1 Nutrition in Plants

In Class VI you learnt that food is essential for all living organisms. You also learnt that carbohydrates, proteins, fats, vitamins and minerals are components of food. These components of food are necessary for our body and are called **nutrients**.

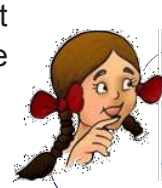
All living organisms require food. Plants can make their food themselves but animals including humans cannot. They get it from plants or animals that eat plants. Thus, humans and animals are directly or indirectly dependent on plants.

Boojho wants to know how plants prepare their own food.

1.1 Mode of Nutrition in Plants

Plants are the only organisms that can prepare food for themselves by using water, carbon dioxide and minerals. The raw materials are present in their surroundings.

The nutrients enable living organisms to build their bodies, to grow, to repair damaged parts of their bodies and provide the energy to carry out life processes. **Nutrition** is the mode of taking food by an organism and its utilisation by the body. The mode of nutrition in which organisms make food themselves from simple substances is called **autotrophic** (auto = self; trophos = nourishment) nutrition. Therefore, plants are called **autotrophs**. Animals and most other organisms take in ready made food prepared by the plants. They are called **heterotrophs** (heteros = other).



Paheli wants to know why our body cannot make food from carbon dioxide, water and minerals like plants do.

Now we may ask where the food factories of plants are located: whether food is made in all parts of a plant or only in certain parts? How do plants obtain the raw materials from the surroundings? How do they transport them to the food factories of the plants?

1. 2 Photosynthesis — Food Making Process in Plants

Leaves are the food factories of plants. The synthesis of food in plants occurs in leaves. Therefore, all the raw materials must reach there. Water and minerals present in the soil are absorbed by the roots and transported to the

Cells

You have seen that buildings are made of bricks. Similarly, the bodies of living organisms are made of tiny units called **cells**. Cells can be seen only under the microscope. Some organisms are made of only one cell. The cell is enclosed by a thin outer boundary, called the **cell membrane**. Most cells have a distinct, centrally located spherical structure called the **nucleus** (Fig. 1.1). The nucleus is surrounded by a jelly-like substance called **cytoplasm**.

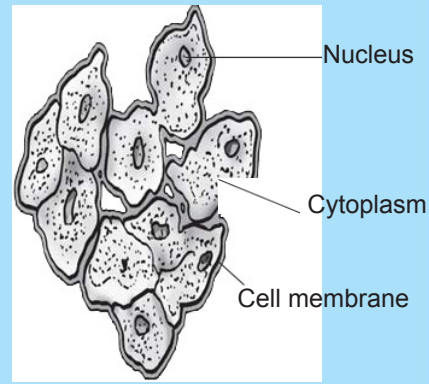


***Fig. 1.1** Cell*

leaves. Carbon dioxide from air is taken in through the tiny pores present on the surface of the leaves. These pores are surrounded by 'guard cells'. Such pores are called **stomata** [Fig. 1.2 (c)].

Boojho wants to know how water and minerals absorbed by roots reach the leaves.

Water and minerals are transported to the leaves by the vessels which run like pipes throughout the root, the stem, the branches and the leaves. They form a continuous path or passage for the nutrients to reach the leaf. You will learn about transport of materials in plants in Chapter 11.

Paheli wants to know what is so special about the leaves that they can synthesise food but other parts of the plant cannot.

The leaves have a **green pigment** called **chlorophyll**. It helps leaves to capture the energy of the sunlight. This energy is used to synthesise (prepare) food from carbon dioxide and water. Since the synthesis of food occurs in the presence of sunlight, it is called **photosynthesis** (Photo: light; synthesis : to combine). So we find that chlorophyll, sunlight, carbon dioxide and water are necessary to carry out the process of photosynthesis. It is a unique process on the earth. The solar energy is captured by the leaves and stored in the plant in the form of food. **Thus, sun is the ultimate source of energy for all living organisms**.

Can you imagine the earth in the absence of photosynthesis!

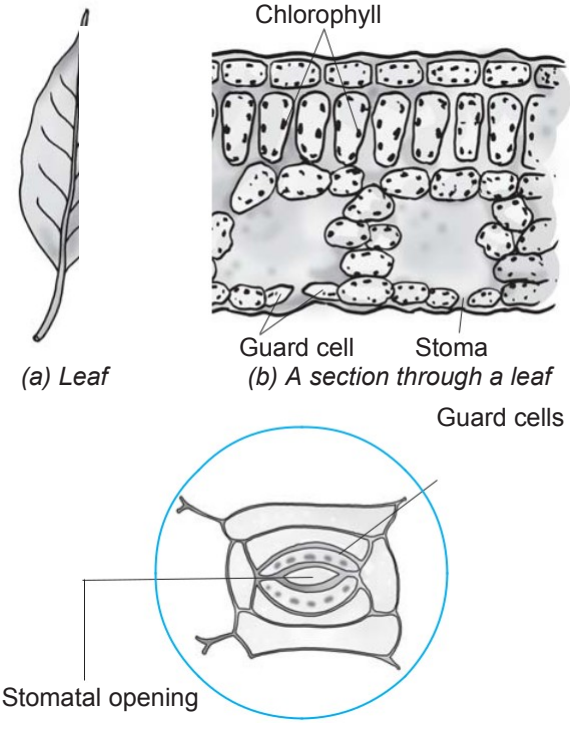
In the absence of photosynthesis there would not be any plants. The survival of almost all living organisms directly or indirectly depends upon the food made by the plants. Besides, oxygen which is essential for the survival

Besides leaves, photosynthesis also takes place in other green parts of the plant — in green stems and green branches. The desert plants have scale- or spine-like leaves to reduce loss of water by transpiration. These plants have green stems which carry out photosynthesis.

of all living organisms is produced during photosynthesis. In the absence of photosynthesis, life would be impossible on the earth.

During photosynthesis, chlorophyll containing cells of leaves (Fig. 1.2), in the presence of sunlight, use carbon dioxide and water to synthesise carbohydrates (Fig. 1.3). The process can be represented as an equation:

$$\text{Carbon dioxide} + \text{water} \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \text{Carbohydrate} + \text{oxygen}$$



(a) Leaf

(b) A section through a leaf

(c) Stomata

Fig. 1.2

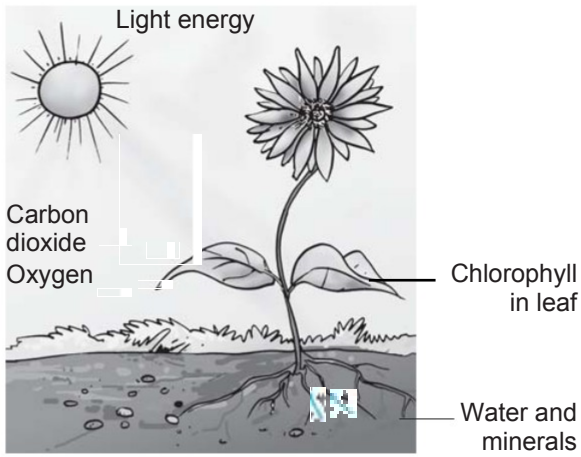


Fig. 1.3 *Schematic diagram showing photosynthesis*

During the process oxygen is released. The carbohydrates ultimately get converted into starch. The presence of starch in leaves indicates the occurrence of photosynthesis. The starch is also a carbohydrate.

Boojho has observed some plants with deep red, violet or brown leaves. He wants to know whether these leaves also carry out photosynthesis.

Activity 1.1

Take two potted plants of the same kind. Keep one in the dark (or in a black box) for 72 hours and the other in the

sunlight. Perform iodine test with the leaves of both the plants as you did in Class VI. Record your results. Now leave the pot which was earlier kept in the dark, in the sunlight for 3 – 4 days and perform the iodine test again on its leaves. Record your observations in your notebook.

The leaves other than green also have chlorophyll. The large amount of red, brown and other pigments mask the green colour (Fig. 1.4). Photosynthesis takes place in these leaves also.

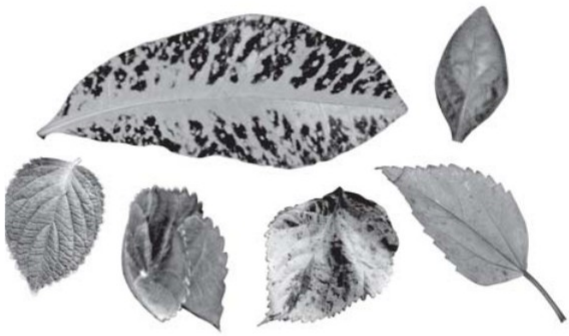


Fig. 1.4 *Leaves of various colours*

You often see slimy, green patches in ponds or in other stagnant water bodies. These are generally formed by the growth of organisms called **algae**. Can you guess why algae are green in colour? They contain chlorophyll which gives them the green colour. Algae can also prepare their own food by photosynthesis.

Synthesis of plant food other than carbohydrates

You have just learnt that plants synthesise carbohydrates through the process of photosynthesis. The carbohydrates are made of carbon, hydrogen and oxygen. These are used to synthesise other components of food. But proteins are nitrogenous substances which contain nitrogen. From where do the plants obtain nitrogen?

Recall that nitrogen is present in abundance in gaseous form in the air. However, plants cannot absorb nitrogen in this form. Soil has certain bacteria that convert gaseous nitrogen into a usable form and release it into the soil. These soluble forms are absorbed by the plants along with water. Also, you might have seen farmers adding fertilisers rich in nitrogen to the soil. In this way the plants fulfil their requirements of nitrogen along with the other constituents. Plants can then synthesise components of food other than carbohydrates such as proteins and fats.

1.3 Other Modes of Nutrition in Plants

There are some plants which do not have chlorophyll. They cannot synthesise their food. How do they survive and from where do they derive nutrition? Like humans and animals such plants depend on the food produced by other plants. They use the **heterotrophic mode** of nutrition. Look at Fig. 1.5. Do you see yellow tubular structures twining around the stem and branches of a tree? This is a plant called *Cuscuta* (Amarbel). It does not have chlorophyll. It takes readymade food from the plant

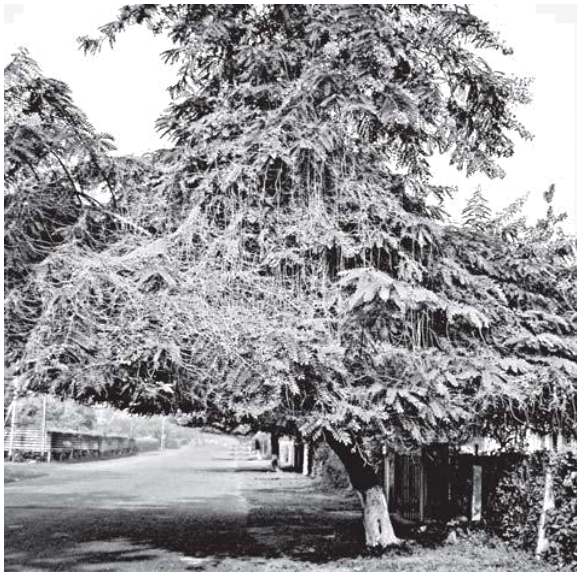


Fig. 1.5 *Cuscuta (Amarbel) on host plant*

on which it is climbing. The plant on which it climbs is called a **host**. Since it deprives the host of valuable nutrients, it is called a **parasite**. Are we and the other animals also parasites for the plants? You should think about it and discuss with your teacher.

Paheli wants to know whether mosquitoes, bed bugs, lice and leeches that suck our blood are also parasites.

Have you seen or heard of plants that can eat animals? There are a few plants which can trap insects and digest them. Is it not amazing? Such plants may be green or of some other colour. Look at the plant in Fig. 1.6. The pitcher-like structure is the modified part of the leaf. The apex of the leaf forms a lid which can open and close the mouth of the pitcher. Inside the pitcher there are hair which are directed downwards. When an insect lands in the pitcher, the lid closes and the trapped insect gets entangled into the hair. The insect is digested by the digestive juices secreted in the pitcher. Such insect-eating plants are called **insectivorous plants**.

Is it possible that such plants do not get all the required nutrients from the soil in which they grow?

Boojho is confused. If the pitcher plant is green and carries out photosynthesis, then why does it feed on insects?

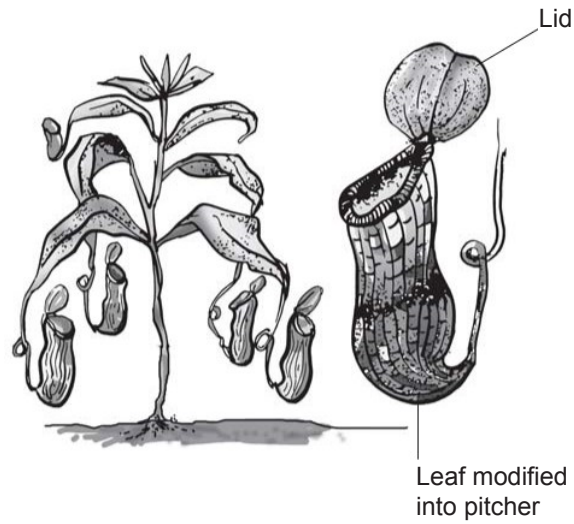


Fig. 1.6 *Pitcher plant showing lid and pitcher*

Figure 1. Green plants can make food themselves by photosynthesis, so they are autotrophs. Green plants have autotrophic mode of nutrition.

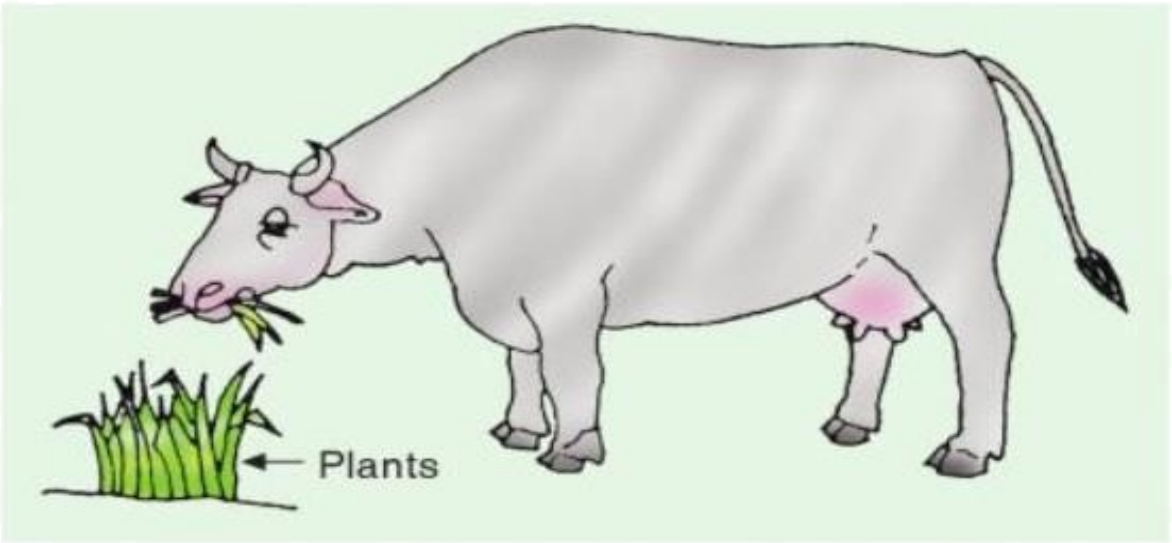
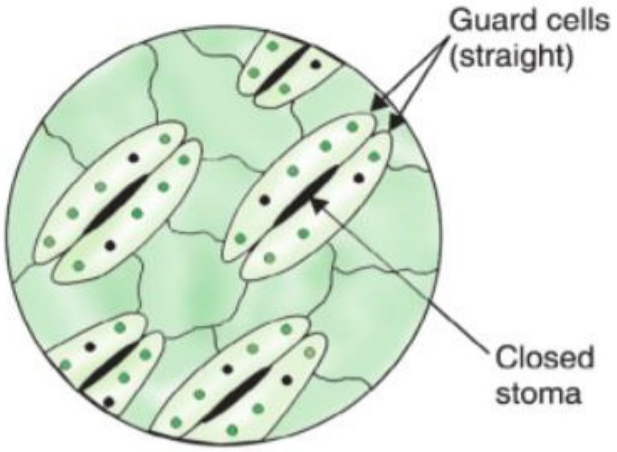
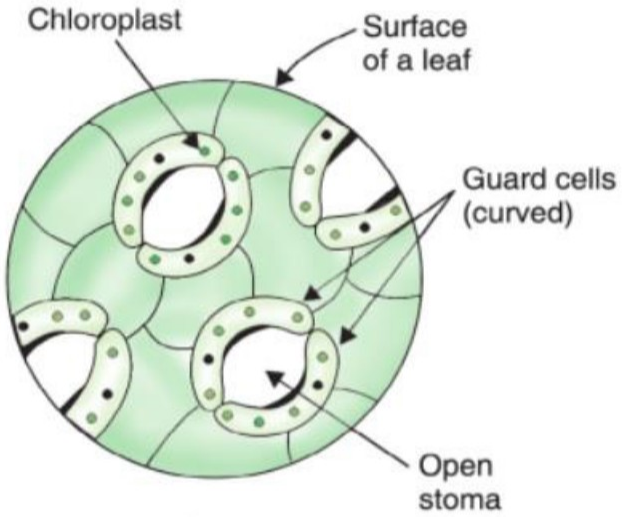


Figure 2. Animals obtain their food from other organisms (like plants or other animals), so they are heterotrophs. Animals have heterotrophic mode of nutrition. This cow is an animal which is eating plants as food.



(*b*) Closed stomata



(*a*) Open stomata

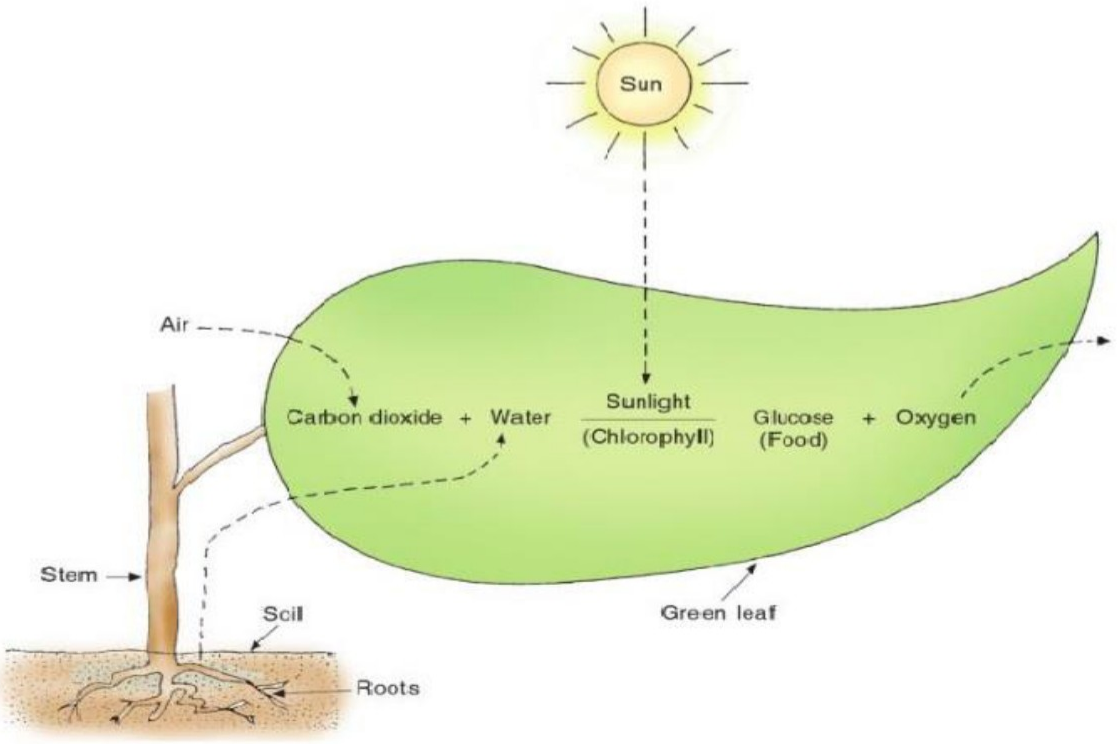


Figure 3. Diagram to show the process of photosynthesis.

GURU GOBIND SINGH PUBLIC SCHOOL

CLASS : VII **BIOLOGY ASSIGNMENT**

Study materials :-

Modes of nutrition, Autotrophs and Heterotrophs, Photosynthesis

(Conditions necessary for Photosynthesis)

(1) Name the pores through which leaves exchange gases.
(2) Name the process by which plants make food.
(3) What is photosynthesis ?
(4) Name a gas used in photosynthesis .
(5) Name one autotrophic and one heterotrophic plant.
(6) What is special about the leaves that they can synthesize food but other parts of a plant cannot?
(7) Why do organisms need to take food ? What are the two main modes of nutrition in organisms?
(8) Explain why, we cannot make food ourselves by photosynthesis like the plant do.
(9) Draw - To show the process of Photosynthesis.
(10) Draw - Open and closed stomata

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