



HUMAN AND SOCIAL BIOLOGY

UNIT 1 - Living Organisms and the Environment Situations

Lesson

4

Photosynthesis

OBJECTIVES

At the end of this lesson you will be able to:

- a) Explain photosynthesis
- b) Describe how animals depend on plants for food



(See Chapter 6 pages 43-49 in textbook)

Photosynthesis

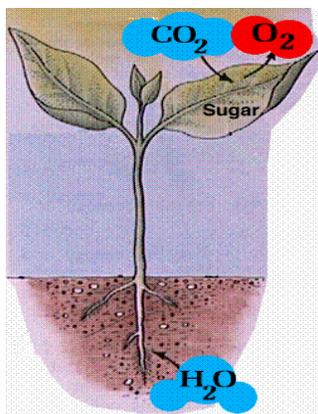
[Photosynthesis](#) is the process by which plants, some bacteria, and some protists use the energy from sunlight to produce sugar, which [cellular respiration](#) converts into [ATP](#), the "fuel" used by all living things. The conversion of unusable sunlight energy into usable chemical energy is associated with the actions of the green pigment [chlorophyll](#). Most of the time the photosynthetic process uses water and releases the oxygen that we absolutely must have to stay alive.

We can write the overall reaction of this process as:



The above chemical equation translates as:

Six molecules of water plus six molecules of carbon dioxide produce one molecule of sugar plus six molecules of oxygen.



Photosynthesis is the process of converting light energy to chemical energy and storing it in the bonds of sugar. This process occurs in plants and some algae (Kingdom Protista). Plants need only light energy, CO_2 , and H_2O to make sugar. The process of photosynthesis takes place in the **chloroplasts**, specifically using **chlorophyll**, the green pigment involved in photosynthesis.

Photosynthesis takes place primarily in plant leaves, and little to none occurs in stems, etc. The parts of a typical leaf include the **upper and lower epidermis**, the **mesophyll**, the **vascular bundle(s)** (veins), and thea. The upper and lower epidermal cells do not have chloroplasts, thus photosynthesis does not occur there. They serve primarily as protection for the rest of the leaf. The stomata are holes which occur primarily in the lower epidermis and are for air exchange: they let CO_2 in and O_2 out. The vascular bundles or veins in a leaf are part of the plant's transportation system, moving water and nutrients around the plant as needed. The mesophyll cells have chloroplasts and this is where photosynthesis occurs.

Chlorophyll looks green because it absorbs red and blue light, making these colors unavailable to be seen by our eyes. It is the green light which is NOT absorbed that finally reaches our eyes, making chlorophyll appear green. However, it is the energy from the red and blue light that are absorbed that is, thereby, able to be used to do photosynthesis. The green light we can see is not/cannot be absorbed by the plant, and thus cannot be used to do photosynthesis.

Animal dependence on photosynthesis

Photosynthesis has far-reaching implications. Like plants, humans and other animals depend on glucose as an energy source, but they are unable to produce it on their own and must rely ultimately on the glucose produced by plants. Moreover, the oxygen humans and other animals breathe is the oxygen released during photosynthesis. Humans are also dependent on ancient products of photosynthesis, known as fossil fuels, for supplying most of our modern industrial energy. These fossil fuels, including **natural gas**, **coal**, and **petroleum**, are composed of a complex mix of hydrocarbons, the remains of organisms that relied on photosynthesis millions of years ago. Thus, virtually all life on earth, directly or indirectly, depends on photosynthesis as a source of food, energy, and oxygen, making it one of the most important biochemical processes known.

Plants are the only living organisms that can make their own food. This is one of the main ways of deciding if something is a plant.

If plants could not turn the sun's energy into food, we would all die. That is because we can eat all sorts of things plants grow, such as leaves, seeds, fruits, roots, nuts and flowers. But we can't eat sunshine!

Light is so important to plants, that their leaves grow in many patterns so as to catch the most light.

Interesting facts

- In many tropical areas of the world there are huge forests. These are often known as the 'lungs of the world' because they produce oxygen. These forests are really important because they reduce the amount of carbon dioxide in the air. This is a gas that is increasing because of industrial pollution. It is thought to be creating a 'greenhouse' in the sky that heats up the planet and changes the weather.
- Millions of years ago, the sun's energy helped prehistoric plants to grow. When we burn coal we are reusing that ancient sun-energy, because coal is made from prehistoric trees.
- There is an amazing plant from Southern Africa called *Welwitschia mirabilis* or Tree Tumbo, some of which are nearly 1,000 years old. It only ever has two leaves! Each leaf can be over 8m (27ft) long - that is longer than four baths!
- The largest leaves grow on the Amazon water lily. In a single year the plant will produce leaves of more than 2m (6.6ft) across.

Questions on photosynthesis

1. In which organelles does the process take place?
2. Where does the energy for the process come from?
3. Which pigment converts light energy into chemical energy?
4. What are the two sets of reactions called?
5. Give 4 factors that affect the rate of photosynthesis.

6. What is the importance of photosynthesis to living things other than plants?



ASSESSMENT

Consider the following things and use the characteristics of life to determine if it is living or non-living by using your own knowledge of them.

- a.) A dog
- b.) A car
- c.) A virus
- d.) A mango tree.

Also questions nos. 3-6 on pg. 14 in text.