BBC BITESIZE

Hello, I'm Dr Alex Lathbridge and this is Bitesize Biology.

This is the last episode of our six-part series on the organisation of plants and animals.
In this episode we're going to talk about plants and how they are organised, the different tissue structures in leaves, and we're going to revisit those two transport tubes in plants - the xylem and the phloem - and talk about what they do, transpiration and translocation.

So where to start? Well the first thing to know is that plants have a similar organisational structure to animals: cells, tissues, organs and organ systems (that's episode one stuff, so go back and have a listen if you don't remember.)

Plants' organs are leaves, roots and stems. Yes, the leaf of a plant is actually one of its organs. The leaf is the main organ for photosynthesis, which is how plants make food, by absorbing energy from the sun and turning it into glucose, a sugar. Just like us humans, plant organ systems work together to transport different substances around the plant.

So the leaf is an organ. And we remember what an organ is? It's a group of different types of tissues in the same place, all working together to complete a function.

So let's imagine that we're taking a microscope and zooming in on a little cross section of a leaf, to see all the different layers of tissue inside it. Each layer has adaptations for its functions: photosynthesis and gas exchange. Each layer is a bit like a big sponge cake, with different fillings.

Now you'll need to remember the layers, so I really suggest grabbing a pen and writing it down, this always confused me, so it might help you to draw your own diagram.

The top layer of a leaf is the upper epidermal tissue. This is very thin and transparent, so it allows as much light in as possible for photosynthesis to happen.

The leaf's epidermal tissue is coated in a waxy cuticle. And so that makes leaves look shiny and smooth, and this helps them to remain waterproof.

Then below the epidermis there's the palisade mesophyll tissue. This layer is packed with lots of chloroplasts, where photosynthesis happens. (Now if you don't remember what photosynthesis is, you can go back to the series on The Cell and listen to episode 6.) The palisade mesophyll tissue is right at the top of the leaf to absorb as much light as possible and increase the rate of photosynthesis.

Now if you need to remember this, palisade mesophyll tissue is filled with chloroplasts. And what are chloroplasts filled with? Chlorophyll.

Below the palisade mesophyll tissues are spongy mesophyll tissues. Now this layer of tissue has big gaps, or air spaces, which mean that gases can diffuse in and out really easily.

Running up and down the plant, so that's through the roots, stems and leaves, are two special tubes: the xylem and the phloem (you can go back to the series on The Cell and episode three if you've forgotten about them.)

These are the plant's plumbing system. They transport substances like nutrients, water and minerals through the whole plant. We'll be looking at them in more detail in a little bit...

And finally, the lower epidermal layer. This has special holes in it to help with gas exchange and these holes are called stomata that open and close. This is where gases like carbon dioxide enter and oxygen leaves the leaf. The stomata open and close using guard cells

As the stomata open to let gases out, water gets lost by the process of transpiration. So closing the stomata helps to control water loss.

So let's look at the xylem and phloem – the plant's plumbing system.

Plants are equipped with two special tubes to carry water and nutrients to the rest of the plant. In our series on The Cell we looked at the features of the xylem and phloem that make them specially adapted to their functions (and you should listen to that series again if you need a refresher). Now we're going to look at how substances move around the xylem and phloem.

The phloem's main job is to move food, in the form of liquid sugar produced by photosynthesis in the leaves, known as sap, to different areas of the plant. Food is transported up and down the plant in a process called translocation. Literally transpiration moving from one location to another.

The xylem is a column of dead cells with ends eroded away to make tubes, where water and minerals can move up from the roots, through the xylem and to the leaves. This movement of water through the xylem is called.

Think of transpiration as one long column of water constantly being pulled up through the plant, all the way from root to leaf. When the water from inside a leaf evaporates into the air, this causes a shortage of water in the rest of the plant. So water then gets drawn up and through the xylem to replace this lost water. This means that more water gets drawn up from the root, so there are never gaps.

Think of this column of water as one long line of water molecules all linking arms, where they never let go. Transpiration is not driven by the roots, it's not the roots pushing water up, it's the other way round. Water evaporates out of the leaf, and the water column is pulled up towards the xylem.

You need to make sure that you get the spelling right, because these things are spelled weirdly:
Xylem – x-y-l-e-m – xylem – that's for water, transpiration

Phloem – p-h-l-o-e-m – phloem - for food, and that's translocation

Finally there a few factors that can affect how well transpiration works and we have to consider

them:

1. Temperature. When the temperature is higher, molecules move faster, so water evaporates from the leaves quicker, increasing the rate of transpiration.

2. Humidity. Humidity is how much water vapour is in the air. When there is low humidity, it's very dry, transpiration speeds up. Because the diffusion of water between the leaf and the air increases, because there's a high concentration gradient – lots of water in the leaf, no water in the dry environment. So water gets sucked out.

3. Air movement. The movement of air around a plant can affect transpiration. If an environment has good airflow (a fun way of saying windy), the transpiration rate will increase. If there is very little wind, the transpiration rate will decrease because water vapour will stay surrounding the leaf, so there is a low concentration gradient between the leaf and the air.

4. Light intensity. The more light there is, the more photosynthesis will occur. During photosynthesis, stomata open and so more water diffuses out of the leaf.

I'm Dr Alex Lathbridge and this is Bitesize Biology – to hear more, search Bitesize Biology on BBC Sounds