

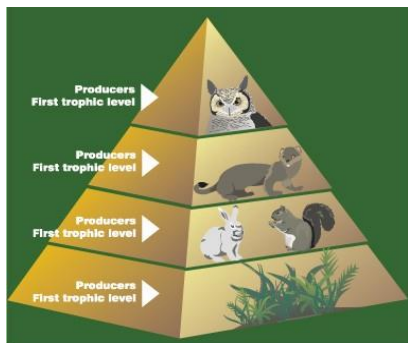
Photosynthesis

Real World Energy
Backgrounder
Grade Level: 9-12



Photosynthesis is an extremely important process in nature. It is a process that takes place in green plants. Without it, there very likely would be no life on Earth. Through photosynthesis, plants are able to make their own food from nothing more than water and carbon dioxide, with the help of energy from the sun.

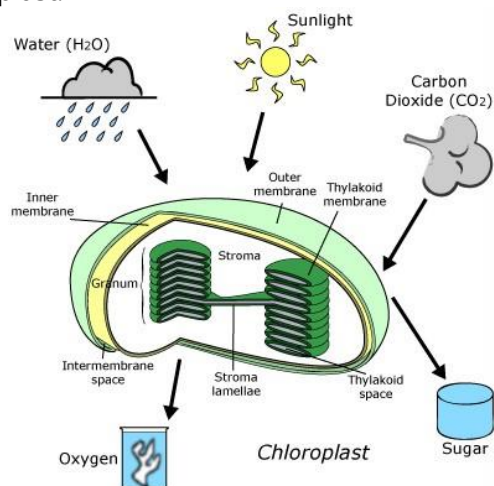
The food that plants make is sugar called glucose. All living things need glucose as their most basic food source, even we humans! Plants need it for their normal processes of growth and reproduction. Fortunately for the rest of the living things on Earth, plants make enough glucose to supply all the non-plant organisms with food, too. For this reason, plants are at the beginning of every important food chain.



Plants at the base, with various levels of animal consumers. Plants are the source of food for all other organisms on Planet Earth.

Photosynthesis Basics

So exactly what is photosynthesis, and how does it work? The word photosynthesis literally means, “building things with light.” Below is a diagram of a chloroplast.



Photosynthesis takes place inside the plant cell, in bean-shaped objects called **chloroplasts**. The chloroplast contains several chemicals that have the ability to absorb light and harvest energy from it. These chemicals are called **photosynthetic pigments** and the main one is called **chlorophyll**. These pigments give plants their characteristic green colour. Chlorophyll, along with other photosynthetic pigments, can harvest energy from sunlight. This energy is used to power a complicated series of chemical reactions inside the chloroplast that results in glucose.

Did You Know? Leaves Put on Spectacular Show

Every autumn, the leaves of trees in Canada put on a spectacular show. Why does this happen? It has to do with the photosynthetic pigments inside their cell. As a tree leaf dies, the main pigment chlorophyll breaks down chemically, revealing the other pigments inside the chloroplast. The remaining pigments are richly coloured and give the forest its characteristic blend of red, orange, yellow, and brown.

To make glucose, a plant cell needs just two ingredients: water and carbon dioxide. The plant takes the carbon dioxide from the atmosphere through pores on the surface of its leaves. Water is brought in through the roots and stem or can be absorbed directly by the leaf. In a complex chemical process, the atoms that make up the water and carbon dioxide molecules are rearranged to form glucose. A by-product of photosynthesis is the gas **oxygen**. This gas is moved back to the atmosphere through the leaf's pores.

Without glucose, the plant's cells would quickly die. So how does a plant survive when there is no sunshine, such as at night? And what about its roots, which get no sunshine whatsoever? The answer is that plants make extra glucose during the day, which they store for use at night, or send to other parts of the plant that cannot make their own glucose.

To store glucose, most plants package it into large molecules called **starch**. Starch is often found in seeds, roots, stems, and other parts. Starch stored in the leaves during the day is broken down into glucose and used by those same cells at night. Large amounts of starch are stored in seeds to provide a food supply for the future seedling as it pushes its way to the surface of the soil.

Plants can also use glucose to make cellulose, another important substance in nature. Cellulose is the stiff stringy material found in plant stems. It is the main ingredient in wood. Glucose made in the leaf is sent down to the stem and roots through the veins of the plant.

Did You Know? Oxygen

Oxygen is a waste product from the process of photosynthesis. But for almost every other living thing, oxygen is essential for survival. Green plants have been building up the Earth's oxygen supply for about 2.5 billion years. At the time photosynthesis began, the atmosphere contained no oxygen but was rich in carbon dioxide. Now the situation is reversed. Oxygen now makes up about 21 percent of the atmosphere, and carbon dioxide is present only in trace amounts (less than 0.04 percent).

Photosynthesis, taking place over millions of years, has slowly removed the carbon dioxide from the atmosphere, and replaced it with oxygen.

Glucose: Cell Fuel

Glucose is the basic food of all life forms on the planet. It is the main fuel for all of the activities of cells. These activities include the making of hormones and enzymes (chemicals that help reactions take place inside cells and inside digestive organs such as the stomach and intestine), movement, fighting diseases, generating heat, removing wastes, sending nerve impulses, and many others.

Animals cannot make their own glucose, so they eat other organisms that can, such as grass. Green plants are the only organisms that make their own glucose. Every other kind of organism on the Earth must either eat plants or eat other organisms that eat plants, to get their food.

Did You Know? Over to the Dark Side

Some plants have gone over to the "dark side," and given up photosynthesis as a way of life. They have evolved into parasites. They get their glucose by tapping into the root systems of other plants instead of making their own. As a result, they have no chloroplasts and are a ghostly white colour.

Phytoplankton: Superhero Photosynthesizers

Most of the photosynthesis that provides oxygen to the Earth's atmosphere happens in the oceans. Single-celled green plants called **phytoplankton** live near the sunlit surface of all of the world's oceans.

They absorb water and carbon dioxide from seawater and make glucose and oxygen. Marine scientists are concerned that rising ocean temperatures around the world are affecting the oceans' ability to produce phytoplankton, which could over time affect the amount of oxygen in the atmosphere.

Key Points to Remember

- Photosynthesis is the use of energy from sunlight to make sugar. Photosynthesis occurs only in the cells of green plants.
- Photosynthesis occurs inside a structure called a chloroplast.
- Photosynthesis requires sunlight, water, and carbon dioxide.
- The products of photosynthesis are a sugar (glucose) and oxygen.
- Oxygen produced by plants has built up in the atmosphere, while carbon dioxide has been reduced.
- Animals depend on both the oxygen and the sugars made by plants.