

Cells

If you take a look down a **microscope**, you might see **cells** — the **microscopic** building blocks of **all life**.

Plant and Animal Cells have Similarities and Differences

Animal Cells

One of the big differences between plant and animal cells is the **structures** in the cells. Most **animal** cells have the following structures — make sure you know them all:

1) **Nucleus** — contains **genetic material** that controls the activities of the cell.

3) **Cell membrane** — holds the cell together and controls what goes **in** and **out**.

2) **Cytoplasm** — gel-like substance where most of the **chemical reactions** happen. It contains **enzymes** (see page 31) that control these chemical reactions. It also contains other **cell structures**.

4) **Mitochondria** — these are where most of the reactions for **aerobic respiration** take place (see page 78). Respiration transfers **energy** that the cell needs to work, so mitochondria are found in **large numbers** in cells with **high rates** of **metabolism**. Almost **all** cells except **prokaryotes** (e.g. bacteria) have mitochondria.

5) **Vesicles** — fluid-filled sacs surrounded by a membrane. They **transport substances** in and out of the cell, and between structures in the cell.

6) **Rough endoplasmic reticulum** — a system of membranes enclosing a fluid-filled space. The surface is covered with **ribosomes** (which are involved in protein synthesis — see p.126). Almost **all** cells except **prokaryotes** have **rough endoplasmic reticulum**.

Supplement

Supplement

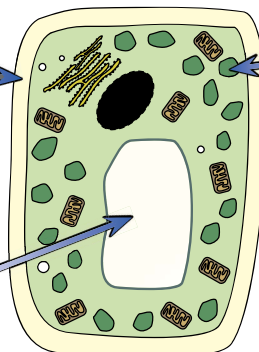
Plant Cells

Plant cells usually have **all the structures** that **animal** cells have, plus a few **extra** things that animal cells **don't** have:

1) **Rigid cell wall** — made of **cellulose**. It **supports** the cell and strengthens it.

3) **Vacuole** — contains **cell sap**, a weak solution of sugar and salts. It helps to keep the cell **plump** and **swollen**.

2) **Chloroplasts** — these are where **photosynthesis** occurs, which makes food for the plant (see page 36). They contain a **green** substance called **chlorophyll**, which absorbs the **light** needed for photosynthesis.



Specialised Cells

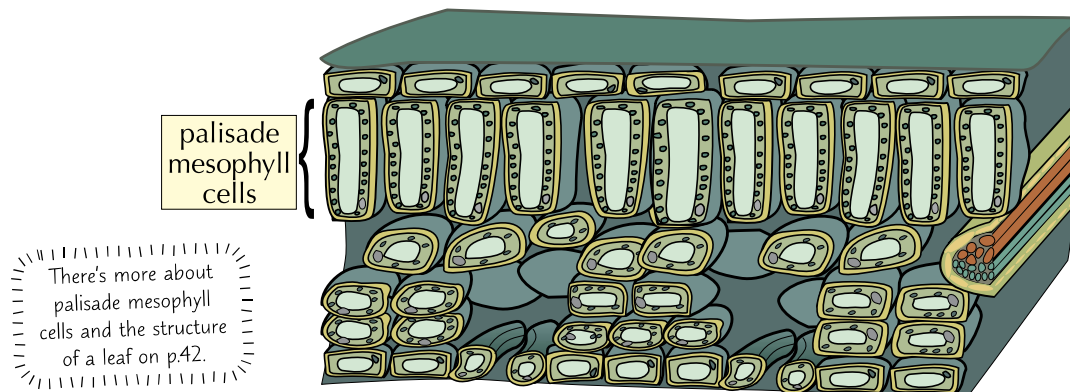
The previous page shows the structure of some **typical cells**. However, most cells are **specialised** for a particular function, so their **structure** can vary...

Different Cells Have Different Functions

- 1) **Multicellular organisms** are organisms that contain lots of different **types** of cells (i.e. cells with different **structures**).
- 2) Cells that have a structure which makes them **adapted** to their function are called **specialised cells**.
- 3) You need to know examples of how some specialised cells are **adapted** to their functions.
Let's take a look at palisade mesophyll cells first:

Palisade Mesophyll Cells are Specialised for Photosynthesis

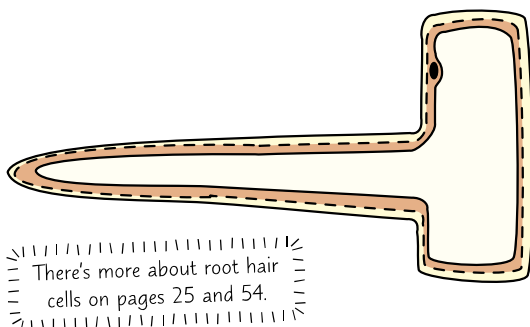
- 1) Palisade mesophyll cells are where most of the **photosynthesis** happens in a plant **leaf**.



- 2) Palisade mesophyll cells are found in a **layer** near the **top** of the leaf. Being near the top means they can get the most **light** for photosynthesis.
- 3) The cells have **lots of chloroplasts** (the structures where photosynthesis takes place).
- 4) They're also **long** and **thin**, so more of them can be packed into the same space.

The upper layers of the leaf are transparent so that light can pass through it to the palisade mesophyll layer.

Root Hair Cells are Specialised for Absorbing Water and Minerals

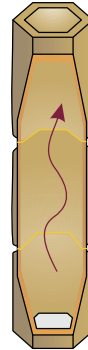


- 1) Root hair cells are cells on the surface of plant roots, which grow into long "**hairs**" that stick out into the soil.
- 2) This gives the plant a **big surface area** for absorbing **water** and **mineral ions** from the soil.

Specialised Cells

Xylem Cells are Specialised for Transporting Water

- 1) **Xylem cells** form xylem vessels (tubes). These are the water **conduction vessels** in a plant — they **transport water** around the plant.
- 2) Xylem vessels are **strengthened** with a material called **lignin**. This allows them to provide the plant with **support**.
- 3) The cells are long and joined **end to end** to form the xylem vessels.
- 4) The cells are **hollow** in the centre, so that water can **flow through** them.

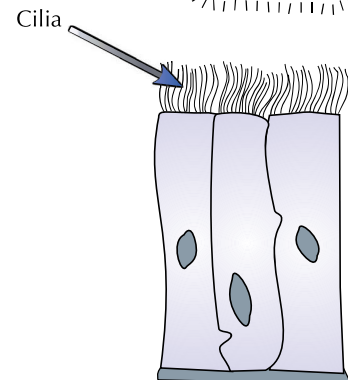


There's more about xylem vessels on page 53.

Ciliated Cells Are Specialised for Moving Materials

- 1) Ciliated cells **line the inner surfaces** of some animal organs.
- 2) They have **cilia** (hair-like structures) on the **top surface** of the cell.
- 3) The function of these **ciliated cells** is to **move substances** — the cilia beat to **move** substances in **one direction**, **along the surface** of the tissue.

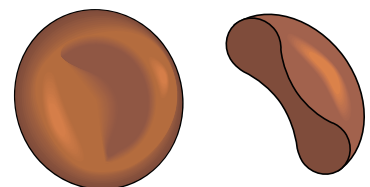
In the **trachea** and **bronchi** (tubes that carry air to and from your lungs), ciliated cells help to move **mucus** (and all of the particles from the air that it has trapped) up to the **throat** so it can be **swallowed** and **doesn't reach** the lungs.



There's more about ciliated cells on p.75.

Red Blood Cells are Specialised to Transport Oxygen

- 1) The job of red blood cells is to transport **oxygen** from the lungs to all the cells in the body.
- 2) Their shape is a **biconcave disc** (a disc that's squashed in the centre) — this gives a **large surface area** for absorbing **oxygen**.
- 3) They contain a red pigment called **haemoglobin**. This substance allows red blood cells to carry oxygen.
- 4) They **don't** have a nucleus — this allows more room to carry oxygen.

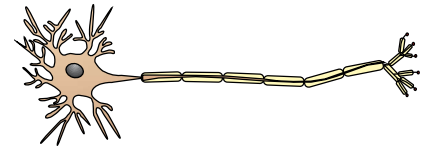


There's more about red blood cells on p.63.

Specialised Cells

Nerve Cells are Specialised for Impulse Conduction

- 1) The function of **nerve cells** is to **conduct** (carry) **impulses** (electrical signals) from one part of the body to another.
- 2) These cells are **long** (to cover more distance) and have **branched connections** at their ends to **connect** to other nerve cells and form a **network** throughout the body.

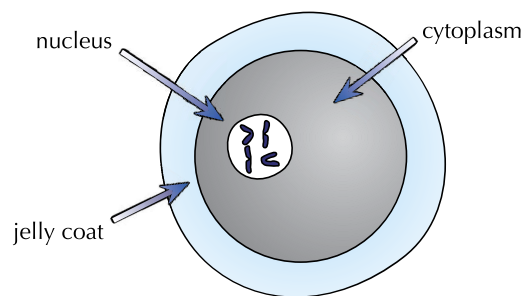


There's more about nerve cells on p.87.

Sperm and Egg Cells are Specialised for Reproduction

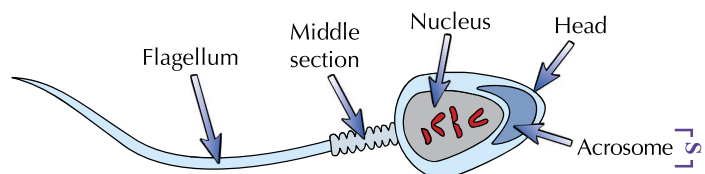
- 1) The main functions of an **egg** are to carry the **female DNA** and to **nourish** the **developing embryo** in the early stages of its development.
- 2) An egg cell is adapted to nourish the embryo because it is **large** and contains **nutrients** in the **cytoplasm** to feed the embryo.

There's more about sperm and egg cells on page 112.



- 3) The **function** of a sperm is to **transport** the **male's DNA** to the **female's egg**. This is how it's adapted to its function:

- 1) A sperm cell has a **long flagellum** (tail) and a **streamlined head** to help it **swim** to the egg.



- 2) It has **enzymes** in its 'head', which are needed to **digest** through the **membrane** of the egg cell. These enzymes are stored in the **acrosome**.

- 3) It has lots of **mitochondria** (p.11) in the middle section to provide the **energy** (from respiration) needed to **swim** this distance.

Supplement



Cells have the same basic structures but are often specialised

Make sure you know the structures of a typical animal and plant cell. Try copying out the diagrams and see if you can remember all the labels. And remember, specialised cells might look different from these typical cells and not all of them will contain all of the structures.

Levels of Organisation

Multicellular organisms contain lots of cells. These need some form of organisation.

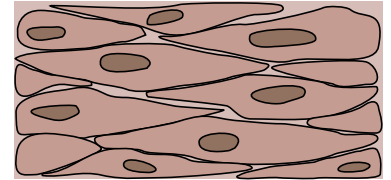
Similar Cells are Organised into Tissues

- 1) You need to know the definition of a **tissue**:



A tissue is a group of similar cells that work together to carry out a shared function.

Muscular tissue



- 2) A tissue can include more than one **type** of cell.

In mammals (like humans) an example of a tissue is **muscular tissue**. This **contracts** (shortens) to **move** whatever it's attached to. E.g. when you breathe in, **intercostal muscles** between the ribs contract to move the ribs upwards (see page 74).

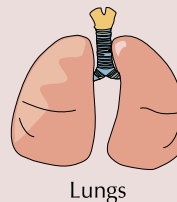
Tissues are Organised into Organs

You need to know the definition of an **organ**:



An organ is a group of different tissues that work together to perform specific functions.

Lungs in mammals and **leaves** on plants are two examples of **organs** — they're both made up of several **different tissue types**. The function of the lungs is **gas exchange**. Leaves have several functions, including carrying out most **photosynthesis**.



Lungs



Leaves

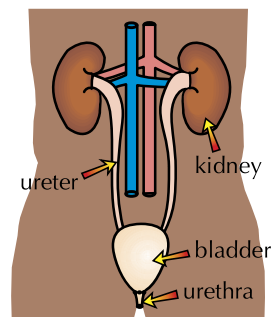
Organs Make Up Organ Systems

You need to know the definition of an **organ system**:



An organ system is a group of organs working together to perform body functions.

For example, in mammals, the **urinary system** is made up of organs including the kidneys, ureters, bladder and urethra. Its function is the **removal** of **waste** from the body.



The Urinary System

Remember — cells, tissues, organs, organ systems

It's important to understand the levels of organisation in organisms. Read the page again if you need to.