells** are found on the upper surface of a leaf. They form **palisade mesophyll tissue**.
- **Absorb light** so are packed with many chloroplasts (site of photosynthesis). They are **arranged closely** together to maximise light absorption.

Guard Cells



- Guard cells are found on the **underside of a leaf** (see diagram above).
- Guard cells **control the size of the stomata.** Stomata are tiny holes found in the underside of leaves. They allow water vapour and oxygen out of the leaf and carbon dioxide into the leaf.
- In bright light the guard cells **take in water by osmosis** and become **plump and turgid**, opening the stomata. In low light the gu**ard cells lose water and become flaccid**, causing the stomata to close.