2. **Electron Transport Through the Cytochrome Complex Generates a Proton Gradient.** The electron carrier from PSII passes through the thylakoid membrane and transfers its electrons to the cytochrome complex, which consists of several subunits including cytochrome *f* and cytochrome b_6. A series of redox reactions within the complex ultimately transfer the electrons to a second electron carrier that acts as a shuttle to photosystem I (PSI). As electrons are transported through the complex, protons (H^+) outside the thylakoid are carried to the inner thylakoid space. The increase in proton concentration inside the thylakoid space creates a proton gradient across the thylakoid membrane.

3. **Light Absorption by PSI Excites Electrons and Facilitates Electron Transfer to an Electron Acceptor Outside the Thylakoid Membrane.** PSI is another large protein-pigment complex that contains light-absorbing antenna molecules and a reaction center. Light absorbed by the PSI reaction center energizes an electron that is transferred to ferredoxin (Fd), a molecule that carries electrons to other reaction pathways outside the thylakoid. The reaction center replaces the electron transferred to ferredoxin by accepting an electron from the electron-carrier molecule that moves between the cytochrome complex and PSI.

4. **Under Certain Conditions, Ferredoxin can Carry Electrons to Hydrogenase.** Normally, ferredoxin shuttles electrons to an enzyme that reduces NADP+ to NADPH, an important source of electrons needed to convert CO_2 to carbohydrates in the carbon-fixing reactions. Under anaerobic conditions, hydrogenase can accept electrons from reduced ferredoxin molecules and use them to reduce protons to molecular hydrogen (H_2).

5. **Dissipation of Proton Gradient is Used to Synthesize Adenosine Triphosphate (ATP).** ATP synthase couples the dissipation of the proton gradient generated in step 2 to the synthesis of ATP. Translocation of protons from a region of high concentration (thylakoid space) to a region of low concentration (outside thylakoid) releases energy that can be used to drive the synthesis of ATP from adenosine diphosphate (ADP) and phosphate (P). ATP is a high-energy molecule used to convert CO_2 to carbohydrates in the carbon-fixing reactions.

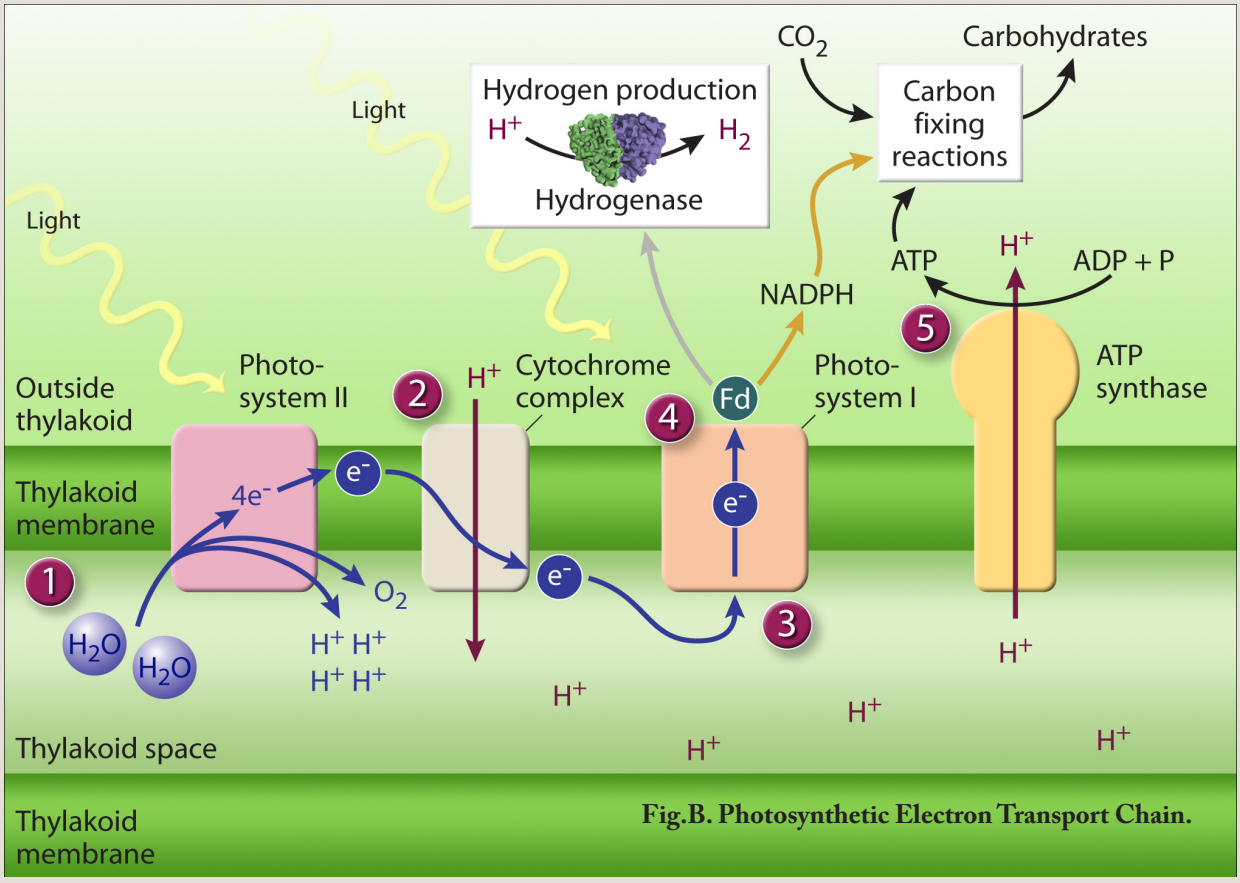

Fig.B. Photosynthetic Electron Transport Chain.