

GENERAL BOTANY Lecture 9 - Photosynthesis

- I. **Photosynthesis - The process that occurs in the chloroplasts of green plants in which simple sugars are formed from carbon dioxide and water in the presence of light and chlorophyll.**
  - A. **Two major parts of photosynthesis**
    - 1. **Light reactions**
      - a) **Conversion of light energy into ATP and NADPH**
    - 2. **Dark reactions**
      - a) **Use of energy (ATP & NADPH) to form carbohydrates**
  - B. **Purpose of photosynthesis**
    - 1. **Main biosynthetic pathway by which carbon and energy enter the web of life**
- II. **Where it occurs**
  - A. **Chloroplast**
    - 1. **Light reactions - granum (several thylakoids) and thylakoid membranes**
    - 2. **Dark reactions - stroma**
- III. **Light reactions**
  - A. **Light-trapping molecule**
    - 1. **Chlorophyll (antenna chlorophyll pick up light)**
      - a) **Transmits green and absorbs red and blue, etc.**
      - b) **Right wavelength of energy excites an electron of chlorophyll**
      - c) **Inductive resonance carries excitation energy from molecule to molecule**
      - d) **Energy (P700 or P680) is transferred to an acceptor molecule**
  - B. **Two options for electron excitation energy**
    - 1. **Cyclic (short) pathway**
    - 2. **Non-cyclic (long pathway)**
  - C. **Cyclic photophosphorylation**
    - 1. **(Photosystem I) LIGHT - P700 - P700\* (Chl a/b redox) - [ETS: Fe-S protein-Ferredoxin-Plastoquinone] - P700 + ATP**
  - D. **Non-cyclic photophosphorylation (Photosystem II and then I)**
    - 1. **(Photosystem II) LIGHT - (OEC) - P680 - P680\* (Pheophytin a) - [ETS: Plastoquinone-Plastocyanin + ATP - (Photosystem I) W/LIGHT - P700 - P700\* (Chl a/b redox) - [ETS: Fe-S protein-Ferredoxin] - NADPH (NADPH from 2 e<sup>-</sup> and 1 H<sup>+</sup>)**
    - 2. **Electrons replaced by water (O<sub>2</sub> is released and H<sup>+</sup> goes into thylakoid)**
    - 3. **Split of water referred to as photolysis**
    - 4. **ATP comes from proton gradient (H<sup>+</sup> stored in thylakoid leaves to makes ATP)**
  - E. **Use of products from photosynthesis**
    - 1. **ATP - energy**
    - 2. **NADPH - reducing equivalents for organic synthesis**