Plant Structure & Photosynthesis

Chps 8 & 22
I. The Leaf

A. Basic Structure

1. Blade
2. Stalk
3. Veins
B. Tissues in a leaf

1. Veins
   a) transport (carry) materials to and from the leaf
   b) Water to the leaf
   c) Food away
2. Epidermis
   
   a) Outer protective tissue of a leaf
   b) Protects from water loss
   c) Only 1 cell layer thick
   d) Upper epidermis = top of leaf
   e) Lower epidermis = underside of leaf
3. Cuticle
   a) Waxy layer covering the epidermis
   b) Helps protect from water loss
4. **Palisade Layer**
   
a) Row of cells just below the upper epidermis
b) Contain many chloroplasts
5. **Spongy Layer**

   a) Loosely packed cells below the palisade layer
   
   b) Contain chloroplasts
6. Stomates
   a) Tiny openings (holes or pores) in the epidermis
   b) $\text{CO}_2$ enters the leaf
   c) $\text{H}_2\text{O}$ and $\text{O}_2$ out

7. Guard cells
   a) 2 bean shaped cells which form the stomate
   b) Let materials in and out by opening and closing
Leaf Cross Section Quiz

• Draw a diagram of a leaf cross section and label the 8 parts.
Guard cells

Top of leaf

Guard cells (swollen)

Guard cells (shrunken)

Chloroplast

Vacuole

Cell wall

Stoma

Nucleus

Stoma open

Stoma closed
II. Food-making in plants

*Sun provides energy plants need to make food

A. Chloroplast

1. Green, oval structures
2. Contain **chlorophyll**
   a) Uses sun's energy to make food
   b) Makes plants green
   c) Plants need light to make chlorophyll
B. Photosynthesis

1. Process by which plants use light energy to make glucose & release oxygen

2. Takes place in chlorophyll inside chloroplasts
3. 2 stages of photosynthesis
   a) Light phase
      • Requires light as a source of energy
        Step 1: chlorophyll uses energy from sun to split water molecules
        Step 2: water molecules split into H & O
        Step 3: O₂ released to atmosphere
        Step 4: chlorophyll stores some light energy in ATP
b) Dark Phase (Calvin Cycle)

- Part of photosynthesis that doesn’t require light
  Step 1: hydrogen which split from $\text{H}_2\text{O}$ combines with $\text{CO}_2$ using energy stored in ATP
  Step 2: this combination forms glucose ($\text{C}_6\text{H}_{12}\text{O}_6$)
  Step 3: water is formed (byproduct)
Photosynthesis reaction in chloroplast of plants

**Light reaction**
- light
- chlorophyll
- reducing power to drive reaction
- chemical energy
- chemical energy (ATP)

**Dark reaction**
- light
- H₂O
- CO₂
- reducing power to drive reaction
- chemical energy (ATP)
- sugars

**Outputs**
- O₂
- H₂O
- sugars
What you’ll learn about photosynthesis in college...
*respiration occurs in plant cells also, when they need to release the energy stored in glucose
Figure 24. Photosynthesis, respiration, leaf water exchange, and translocation of sugar (photosynthate) in a plant.
III. Transport

A. Plants need CO$_2$ & H$_2$O
   1. CO$_2$ from air through stomates
   2. H$_2$O from roots up through tubes into veins

B. Photosynthesis produces glucose, O$_2$, & H$_2$O
   1. O$_2$ & H$_2$O out into air through stomates
   2. Glucose to other parts of plant through tubes
C. Vascular system

1. Xylem
   a) Tubes that transport sap (water and nutrients) up from roots
   b) Found in stem

2. Phloem
   a) Tubes that transport dissolved food materials
   b) Glucose made in leaves moved to other parts of plant
   c) Roots store food during winter
IV. Growth & Response

A. Hormones

1. Growth regulators
2. Chemical messenger made in one part of an organism & transported to another part
3. Transported by phloem
4. Example: ethylene = ripens fruit
B. Stimuli

1. Any change in the environment that causes a response in an organism
2. Can trigger plant hormones
C. Tropism

- Growth of a plant in response to a stimulus
- Hormone = auxin

1. Phototropism: response to light
   - Positive: leaves & stem grow toward light
   - Negative: roots grow away

2. Gravitropism: response to gravity
   - Positive: roots grow down
   - Negative: stems grow up

3. Thigmotropism: response to contact
   - Helps vines wind around support
(a) Straight growth  
(b) Phototropism  
(c) Gravitropism