

# MOVEMENT OF FLUIDS

Fluids, such as water, need to reach all the parts of a plant for its cells to stay healthy. A plant's fluids are carried by its **vascular tissue**, made up of xylem and phloem. The **xylem** carries water from the roots to the leaves, and the **phloem** carries dissolved foods from the leaves to all other areas. The movement of fluids inside a plant is called **translocation**.

## WATER MOVEMENT

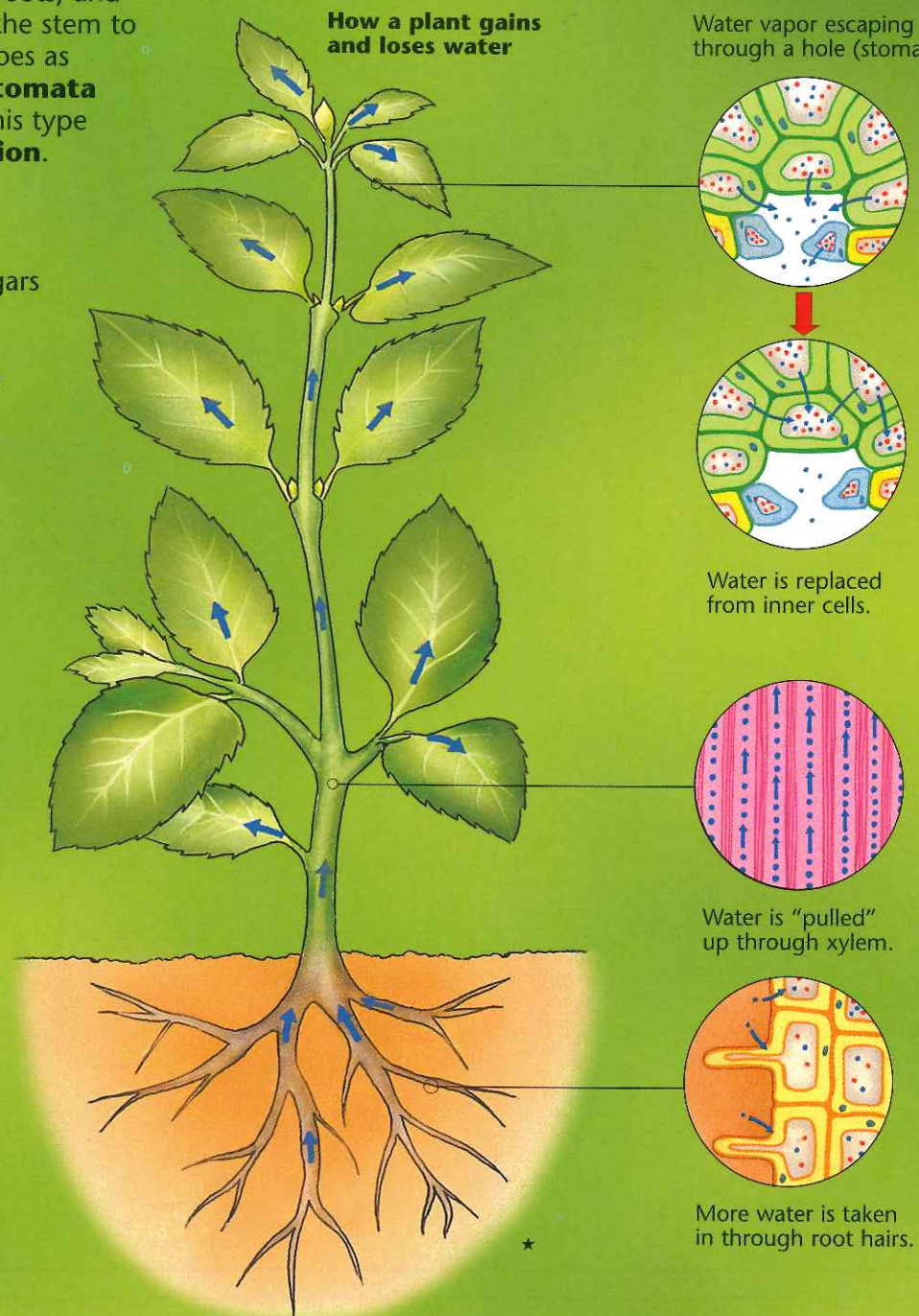
Water is taken into a plant by its roots, and travels up in the xylem, through the stem to the leaves. There, some of it escapes as vapor through tiny holes called **stomata** on the underside of the leaves. This type of water loss is called **transpiration**.

As the outer leaf cells lose water by transpiration, the concentration of minerals and sugars inside them increases. So water from the cells further in passes into the outer cells, to replace the water that has been lost.

The inner cells in turn take water from cells further down, and so on. Water is "pulled" up through the plant from the roots, which take in more from the soil. This upward movement of water is called a **transpiration stream**.

At certain times, such as at night or on a damp, humid day, the rate of transpiration slows down. However, water from the soil continues to enter the roots. This is because it still has a weak attraction to the xylem walls, which drags it upward. This is called **capillary action**.

As water is taken into the roots, **root pressure** begins to build up. This is strong enough to push the water up the stem and into the stream.



Here you can see water droplets oozing out of tiny holes around the leaf's edge.

## LOSING LIQUID

If a plant does not lose enough water vapor by transpiration, and root pressure is still pushing water up the stem, the plant may also lose water in liquid form. Droplets are forced out of the plant through tiny holes at the tips or along the edges of leaves. This type of water loss is called **guttation**.



Water containing blue ink

### See for yourself

To see how fluids move inside a plant, put some white flowers, such as carnations, into water containing blue ink. After a few days, their petals will have turned blue. This is because the inky water has been transported around the plants.

The lighter flowers in this picture have been in the dye for one day. The darker flowers have been in the dye for three days.

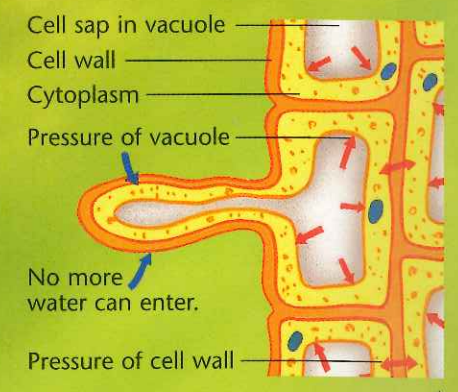
## STANDING FIRM

Healthy plants usually stand firm and upright. This is because their vacuoles are full of cell sap, and push outward against the cytoplasm and cell walls. Each cell is described as **turgid**, and the plant is in a state of **turgor**.



A healthy plant

### Root cells of a healthy plant



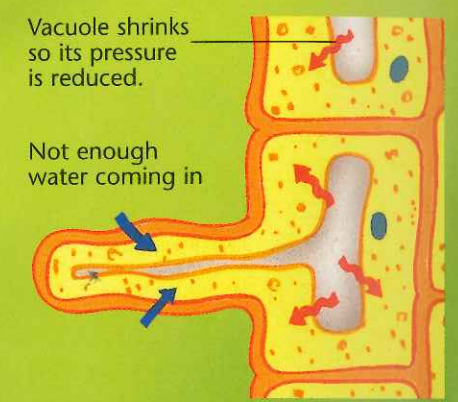
## WILTING

In hot or dry conditions, a plant may lose more water than it can take in. The pressure of water in its vacuoles drops to become less than that of the cell walls. This makes the cells limp.



A wilting plant

### Root cells of a wilting plant



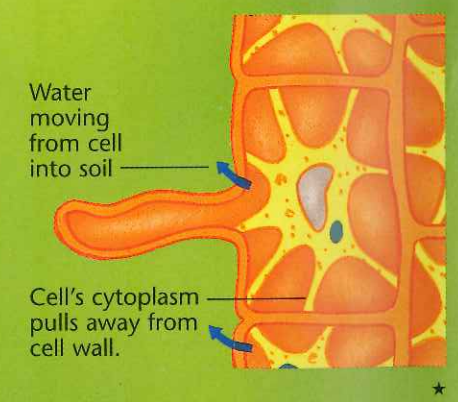
## DYING

In extreme cases, a plant may lose too much water through its leaves, and also through its roots into very dry or mineral-rich soil. Its cell vacuoles then shrink so much that the cytoplasm is pulled away from the cell walls. This state, called **plasmolysis**, may kill the plant unless it receives more water quickly.



A dying plant

### Root cells of a dying plant



### Internet links

Go to [www.usborne-quicklinks.com](http://www.usborne-quicklinks.com) for links to the following Web sites:

**Web site 1** A step-by-step guide to fluid transport, with excellent microscope images.

**Web site 2** An experiment showing capillary action.

**Web site 3** An advanced explanation of fluid transport.