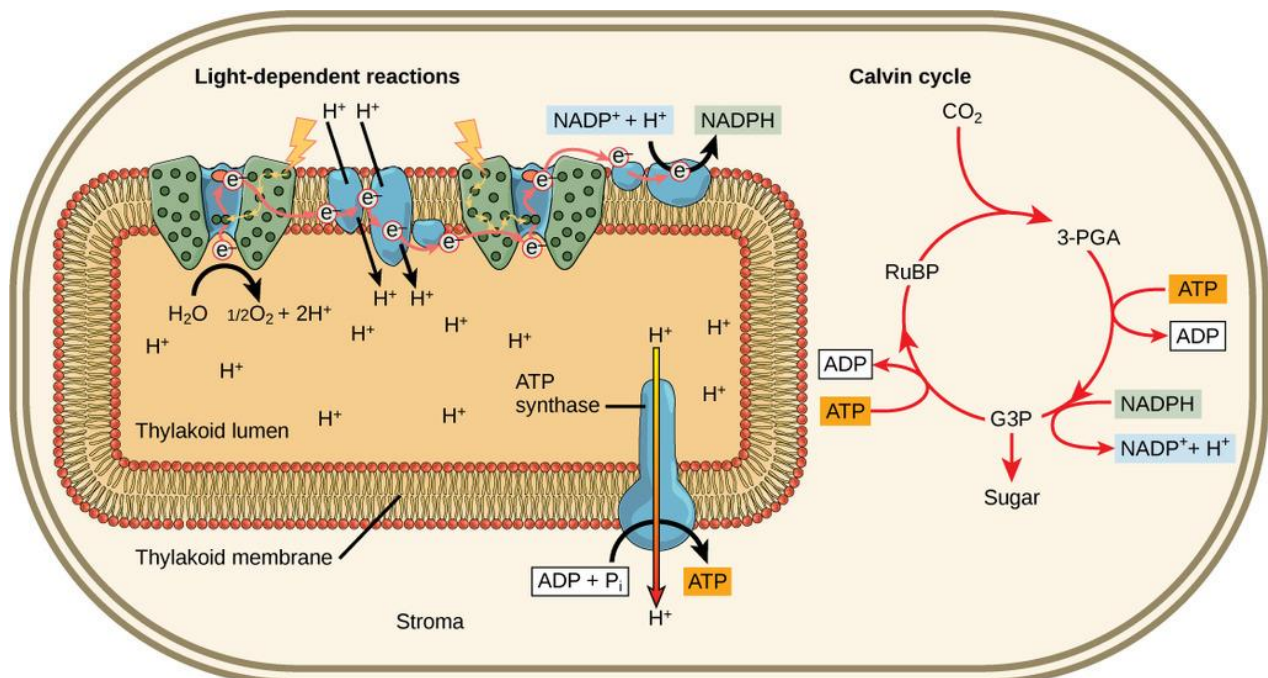


# Photosynthesis

- Takes place in **chloroplast**
- Two stages
  - **Light Dependent Reaction** (Electron Transport Chain)
    - In **thylakoid membrane**
    - Uses **H<sub>2</sub>O**
      - Light energy strikes **Photosystem II** (containing **chlorophyll**) used to break H<sub>2</sub>O → hydrogen ions (**H<sup>+</sup>**) + electrons (**e<sup>-</sup>**) + oxygen (**½O<sub>2</sub>**)
        - Energized electrons travel through electron transport chain and provide energy to pump additional H<sup>+</sup> ions into interior space
      - With an additional energy boost from light energy in **Photosystem I**, the energized electrons help produce **NADPH**
      - **H<sup>+</sup> ions** will eventually provide energy, when they travel through ATP Synthase molecule, to make **ATP**
    - Produces **O<sub>2</sub>**
    - Overall function = transform light energy into chemical potential energy
  - **Light Independent Reaction (Calvin Cycle)**
    - A cyclic reaction
    - In **Stroma**
      - Uses **CO<sub>2</sub>**
      - Energy from **ATP** and **NADPH** made in first stage will provide energy to bond carbons from **CO<sub>2</sub>** together to form **C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>**
        - ADP and NADP<sup>+</sup> produced go back to light dependent stage and get turned back into ATP and NADPH
      - Produces **C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>**
    - Overall function = transform chemical potential energy of ATP and NADPH into another form of chemical potential energy (glucose C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)



# Cellular Respiration

- Takes place in 3 stages
  - **Glycolysis**
    - Takes place in **cytoplasm**
    - **Anaerobic** process (no  $O_2$ )
    - **Glucose** ( $C_6H_{12}O_6$ ) enters and is broken down into **pyruvic acid** (pyruvate ( $C_3H_3O_3^-$ ))
    - Energy from breaking glucose bonds produces **2 ATP**
  - **Krebs Cycle** Aerobic process (requires  $O_2$ )
    - Takes place in **mitochondria**
    - **Pyruvate** ( $C_3H_3O_3^-$ ) enters mitochondria and is broken down into  **$CO_2$**
    - Energy from breaking carbon bonds used to produce chemical potential energy in the form of **ATP** and **NADH** and **FADH<sub>2</sub>**
    - **2 ATP** produced
  - **Electron Transport Chain (ETC)**
    - Takes place in **membrane** within mitochondria
    - **$O_2$**  enters and produces  **$H_2O$**
    - Powered by energy from Krebs cycle (**FADH<sub>2</sub>** and **NADH**)
      - **FAD** and **NAD<sup>+</sup>** produced when energy is taken from FADH<sub>2</sub> and NADH travel back to Krebs Cycle to get turned back into **FADH<sub>2</sub>** and **NADH**
    - **FADH<sub>2</sub>** and **NADH** carry electrons to electron transport chain (ETC)
    - **Electrons** travel through **ETC** and provide energy to pump **H<sup>+</sup> ions** into interior space
    - **H<sup>+</sup> ions** build up and eventually pass through **ATP Synthase** to produce bulk of **ATP** (**32 molecules of ATP**)

