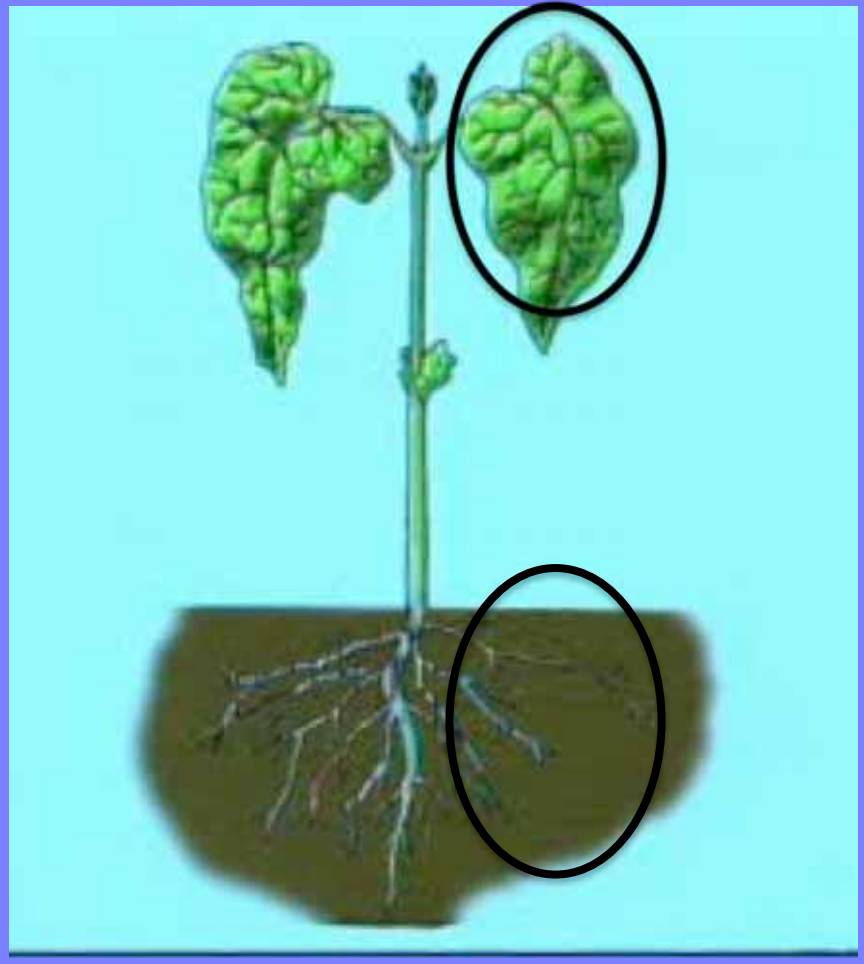
Question

- What is the name for the respiratory system of insects?
- Gas is exchanged in human lungs in small air sacs called what?
- _____ _____ helps maintain a constant pressure potential of oxygen in bird lungs.

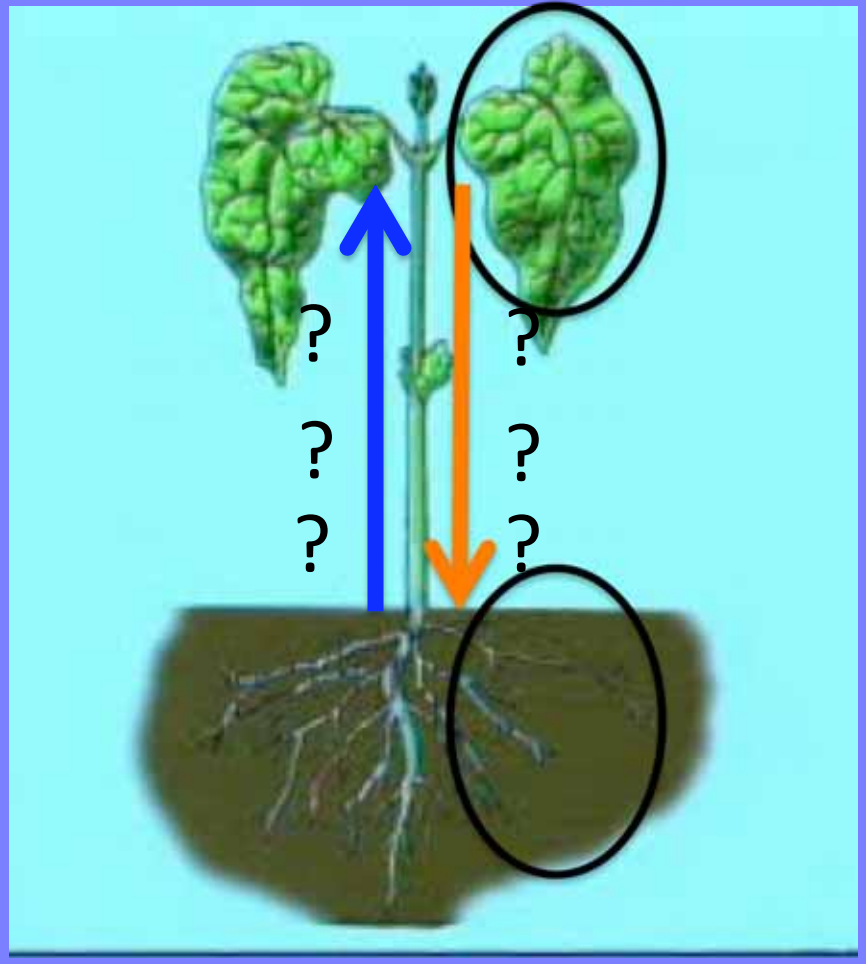
Review



- Photosynthesis – how plants make energy
- How plants obtain nutrients and water through the root hair and travel to the xylem

http://video.ecb.org/badger/download/vlc/animations/thumbs/Plant_Diagram_.jpg

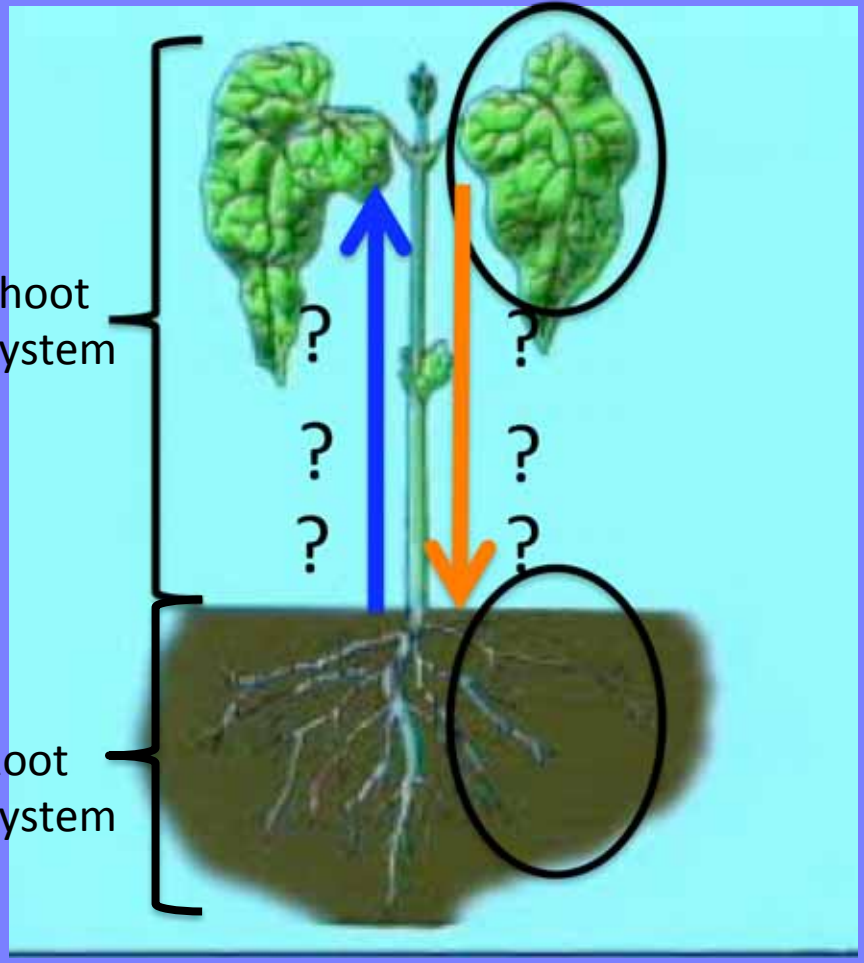
Questions



- How do those nutrients get from the leaves to the roots and shoots?
- How does the water get from the roots to the shoots?

http://video.ecb.org/badger/download/vlc/animations/thumbs/Plant_Diagram_.jpg

Questions



- How do those nutrients get from the shoots to the roots?

  Translocation

- How does the water get from the roots to the shoots?

  Transpiration

http://video.ecb.org/badger/download/vlc/animations/thumbs/Plant_Diagram_.jpg

Transpiration vs. Translocation

Transpiration	Translocation

Translocation

- Movement of sugars through the plant
- Phloem cells
- Movement in either direction
- Energy required

Translocation (why? where?)

Sources?

Sinks?

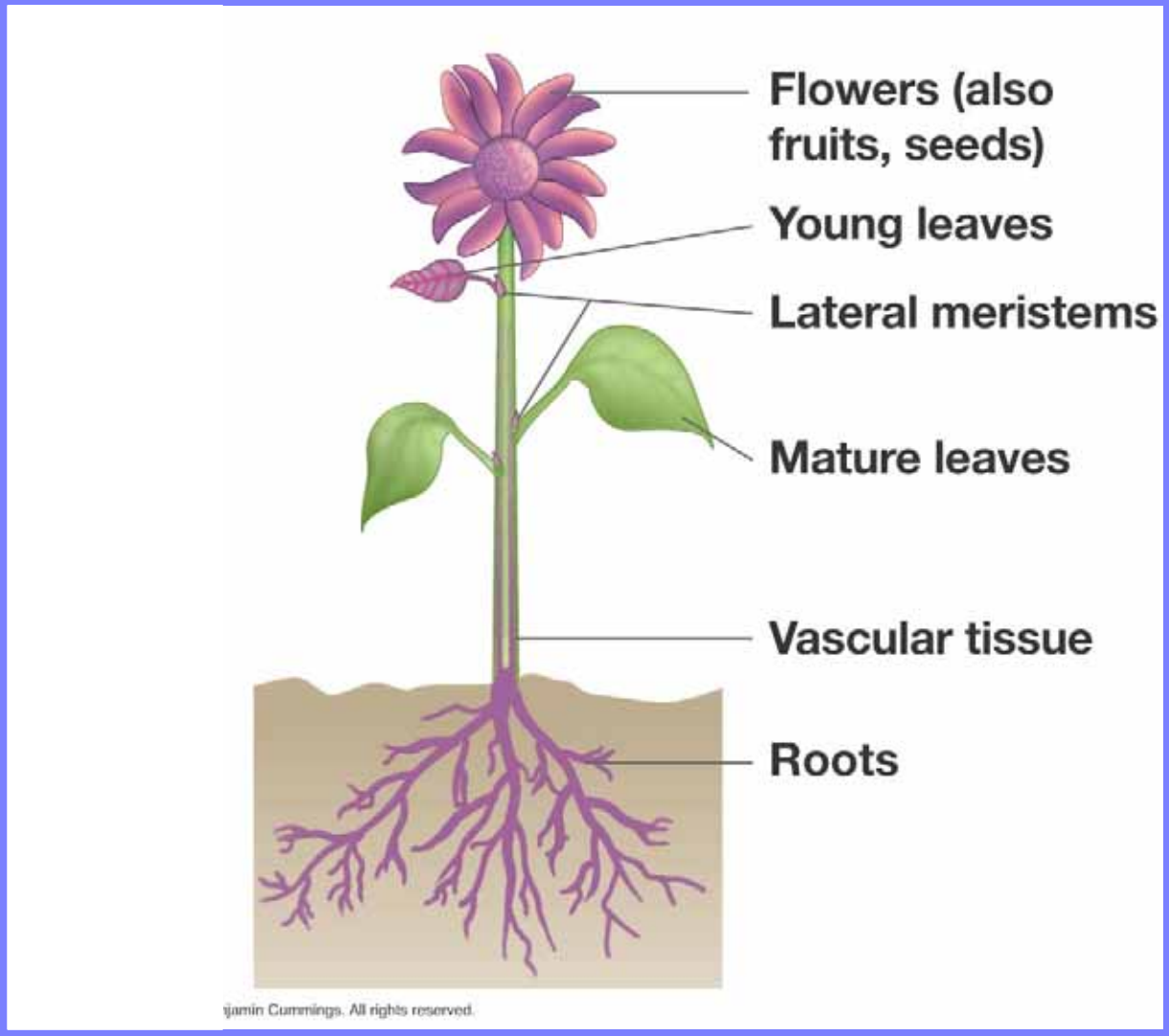


Fig 37.17 pg 829

Translocation (why? where?)

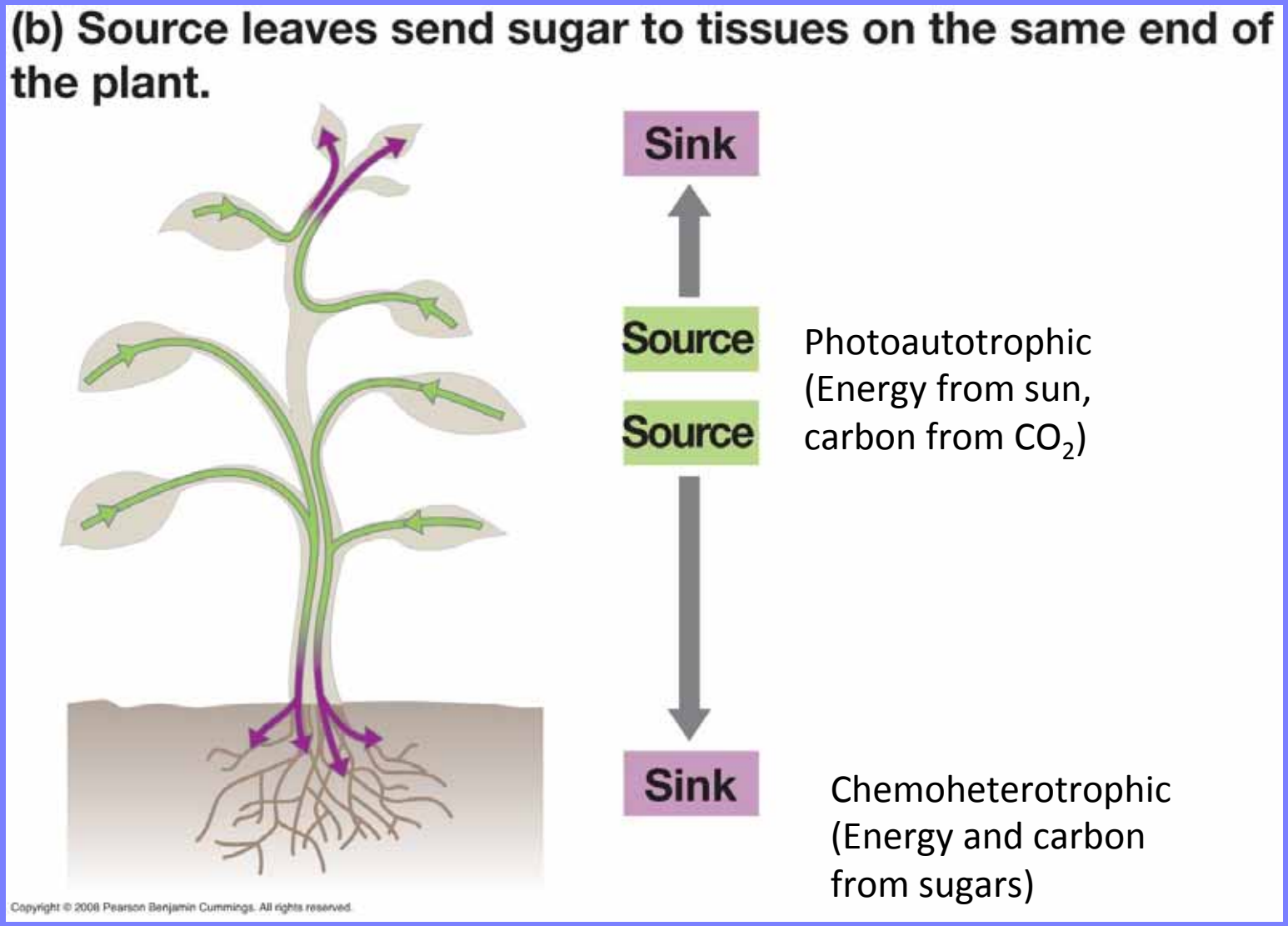
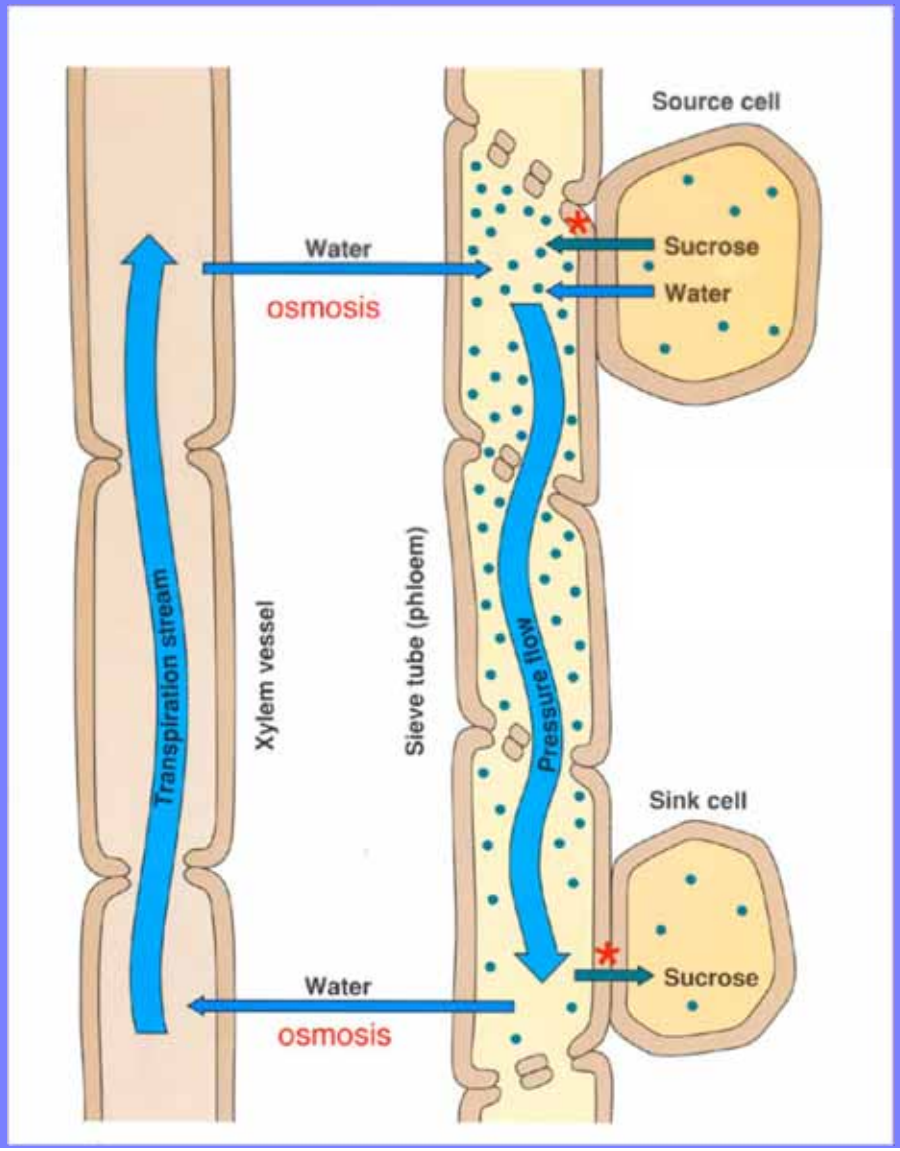


Fig 37.18

Translocation (where?)



Phloem cells

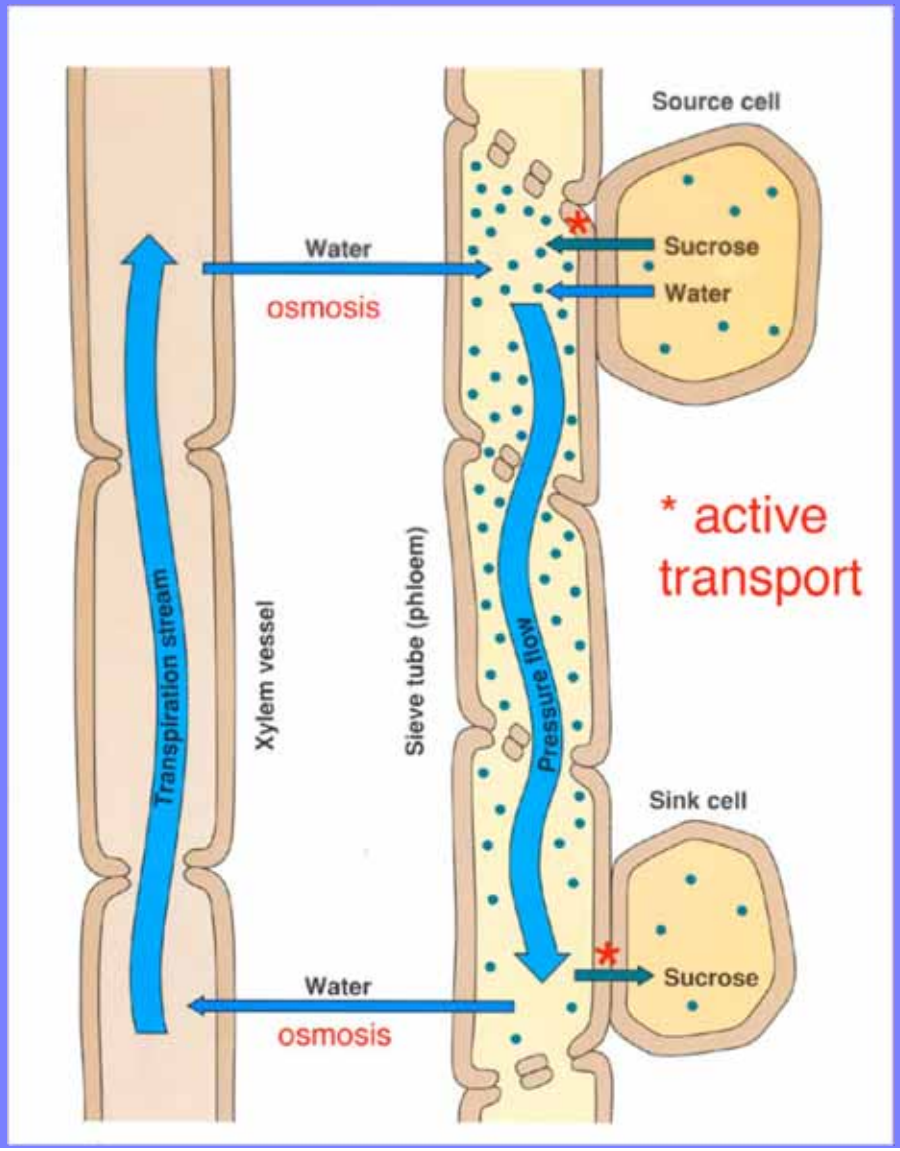
Alive when mature

lack major organelles

Connected via sieve plates

plasmodesmata

Translocation (how?)



Think cause and effect

1. Sugars (actively) transported into phloem from source (how?)
2. Osmotic potential pushes water in, creates high pressure
3. Pressure potential causes movement of water to low pressure (sink)
4. Sugars (actively) transported into sink

Transpiration

- Loss of water at the stoma (leads to movement of water throughout plant)
- Xylem cells
- Movement from root to shoot only
- Passive process

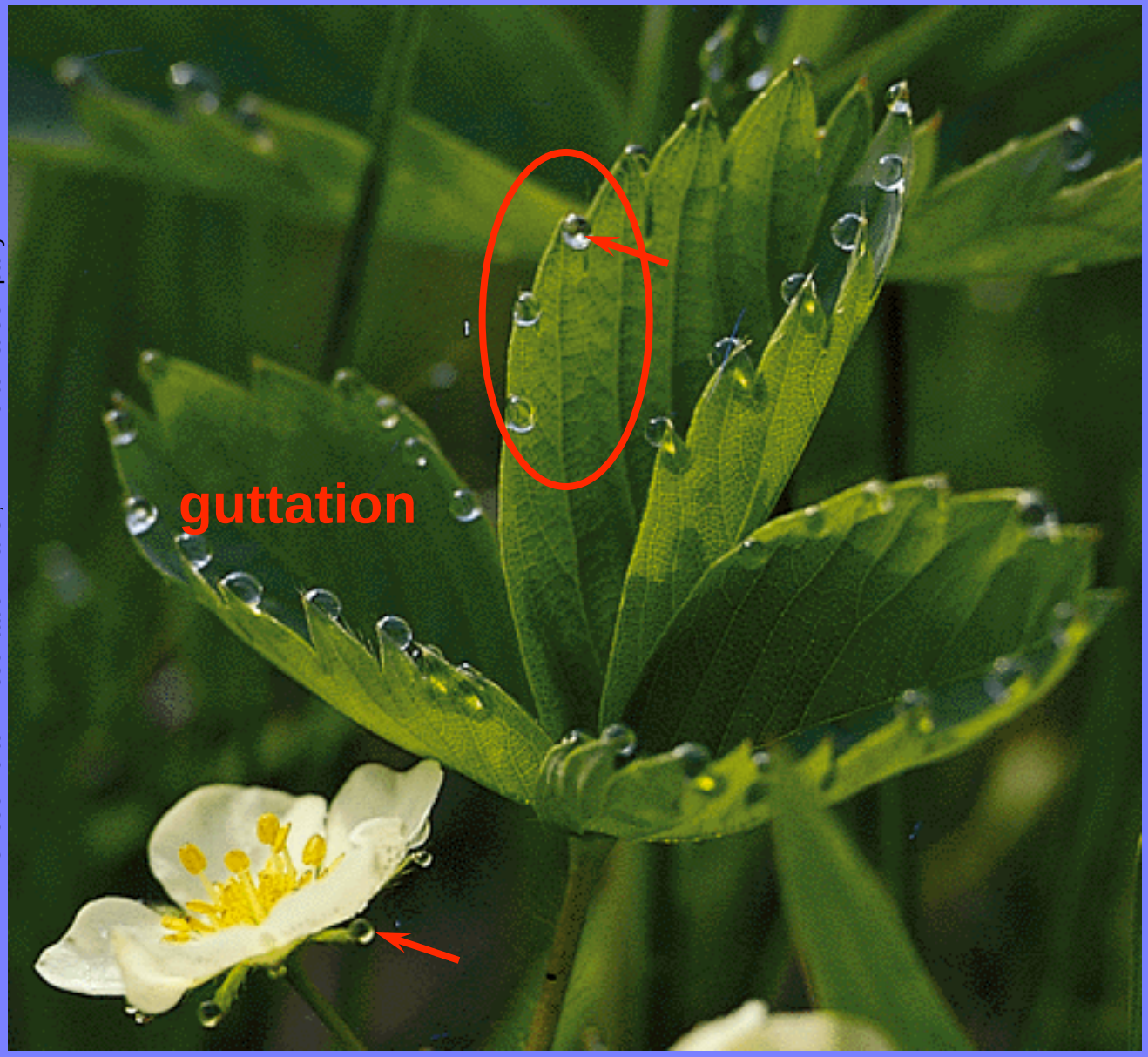
- Evaporation, capillary action, root pressure, guttation
- Xylem, dead cells, tracheids

Transpiration (how?)
Root pressure

- Combination of 3 factors

1. Root pressure
2. Capillarity
3. Evaporation

Transpiration: root pressure (osmotic “push”)



Ions accumulate in roots from soil.

Water from the soil moves in by osmosis.

Accumulating water in the root causes a high water potential.

Water potential pushes water up the xylem.

Can push water up to a meter up.

This is not “dew” condensing!

Transpiration: root pressure (osmotic “push”)

http://img.fotocommunity.com/photos/8489473.jpg

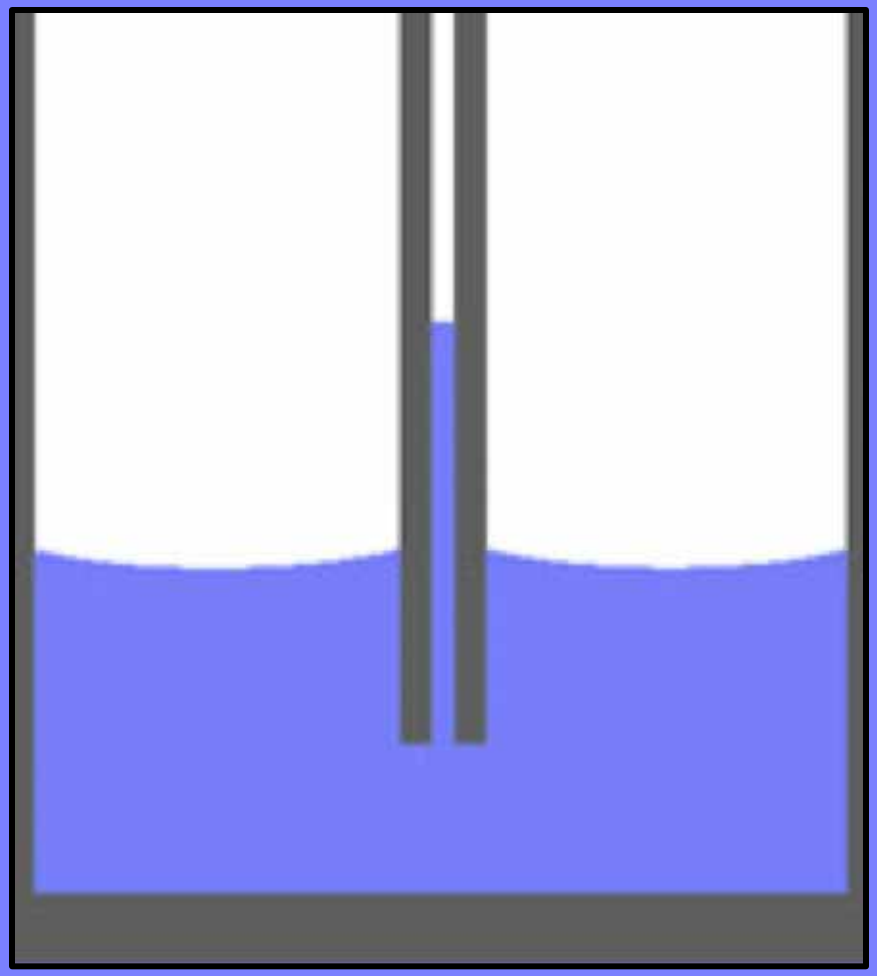
The veins (coarse and fine) show that no cell in a leaf is far from xylem and phloem (i.e.water and food!).

The xylem of the veins leaks at the leaf margin in a modified stoma called the hydathode.

These droplets are xylem sap.

Root pressure accounts for maybe a half-meter of “push” up a tree trunk.

Transpiration (how?)
Capillary Action



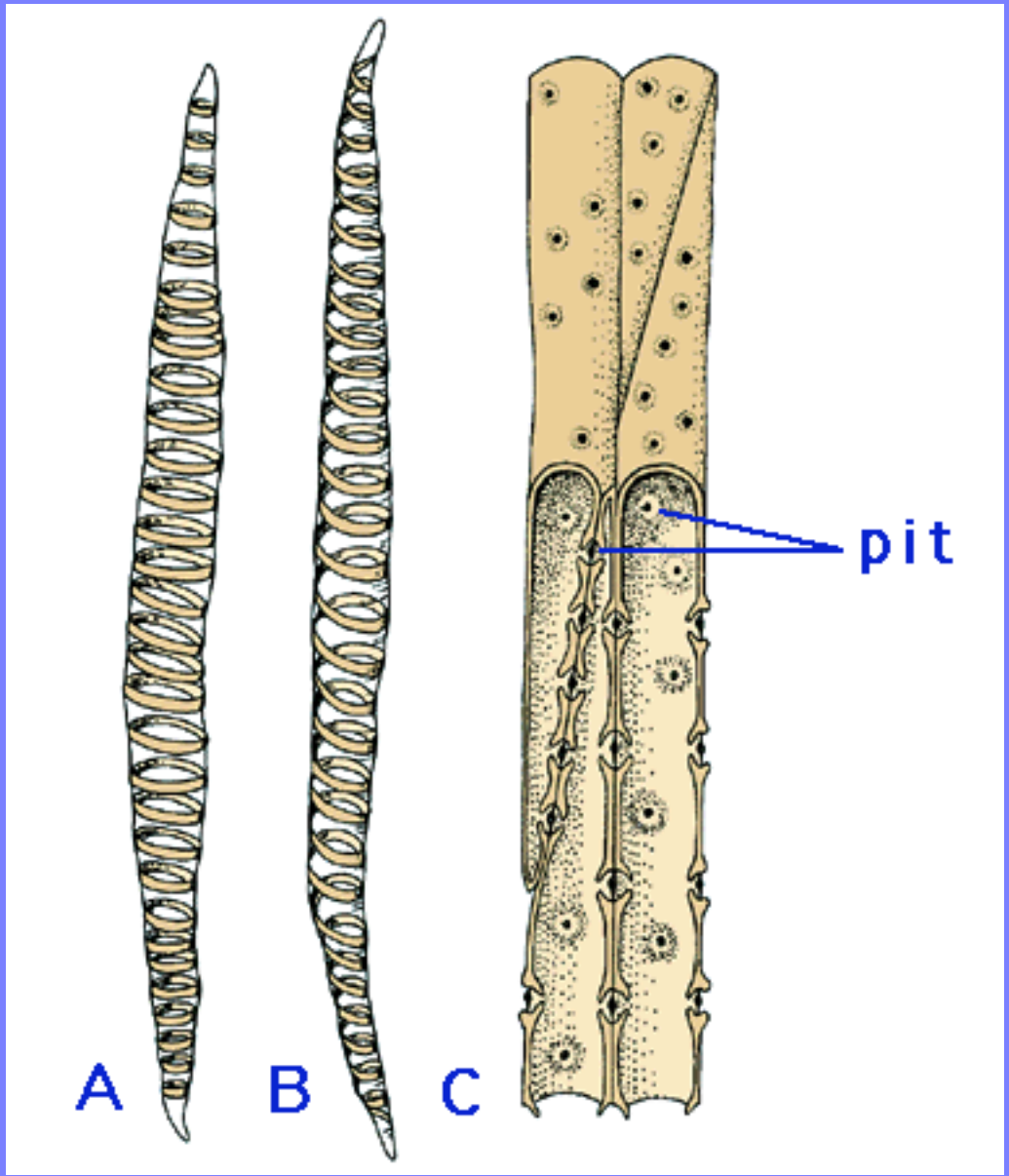
- Adhesion
  - Attraction to unlike molecules
  - Xylem cells
- Cohesion
  - Attraction to like molecules
  - Water molecules
- Both possible through hydrogen bonding

http://www.cse.ohio-state.edu/~whmin/Wang-2005-WDS/Wang-2005-WDS.htm

Transpiration (how?)
Evaporation

Two Xylem Conducting Cells: Tracheids

Annular Helical Pitted



When flowering plants are young, water needs are limited, tracheids suffice.

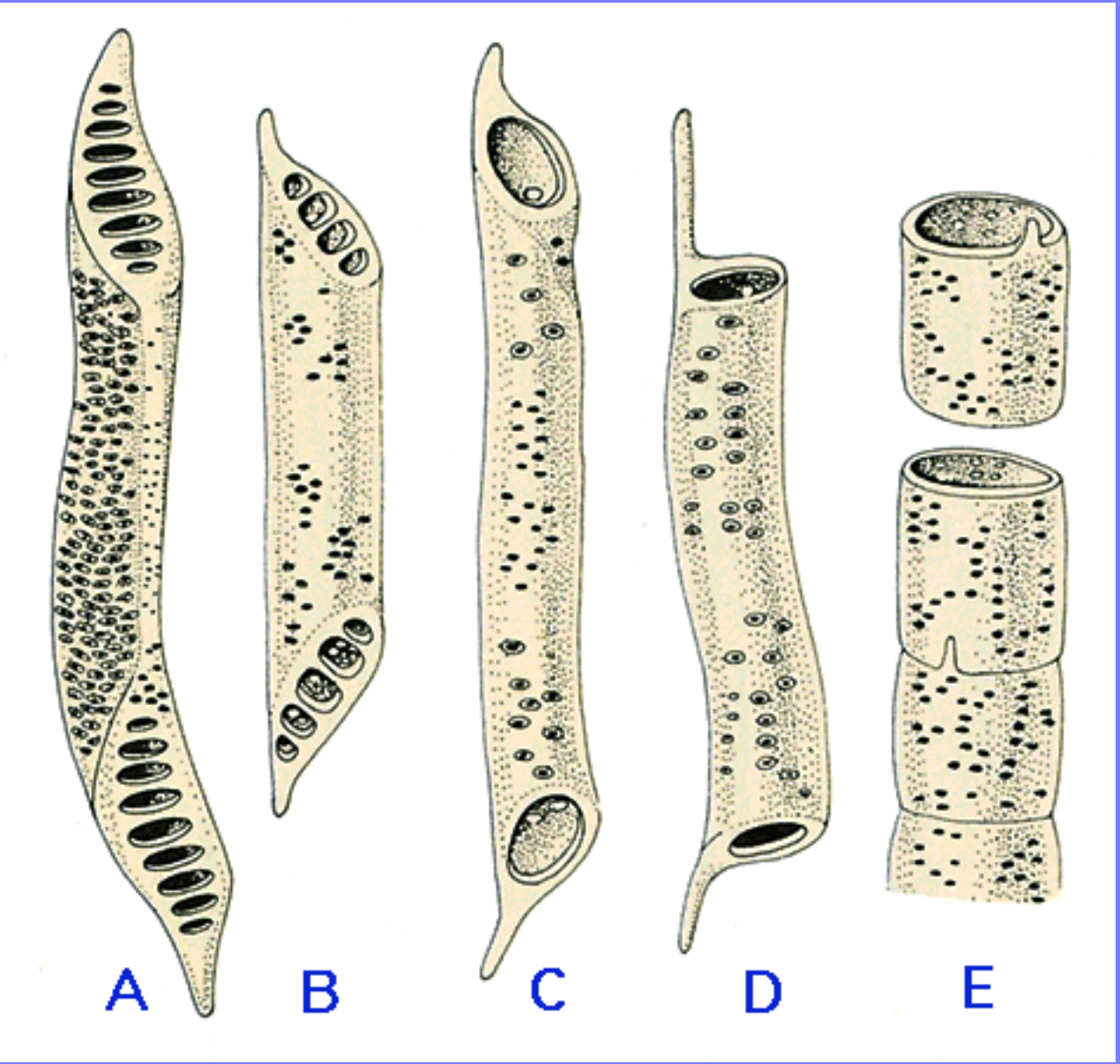
The walls are strengthened with secondary thickenings including lignin.

Pits allow for lateral movement

Compare Fig. 36.26 Page 806

Two Xylem Conducting Cells: Vessel elements

plesiomorphic → apomorphic

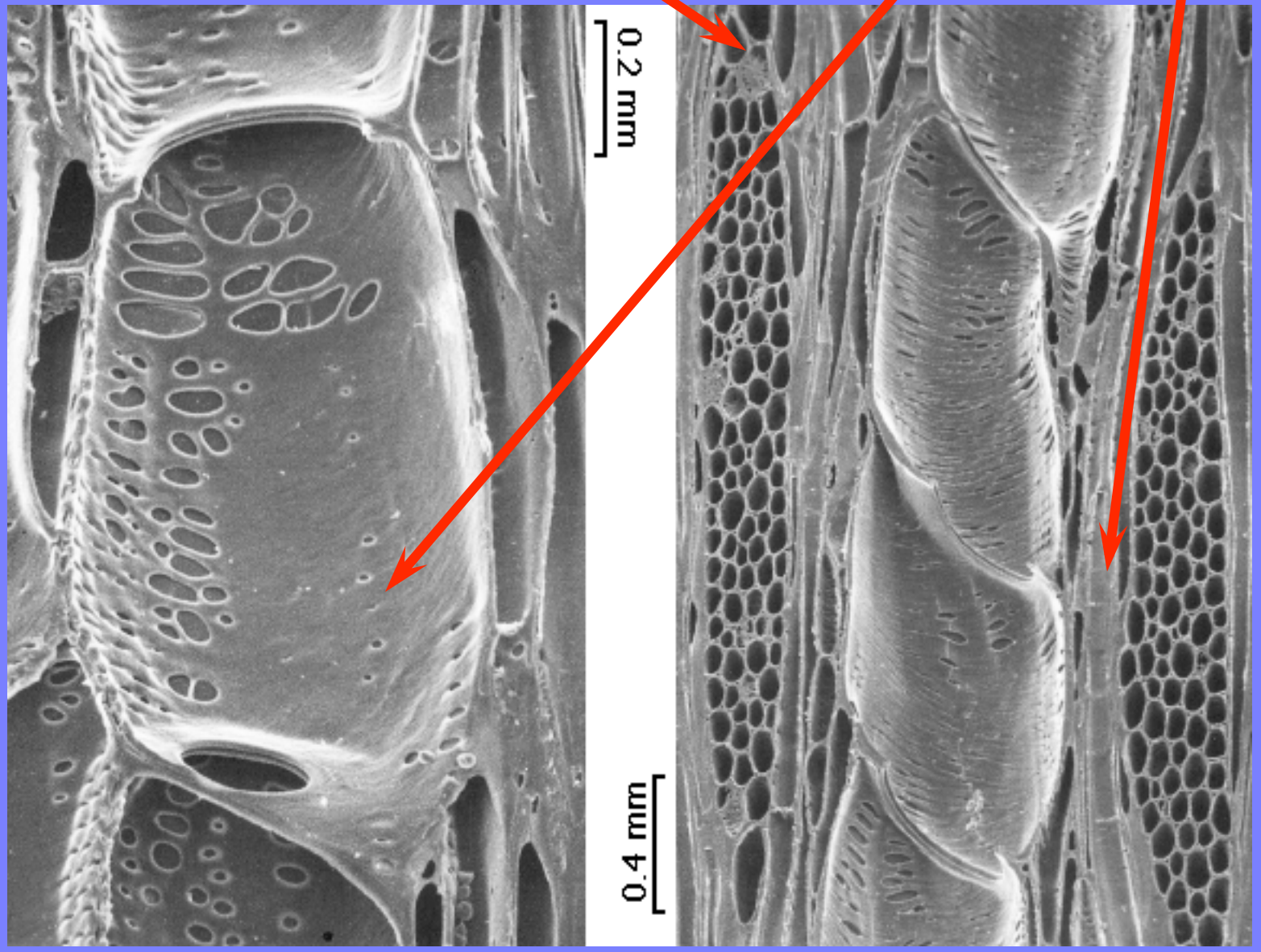


As flowering plants age and grow, water needs increase, and tracheids need to be supplemented.

Flowering plants evolved xylem cells with larger cell diameter and perforated end walls to increase water flow.

Vessels have perforated end walls or lack end walls, but lateral flow between cells is still through pits.

Dicot stem anatomy: xylem parenchyma, vessels, and tracheids



The huge vessel transports lots of water longitudinally, and shows lots of pits for lateral transport

Questions

- Translocation of material moves through which cells?
- Which type of transport is a passive process?
- What three things are necessary to move water up xylem cells?