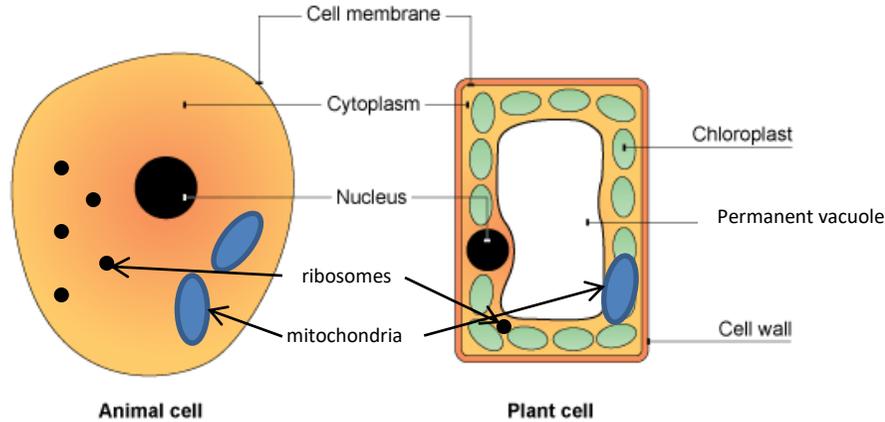


Biology Knowledge Organiser

Topic 3: Threshold Concepts in Biology

Eukaryotic Cells

Eukaryotic cells include all plant and animal cells. Their most important feature is that they have a nucleus, unlike prokaryotic cells.

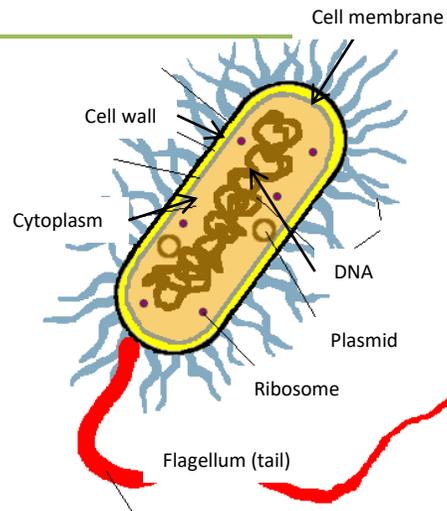


Prokaryotic Cells

Bacteria are prokaryotic cells (all bacteria are single-celled organisms). The most important differences to eukaryotic cells are that they are smaller and their genetic material (DNA) is not enclosed in a nucleus.

Prokaryotic cells have DNA in a loop, and, in addition to the main loop of DNA, they have small loops of DNA called plasmids.

Plasmids allow bacteria to swap genetic information between them.



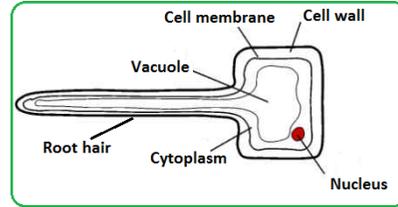
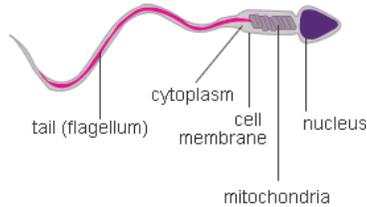
Key Terms	Definitions
Cell	The basic unit of all forms of life.
Eukaryotic Cells	Cells with a nucleus – e.g. plant and animal cells.
Prokaryotic Cells	Bacterial cells; these don't have a nucleus to enclose their genetic material.
Cell Membrane	The border of all types of cell. The cell membrane separates the inside of the cell from the environment. It controls the movement of substances into and out of the cell.
Sub-cellular structure	A part of a cell. (Sub- means less than – so these are the component parts of cells.)
Nucleus	The enclosure for genetic material found in plant and animal cells.
Cytoplasm	The interior of a cell, where most of the chemical reactions needed for life take place.
Mitochondria	The sub-cellular structure where aerobic respiration takes place.
Ribosome	The sub-cellular structure where proteins are made (synthesised)
Chloroplast	A sub-cellular structure responsible for photosynthesis – only found in plant cells and algal cells.
Permanent Vacuole	A sub-cellular structure only found in plant and algal cells – it is filled with cell sap (a store of nutrients for the cell).
Cell Wall	A sub-cellular structure that is never found in animal cells. It is made of cellulose, it is outside the cell membrane and it strengthens the cell.
DNA	The molecule that holds the genetic information in a cell. In eukaryotic cells, it is one linear strand. In prokaryotic cells, the DNA forms a loop.
Plasmid	A small loop of DNA, only found in prokaryotic cells.

Biology Knowledge Organiser

Topic 3: Threshold Concepts in Biology

Multicellular Organisms

You are a multicellular organism, just like all animals, plants and many types of fungus. But, not all your cells are the same. Cells become specialised by **differentiation**, which means they develop new features to help them perform a specific function. E.g. sperm cells and root hair cells.



Tissues are formed when cells with similar structures and functions work together. For example: muscle tissue in animals; phloem tissue in plants.

Organs are formed from multiple tissues working together. For example: the stomach in animals; the leaf in plants.

Organ systems are formed when multiple organs work together. For example: the digestive system in animals; the vascular (transport) system in plants.

Microscopy

Use of a microscope is called microscopy. Microscopes allowed scientists to discover cells and find all the sub-cellular structures.

Because cells and their parts are very small, it is not useful to measure them in metres. Instead, we use small divisions of the metre as follows:

Centimetre = 1/100 metre (10^{-2}). A centimetre is 1 one hundredth of a metre. (cm)

Millimetre = 1/1000 metre (10^{-3}). A millimetre is 1 one thousandth of a metre. (mm)

Micrometre = 1/1 000 000 (10^{-6}). A micrometre is 1 one millionth of a metre. (μm)

Nanometre = 1/1 000 000 000 (10^{-9}) A nanometre is 1 one billionth of a metre. (nm)

Electron microscopes were a vital invention for understanding cells. They have higher magnification and more resolving power than light microscopes, so they let you see smaller structures.

Key Terms	Definitions
Organism	Any living thing: can be made of one cell or be multicellular.
Multicellular	This describes an organism that is made of lots of cells – such as animals or plants.
Specialised Cell	Almost all cells in multicellular organisms have a particular job, or function. While they usually have all the parts labelled on your cell diagrams, they change to suit their functions. This may include developing different sub-cellular structures (e.g. the tail of a sperm cell).
Tissue	A group of cells with similar structures and functions – i.e. a group of specialised cells.
Organ	An organ is a collection (or aggregation) of tissues performing a specific function.
Organ System	Organs don't operate alone: they work together to form organ systems.
Organism (again)	An organism has many organ systems, all contributing to its survival.
Light microscope	A usual school microscope is a light microscope. You can see large sub-cellular structures like a nucleus with it, but not a lot more detail than that.
Magnification	This is the measure of how much a microscope can enlarge the object you are viewing through it.
Resolution	This is the measure of the level of detail you can see with a microscope.
Electron microscope	A type of microscope with much high magnification and resolution than a light microscope. Essential for discovering the smaller sub-cellular structures.

Equation	Meanings of terms in equation
$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$	<p>The image is how it looks through the microscope. The real object is what you are looking at. The image and object must be measured with the same unit, e.g. both in nm.</p>