Section 9.2
Photosynthesis: An Overview
I Can...

• **LS 1.8** I can create a model that supports the relationship of chloroplast structure to its function.

• **LS 1.8** I can develop a model to explain the flow of matter and energy in photosynthesis.
Key Questions

1. What role do pigments play in the process of photosynthesis?
2. What are the electron carrier molecules?
3. What are the reactants and products of photosynthesis?
Vocabulary

• Pigment
• Chlorophyll
• Thylakoid
• Stroma
• NADP⁺
• Light-dependent reactions
• Light-independent reactions
Chlorophyll

• Light energy from the sun must be captured

• Sunlight is perceived as “white” light, but is a mixture of different wavelengths
  • Known as the visible spectrum

• Plants gather the sun’s energy with light-absorbing molecules called **pigments**.

• The principle pigment of green plants is known as **chlorophyll**.
  • Chlorophyll a and b- do not absorb green light
Plants also contain red and orange pigments, such as carotene.

Chlorophyll breaks down first as temperature drops in autumn, leaving the reds and oranges to see.
Chloroplasts

• Photosynthesis takes place inside organelles called chloroplasts.
  • Surrounded by two membranes

• Filled with chlorophyll-containing membranes called **thylakoids**
  • Interconnected and in stacks called *grana* (singular: *granum*)

• The fluid-portion of the chloroplast, outside the thylakoids, is known as the **stroma**.
Energy Collection

• Chlorophyll and other pigments absorb light and transfer the energy to their own electrons.

• These high-energy electrons are then available to do chemical work, like building sugar molecules.

• The high-energy electrons produced by chlorophyll are highly reactive and require a special “carrier.”
High-Energy Electrons

• An *electron carrier* is a compound that can accept a pair of high-energy electrons and transfer them, along with most of their energy, to another molecule.

• **NADP**\(^+\) accepts and holds 2 high-energy electrons along with a hydrogen ion (H\(^+\)). This converts the NADP\(^+\) into NADPH.

• NADPH can carry the high-energy electrons that were produced by light absorption in chlorophyll to chemical reactions elsewhere in the cell.
An Overview of Photosynthesis

- Photosynthesis uses the energy of sunlight to covert water and carbon dioxide (low-energy reactants) into high-energy sugars and oxygen (products).

\[ 6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \]

- carbon dioxide + water  \( \rightarrow \)  sugars + oxygen
The Two Reactions of Photosynthesis

1. The light-dependent reactions
   • Location: thylakoid membrane

2. The light-independent reactions
   • Also called the Calvin cycle of Dark reaction
   • Location: stroma
The End 😊