

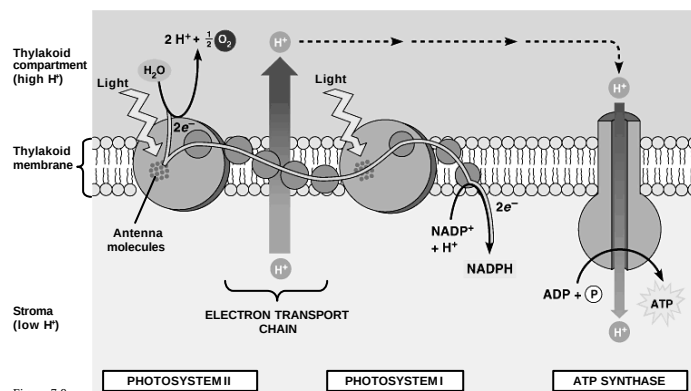
1. Light reactions overview

- Occurs at **grana**
- Light energy is absorbed by **chlorophyll**
- This energy is used to generate **ATP** via chemiosmosis
- NADP^+ is reduced to make **NADPH**
 - Do not be confused with NAD^+ and NADH
- H_2O is consumed and O_2 is generated as waste

3. Three protein components of the light reactions

- **Photosystem I and II**
 - Chlorophyll-containing light harvesting units (absorbs light energy)
- **Electron transport chains**
 - **Pumps H^+** from the stroma to the thylakoid compartment
- **ATP synthase**
 - **Synthesize ATP** using energy obtained from the movement of H^+ from the thylakoid compartment to the stroma

2. Light reactions schematic



4. Light reactions detail

1. Light hits photosystems
2. Chlorophyll gives out **high energy electrons**
3. The lost electrons are replaced by electrons obtained from splitting H_2O . O_2 is generated as waste.
4. High energy electrons are transferred to **the electron transport chains**.
5. Electrons move through electron transport chains, releasing energy each time.

5. Light reactions detail (continued)

5. The energy is used to **pump H^+** from the stroma to the thylakoid compartment.
6. H^+ ions build up in thylakoid compartment
7. H^+ move back through **ATP synthase**
8. The energy obtained from the movement of H^+ is used to synthesize **ATP (Chemiosmosis)**
9. At the end of electron transport chains, $NADP^+$ is reduced to **NADPH**

6. Calvin cycle overview

- Occurs in **stroma**
- NOT dependent on light
- $CO_2 \rightarrow C_6H_{12}O_6$ (generation of glucose from CO_2 gas) - **carbon fixation**
- The **endergonic reaction** is fueled by the **ATP** generated by the light reactions
- **NADPH** provide hydrogen needed for generating glucose

7. Chloroplast vs. Mitochondrion

Similarities

- contain double membrane
- contain DNA
- exhibit similarity to prokaryotes
- electron transport chains
- synthesize ATP via chemiosmosis

8. Photosynthesis vs. Respiration

Photosynthesis	Cellular respiration
• Chloroplast • Light is energy source • Electron transport chains obtain energy from photosystems. • O_2 is generated as waste. • CO_2 is consumed. • NADPH	• Mitochondrion • Glucose is energy source • Electron transport chains obtain energy from NADH. • O_2 is consumed. • CO_2 is generated as waste. • NADH, $FADH_2$