

# Photosynthesis — A Short Primer

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## What is photosynthesis?

Photosynthesis is the biological process by which green plants, algae, and certain bacteria convert sunlight into chemical energy. The energy is stored in the form of glucose and other organic compounds. Photosynthesis is the primary source of energy for almost all life on Earth, and it is responsible for the oxygen we breathe.

## The overall reaction

The simplified chemical equation is:  $6 \text{CO}_2 + 6 \text{H}_2\text{O} + \text{light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2$ . Plants take in carbon dioxide from the air and water from the soil, then use sunlight to combine them into sugar (glucose) and release oxygen as a by-product.

## Where it happens

Photosynthesis takes place mainly in the leaves of plants, inside organelles called **chloroplasts**. Chloroplasts contain a green pigment called **chlorophyll**, which absorbs red and blue wavelengths of light and reflects green light — that's why most plants appear green.

## Two stages

Photosynthesis has two main stages. The **light-dependent reactions** happen in the thylakoid membranes and convert light energy into ATP and NADPH while splitting water molecules to release oxygen. The **Calvin cycle** (light-independent reactions) takes place in the stroma and uses ATP and NADPH to fix  $\text{CO}_2$  into glucose.

## Why it matters

Photosynthesis underpins the food chain — plants produce the energy that all herbivores depend on, and predators in turn depend on herbivores. It also regulates atmospheric oxygen and removes carbon dioxide, playing a central role in the global carbon cycle and climate.

## Factors that affect the rate

The rate of photosynthesis depends on light intensity, carbon dioxide concentration, temperature, and water availability. Below a certain light level, the rate increases linearly with light. Above an optimum, very high temperatures damage the enzymes involved and the rate drops sharply.