GENERAL BIOLOGY Lecture 9 - Photosynthesis (Part I)

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 (O_2 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**