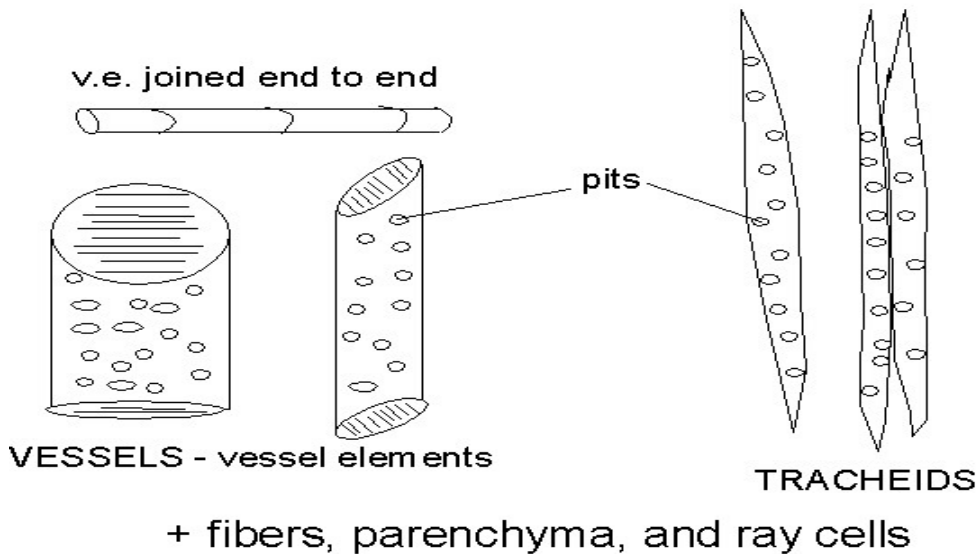


Lab. 11 :Water translocation (ascent of water in the xylem tissue)

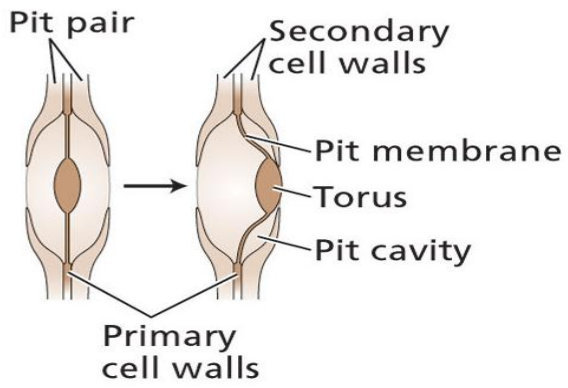
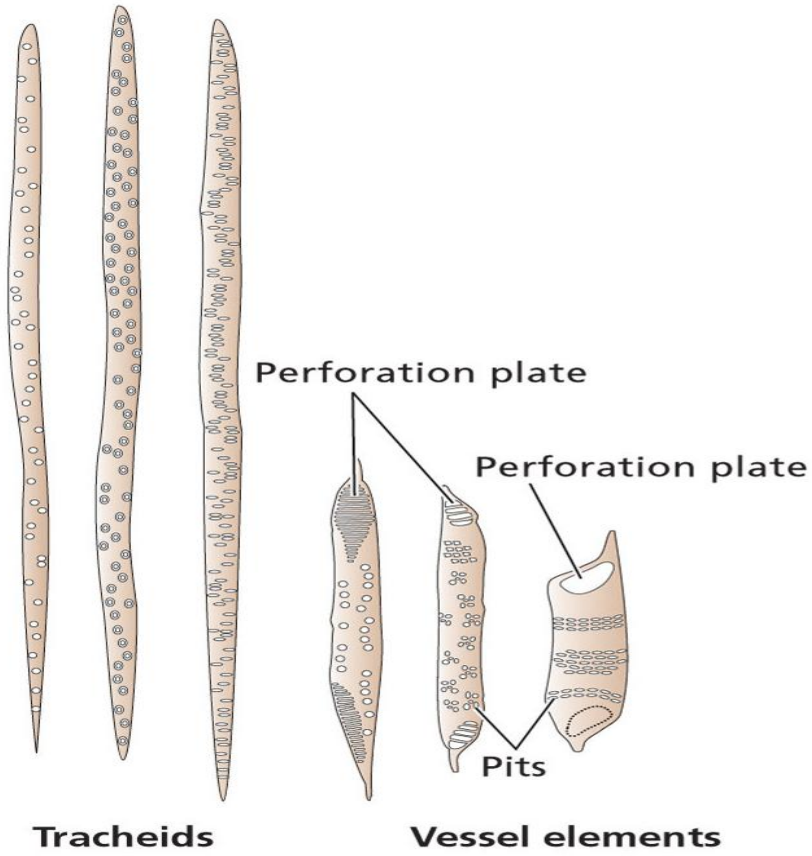
Xylem tissue consists from:

- Xylem parenchyma
- Xylem fibers
- Tracheids
- Vessels

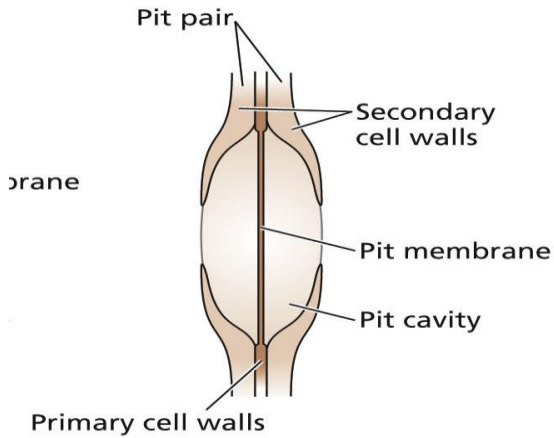
COMPONENTS OF XYLEM



- A single tracheid is highly elongated or tube-like cell with hard, thick and lignified walls and a large cavity. Tracheids occur alone in the xylem of ferns and gymnosperms. Pits concentrated in overlapping tapered ends of cells. Water must pass through the membrane of pit pair.
- The end walls of vessel elements, called perforation plates, have large holes. Water passes through the perforation plate from one vessel element to the next. Pits in side walls, perforations in end walls. More efficient water conductor than tracheids. Vessels occur in the xylem of angiosperms.

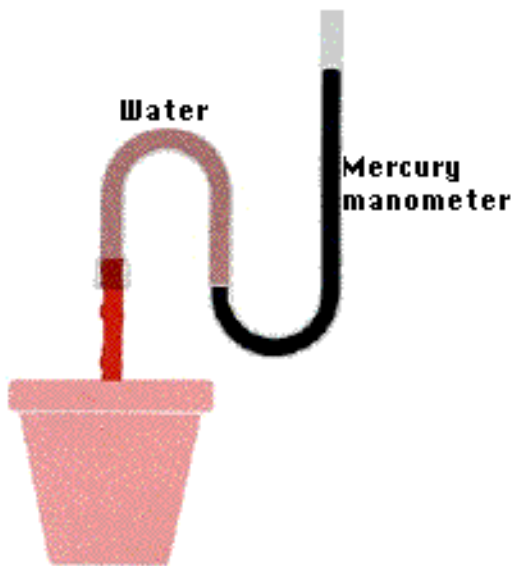


For conifers



Other vascular plants

Mechanism of water translocation



There is two theories explain this mechanism:

1. Root pressure theory

- Solute accumulation in the xylem can generate “Root Pressure”.
- Roots generate positive pressure by absorbing ions from the dilute soil solution and transporting them into the xylem.
- This lowering of the xylem (W.P) makes a force for water absorption.

- Root pressure is most occur when soil water potential (W.P) are high and transpiration rates are low.
- This pressure in the root lead to produce liquid droplets on the edges of their plant leaves, this phenomenon is known as (Guttation), it's appear when the transpiration rate is low and humidity is high, such as during the night.

2. The cohesion – tension theory

- When the transpiration occurs in the leaves, losses of water molecules through the stomata, develops a large negative pressure (low water potential), and they pull other water molecules by cohesion force, water molecules are also attracted to the sides of the tracheids and vessels by adhesion force.
- These forces (Transpiration – cohesion – tension) pull water through the xylem.

Practice part:

1. Experiment to prove that water rises upwards in the plant through xylem (Movement of Dyes).



Eosin test to demonstrate ascent of sap

A leafy green shoot of Balsam plant with a transparent stem is placed in eosin solution. It is noticed that after some time red streaks appear in the stem and veins of leaves become red. When transverse section of stem is taken it is noticed that only walls of xylem vessels have been stained red.

This proves that xylem is a true tissue which conducts water upwards in the plant.

2. Ringing Experiment

In this experiment bark is removed (all tissues external to xylem) from a part of branch, this process called girdling. Now this ringed twig is placed in a beaker containing water. It is noticed that upper leaves of shoot remains turgid and indicates water is still moving upwards through xylem.



Ringing experiment to show the path of ascent of through xylem