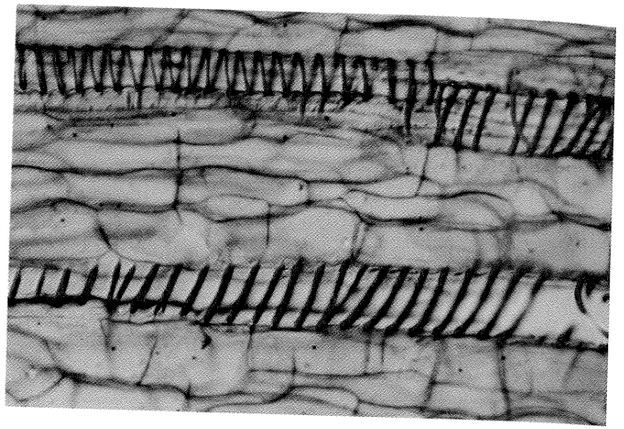
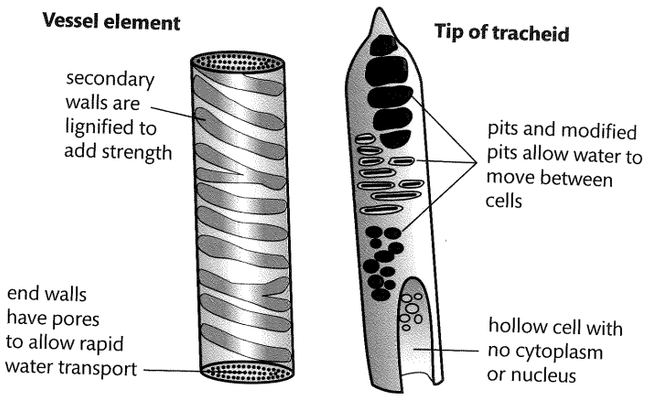
micrograph of a section through pumpkin tissue ng the lignified walls of the vessel elements.

a complex ompound that rengthens alls of lants. It also ofs plant parts protection thogens. The ell wall of ade up of In some plants, e they form ry cell wall l of materials cellulose. materials in orming wall is

e 9.2 Vessel elements acheids. Water passes e tracheid to another gh thin regions called essel elements, water es through pits in the all areas and through d walls. Observations tracheids and vessels ovided evidence that ements evolved after tracheids.

ed lides or graphs of stem -sections of types, draw primary . Careful hould reveal s with pits allow lateral ovement of





Ancient flowering plants only had tracheids, while most modern flowering plants only have vessel elements. Vessel elements appear to be more efficient in the transport of water.

The most widely accepted explanation for the movement of water and minerals upwards in plants has several names. Some biologists call it the transpiration–cohesion–tension mechanism, while others call it simply the cohesion–tension theory.

A 'living' model to observe water transport in plants

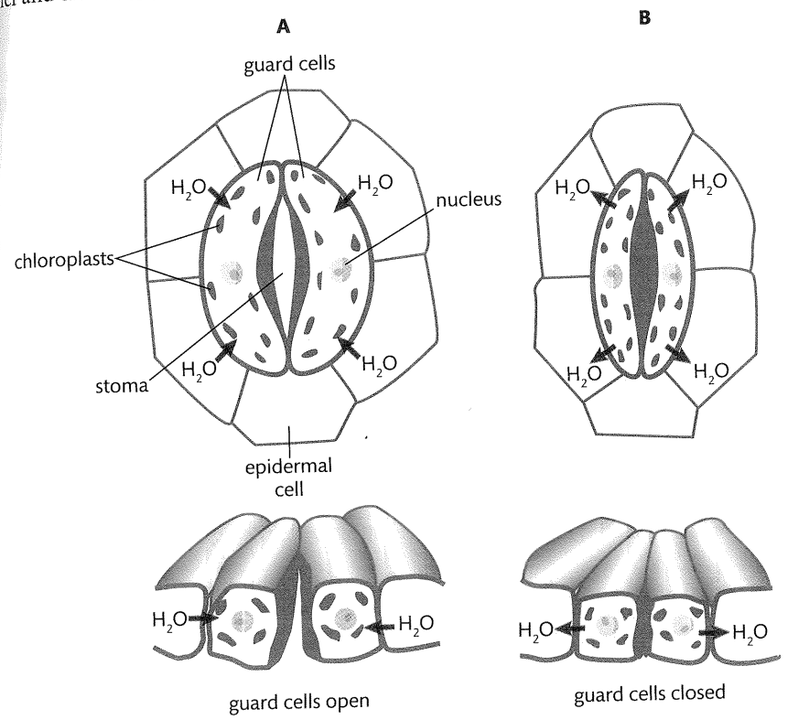
Safety alerts: Wear eye protection and aprons during this procedure. It is recommended to use protective gloves when handling the Congo red or red ink. Follow all directions from your teacher in the disposal of all chemicals used. Wash your hands thoroughly after completing this lab.

The plant species *Impatiens wallerana* has translucent stems because of the presence of large, thin-walled cells. This species can be grown from seed or bought from a local florist. Follow these general procedures.

- Carefully remove the plant and its root system from the soil.
- Gently wash the roots and place [illegible]

Stomata and guard cells

Stomata can only be closed on a short-term basis. This is because carbon dioxide must enter the mesophyll region of the leaf so that photosynthesis can occur. The stomata open and close because of changes in the turgor pressure of the guard cells that surround them. These guard cells are cylindrical and their cell wall thickness is uneven. As you can see in Figure 9.3, the thickened area of the guard cell wall is oriented towards the stoma. Thus when the cells take in water and swell, they bulge more to the outside. This opens the stoma. When the guard cells lose water, they sag towards each other and close the stoma.



The gain and loss of water in the guard cells is largely because of the transport of potassium ions. Light from the blue part of the light spectrum triggers the activity of adenosine triphosphate (ATP)-powered proton pumps in the plasma membrane of guard cells. This triggers the active transport of potassium into the cell. The higher solute concentration within the guard cells causes inward water movement by osmosis.

When potassium ions passively leave the cells, water also leaves. The plant hormone abscisic acid causes potassium ions to diffuse rapidly out of the guard cells. The result is stomatal closure. This hormone is produced in the roots during times of water [illegible] during a drought

NATURE OF SCIENCE

Models are often used to represent the movement of water in plants. Simple apparatus, such as blotting or filter paper, porous pots and capillary tubing, can be used. Often models use organisms in a novel way to represent a particular process. An example of such a model is provided in the *Impatiens wallerana* lab.

Turgor refers to the pressure in a cell that liquid exerts on the membrane and/or cell wall.

Figure 9.3 A: When solution pressure is high inside the guard cells, they bow outwards and open the stoma. B: When solution pressure is low, the guard cells become limp and the stoma closes.