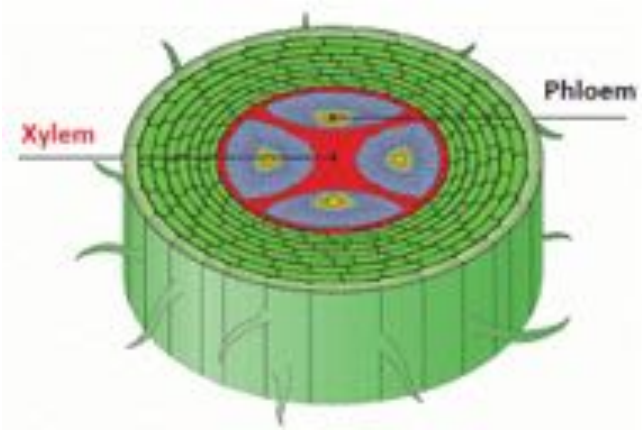
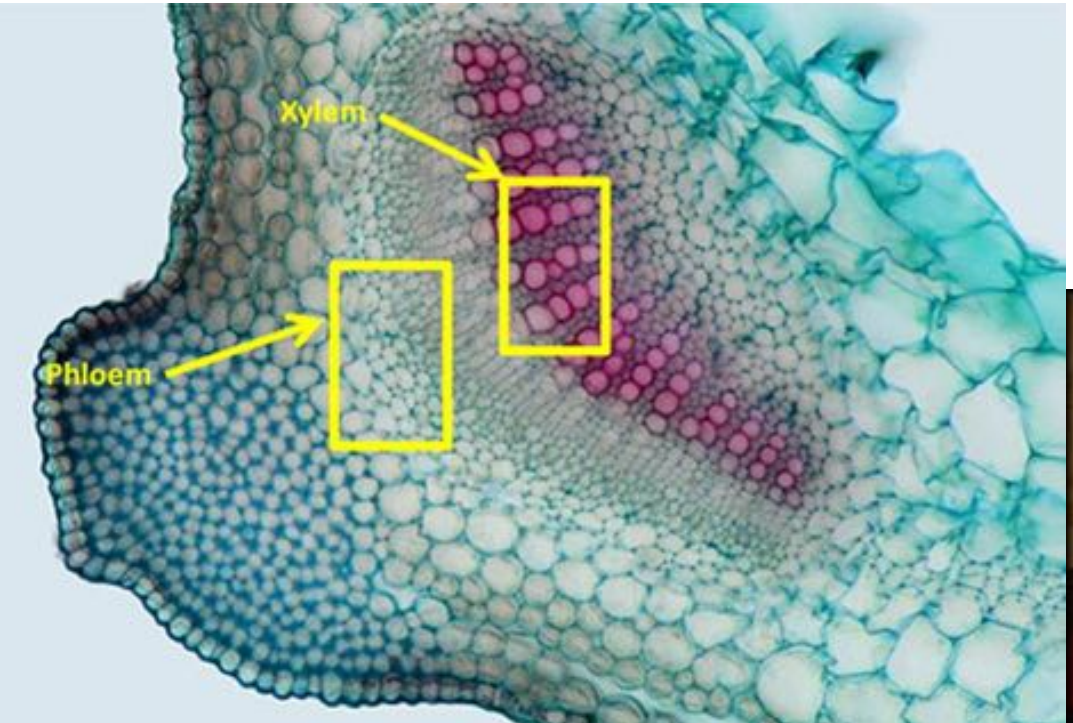
9.2 Phloem Structure and Function





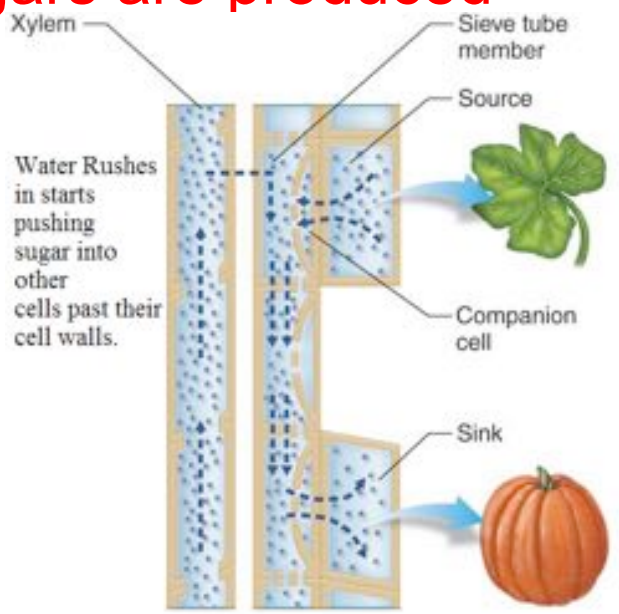
9.2 U. 1 Translocation: Plants Transport organic compounds from sources to sinks

–Movement from Source to Sink

- A process of **phloem transport** moves sugars through a plant from a source to a sink.

- A ***source*** is any cell in which sugars are produced by photosynthesis.

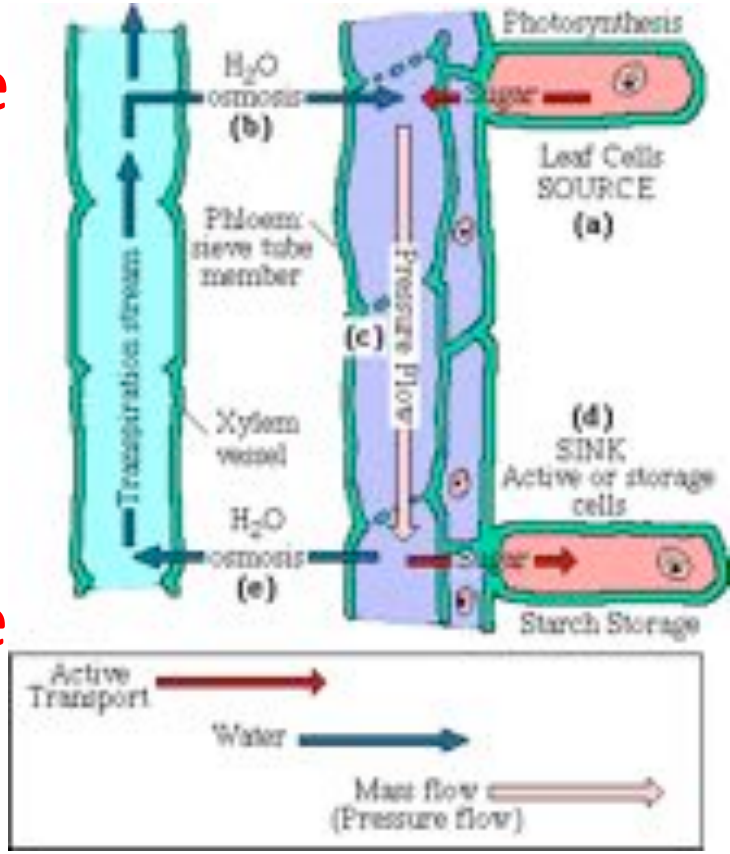
- A ***sink*** is any cell where the sugars are used or stored (fruits, roots, seeds).



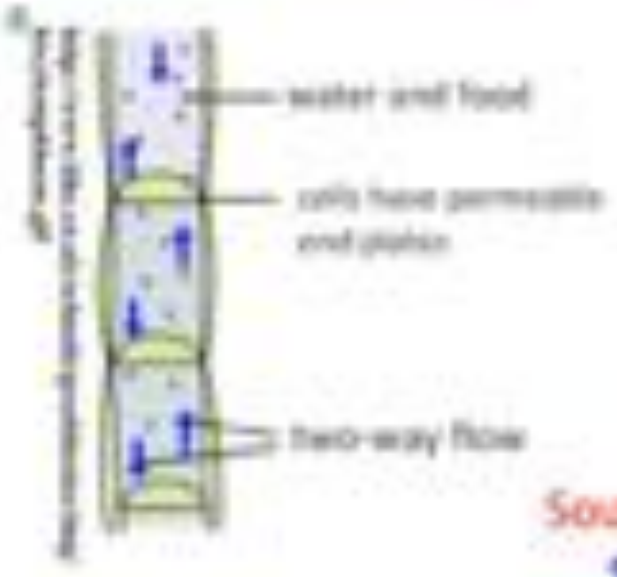
Plant Sinks

9.2 U.2 Incompressibility of water allows transport along hydrostatic pressure gradients

- Hydrostatic pressure is in liquids
- High concentrations of sugar in the sieve tubes leads to an uptake of water due to the creation of a low concentration of water in the sieve tube
- As sugar is removed at the storage site, the concentration gradient shifts and water exits the tube by osmosis



Active translocation occurs in the phloem (moving food around)



Plants produce their own carbohydrates in the leav
through photosynthesis. For the plant to grow a
reproduce, this food needs to be transport
(translocated) to the tissues that need
This is also true of proteins and amino aci

The movement of phloem sap requires energy - it is
active process, so we call it active translocati

Source = site of production or storage
Sink = destination/ site of use

Sugars

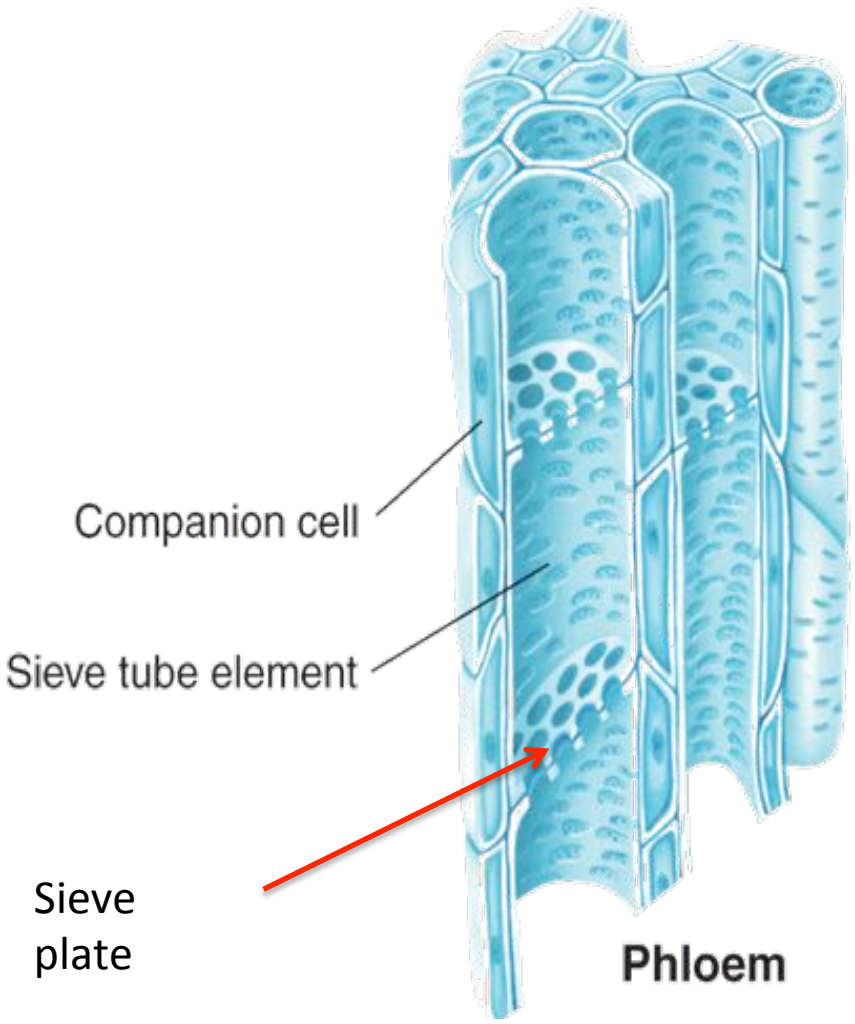
Source: green leaves and stems
storage tissues in seeds
Sinks: growing roots and stem
roots absorbing minerals
fruit production or other
energy storage
flowering and reproduction

Amino Acids

Sources: roots or tubers, rhizomes
storage in germinating seeds
Sinks: growing roots and stem
developing leaves, fruits
flowering and reproduction

PHLOEM Tissue

- Phloem Cells are **alive.**
- **Sieve Tube elements (cells)** lacks nucleus & cytoplasm
- Sieve tube elements are connected to each other via **sieve plates**
- Sieve plates have holes which allow movement of water and dissolved organic molecules
- **Companion Cells** has nucleus and dense cytoplasm
- Companion cells are attached to sieve tube element via **plasmodesmata**



9.2.U.3 Active transport is used to load organic molecules into phloem sieve tubes at the source

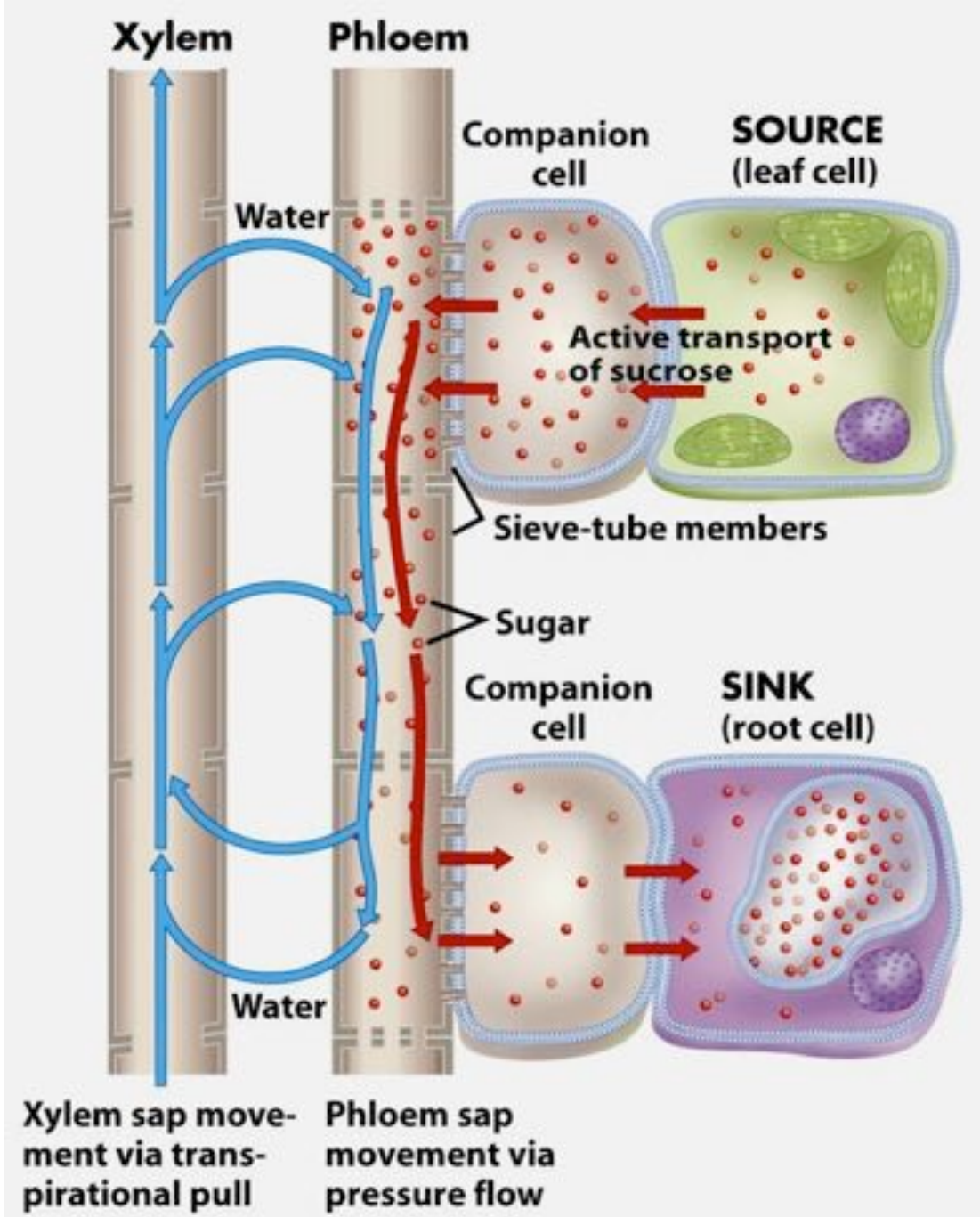
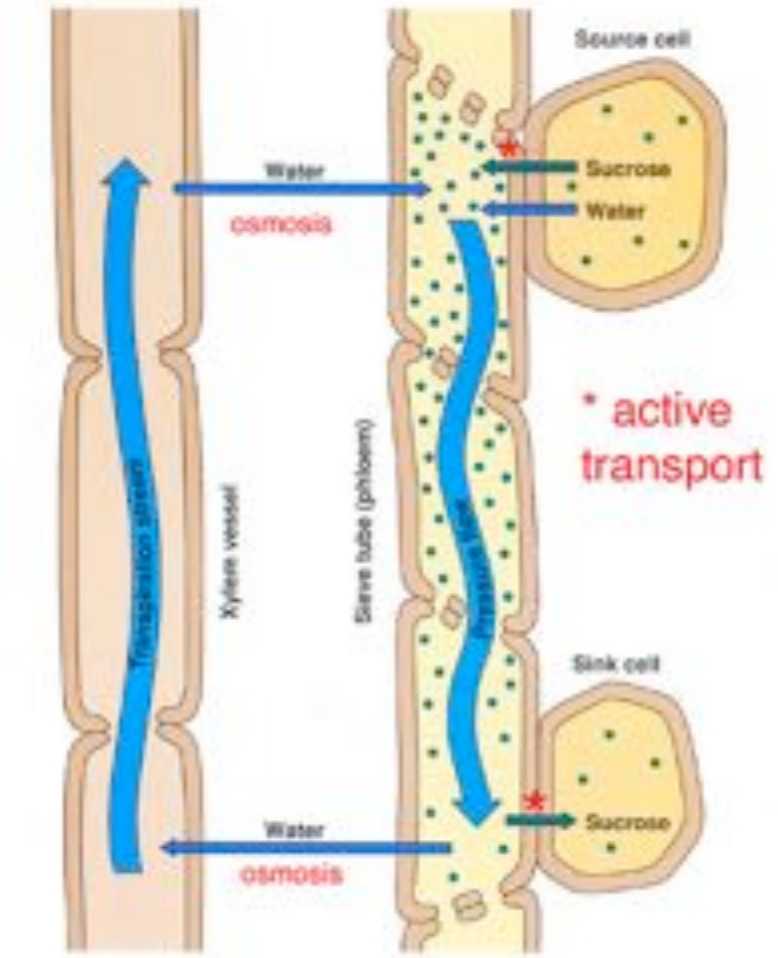


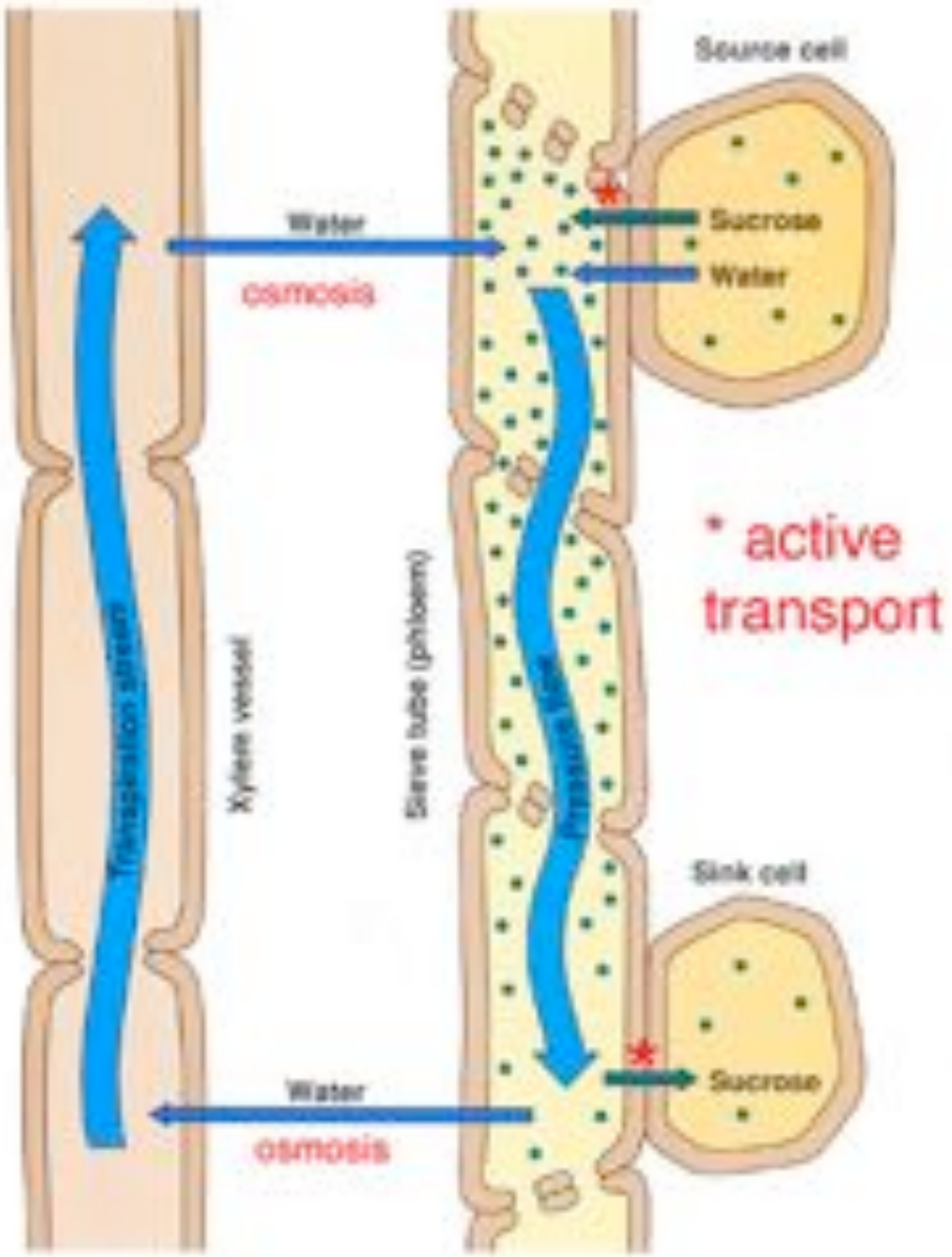
Figure 36-19 Biological Science, 2/e

9.2. U.4 High concentrations of solutes in the phloem at the source lead to water uptake by osmosis

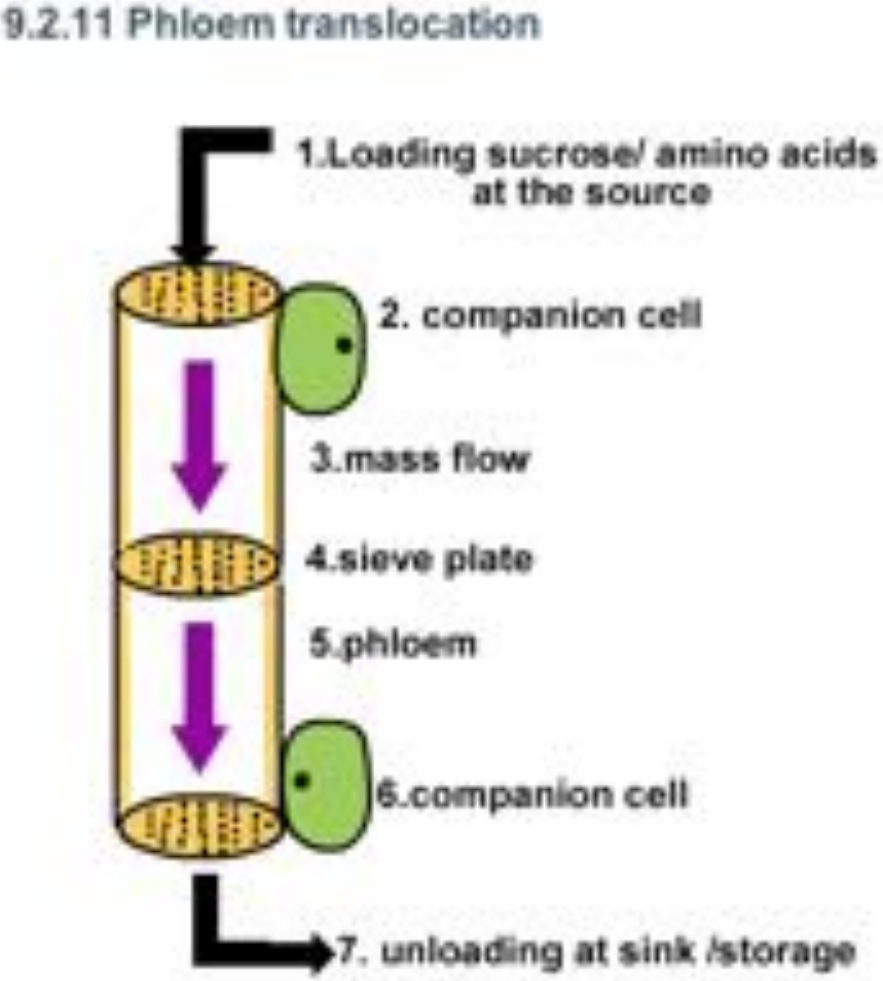
- The source during growing season is the leaf
- Glucose from photosynthesis is converted to sucrose for transport
- Companion cell uses ATP to actively load sucrose into phloem, increasing concentration
- Water flows from xylem to phloem by osmosis



- Sap volume and pressure increase leading to mass flow
- Organic molecules unloaded at sink, converted to insoluble starch for storage
- Water released and flows back into xylem by osmosis and cycle continues

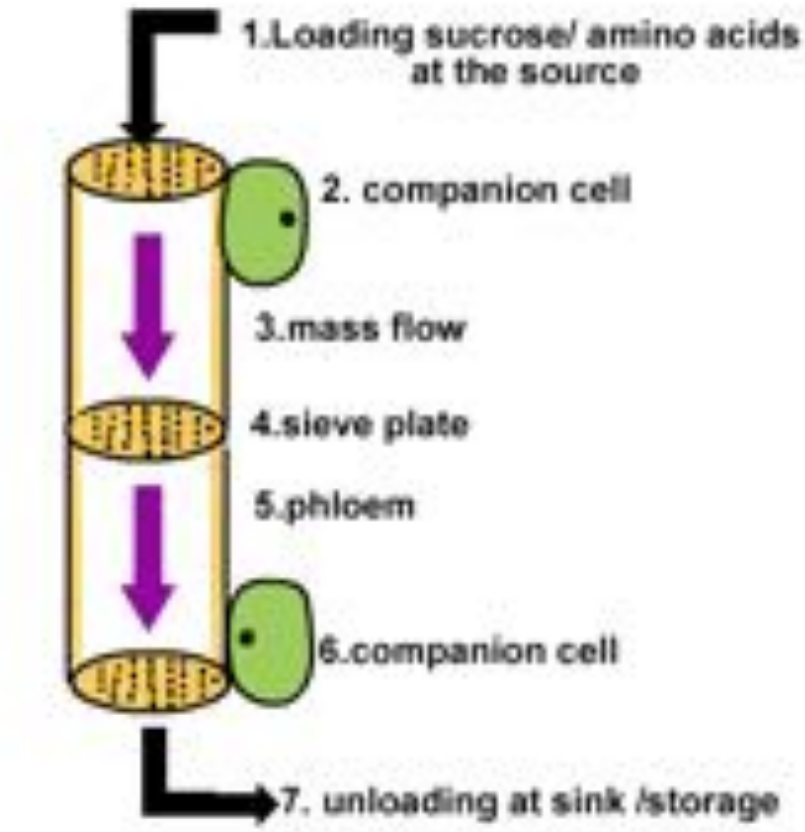


9.2 U.5 Raised hydrostatic pressure causes the contents of the phloem to flow towards the sink



- 1.**Translocation** moves the organic molecules (sugars, amino acids) from their **source** through phloem to the **sink**. Phloem vessels still have cross walls called sieve plates that contain pores.
- 2. **Companion cells** actively (active transport) load sucrose into the phloem.

9.2.11 Phloem translocation



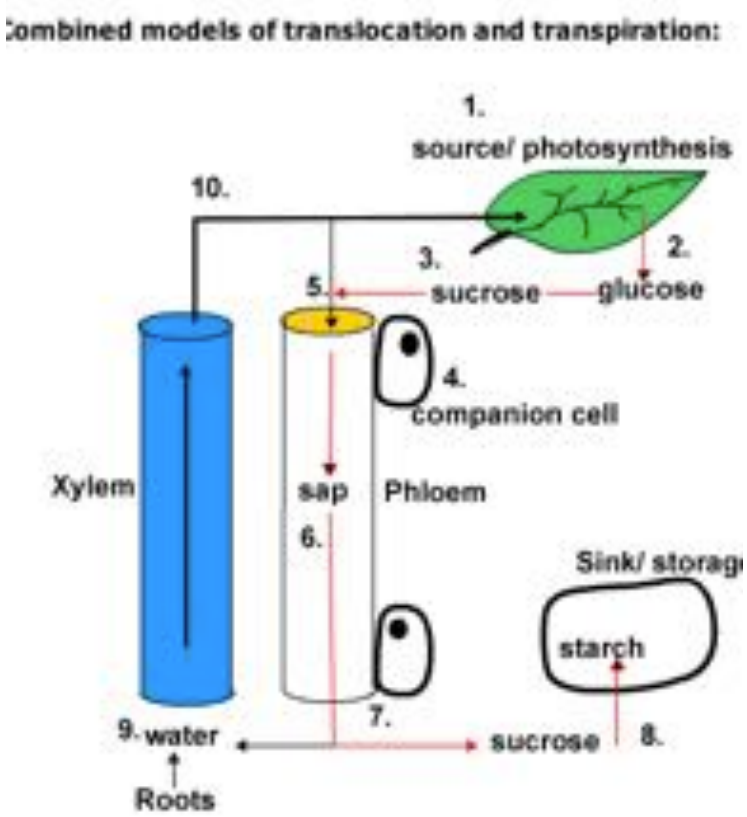
- 3. Water follows the high solute in the phloem by **osmosis.** A positive pressure potential develops moving the mass of phloem sap forward.
- 4. **Companion cells** actively unload (ATP used) the organic molecules
- 5. **Organic molecules** are stored (sucrose as starch, insoluble) at the sink. Water is released and recycled in xylem.

Watch the below animations on translocation

Click on the links below to access animations:

- http://www.youtube.com/watch?v=-b6dvKgWBVY&feature=related
- http://www.youtube.com/watch?v=MxwI63rQubU&feature=related
- https://youtu.be/xGCnuXxbZGk

Transport in Plants Summary



- 1. Source produces **organic molecules**
- 2. Glucose from photosynthesis produced
- 3.Glucose converted to **sucrose** for transport
- 4**. Companion cell** actively loads the sucrose
- 5. Water follows from xylem by **osmosis**
- 6. Sap volume and **pressure increased** to give Mass flow
- 7. Unload the organic molecules by the **companion cell**
- 8. Sucrose stored as the **insoluble and unreactive starch**
- 9. Water that is released is picked up by the **xylem**
- 10. water recycles as part of transpiration to re supply the sucrose loading