

Chapter 25 - Transport in Plants

Flowering plants are made up of roots, stems, leaves and flowers.

Roots

The roots grow down towards gravity (Geotropism)

They anchor the plant to give support

They take in water and minerals

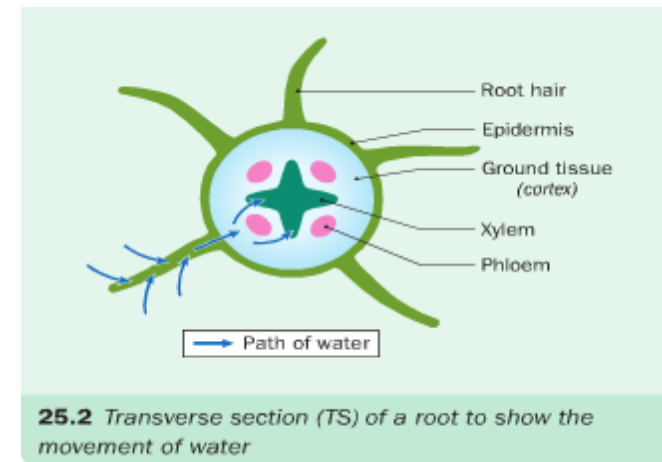
They can store food, e.g. Carrots

Stem

The stem supports the leaves and flowers.

It carries water and minerals from the roots to the shoots.

It carries food from the leaves all around the plant.



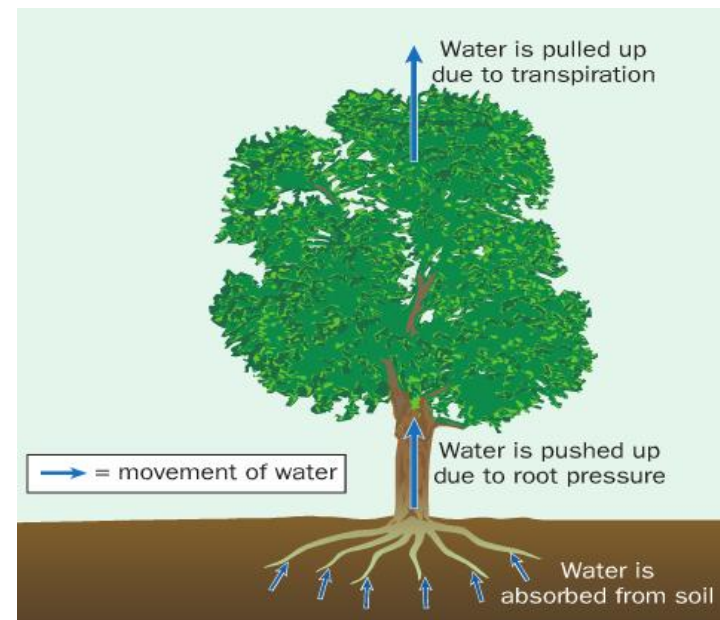
Water transport in Plants

Xylem - carries water and dissolved minerals from root to leaf.

Xylem is made of cells like straws (**vessels**) that can let water move up through them. The water moves in a stream from the roots, up through the plant into the leaves and out of tiny pores under the leaves called 'stomata'.

This movement of water is called the '**transpiration stream**'.

Transpiration - is the loss of water vapour from the surface of a plant.



Mineral uptake by diffusion

Plants use active transport (needs energy) to take in minerals from the soil.

McGraw Hill Mineral Uptake



The diagram illustrates a cross-section of a plant root. The root is covered in numerous fine, hair-like structures called root hairs. A central part of the root is shown in a semi-transparent view, revealing internal cellular structures. The background is a soft, orange-hued gradient, suggesting the soil environment.

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Most of the water and minerals absorbed by plants come in through root hairs, which collectively have an enormous surface area.

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Root Pressure

Water is drawn into the root hairs and root cells by **Osmosis**. Water keeps moving into the cells and moves from cell to cell. The cells become full and turgid and the water moves up the plant. Osmosis 'pushes' the water up to the height of about 1 metre. This is called **root pressure**.

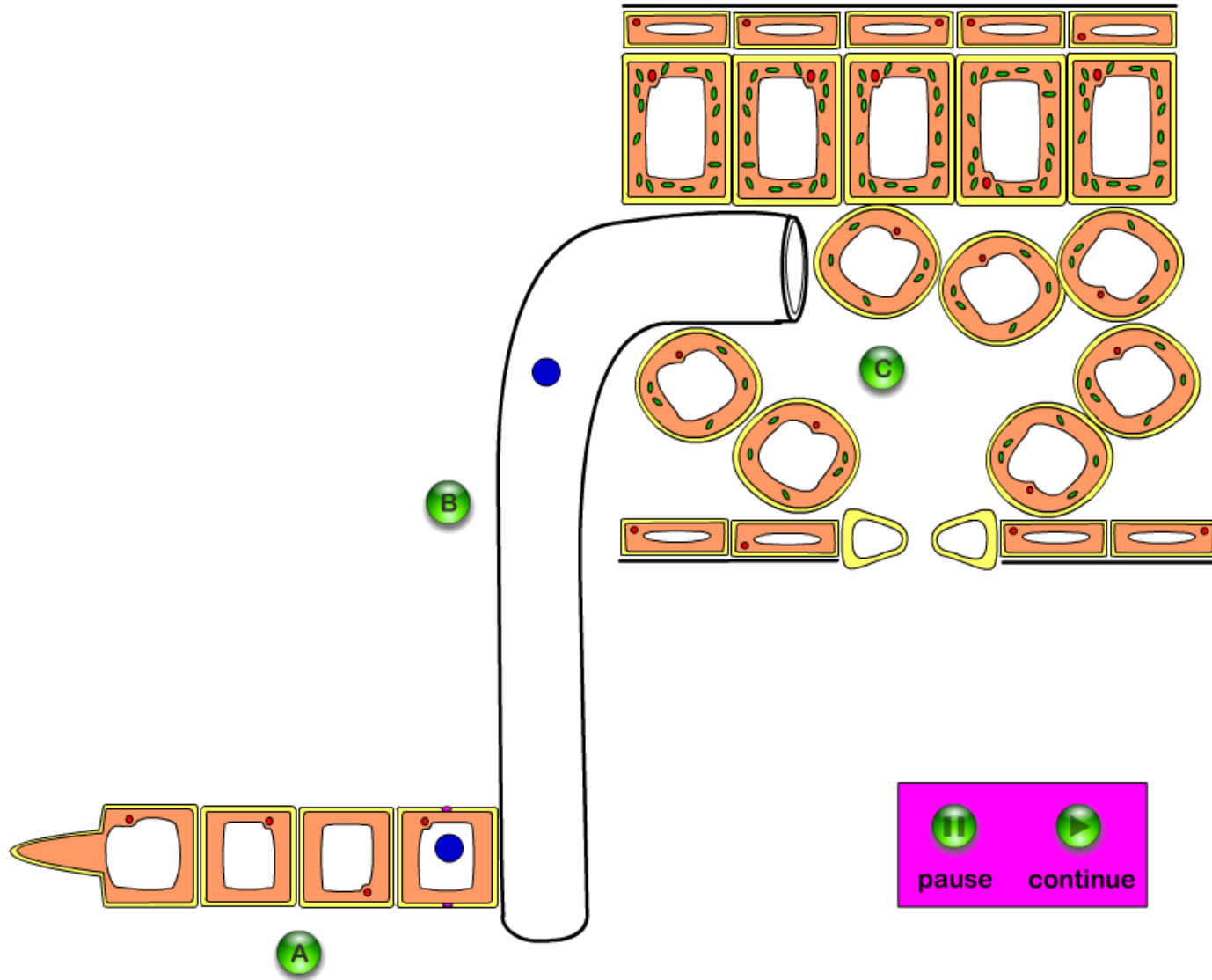
Root pressure is not strong enough to get water up to the top of tall trees. For this the plants use **evaporation**.

The evaporation pulls the water out of the plant and pulls up the next drop of water to be evaporated.

This is called the **Cohesion-tension model** of water transport.

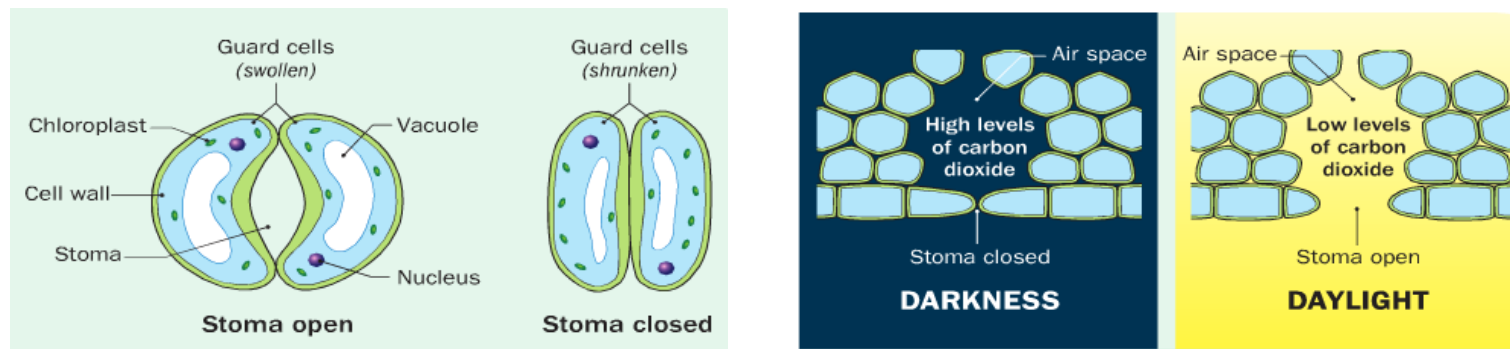


A cut stem shows root pressure.



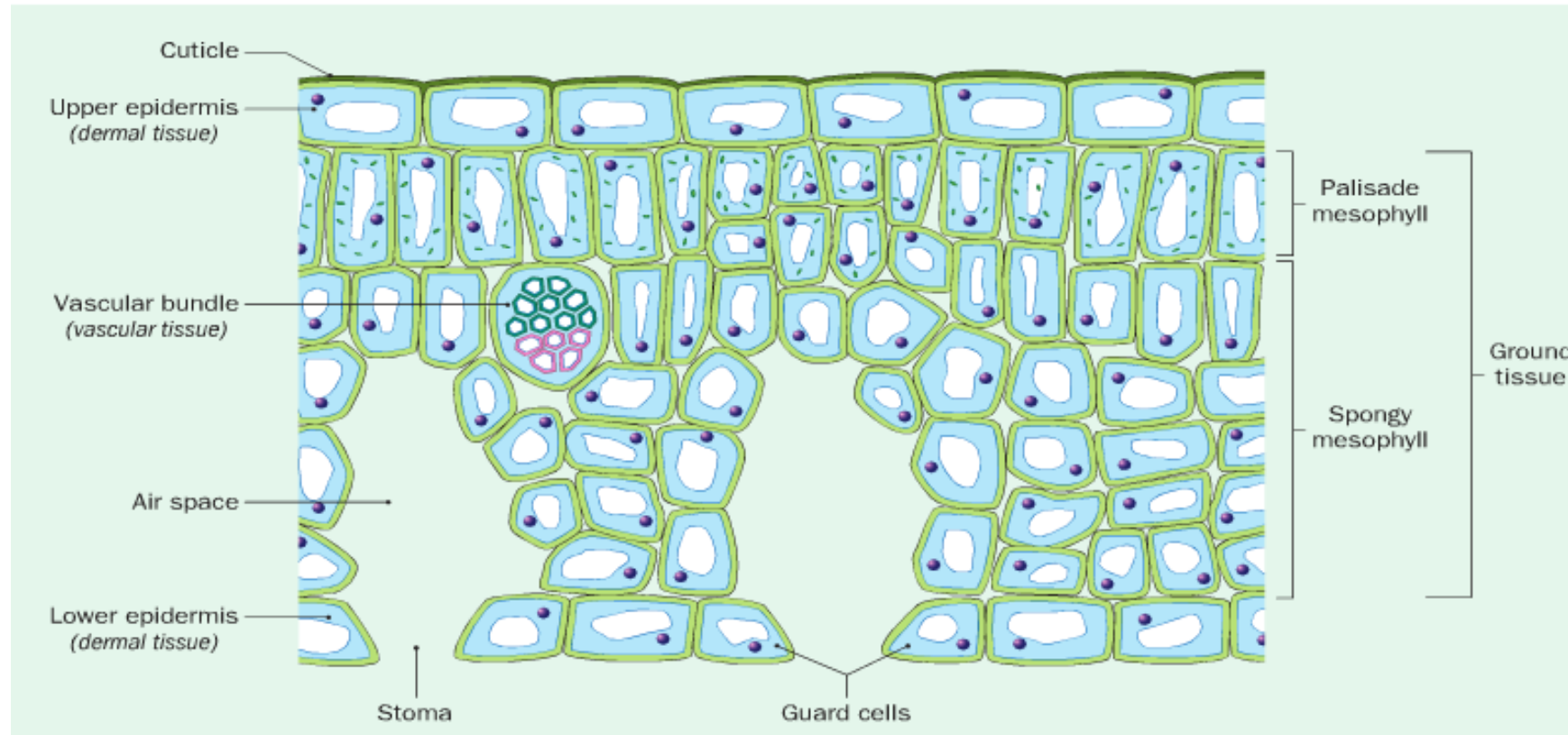
Control of Transpiration by the Leaves

1. The waxy cuticle on the leaf surface stops water loss.
2. Stomata are underneath the leaf to reduce evaporation.
3. Guard cells open during the day and close at night.
They can also close by the day when,
 - > the plant loses too much water,
 - > the temperature is too high (too much evaporation)
 - > the wind is too strong (too much evaporation).



Carbon Dioxide is the main controller of the stomata. The guard cells **fill** with water and become **turgid**. This keeps the stomata **open**. If the guard cells have **little** water then they **collapse**. This **closes** the stomata to prevent more water loss.

Transverse section of a leaf



Carbon Dioxide and Glucose

Photosynthesis takes place in the mesophyll (ground tissue) in the leaf.

Sources

Most carbon comes from CO_2 in the **air**. It diffuses into the leaf by the stomata. We can measure this uptake and it's called the apparent rate of photosynthesis.

The other source of CO_2 is from **respiration**. The gas is **recycled** in photosynthesis.



The real rate of photosynthesis is got by adding the amount taken in from the atmosphere (apparent rate) to the amount produced by respiration.

Products of photosynthesis

The **Oxygen** produced by the leaves is either released by diffusion or is recycled in **Respiration**.

The **Glucose** produced is used in **respiration** or stored as **starch** in the spongy mesophyll.

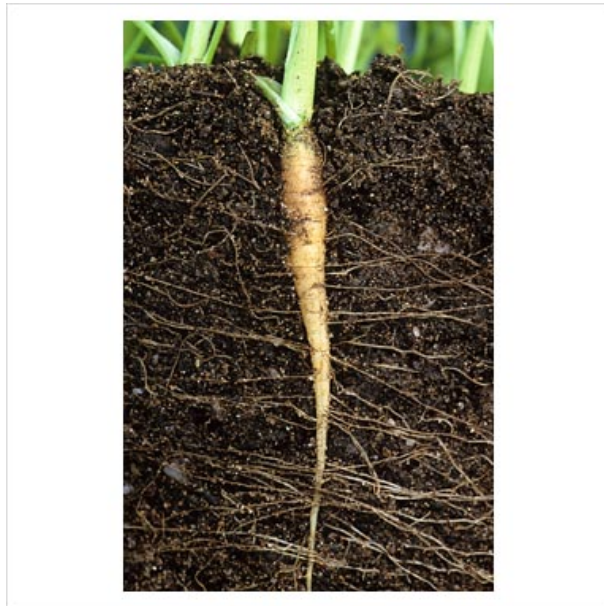
The **Glucose** can also be moved by **diffusion** into the **phloem** sieve cells. From here it can be transported around the plant for **energy** or **storage**.



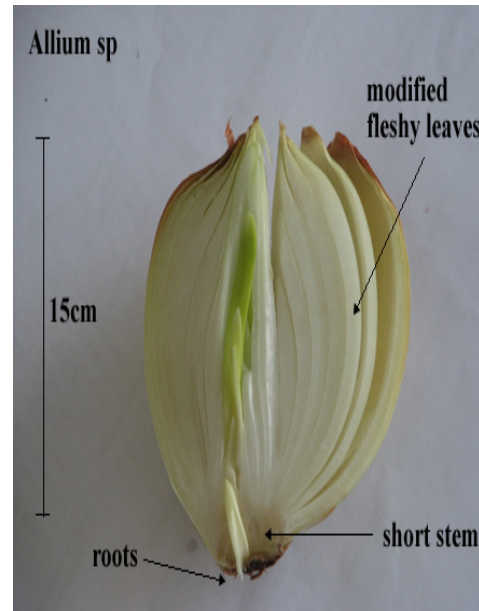
Modified Plant Food Storage Organs

Modified organs are organs that have been changed in order to store more food for the plant.

Carrot Tap-roots



Modified leaves in onions



Modified stems in potato

