

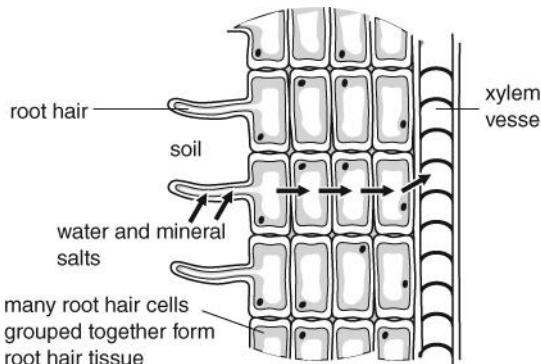
## Photosynthesis

**Photosynthesis** is a series of **chemical reactions** that we can summarise using a **word equation**. Energy and **chlorophyll** are needed for it to happen. The energy is transferred by light (usually from the Sun) and becomes stored in glucose.



## Getting water

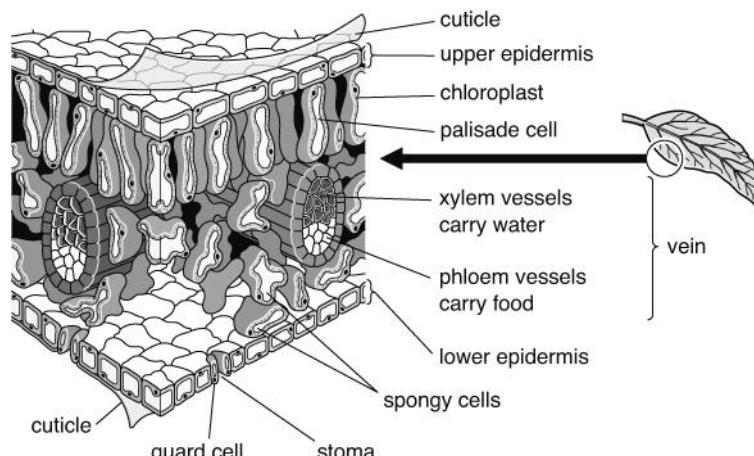
Water is taken out of the soil by the roots. Roots are **adapted** to their **function** by being branched and spread out to help them to **absorb** water from a large volume of soil. They also have **root hair cells**, which have a large surface area to help them absorb water quickly. The water flows up **xylem vessels** (made of hollow cells) to the leaf.



Water is also needed because **mineral salts** are dissolved in it. These keep plants healthy. For instance, plants need **nitrates** to make **proteins**. Water also stops plants **wilting** by filling up their cells, and it can keep their leaves cool.

## Getting carbon dioxide

Air, containing carbon dioxide, **diffuses** into leaves through small holes called **stomata**. Leaves are thin so that the carbon dioxide does not need to go very far before reaching the cells that need it. Increasing the amount of carbon dioxide around a plant can often speed up photosynthesis.



## Getting light

Many leaves are wide so that they have a large surface area to trap as much light as possible. They are also arranged so that they do not shade one another.

Most photosynthesis happens in the **palisade cells**, which are found near the upper surface of leaves. Palisade cells are packed with **chloroplasts**. Chloroplasts contain **chlorophyll**, a green chemical that absorbs energy transferred by light and uses it to power photosynthesis. Increasing the amount of light can often speed up photosynthesis.

## Aerobic respiration

Plant cells release the energy stored in glucose using **aerobic respiration** (another series of chemical reactions):



All living cells need energy and so all living cells respire. Aerobic respiration happens all the time, but photosynthesis can only happen when there is light.

## Uses of glucose

Glucose is a type of sugar. It is used for three things:

- respiration to release energy
- making other substances that act as stores of energy (e.g. starch), which can be turned back into glucose for respiration when needed
- making new materials for growth, e.g. cellulose (for cell walls), lipids (e.g. for cell membranes) and proteins (e.g. for enzymes). To make proteins, mineral salts called **nitrates** are needed.

New substances made by a plant are carried around the plant in **phloem vessels**.

## Farming

Modern farming methods can cause environmental problems.

What is done	Why it is done	Problems this causes
land is cleared of hedges and trees	to create more land for crops and make it easier for machinery to move around	Destroys habitats. Lack of roots can cause soil erosion.
pesticides (e.g. <b>herbicides</b> , <b>insecticides</b> ) are used	to kill pests that compete with or harm the crops	Can kill useful organisms as well as pests. Damages food webs.
fertilisers are used	they contain mineral salts that help plants to grow and increase the yield	Can wash into streams and rivers and cause pollution so that the organisms in the water die.
varieties	varieties of plants are chosen that produce the highest yield	The planting of huge areas of a single variety reduces <b>biodiversity</b> .

## Breeding varieties

Farmers and plant breeders may choose or 'select' a plant with certain characteristics.

This organism is then used to breed from. The offspring that have the best of these characteristics are then bred from again. This is called **selective breeding** and is how many varieties are created.

Sometimes two different varieties are bred together to try to produce offspring with characteristics from both varieties. This is called **cross-breeding**.