

Nutrition in Plants

Learning Points



- ❖ Nutrition and its types.
- ❖ Autotrophic nutrition in plants.
- ❖ Heterotrophic nutrition in plants.
- ❖ Replenishing nutrients in soil.

All living organisms require energy for their growth and survival. The life processes which are essential for the body to stay alive need energy for their proper functioning. These life processes are digestion, respiration, circulation, excretion, reproduction, etc. All these processes are dependent on energy to function efficiently. This energy is obtained by living things from the food. The food has all the nutrients which provide energy, build the body and protect from diseases. The plants and animals all obtain food in different ways. Plants can make their own food whereas all the animals are dependent on them directly or indirectly. In this chapter, we shall learn how the plants make their food and utilize different raw materials during the process of food making.

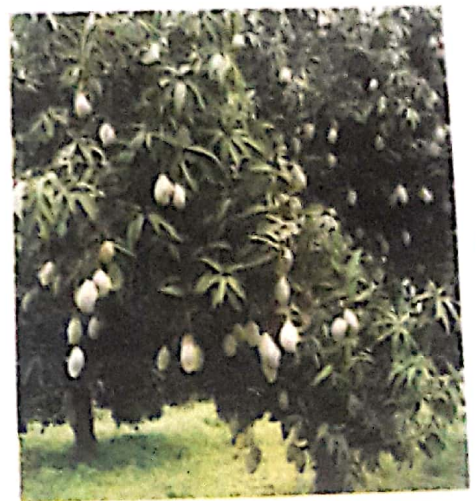


Fig 1.1: Plants can make their own food

Nutrition >>>

The process of taking food and its utilization by the body is called **nutrition**. The meaning of word 'nutrition' is to nourish. The different nutrients are carbohydrates, proteins, fats, vitamins and minerals. **Nutrients** are substances present in our food which provide energy and materials needed by the body to survive and grow. The living organisms show two modes of nutrition-

(i) Autotrophic mode (ii) Heterotrophic mode.

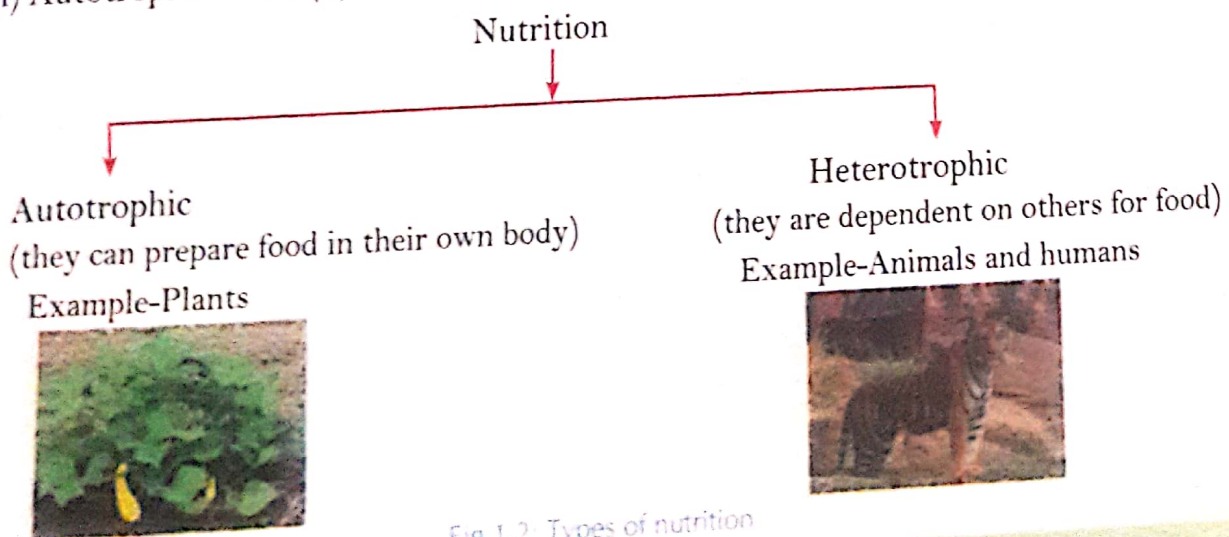


Fig 1.2: Types of nutrition

Autotrophic Nutrition

The type of nutrition in which a living organism makes its own food with the help of substances obtained from the environment is called **autotrophic nutrition**. The living organisms which make their own food are called **autotrophs** or **producers**. For example, green plants.

Heterotrophic Nutrition

The type of nutrition in which a living organism depends on other organisms for its food is called **heterotrophic nutrition**. All animals show heterotrophic mode of nutrition. Heterotrophs are called **heterotrophs**. Heterotrophs cannot make their own food and derive food from plants and animals or both. We shall learn more about this mode of nutrition in next chapter.

Autotrophic Nutrition in Plants >>>

The plants are autotrophs. They prepare their own food. Food is prepared by only those plants which are green in colour. Most of the plants are green due to the presence of **chlorophyll**. Chlorophyll is a green-coloured pigment present in the leaves and also in the young green stems. The process by which green plants prepare their own food in the presence of sunlight is called **photosynthesis**. The word 'photosynthesis' can be separated to make two smaller words - 'photo' means light and 'synthesis' means putting together.

Materials Required for Photosynthesis

The plants need following materials for photosynthesis:

- ♦ Chlorophyll
- ♦ Carbon dioxide
- ♦ Sunlight
- ♦ Water

Chlorophyll: It is a green-coloured pigment and is present in leaves in the structures called **chloroplasts**.

Sunlight: Chlorophyll traps sunlight to use it as energy source for photosynthesis.

Carbon dioxide: Leaves obtain carbon dioxide from air through the small openings called **stomata** (sing. stoma) present mostly on the underside of leaves.

Water: The roots absorb water from soil and make it available for the plant body to carry out photosynthesis. The root consists of primary root, secondary roots and root hair. The root hairs increase the surface area so that required amount of water can be absorbed from the soil.

Process of Photosynthesis

The plants absorb sunlight through chlorophyll and convert it into food. Here, the light energy converts into chemical energy. Carbon dioxide is absorbed from the atmosphere by the small openings known as the **stomata**. Stomata are mostly found on the lower surface of the leaves. The food prepared in the form of sugar and later get converted into starch. The process of photosynthesis can be represented by the following equation.

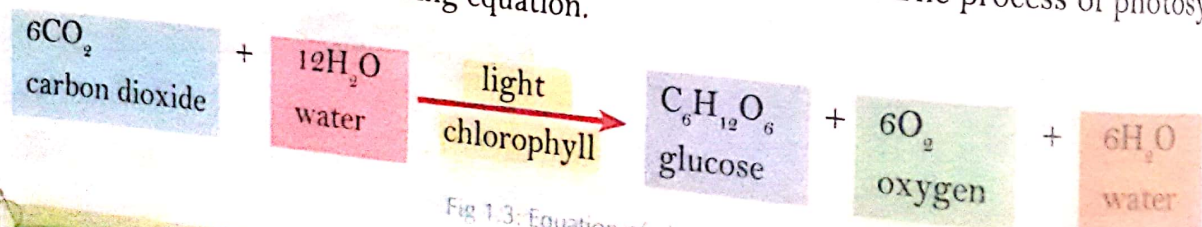


Fig 1.3: Equation of photosynthesis

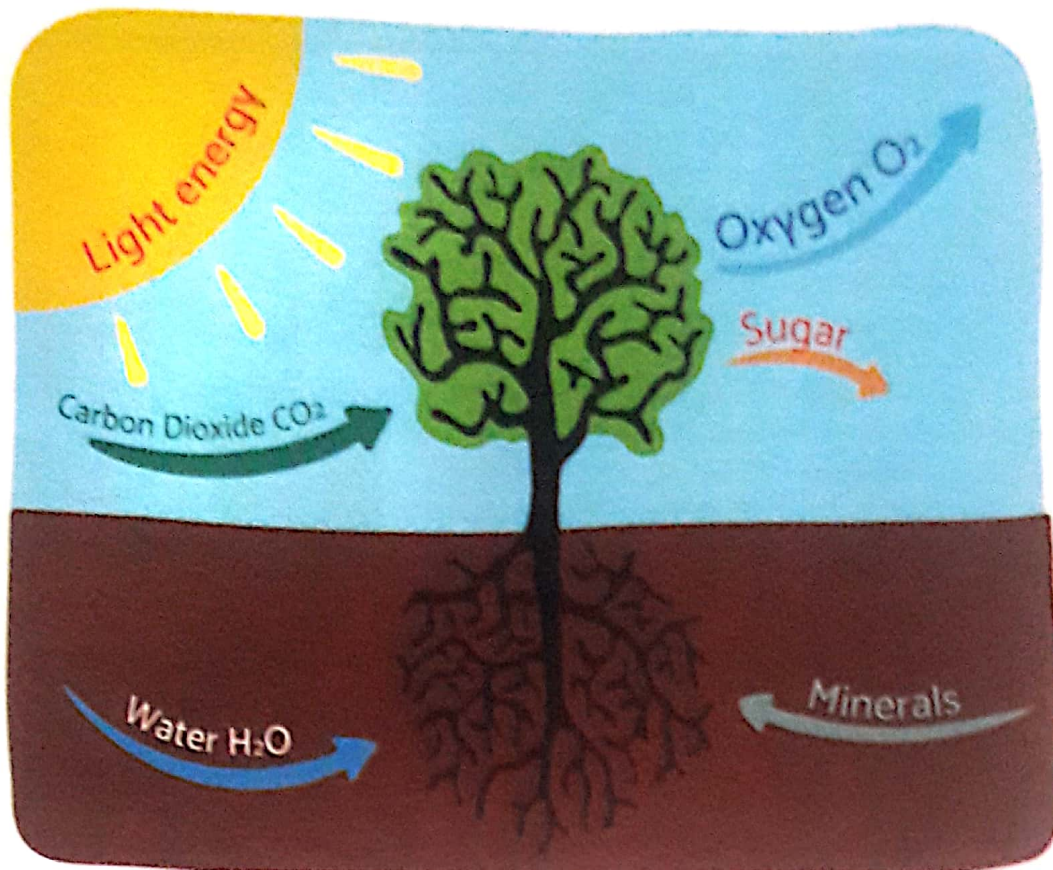


Fig 1.4: Process of photosynthesis in plants



Activity 1.1

To know that leaves contain starch.

Take a green leaf, water, beaker, test tube, alcohol, forceps and a petri dish. Boil some water in a beaker and put the leaf in it for about 2-3 minutes. Remove the leaf from the boiling water and place it in a test tube containing alcohol. Place the test tube in boiling water until the alcohol begins to boil.

When the leaf becomes colourless, wash it with tap water. Place the leaf in a clean dish and pour some iodine solution on it. The leaf changes its colour to bluish-black. Iodine reacts with starch to give this colour. This proves that the starch is present in leaves.

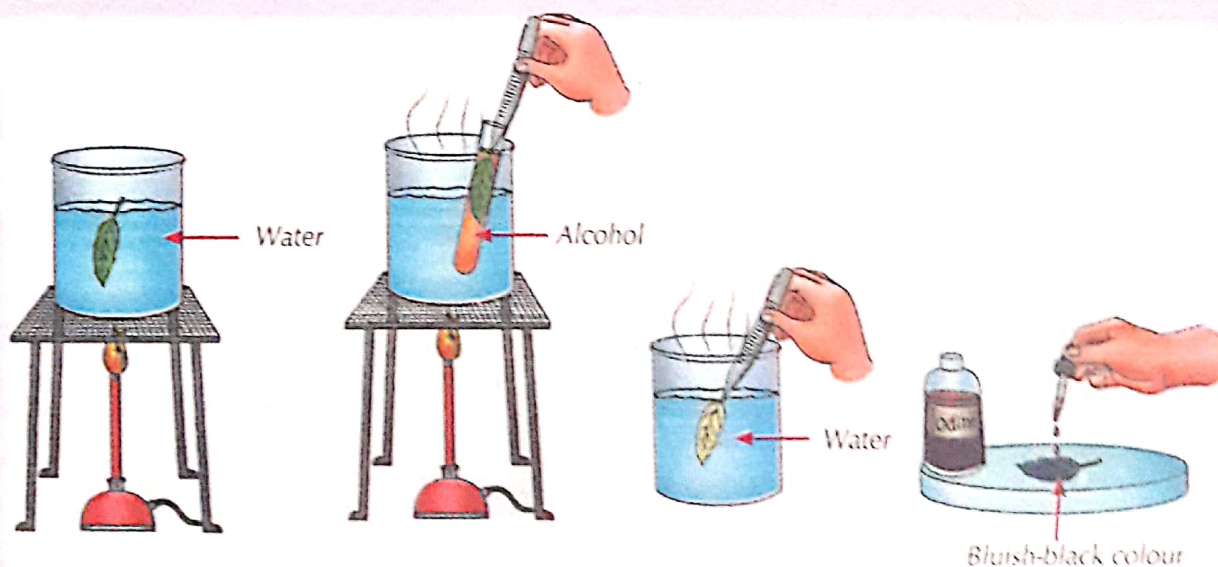


Fig 1.5: Experiment to show that leaves contain starch

Activity 1.2

To find out if light is necessary for photosynthesis. Take a green plant, black paper, scissors, and clip. Cover a part of a leaf using strips of black paper. Destarch the plant by placing it in a dark room for 2-3 days. Pick a leaf from the destarched plant and test it for starch to confirm whether it is fully starch-free. Now place the plant in bright sunlight for at least 6 hours. Pick the leaf covered by the strip of black paper, remove the strip and test it for starch. The covered portion of the leaf does not turn bluish-black. There was no starch formation in the covered part so this part did not turn blue-black. This shows that light is necessary for photosynthesis.

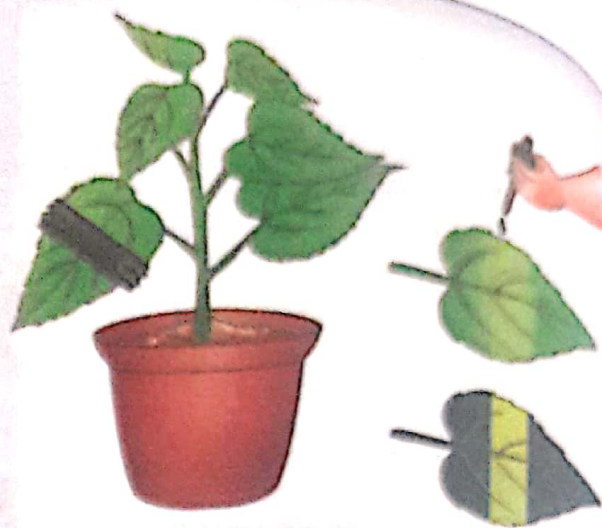


Fig 1.6: Light is necessary for photosynthesis

Activity 1.3

To demonstrate that carbon dioxide is needed for photosynthesis. Take a potted plant, potassium hydroxide solution, a conical flask with a split cork, iodine solution, and a dropper.

Keep the potted plant inside a dark room for a few hours water it. Now pour potassium hydroxide solution inside a conical flask. This absorb carbon dioxide of the air.

Place one of the leaves (without breaking it from the plant) inside the flask and cork it.

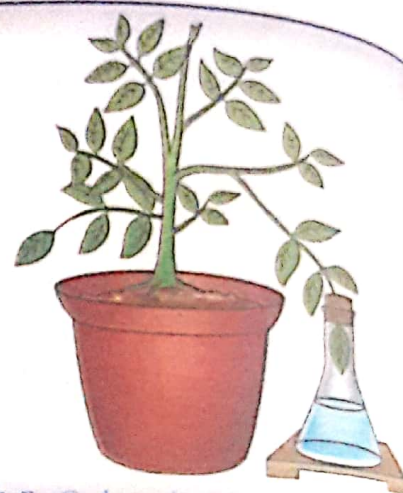


Fig 1.7: Carbon dioxide is required for photosynthesis

Role of Leaves in Photosynthesis

Leaves are the main site of photosynthesis. They possess the following features to carry out photosynthesis.

- The leaf cells contain **chloroplasts** which have chlorophyll in their cells. The chlorophyll helps leaves to capture the sun's energy.

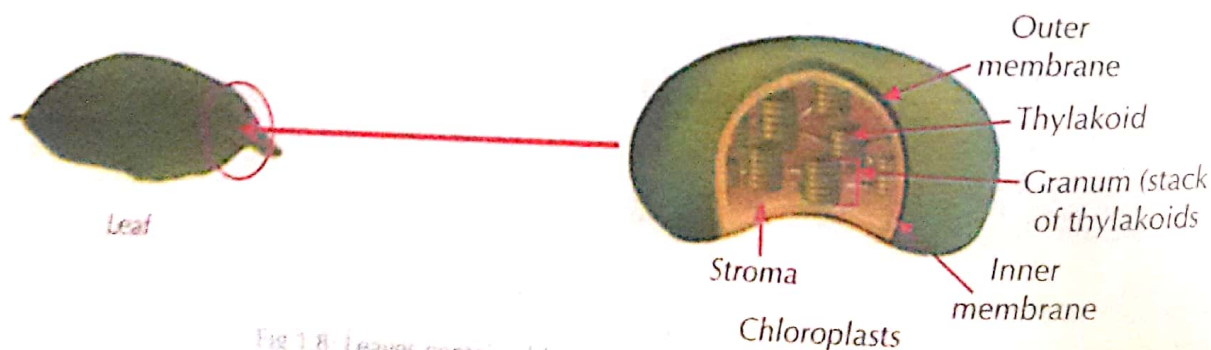


Fig 1.8: Leaves contain chloroplasts

- The **stomata** are minute pores through which exchange of gases takes place. The carbon dioxide is taken in for photosynthesis and oxygen is released as a result of photosynthesis.

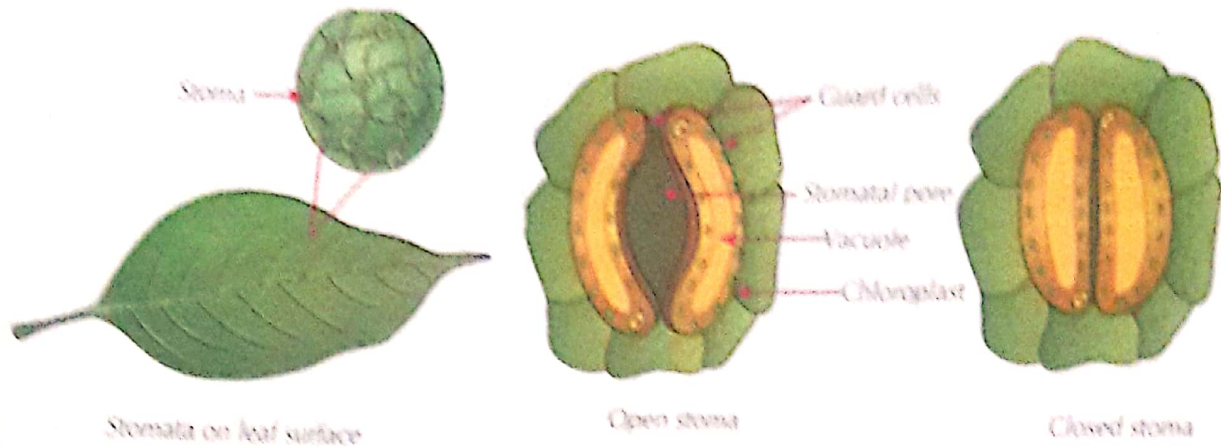


Fig 1.9: Stomata are minute pores on leaves.

- The leaves are arranged in a tree in a way that they can get maximum sunlight for photosynthesis.

KNOW MORE

Some leaves are in addition to green colour other colours like red, brown and yellow are present. Since the amount of red, brown yellow is very high in comparison to the green colour and therefore these pigments mask the green colour. Photosynthesis does take place in all these leaves.

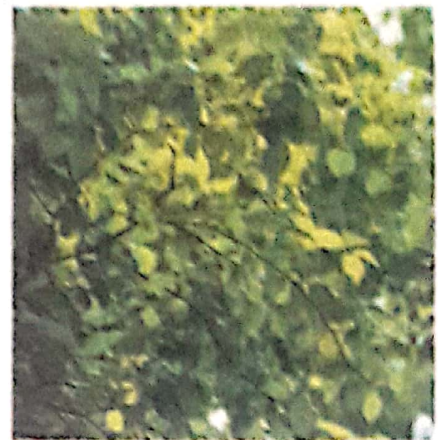


Fig 1.10: Leaves are arranged in tree to get more sunlight.

Importance of Photosynthesis

Life on earth is impossible without the process of photosynthesis. It is important for the living organisms due to the following reasons:

- The food prepared by the process of photosynthesis is used by all the living organisms directly or indirectly.
- Oxygen, a by-product of photosynthesis is used in respiration. Respiration is the process of releasing energy from food. Hence, without oxygen no living organisms can survive.
- Photosynthesis maintains a balance between oxygen and carbon dioxide in the atmosphere.

Practice TIME

Say Yes or No.

1. Oxygen is a by-product of photosynthesis. _____
2. Stomata are mostly found on the upper surface of leaves. _____
3. Heterotrophs cannot make their own food. _____
4. Food is prepared in the form of sugar. _____

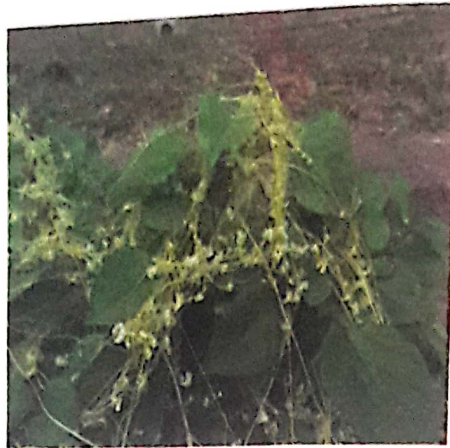
Heterotrophic Nutrition in Plants >>>

The plants are autotrophs and they prepare their food on their own. But, there are some plants which cannot prepare their own food. These are called **heterotrophic plants**. They are dependent on others for food. Heterotrophic plants are of four types:

- ◆ Parasitic plants
- ◆ Saprophytic plants
- ◆ Insectivorous or carnivorous plants
- ◆ Symbiotic plants.

Parasitic Plants

The non-green plants which obtain their food from other living organisms are called **parasitic plants**. The living organisms from which the parasitic plant derives food is called **host**. The common parasitic plants are cuscuta (dodder plant or amarbel) and mistletoe.



Cuscuta



Mistletoe

Fig 1.11: Some parasitic plants

The cuscuta has yellow tubular structures which get attached to the host plants. It has no chlorophyll and cannot carry out photosynthesis. It absorbs food from the host plants on which it climbs, through the special structures called **haustoria**.

Saprophytic Plants

The plants which grow and live on dead and decaying organic matter are called **saprophytes** (sapro-decayed matter, phytos - plants).

Like mushrooms, moulds and yeast are some common



Mushroom



Bread mould

Fig 1.12: Some Parasitic Plant

examples of saprophytes. Saprophytes like parasitic plants. They do not carry out photosynthesis. Saprophytes also lack chlorophyll like mushrooms release digestive juices on the dead decaying matter and convert it into solution form. They then absorb nutrients from the solution. Fungi are commonly found during and after rainy season. Because, the humid weather favours the growth of fungi.

Insectivorous Plants

The plants which eat animals particularly insects are called **insectivorous plants** or **carnivorous plants**. These are green-coloured and prepare their own food. They eat insects because they grow in areas where nitrogen is lacking in soil. So the plants growing in such areas cannot obtain nitrogen from the outside. This is done by trapping and eating insects.

In **pitcher plant**, the pitcher like structure is to catch insects. It is actually a modified leaf. The leaf tip is modified to form a lid which can open or close the mouth of the pitcher. Inside the pitcher, downwards pointing hair are present. Once an insect enters the pitcher, the lid closes and the insect gets trapped in the hair. The insect is digested by digestive juices secreted in the pitcher.

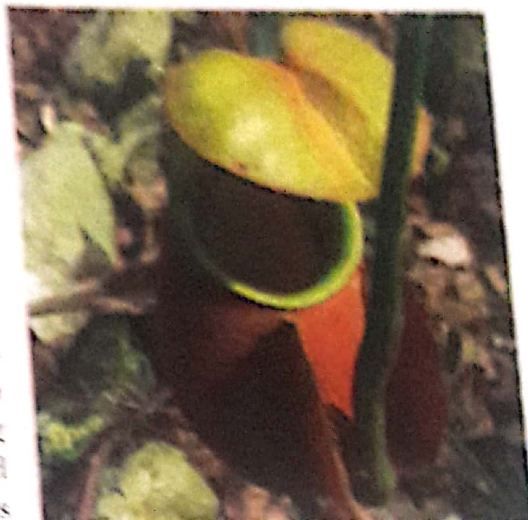


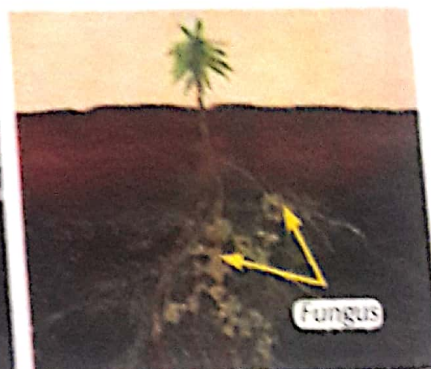
Fig 1.13: Pitcher plant

Symbiotic Plants

The plants which live in association with other plants and share shelter nutrients are called **symbiotic plants**. This association between two different plants is called **symbiotic association** or **relationship**. Some examples of symbiotic association are given below:



Lichen



Mycorrhiza

Fig 1.14: Some symbiotic associations

- The association between a green alga (pl. algae) and a non-green fungus (pl. fungi) is called **lichen**. The fungus provides shelter to alga and in return alga provides food to the fungus, because algae being green prepares food by photosynthesis.
- Certain fungi live in the roots of the trees. These are called **mycorrhiza**. The tree provides nutrients to the fungus. In return, the fungus provides certain nutrients from the soil to the tree.

KNOW MORE

Lichens are called indicators of air pollution. Because they are highly sensitive to polluting gases. They only grow in non-polluted areas.

Replenishing Nutrients in Soil >>>

The plants absorb nutrients from soil for their growth and development. The continuous absorption of nutrients by plants leads to the decline of fertility of soil. The main reason of this is that the farmers continue growing crops year after year. The nutrient amount of soil goes on decreasing due to the continuous growth of plants. The soil needs regular addition of nutrients to maintain its fertility. The farmers and gardeners add fertilizers and manures in their fields to replenish the lost nutrients so that the fertility of soil can be maintained. The soil nutrients can be replenished by the following ways:

By applying Fertilisers: Fertilisers rich in nitrogen, phosphorus and potassium are added to the field depending on the requirements of crops and soil. Examples of some fertilisers used by farmers are urea, superphosphate, ammophos and potassium sulphate.

By Adding Cattle Dung and Manure: Manures are obtained by the decomposition of animal and plant wastes. They supply essential nutrients and humus to the soil and make it fertile.

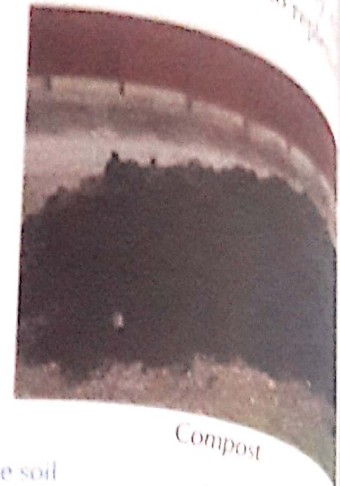
By Adding Compost: Compost is made by the decomposition of biodegradable waste by microorganisms. It is an organic manure that enriches the soil. It is added in the field to replace the loss of nutrients.



Fertiliser



Cowdung manure



Compost

Fig 1.15: Fertilizers, manure and compost enrich the soil

By Growing Leguminous Crop: The crops need a lot of nitrogen to make proteins. After the harvesting season, the nitrogen content of the soil declines as it is used by the crops.

Although, nitrogen is available in plenty in the atmosphere, but plants cannot absorb it in gaseous form. They need it in soluble form so that they can absorb it from soil. There is a bacterium called *Rhizobium*, which lives in the root nodules of legumes, such as gram, moong, etc. These bacteria can absorb nitrogen from the atmosphere and make it available to the plants. *Rhizobium* cannot make its food, hence, it provides nitrogen to the legumes and in return legumes provide them food and shelter. This is an example of **symbiotic relationship**. This has great importance for farmers. Fields, in which leguminous plants are grown from time to time, do not need addition of nitrogenous fertilizers.

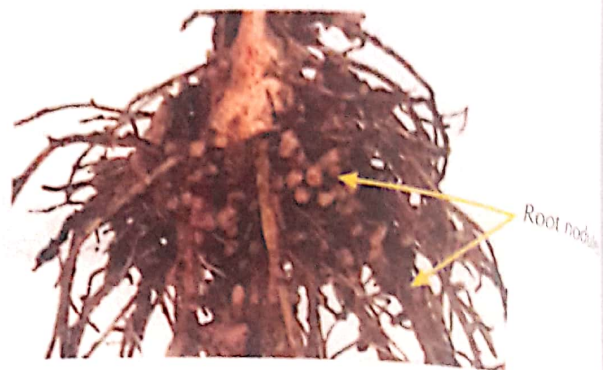


Fig 1.16: Legume plant having root nodules

Practice TIME

Fill in the blanks.

1. Mushroom is a _____ plant.
2. The pitcher in pitcher plant is a _____ leaf.
3. Lichen is a _____ association.
4. _____ weather favours the growth of fungi.
5. Nitrogen is available in plenty in the _____.

Amazing Fact

- About 85 per cent plant life is found in ocean.
- Dandelion plant is completely edible from the petals to the roots.

Life Skills

- ✦ We should grow plenty of plants around us. They help us in keeping our surroundings fresh and clean.
- ✦ Care your plants every day. Water them regularly in right quantity. Add manures, compost and fertilizers to maintain the correct nutrient level in the soil.

Keywords

Life processes	: Basic processes in body which allow living organisms to survive.
Nutrition	: Process of taking in food and its utilization by the body.
Autotrophs	: Who can prepare their own food in their body.
Heterotrophs	: Organisms who cannot prepare their own food and derive it from plants or animals or both.
Parasitic plant	: Non- green plants which live on other living organisms and obtain their food from them.
Host	: Living organism from which a parasite derives its food.
Saprophytic plants	: Plants which live in association with other plants and share shelter and nutrients.

Let's Revise

- Nutrition is a vital requirement for life.
- It may be autotrophic or heterotrophic.
- Plant that contain chlorophyll are green plants and they are autotrophs.
- Non green plants, animals and human beings are heterotrophic.
- Plants prepare food by the process of photosynthesis.
- Carbon dioxide, sunlight, water and chlorophyll are required for the process of photosynthesis.
- Food is synthesized in the form of carbohydrates and oxygen gas is released as a by-product.
- Non-green plants include parasitic, saprophytic, insectivorous and symbiotic plants.
- The soil needs regular addition of nutrients to maintain its fertility.

Quora Watch

A. Tick (✓) the correct option.

- Plants take carbon dioxide from air during photosynthesis through _____.
 - Root hair
 - Leaves
 - Water
 - Flower
- The presence of starch can be tested by _____.
 - Alcohol
 - Iodine
 - Water
 - Hydrochloric acid
- Green plants are also known as _____.
 - Autotrophs
 - Heterotrophs
 - Carnivores
 - Heterotrophs

4. The green pigment in leaves helps to _____
a. Make food
b. Absorb water
c. Absorb sunlight
d. Take in CO_2
5. The simplest carbohydrate made as food during photosynthesis is _____
a. Starch
b. Sugar
c. Glucose
d. Oil
6. *Cuscuta* plant can be categorized as _____
a. Parasite
b. Insectivorous
c. Saprophyte
d. Host
7. The plant that traps and feeds on insects _____
a. *Cuscuta*
b. China rose
c. Rose
d. Pitcher plant
8. The *Rhizobium* bacteria lives inside the root nodules of _____
a. Peas
b. Beans
c. Peanuts
d. All of these

B. Fill in the blanks.

- Carbon dioxide is taken in from _____ animals.
- The food prepared by the plants is stored as _____.
- _____ is a parasitic plant.
- Fungi are _____ are seeds.
- Lichens are natural indicators of _____.
- Insectivorous plants feed on _____.
- Food is synthesised in the form of _____.
- Crops need a lot of nitrogen to make _____.

C. Coin one word for these statements.

- Bacteria which live in root nodules. _____
- Living organism from which the parasitic plant derives food. _____
- Process which maintains balance between oxygen and carbon dioxide in air. _____
- The leaf cells which contain chlorophyll. _____
- The plants which grow and live on dead and decaying organic matter. _____
- The association between a green alga and a fungus. _____

D. Match the following columns.

A

- Chloroplast
- Cuscuta*
- Manure
- Lichen
- Stomata

B

- Cowdung
- Symbiotic
- Lower surface of leaves
- Chlorophyll
- Hauatoria

E. Write 'T' for the true and 'F' for the false statements.

1. Carbon dioxide is released during photosynthesis.
2. Plants which synthesis their food themselves are called saprotrophs.
3. The products of photosynthesis is not glucose.
4. Solar energy is converted into chemical energy during photosynthesis.
5. *Rhizobium* helps leguminous plants in nitrogen fixation in soil.

F. Answer in brief.

1. Why do living organisms need food?
2. Define photosynthesis.
3. Life on earth is impossible without plant. Justify your answer.
4. Differentiate between autotrophs and heterotrophs.
5. Which plants are insectivorous?
6. Write the equation of photosynthesis.

G. Answer in detail.

1. Explain the process of photosynthesis and conditions required for it.
2. Describe the different types of heterotrophic plants.
3. How the pitcher plant catches insects?
4. What are lichens? Why they are called natural indicators of air pollution?
5. How the parasitic plants are different from saprophytes?
6. Write the importance of photosynthesis.



1. Visit a greenhouse or a nursery near your neighbourhood area. Observe how the caretakers or gardeners raise plants. Find out how they regulate the amount of light, water and carbon dioxide to grow the plants properly.



Fig 1.17: Green house

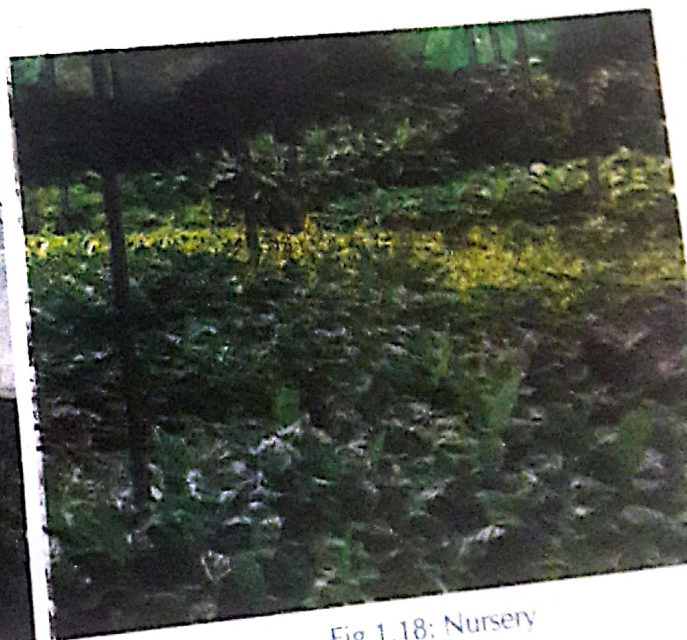


Fig 1.18: Nursery

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Fig 1.17: Green house



Fig 1.18: Nursery

2. Find out and write a project on following topics:
- Why some plants are heterotrophic?
 - In which season and places fungi grow mostly?

10 & Learn

- You can grow fungi at your home. Take a piece of bread, water and a box. Moisten the bread with water and keep it in the closed box for a few days. You will see the whitish-green patches on the bread. These particles are due to fungal growth.
- Collect the leaves of various colours as shown below. Conduct the starch test on them as done in activity given in chapter. Observe carefully that which of these show bluish-black colour on iodine test and which do not. Discuss your observations with your teacher.



Fig 1.19: Leaves of different colours



Form a group of 4-5 friends. Discuss about photosynthesis process in plants and conditions necessary for it. Bring mung dal sprouts in the class and observe the tiny plants growing out of each sprout. Talk about the conditions you provided during making the sprouts grow. You can also make a delicious chat using these sprouts.



Fig 1.20: Sprouts



Nutrition in Animals



Learning Points

- ❖ Types of animals based on nutrition.
- ❖ Various steps in nutrition.
- ❖ Nutrition in Amoeba.
- ❖ Nutrition in humans.
- ❖ Nutrition in grass-eating animals.

All organisms require food for the survival and growth. The mode of intake of food and its utilization in the body are collectively known as **nutrition**. The plants make their food by the process of photosynthesis, but animals cannot make their food themselves. They get their food from plants and animals. Some animals eat plants directly while some animals eat plant-eating animals. Thus, the animals get their food from plants either directly or indirectly. This kind of nutrition is called **heterotrophic nutrition** and the animals are called **heterotrophs**.

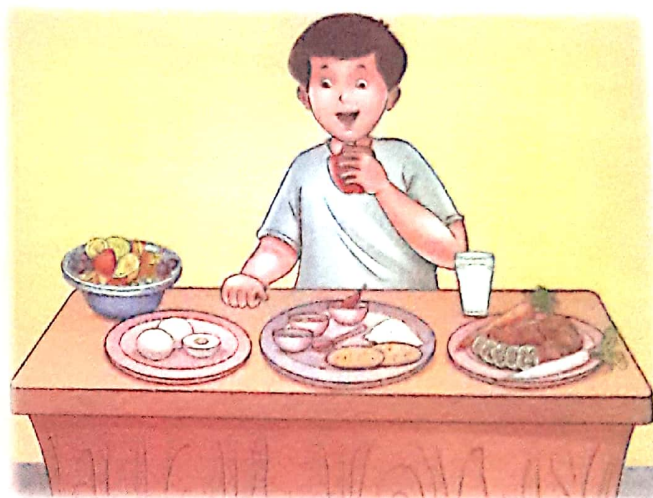


Fig 2.1: We get food from both plants and animals

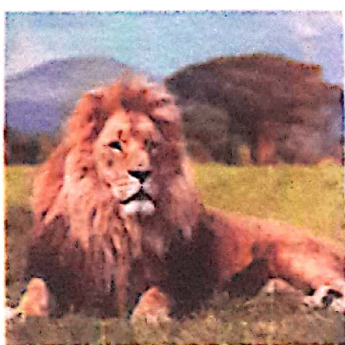
Types of Animals Based on Nutrition >>>

The animals are classified as **herbivores**, **carnivores** and **omnivores** based on their food habits. Herbivores eat plants and therefore depend directly on plants for their food. Carnivores eat herbivores and so are indirectly dependent on plants. Omnivores eat both plants and animals. Scavengers eat dead animals and plants.

The kind of nutrition where food is taken into the body as a liquid or solid, and then further broken down is called **holozoic nutrition**. Most animals exhibit this kind of nutrition.



Herbivore



Carnivore



Omnivore



Scavenger

Fig 2.2: Types of animals based on food habits

Various Steps in Nutrition >>>

The nutrition in animals (holozoic nutrition) is carried out in following steps. These are ingestion, digestion, absorption, assimilation and egestion.

Ingestion: The process of taking food into the body is called **ingestion**. Animals use various ways to ingest food.

Digestion: The food that animals eat cannot be used directly to get energy. It has to be broken down into simpler substances that can be easily absorbed. The process of breaking down complex food, into simpler substances is called **digestion**.

Absorption: The digested food needs to be absorbed by the body to provide energy. This process by which the digested food moves into the blood and cells of the body is called **absorption**.

Assimilation: The process by which the absorbed food is used by the body cells to release energy and repair the worn out parts of the body is called **assimilation**.

Egestion: The process by which the undigested food and waste is sent out of the body is called **egestion**.

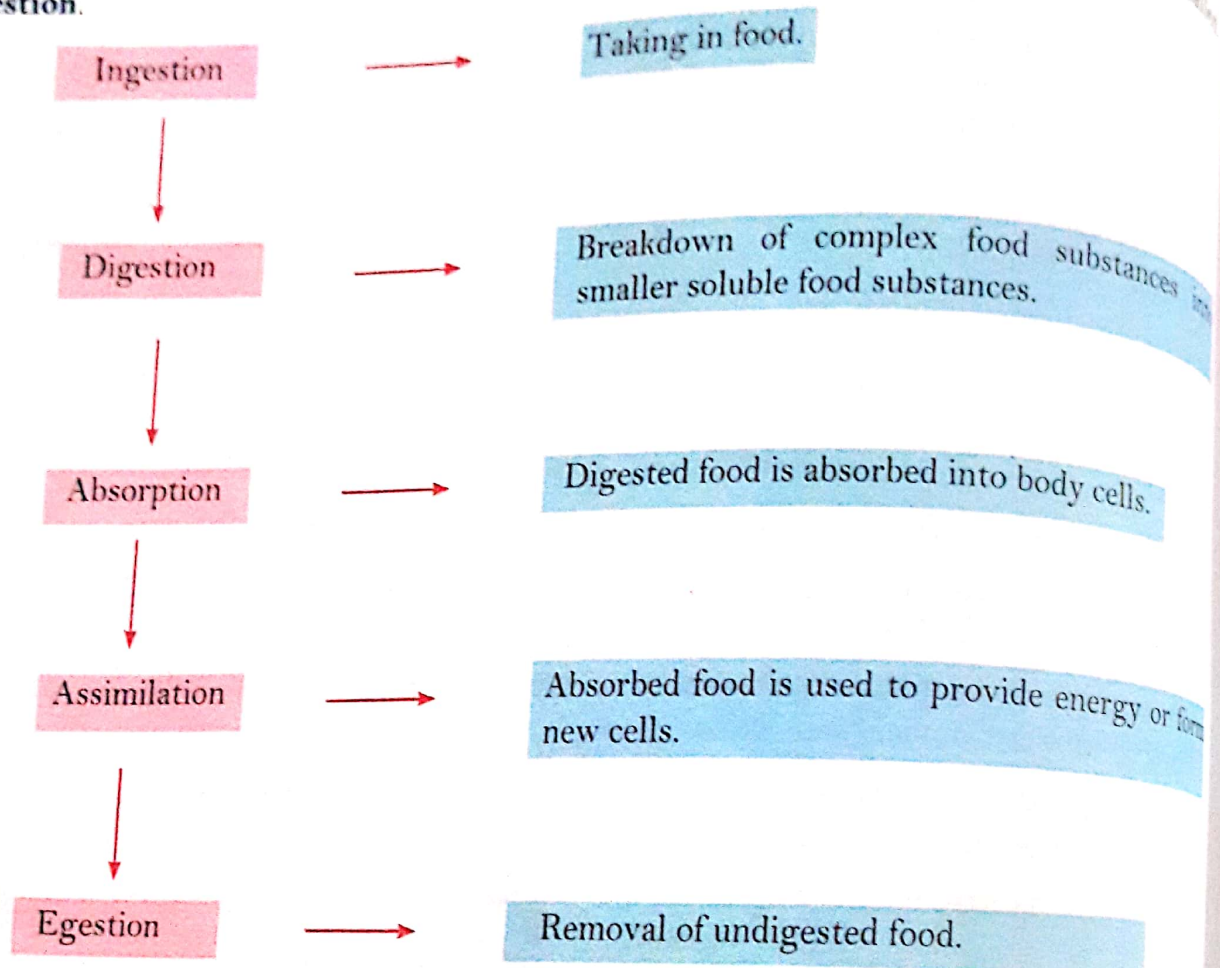


Fig 2.3 : Various steps in animals nutrition

Nutrition in Amoeba >>>

The Amoeba is a unicellular animal. It feeds on microscopic plants and animals present in water. It moves by extending its body into finger-like projections called pseudopodia. The mode of nutrition in amoeba is holozoic. The different processes involved in the nutrition of amoeba are

Ingestion: Amoeba is a unicellular animal, so it does not have a mouth for ingestion of food. Amoeba ingests the food by encircling it by forming pseudopodia. When the food is completely encircled, the food is engulfed in the form of a bag like structure called **food vacuole**.

Digestion: In amoeba, several digestive enzymes react on the food present in the food vacuoles and break it down into simple and soluble molecules.

Absorption: The food digested by digestive enzymes is then absorbed in the cytoplasm by the process of diffusion. The undigested food remains in the food vacuole. If a large amount of food is absorbed by amoeba, the excess food is stored in the body.

Assimilation: In this step, the food absorbed by the body is used to obtain energy, growth and repair.

Egestion: When a sufficient amount of undigested food gets collected in the food vacuole, it is thrown out of the body by rupturing the cell membrane.

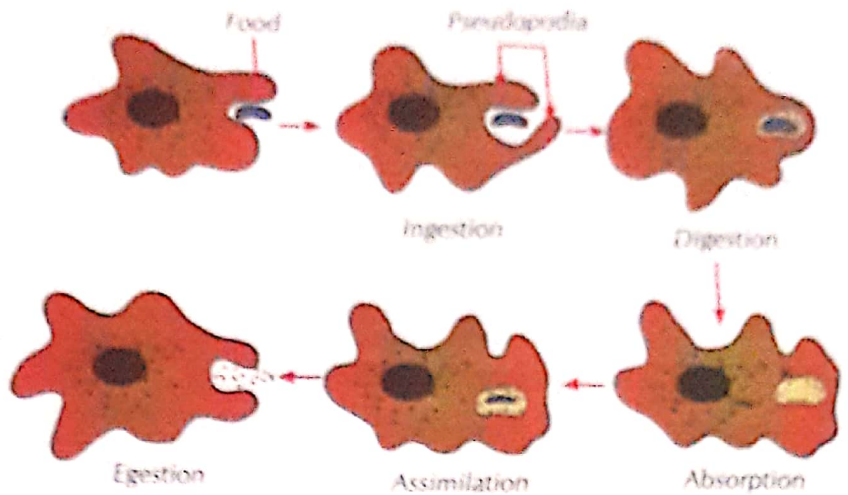


Fig 2.4 : Nutrition in Amoeba

Amazing Fact

Starfish feeds on animals covered by hard shells of calcium carbonate. After opening the shell, the starfish pops out its stomach through its mouth to eat the soft animal inside the shell. The stomach then goes back into the body and the food is slowly digested.



Fig 2.5 : Starfish

Nutrition in Humans >>>

The nutrition in humans also follows the five steps i.e., ingestion, digestion, absorption, assimilation and egestion. The human digestive system consists of several organs, i.e., the **mouth, oesophagus, stomach, small intestine, large intestine, rectum** and **anus**. These organs form the long tube-like structure called **alimentary canal**. The food we eat passes through these organs. The salivary glands, pancreas and liver are accessory organs that secrete digestive juices into the alimentary canal.

Mouth

The ingestion and digestion of food starts in mouth. The main function of the mouth is to chew the food before it is sent to the oesophagus. The process of chewing the food is called **mastication**. The **salivary**

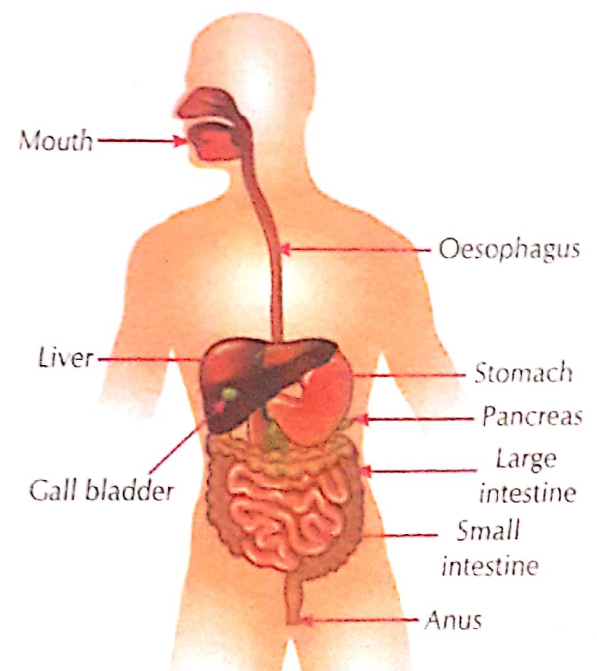


Fig 2.6: Human digestive system

glands secrete saliva into the mouth. The saliva contains digestive juice that digests carbohydrates. It also moistens the food, making it easier to swallow. Thus, the process of digestion begins in the mouth.



Activity 2.1

To study the effect of saliva on food.

Take a bread, 1 watch glass, 1 petri dish, iodine solution, and saliva from your mouth. Take out some saliva from your mouth and put it in a watch glass. Break off a little portion of bread and test it for starch using iodine solution. If it turns blue-black, starch is present. Now take a piece of bread in the petri dish. Pour a little saliva on the bread and watch. After some time, test for starch again on the portion where the saliva was put. The portion where was put does not turn blue-black. Since starch has been converted to sugar by the digestive juices in saliva, there is a negative test for starch.

Teeth

The teeth are used to bite and chew the food. They cut and grind the food to break it down into smaller particles. The adult humans have four types of teeth in their mouth. These are **incisors**, **canines**, **premolars** and **molars**.

- ◆ Incisors are the teeth found in the front of the mouth. These are chisel-shaped and mainly used for biting and cutting food.
- ◆ Canines are pointed and used for piercing and tearing food into smaller pieces.
- ◆ Premolars have a flattened surface and are used for grinding food into very tiny pieces.
- ◆ Molars are similar to premolars, but are larger. They are also used to grind food.

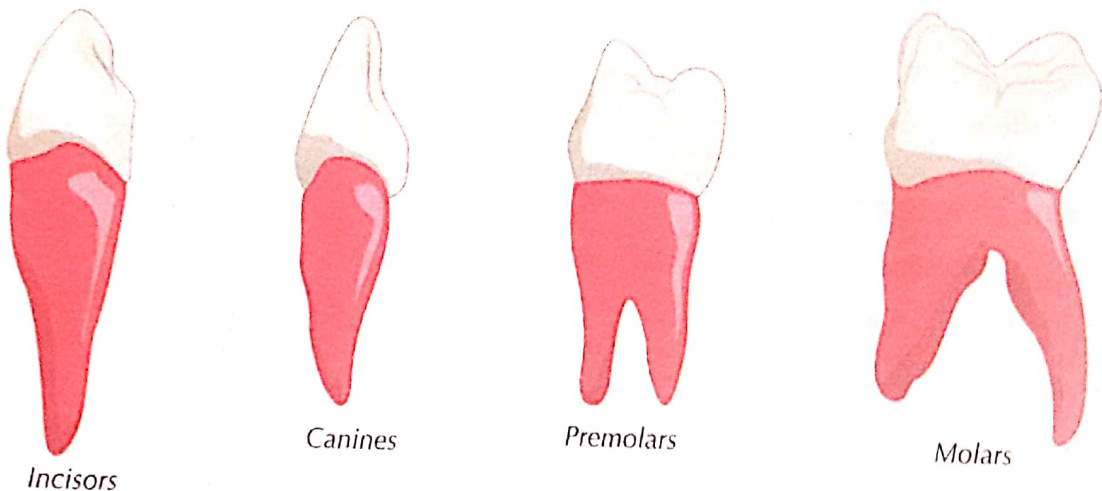


Fig 2.7: Type of teeth

Layers of Teeth: A tooth is coated with **enamel** which is the hardest substance in the body. Beneath the enamel is the **dentin** which is softer. The innermost part of the tooth is called the **pulp**. The pulp contains **blood vessels** and **nerves**.

Numbers of Teeth: Humans have two different sets of teeth in their life time. A new born baby usually has no teeth. Teeth start appearing when the baby is just a few months old. These teeth are called **milk teeth** or **temporary teeth**. A child will have 20 milk teeth (10 in each jaw- 4 incisors, 2 canines and 4 molars).

From the age of five, the roots of the milk teeth gradually loosen and the teeth start falling off one by one. They are replaced by the permanent teeth. The **permanent set** of teeth consists of 32 teeth, 16 in each jaw. On each side of the jaw, there are 2 incisors, 1 canine, 2 premolars and 3 molars.

Tooth Decay: The teeth are very important parts of our body. We should take good care of our teeth to prevent problems like tooth decay or dental caries, cavities and destruction of the tooth enamel.

Tooth decay is caused by bacteria. They produce acid that destroys the tooth's enamel and dentin layer. They build up sticky film on the teeth called **plaque**. The plaque contains saliva, bits of food and other natural substances. It forms most easily in certain places like cracks, pits or grooves in the back teeth, between teeth, near the gum line, etc.

The acid further can seep through pores in the enamel. This is how decay begins in the softer dentin layer, the main body of the tooth. As the dentin and enamel break down, a cavity is created. If the decay is not removed, bacteria will continue to grow and produce acid that eventually will get into the tooth's inner layer. This contains the soft pulp and sensitive nerve fibres leading to severe pain in tooth.

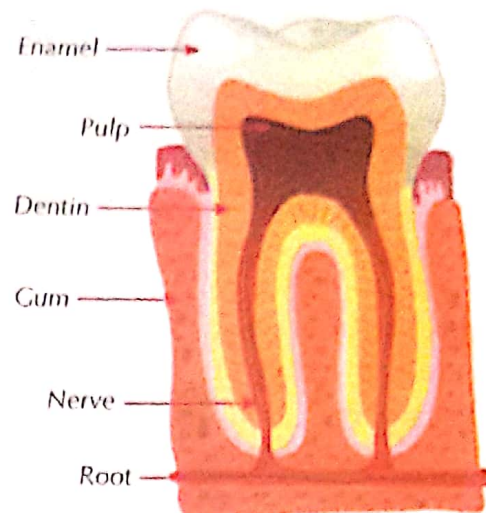


Fig 2.8: Layers of teeth



Fig 2.9: Temporary teeth



Fig 2.10: Permanent teeth

Tongue

The tongue is a sense organ that helps us taste food. We use the taste buds on the surface of the tongue to differentiate between sweet, bitter, salty and sour foods. It is a muscular organ that helps us mix food with saliva. It also helps us roll the chewed food into a ball or bolus which is pushed towards the back of the mouth where it is swallowed.

Practice Time

Say Yes or No.

1. The number of permanent teeth are 16 in each jaw. _____
2. Nutrition in humans occur in three steps. _____
3. Enamel is the hardest substance in the body. _____
4. Ingestion is the process of taking food. _____
5. Egestion is the absorption of food. _____

KNOW MORE

The pharynx passes the chewed food from the mouth to the oesophagus. The flap of tissue known as the epiglottis present in pharynx prevents food from entering into the wind pipe.

Oesophagus

The oesophagus is a muscular tube connecting the pharynx to the stomach. It carries swallowed and chewed food along its length and pushes it down to the stomach.

Stomach

The stomach is a thick-walled muscular bag that is located on the left side of the abdominal cavity. It is the largest part of the human digestive system. Stomach acts as a storage bag for food so that the body has time to digest large food properly. It receives food from the food pipe at one end and opens into the small intestine

at the other end. The inner walls of the stomach consist of the gastric glands which secrete mucus, hydrochloric acid and digestive enzymes. These continue the digestion of food that began in the mouth.

Mucus protects the lining of the stomach while acid kills bacteria that enters the body along with the food. Hydrochloric acid also makes the acidic medium in the stomach, which helps the digestive enzymes like pepsin to act. The digestive enzymes break down proteins into simpler substances.

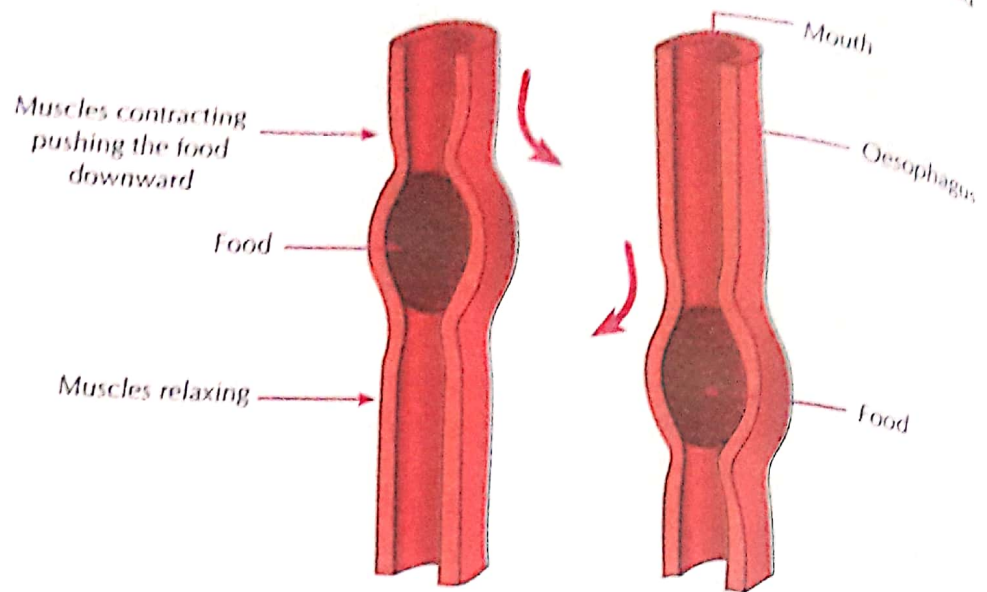


Fig 2.11: Food passes along the oesophagus

KNOW MORE

The working of the stomach was discovered by a strange accident. In 1822, a man named Alexis St. Martin was badly hit by a short gun. The bullet had seriously damaged the chest wall and made a hole in his stomach. He was brought to an American army doctor William Beaumont. The doctor saved patient but he could not close the hole properly and left it bandaged. Beaumont took it as an opportunity to see the inside of stomach through the hole. He made some wonderful observations.

He found that the stomach was churning food. Its wall secreted a fluid which could digest the food. He also observed that the end of the stomach opens into the intestine only after the digestion of the food inside the stomach is completed.

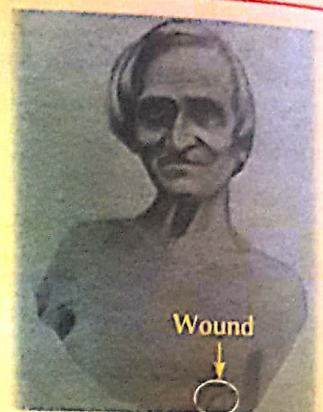


Fig 2.12: Alexis St. Martin's shotgun wound

Small Intestine

The small intestine is a highly coiled long, thin tube which is about 7.5 meters in length. The length of the small intestine depends on the diet of the organism. A major proportion of digestion

takes place in the small intestines. All types of nutrients are digested here with the help of secretions which it receives from the liver and the pancreas. The walls of the small intestine also secrete juices for digesting food.

The liver releases **bile juice** which emulsifies the fat content. The pancreas secretes **pancreatic juice** that digests the proteins and lipids. Finally, the intestinal secretions convert the carbohydrates into glucose, proteins to amino acids and fats into fatty acids and glycerol. Once the food is broken down into the simple particles, it is ready to be absorbed by the body.

The inner walls of the small intestine have numerous projection called **villi**. The villi enter the blood vessels through their thin walls by increasing the surface area. The absorbed food is then transported to different parts of the body through the blood vessels for cell activities. The small intestine also plays an important role in the absorption of the digested food into the blood stream.

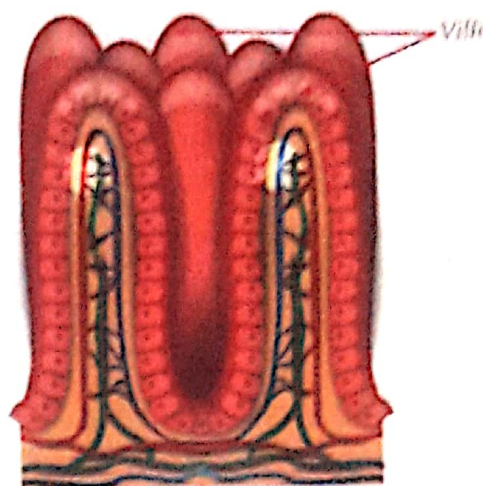


Fig 2.13: Intestinal villi

Large Intestine

The large intestine is a long, thick tube which is about 1.5 meters long. It absorbs water and small amounts of nutrients from the undigested food. The remaining undigested food passes into the rectum, where it remains for short time as semi-solid faeces. Faeces exit the body through the anus. This process is called **egestion**.

Assimilation of Digested Food

The digested food enters the blood in the small intestine. This is carried throughout the body through the blood stream. The process of utilisation of absorbed food, such as glucose, amino acids, fatty acids and glycerol is called as **assimilation**. Energy needed for various activities is obtained from glucose. Glucose is broken in the cells in the presence of oxygen to synthesise energy. Amino acids are used for building and repairing body parts. Fatty acids and glycerol are stored in the adipose tissue and under the skin.

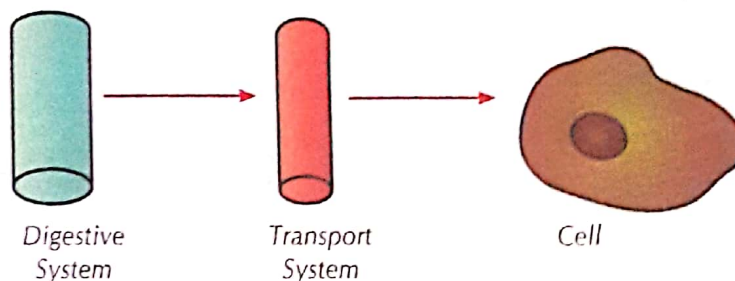


Fig 2.14: Assimilation of digested food

KNOW MORE

Sometime you may have experienced the need to pass watery stool frequently. This condition is known as **diarrhoea**. It may be caused by an infection, food poisoning or indigestion. It is very common in India, particularly among children. Under severe conditions it can be fatal. This is because of the excessive loss of water and salts from the body. Diarrhoea should not be neglected. Even before a doctor is consulted the patient should be given plenty of boiled and cooled water with a pinch of salt and sugar dissolved in it. This is called **oral Rehydration solution** (ORS).

Nutrition in Grass-eating Animals >>>

The cellulose is a major component of the food eaten by herbivores or grass-eating animals. Their stomach is divided into four chamber, i.e., **rumen**, **reticulum**, **omasum** and **abomasum**. They digest their food in two steps.

First of all, half chewed food is swallowed and it then goes from mouth to the rumen, the first chamber of the stomach. Here, it is acted upon by bacteria. The bacteria digest the cellulose. This semi-digested food goes to the second muscular chamber, the reticulum. From the reticulum the food is sent back to the mouth as cud, to be chewed again. Chewing of the cud is called **rumination** and such animals are called **ruminants or cud-chewing animals**. Cow, goat, buffalo, sheep, bison, deer, sheep, etc., are some examples of ruminants. The re-chewed food is swallowed for the second time.

After passing the first two chambers it enters the third chamber, the omasum. Here, the food is further broken down into smaller pieces and finally enters the fourth chamber, the abomasum. In abomasum, all the digestive juices act upon the food and the digestion is completed.

The digested food then enters the small intestine, where further digestion takes place. The liver and the pancreas secrete juices in intestine. The digested nutrients are absorbed here. Water is absorbed in the large intestine and the undigested food is eliminated through the rectum and anus.

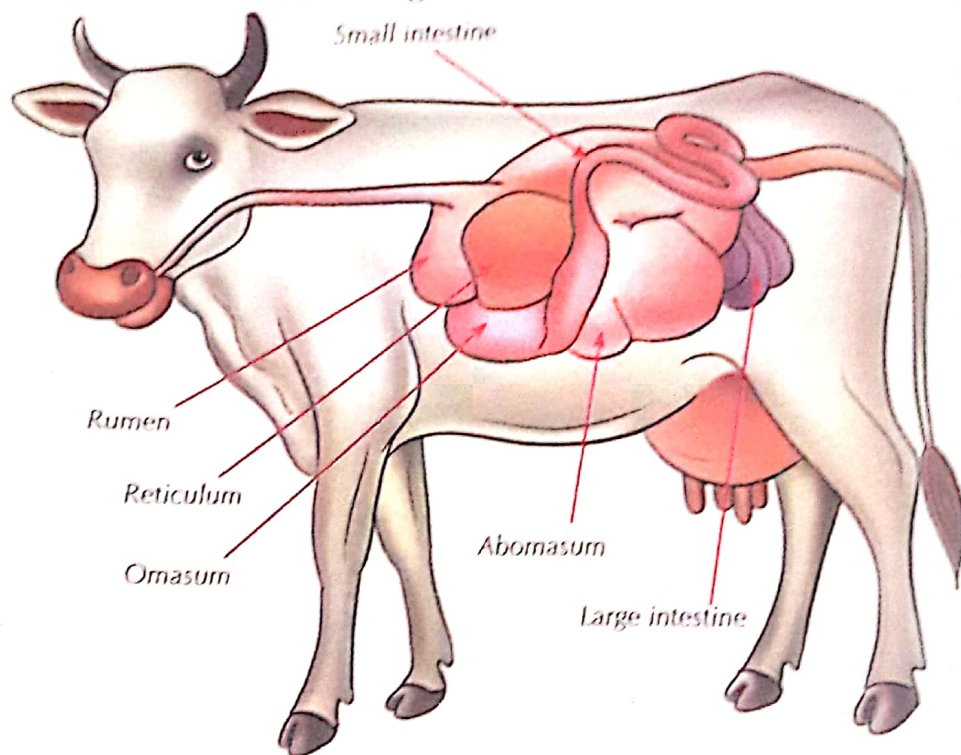


Fig 2.15: Digestive system of grass-eating animals

Practice TIME

Fill in the blanks.

1. Amino acids are used for _____ and repairing body parts.
2. The digestive _____ break down proteins into simpler substances.
3. The inner walls of the small intestine have numerous projections called _____.

Life Skills

- ♦ Take proper care of your teeth. Visit the dentist regularly to check if there is any cavity in your teeth. Learn the proper way of brushing teeth. The tooth decay is a serious problem. If occurs it can cause immense pain.
- ♦ Always take your meals in proper time so that the digestive system works properly. This will keep you energetic all the time. Also, include exercise and adequate rest in your daily routine.

Keywords

Digestion	: Process by which complex food substances convert into simpler ones.
Ingestion	: Process by which food is taken inside the body of an organism.
Absorption	: Process by which the digested nutrients are taken to different parts of the body by the circulatory system.
Assimilation	: Process of using absorbed food molecules for producing energy and growth.
Egestion	: Removal of undigested food.
Rumination	: Process of chewing cud by grass-eating animals.

Let's Revise

- The process of nutrition involves the following five stages: ingestion, digestion, absorption, assimilation, and egestion.
- Digestion in Amoeba is simple and direct.
- The four different types of teeth in human are incisors, canines, premolars, and molars.
- In human, two sets of teeth arise in their lifetime: the milk teeth and the permanent teeth.
- The process of digestion begins in the mouth where the food is mixed with saliva.
- The major part of the digestive process take place in the stomach and the small intestine.
- The main job of intestine is to absorb nutrition.
- Solid waste is stored in the rectum and passed out of the anus.
- Ruminants have a four-chambered stomach made up of the rumen, reticulum, omasum, and abomasum.
- Absorption begins in the rumen and the omasum but the majority of the nutrients are absorbed in the small and the large intestines.
- Faeces are stored in the rectum and excreted out of the anus.

Quora Watch

A. Tick (✓) the correct option.

1. Which of the following set is the correct combination of organs that do not carry out any digestive functions?
 - a. Oesophagus, large Intestine, rectum
 - b. Buccal cavity, oesophagus, rectum
 - c. Buccal cavity, oesophagus, large Intestine
 - d. Small Intestine, large Intestine, rectum

2. The acid present in the stomach _____
 - a. Kills the harmful bacteria that may enter along with the food.
 - b. Protects the stomach lining from harmful substances.
 - c. Digests starch into simpler sugars.
 - d. Makes the medium alkaline.
3. The finger-like outgrowths of human intestine helps to _____
 - a. Digest the fatty food substances.
 - b. Make the food soluble.
 - c. Absorb the digested food.
 - d. Absorb the undigested food.
4. The simplest carbohydrate made as food during photosynthesis is _____
 - a. Starch
 - b. Sugar
 - c. Glucose
 - d. Oil
5. Cuscuta plant can be categorized as _____
 - a. Parasite
 - b. Insectivorous
 - c. Saprophyte
 - d. Host
6. The plant that traps and feeds on insects is _____
 - a. Cuscuta
 - b. China roes
 - c. Rose
 - d. Pitcher plant
7. The *Rhizobium* bacteria live inside the root nodules of _____
 - a. Peas
 - b. Beans
 - c. Peanuts
 - d. All of the above
8. The presence of starch can be tested by _____
 - a. Alcohol
 - b. Iodine
 - c. Water
 - d. Hydrochloric acid

B. Fill in the blanks.

1. _____ is the process of elimination of undigested material from the body.
2. Digestion begins in the _____ and ends in the _____ intestine.
3. Food pipe or _____ connects mouth to stomach.
4. _____ help in movement and _____ in Amoeba.
5. Four types of teeth are _____ and _____
6. _____ have four-chambered stomach.
7. The inner walls of the stomach consist of the _____.

C. Coin one word for these statements.

1. It is the part of digestive system where ingestion of food occurs.
2. It is the sticky film on the teeth.
3. Liver releases it to emulsify the fat content of food.
4. It is the first and largest chamber of the ruminants.
5. The process of utilisation of absorbed food by the body.
6. The process of chewing the food.

D. Match the following columns.

A

1. Premolars
2. Incisors
3. Small intestine
4. Canines
5. False feet
6. Stomach
7. Large intestine

B

- a. Cutting and biting teeth
- b. U-shaped organ
- c. Pseudopodia
- d. Reabsorbs water from undigested food
- e. Piercing and tearing teeth
- f. Chewing and grinding teeth
- g. 7.5 m long

E. Write 'T' for the true and 'F' for the false statements.

1. Liver secretes enzymes.
2. Digestion is a process of breaking down food.
3. Food pipe is also called alimentary canal.
4. Nutrition in most animals is holozoic type.
5. Digestion process is very much different in ruminants.

F. Answer in brief.

1. Which organs secrete bile juice and pancreatic juice?
2. In which organ maximum digestion takes place?
3. What is the reason of tooth decay?
4. Name the number of teeth in temporary set and permanent set.
5. How does ingestion of food occur in amoeba?

G. Answer in detail.

1. Explain the different steps in the process of nutrition.
2. Draw and explain the human digestive system.
3. How does digestion takes place in ruminants? Explain with the help of diagram.
4. Name the four different types of teeth found in human and write their function?
5. What are villi? What is their location and function?
6. Where and how does digestion start in digestive system of humans? Elaborate.
7. Write the function of small intestine, liver, pancreas, saliva and tongue.



1. Observe a land animal and an aquatic animal to know their food habits. Provide them food and continue it for a week. Write a report on your observations. Discuss with your friends.
2. Visit a dairy farm and observe cow and buffaloes chewing cud. Note the movement of their jaws and time they take in cud-chewing.

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