9/12/13

BY 124 SI Session 4

Acquiring Resources

- What are xylem sap and phloem sap? In which directions are both transported?

Xylem sap = H_2O + minerals; moves ↑ from roots to shoots

phloem sap = sucrose, amino acids, hormones, minerals; moves from site of sugar production to site of storage or use

- Where does gas exchange occur in the plant?

stomata (leaf) — CO_2 in, O_2 out

roots - O_2 in, CO_2 out

Transport

- What is the difference between passive and active transport?

passive = no energy (think diffusion)

active = energy (proton pumps etc.)

- What is a membrane potential, and how is it formed?

membrane potential is a difference in charges across a membrane

* generated by proton pump

- What are the three main compartments of most plants?

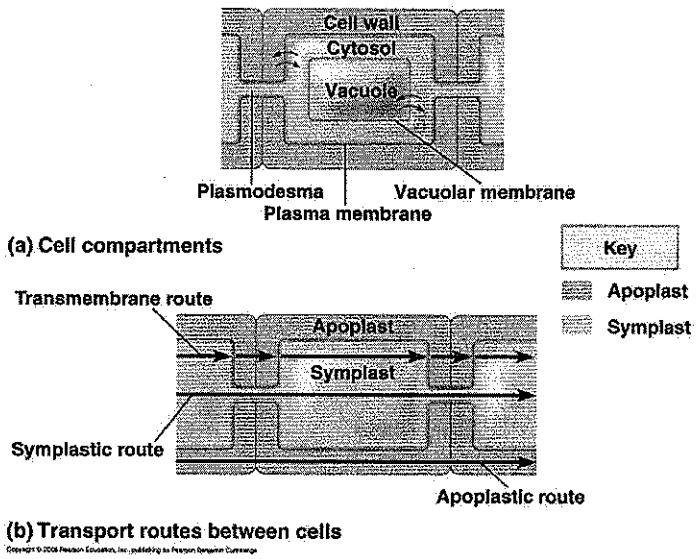
cell wall, cytosol, vacuole

- List and describe the three major pathways of transport found in a cell (refer to below picture).

1. Apoplast - H_2O moves through cell walls only

2. Symplast - H_2O moves through one cell membrane, then through the plasmodesmata

3. Transmembrane - H_2O moves through cell membranes only



- What is bulk flow, where does it occur, and why is it more efficient than diffusion and active transport?

movement of fluid over a long distance due to pressure differences
- occurs in tracheid & vessel elements; sieve tube in phloem
- more efficient due to lack of cytoplasm in cells (hollow tubes)

- What is the difference between positive and negative pressure? During bulk transport, which type of pressure is used in the xylem? What about the phloem?

positive pressure is pushing
negative pressure is pulling
*

Xylem
Root pressure is positive
T-C-* is negative

Phloem
positive

- What is root pressure? What is the transpiration-cohesion-tension mechanism? How are they different?

when H_2O flows in from the root cortex; this is positive

negative pressure

- Bulk transport in the xylem: Water and minerals are absorbed by the root cells, transported through the endodermis, released into the vessels and tracheids of the xylem, and carried to the tops of plants via bulk flow, which is driven by transpiration (solar energy)

- What are sugar sources and sugar sinks, and how are they important to bulk transport of phloem sap?

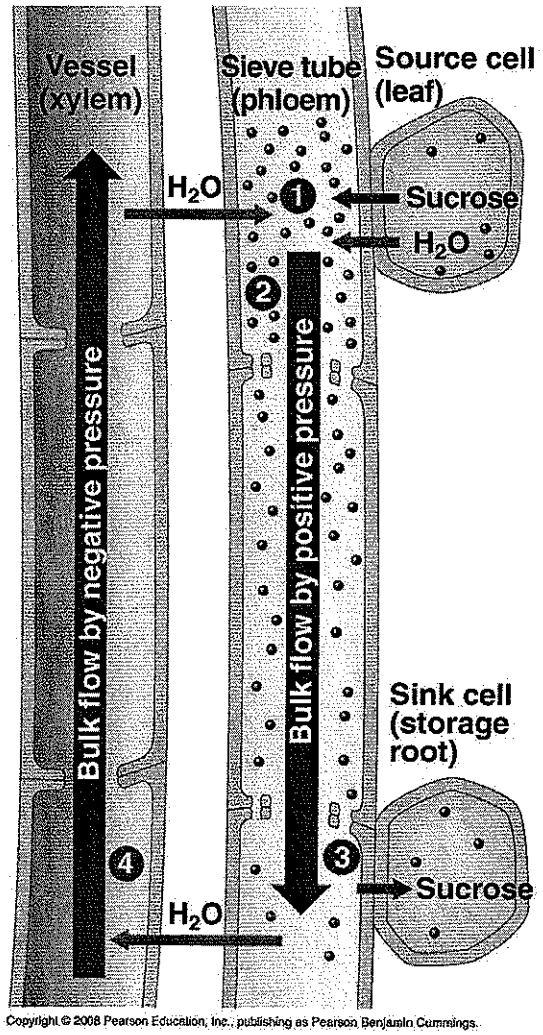
- sources – where sugar is produced (leaves)
- sinks – where sugar is needed/stored

sugar flows from source → sink by pressure & concentration gradient

- Bulk transport in the phloem: The bulk movement of sugars in the phloem is called translocation. First, the sugar is loaded into the sieve tube elements at the sugar source, a processes requiring

active transport by means of proton pumps and cotransporters. Once the sugar is loaded into the sieve tube elements, the water potential there is reduced, causing the tube to take up water by osmosis & diffusion from the xylem. This uptake of water generates a positive pressure that forces the phloem sap to flow along the tube. The pressure is relieved by the unloading of sugar and the consequent loss of water (back to the xylem) at the sugar sink. The xylem recycles the water from sugar sink to sugar source.

Bulk Flow by Positive Pressure (Label the steps, ~~1-5~~ 1-4)



1. sugar loaded in to sieve tube
2. H_2O moves into phloem due to concentration gradient
3. Sugar moves by bulk flow (pressure differences) & is deposited into sink
4. H_2O moves back into xylem because of concentration gradients