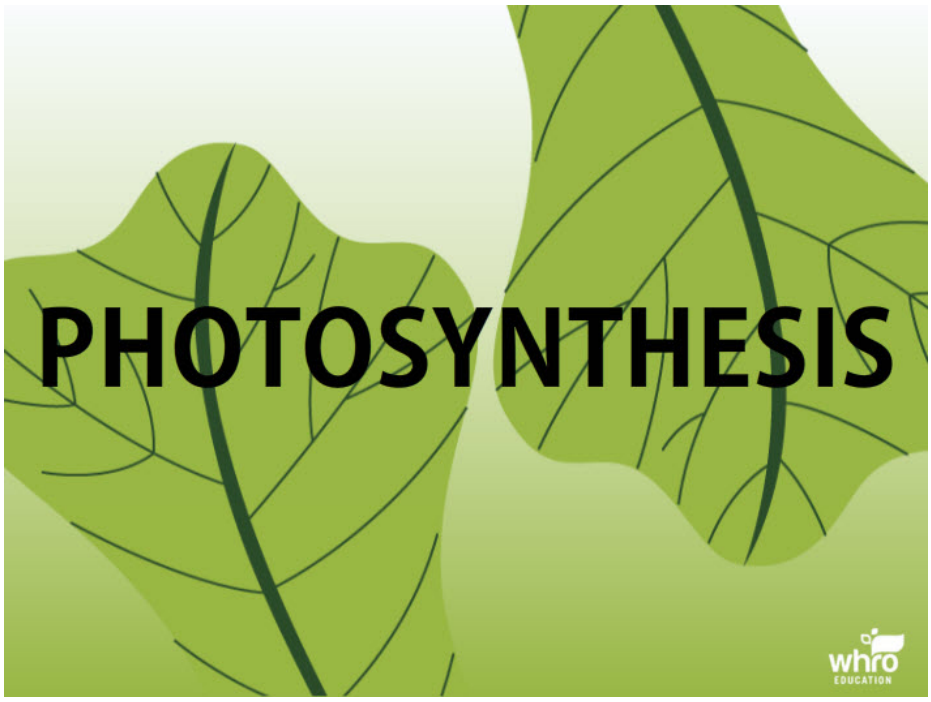
Module 3: Cell Biology - Structure and Function

Topic 5 Content: Photosynthesis Notes

Introduction



Photosynthesis

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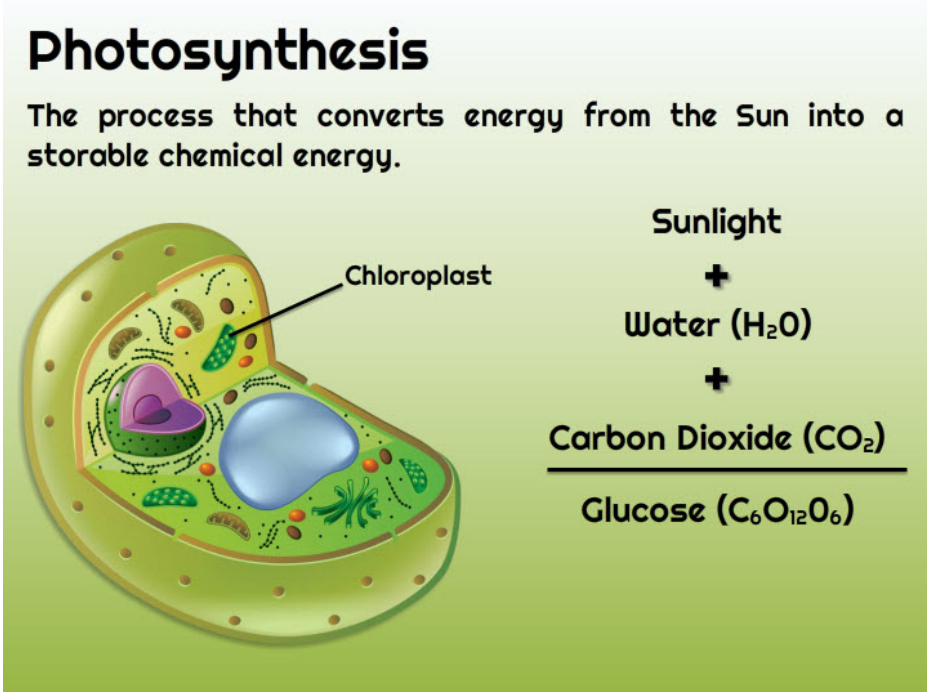
Photosynthesis



Photosynthesis is the process that converts energy from the Sun into storable chemical energy. In order for photosynthesis to function properly, sunlight, water, and carbon dioxide are used to produce the simple sugar glucose. The oxygen you breathe is a byproduct of photosynthesis. In plant cells, photosynthesis takes place in the organelle called a chloroplast. Click the chloroplast to learn more about the process of photosynthesis.

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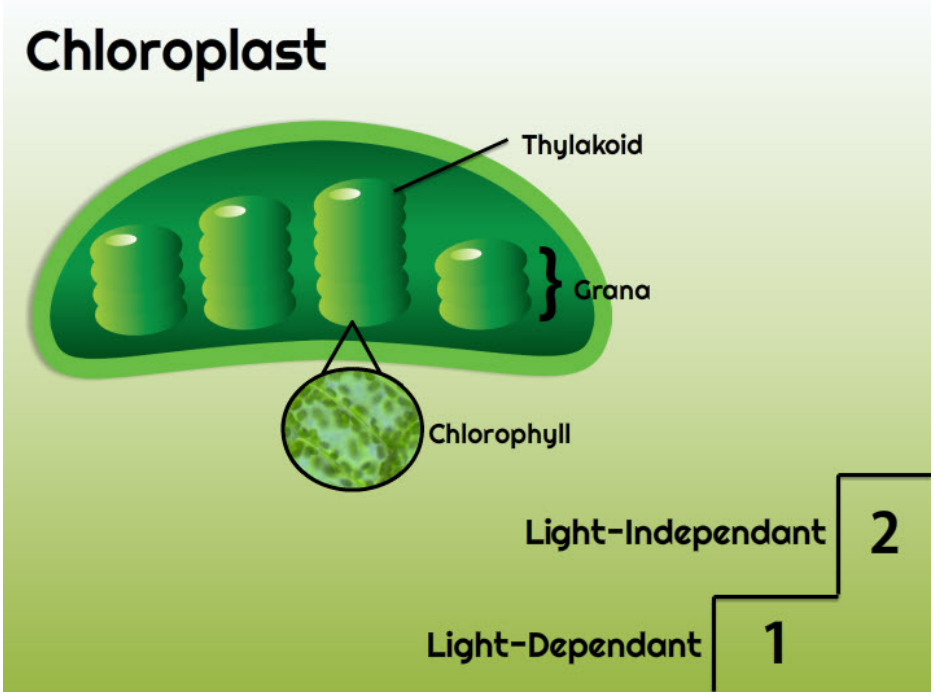
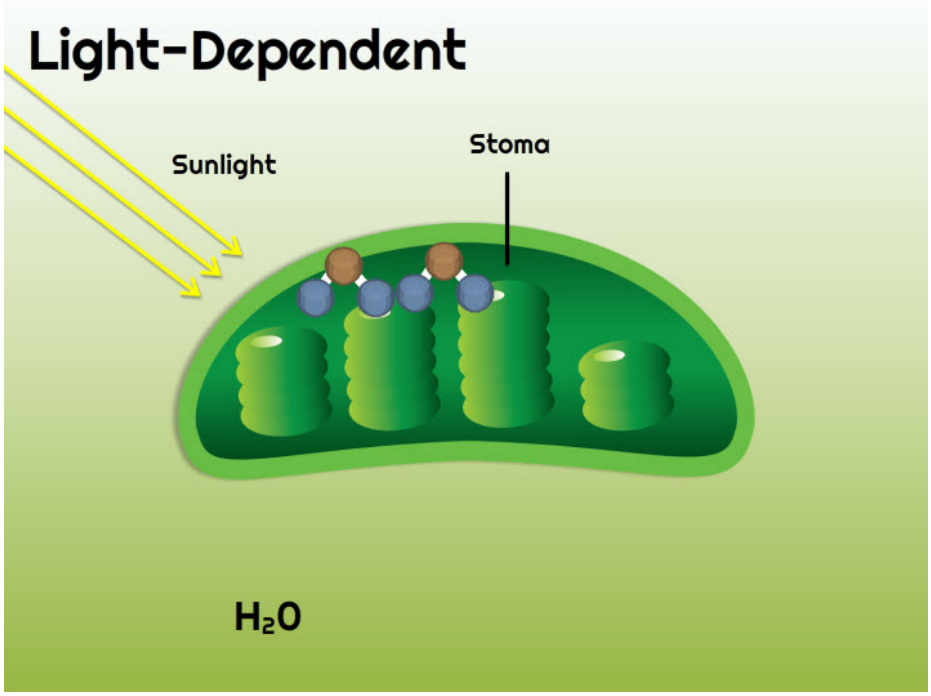
Chloroplast



Photosynthesis is a two-step process: the light-dependent reactions and the light-independent reactions. The first step is the light-dependent reactions. The light-dependent reactions occur in the chloroplasts in the cells of photosynthetic organisms.

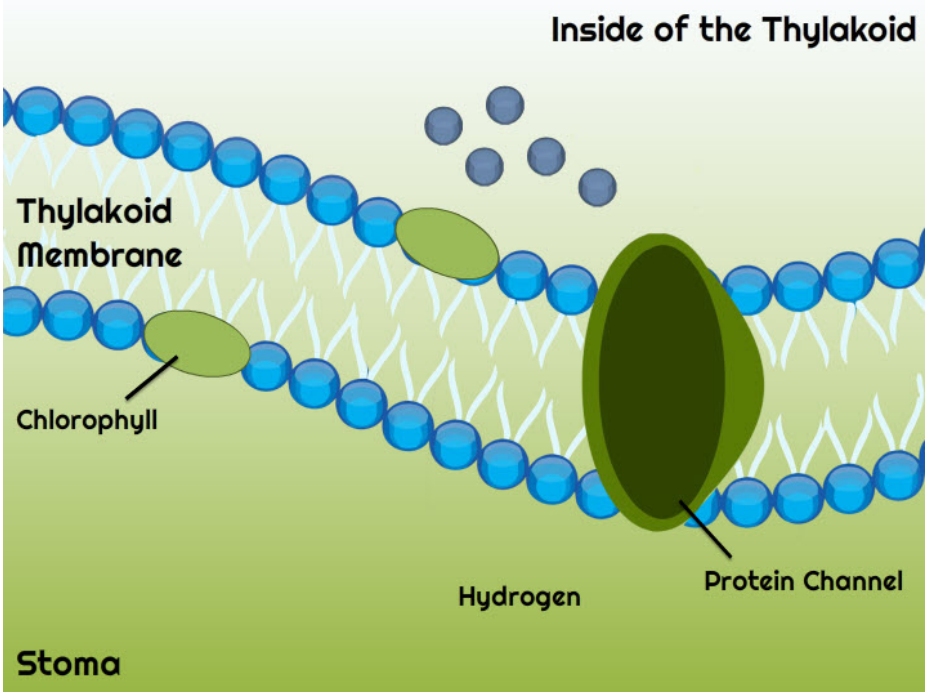
Thylakoids are flattened membranes within the chloroplast. The thylakoids are arranged in stacks called grana, and light-absorbing chlorophyll pigments are inside the thylakoids. The large surface area of the thylakoids provides the space for light absorption and for the transport of electrons along the membranes. Click the chloroplast to learn more about the light-dependent reactions.

Light-Dependent



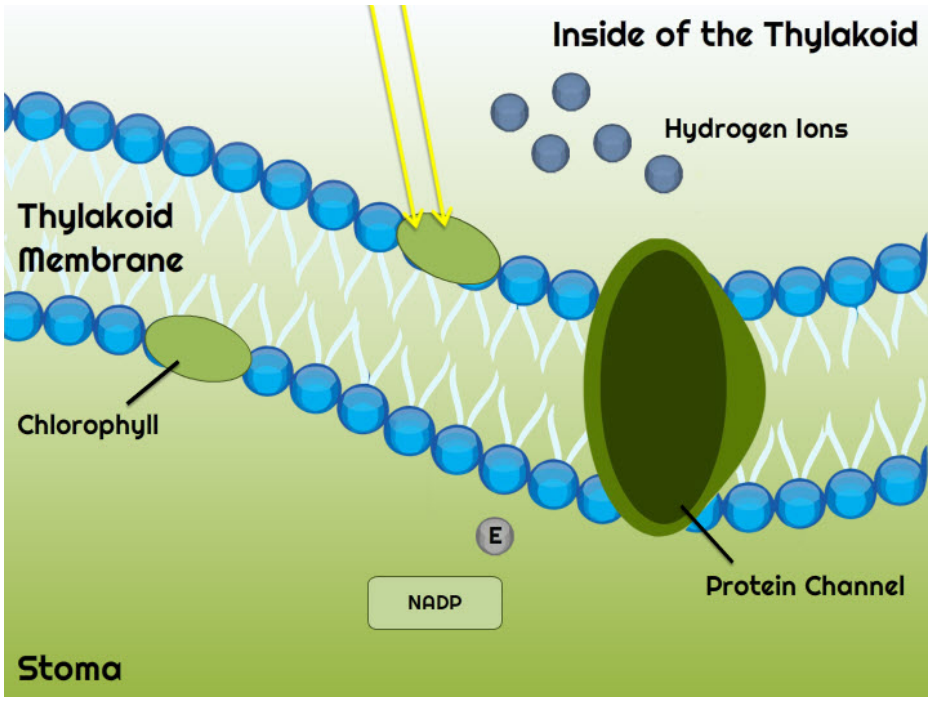
The first stage of the light-dependent photosynthesis process occurs within the stoma of the chloroplast. In this stage, energy is absorbed from sunlight, water molecules are broken down, and oxygen is released. Click the thylakoid to zoom in and continue learning about the light-dependent reactions.

Thylakoid membrane



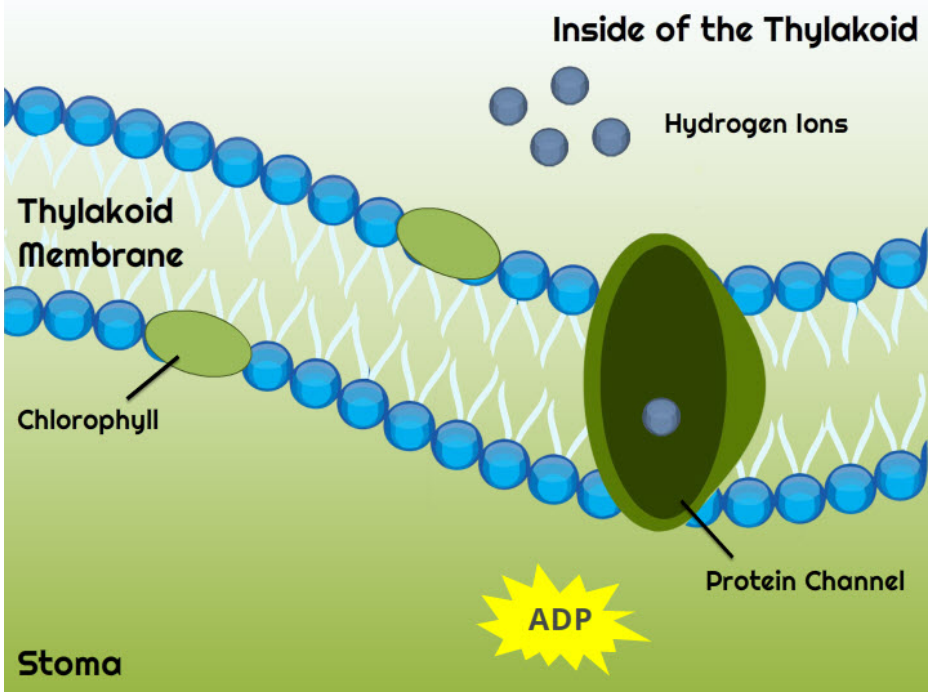
After energy is absorbed, water molecules are broken down, and oxygen is released, hydrogen molecules are transported from the stoma across the thylakoid membrane. To continue learning about the light-dependent reactions, click chlorophyll.

Chlorophyll and NADPH



In the next step, energy is absorbed from sunlight by the chlorophyll. The phosphate NADPH, known as nicotinamide adenine dinucleotide phosphate-oxidase, is created when the electron is added to nicotinamide adenine dinucleotide phosphate, or NADP. Click on the hydrogen ions to learn about the final step in the light-dependent reactions of photosynthesis.

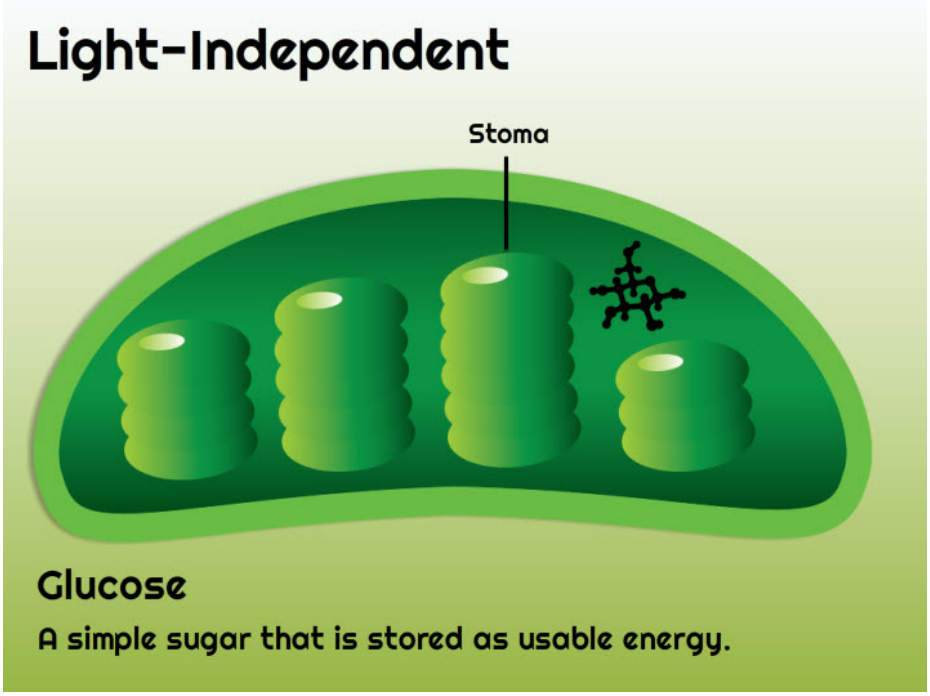
ADP and ATP



After NADPH is produced, hydrogen ions diffuse through the thylakoid membrane through the protein channel. The hydrogen changes ADP to ATP.

The light-independent portion of photosynthesis occurs in the stoma of the chloroplast. Click anywhere in the stoma to zoom out and learn more about these reactions.

Calvin Cycle



The light-independent reactions of photosynthesis can occur in the presence or absence of light. Another name for the light-independent reactions is the Calvin Cycle. During the Calvin Cycle, carbon dioxide is "fixed" by joining with organic molecules. As the Calvin Cycle progresses, the energy from ATP and the phosphate NADPH convert the high energy organic molecules into glucose. Glucose is a simple sugar that is stored and used for energy. Click on the glucose molecule to review the process of photosynthesis.

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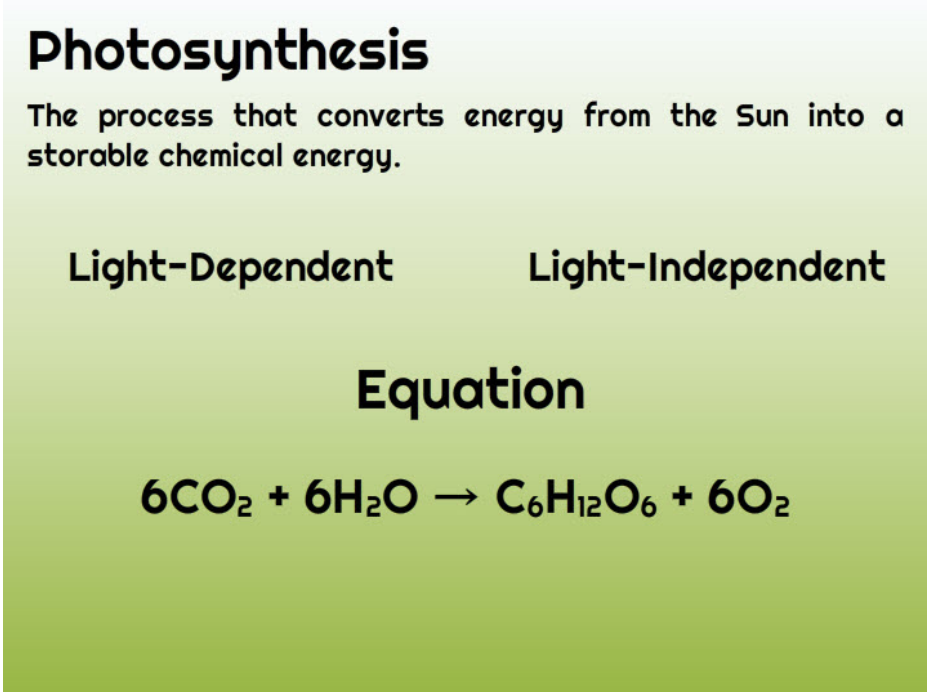
Summary



Photosynthesis is a two-step process. The first portion of photosynthesis depends on sunlight for energy. The second portion, called the Calvin Cycle, converts carbon dioxide and organic materials using ATP and NADPH. A byproduct of photosynthesis is oxygen gas. Photosynthesis is represented by the following chemical equation:

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$