GENERAL BIOLOGY Lecture 24 - Plants: Absorption & Transport

I. Water and mineral absorption by roots
- **A. Absorption of water by roots**
  - **1. Driven by transpiration - negative pressure in xylem draws water in through roots**
  - **2. Root pressure (driving force when transpiration is low - high humidity)**
    - **a) Solutes (sugars) built up in roots cause an osmotic drive of water from surrounding media solution to inner root (i.e., water moves from higher potential to lower potential)**
    - **b) Xylem transport driven by positive pressure - source for guttation**

II. Uptake of mineral nutrients
- **A. Passive uptake of minerals (mineral ions move freely into free space of cortex)**
  - **1. Movement of ions by the "sweeping effect"**
    - **a) Ions can cross the endodermal cell membranes passively by being "swept" into the stele with water**
- **B. Active uptake of minerals**
  - **1. Energy-requiring transport of ions into cells of the cortex (mostly minerals in low abundance in soil solution - nitrate, potassium, sulfate, phosphate, etc.)**
  - **2. Movement into xylem is blocked by special barrier (Casparian strip of an endodermis) - promotes active transport**
    - **a) Endodermis (with Casparian strip) requires that molecules pass through a plasma membrane to enter (or leave) the vascular cylinder**

III. Xylem & phloem transport
- **A. Mechanism of xylem transport (cohesion-adhesion-tension hypothesis)**
  - **1. Xylem is usually dead, empty cells**
  - **2. Transport by bulk flow - driven by transpiration**
    - **a) Transpiration causes "suction" and negative pressure on water in xylem**
  - **3. Important characteristics of water**
    - **a) Cohesion - attraction of water molecules to each other**
    - **b) Adhesion - attraction of water to other molecules (like cell walls)**
    - **c) Tension - ability of water to withstand negative pressure**
- **B. Mechanism of phloem transport (pressure-flow hypothesis)**
  - **1. Source is high pressure; sink is low pressure**
  - **2. "Source-sink" directionality (photosynthesis is source; meristem is sink)**
    - **a) Sugar (photosynthate) is actively transported into phloem at a source**
    - **b) Water moves into sieve tube by osmosis**
    - **c) Water uptake pushes phloem sap (photosynthate) towards sink**
    - **d) Sap (photosynthate) is unloaded at sink;**
    - **e) Water returns to xylem**

IV. Mineral nutrition
- **A. CHOPKNS CaFe Mg B Mn CuZn Cl Mo**
  - **1. CHO - carbohydrates**
  - **2.**

P - ATP	**K - enzymes & stomates**	**N - proteins**
S - amino acids	**Ca - membranes**	**Fe - ETS & photosynthesis**
Mg - chloro.	**B - CHO breakdown**	**Mn, Cu, Zn - enzymes**
Cl - OEC	**Mo - enzymes**	