PLANT ANATOMY Lecture 13 - Phloem

I. Location and function of phloem
- A. Found in vascular bundles and tissues in all plant parts
- B. Gross wood anatomy (note: phloem is the Greek word for "bark"
  - 1. Axial system (longitudinal system)
    - a) Sieve elements - food transport
      - 1) Sieve cells and sieve-tube members (with companion cells)
    - b) Sclerenchyma cells - support and some storage
      - 1) Fibers and sclerids
    - c) Parenchyma cells - storage
  - 2. Ray system (cross or horizontal system) - there really isn't a phloem ray system
    - a) Parenchyma cells - storage & radial transport
- C. Main functions
  - 1. Sugar (food) transport
  - 2. Support (to a lesser extent than xylem)
- D. Terms associated with phloem: "SAPS"
  - 1. Sugar sieve cells, sieve tube members, companion cells, active, down, symplast (living)

II. Primary and secondary phloem
- A. Primary: protophloem & metaphloem
- B. Secondary: secondary

III. Types of Phloem (all are called "sieve elements")
- A. Sieve cells (analogous to tracheids)
  - 1. Found mostly in gymnosperms and lower vascular plants - very few angiosperms
  - 2. Function to provide primitive sugar transport
  - 3. Long and moderately narrow with rounded ends
  - 4. Holes in end walls referred to as sieve areas
  - 5. Associated cells called albuminous cells
- B. Sieve tube members (analogous to vessel elements)
  - 1. Found only in angiosperms
  - 2. Efficient in the transport of sugar
  - 3. Relatively wide with flat end walls
  - 4. Holes in side walls called sieve areas
  - 5. Holes in the end wall form a sieve plate
  - 6. Associated cells called companion cells

IV. Additional information and development of phloem
- A. Sieve tube members are alive at maturity but have no nucleus
  - 1. Companion cells help out sieve tube members; albuminous cells help out sieve cells (companion cells are really BIG in minor leaf veins)
  - 2. Nucleus for STM is in companion cell
  - 3. Connection between STM and companion cell is sieve area
  - 4. Minor veins of leaves - companion cells are transfer cells (herbaceous dicots)
    - a) Ingrowth of cell wall increases surface area of membrane
    - b) Enables more sugar to be pushed into STM
    - c) Ingrowths enable more active energy transport
- B. Structural features of STMs
  - 1. Callose forms around pores of sieve plate for protection
  - 2. P-protein exists in STMs and tends to pile up against the sieve plate when damage occurs - forms toward the point of damage
- C. Sieve tube members in comparison to xylem
  - 1. Sieve tube members are under positive pressure (xylem is under negative pressure)
  - 2. STMs are constantly ballooning out - STMs tend to explode
  - 3. Analogous to vessel is the sieve tube - but all sieve tubes have openings
- D. Development of STM & companion cell
  - 1. Begin as one cell that divides
  - 2. May be more than one companion cell per STM
  - 3. Trend encountered in STM: from sieve cell to STM (shorter & fatter)