

PLANT PHYSIOLOGY Lecture 7 - Photosynthesis

- I. Photosynthesis - The process which 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⁻ and 1 H⁺)
 - 2. Electrons replaced by water (O₂ is released and H⁺ goes into thylakoid)
 - 3. Split of water referred to as photolysis
 - 4. ATP comes from proton gradient (H⁺ stored in thylakoid leaves to makes ATP)
 - E. Use of products from photosynthesis**
 - 1. ATP - energy
 - 2. NADPH - reducing equivalents for organic synthesis