

Class-VII

The LIVING WORLD

(A Book of Science & Technology)



Publication Division
D.A.V. College Managing Committee
Chitra Gupta Road, New Delhi-110055

CONTENTS

<i>S.No.</i>	<i>Topic</i>	<i>Page No.</i>
1.	Nutrition in Living Organisms—Plants	1 – 13
2.	Nutrition in Living Organisms—Animals and Man	14 – 30
3.	Chemical Substances and Processes	31 – 45
4.	Acids, Bases and Salts	46 – 58
5.	Heat	59 – 80
6.	Motion and Time	81 – 101
7.	Respiration in Organisms	102 – 114
8.	Transportation in Plants and Animals	115 – 128
9.	Reproduction in Plants	129 – 144
10.	Soil	145 – 158
11.	Electric Charges at Rest	159 – 175
12.	Light	176 – 197
13.	Weather, Climate and Adaptation of Animals	198 – 212
14.	Fabric from Fibre	213 – 221
15.	Forests	222 – 236
16.	Water	237 – 245
17.	Electric Current and Its Effects	246 – 262



CHAPTER

1

Nutrition in Living Organisms—Plants

In Class-VI, we have already learnt that food is essential for all living organisms. We also learnt that carbohydrates, proteins, fats, vitamins and minerals are all important components of our food. These components of food are necessary for our body and are called **nutrients**. The nutrients enable living organisms to build their bodies, to grow, to repair damaged parts of their bodies and to provide the energy to carry out life processes.

Nutrients are 'taken in' through their food by living organisms and are utilised in their bodies. This process of obtaining, and utilising food by an organism, is known as **nutrition**. The process of obtaining food is not the same in all organisms. On the basis of food habits, the modes of obtaining the required nutrition, by the body, have been divided into the following two categories:

- **Autotrophic Nutrition**

It is the mode of nutrition in which organisms can make their own food from simple raw materials. All green plants and some bacteria are **autotrophs**. (In Greek, *auto* = self, *trophe* = nutrition).

- **Heterotrophic Nutrition**

It is the mode of nutrition in which organisms cannot prepare their food on their own and depend on others for it. All animals, and a few plants, are **heterotrophs**. (In Greek, *heterone* = (an) other)

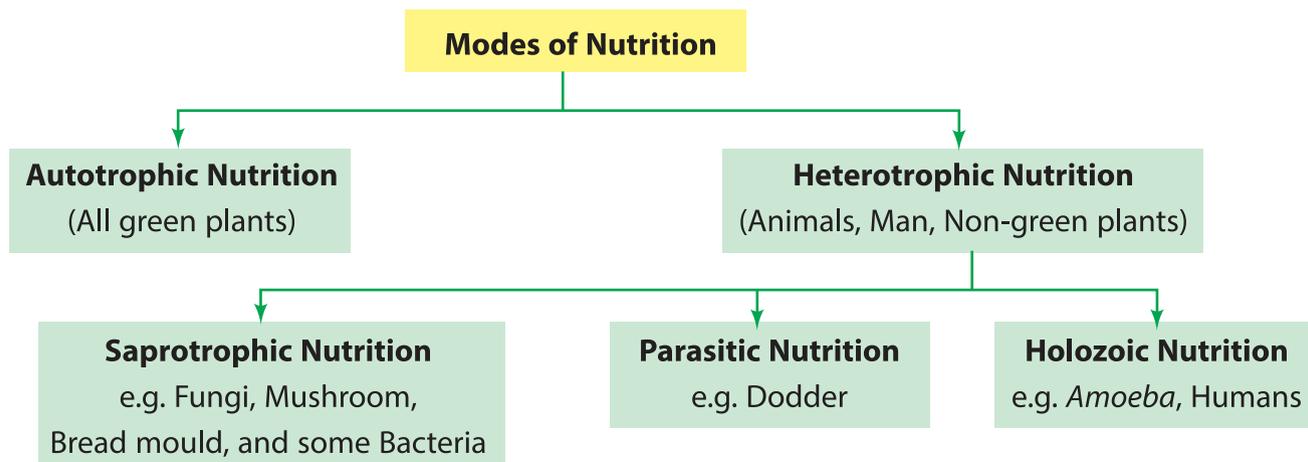


I can prepare my own food by using water and carbon dioxide in the presence of sunlight that is captured by chlorophyll.

I cannot prepare food on my own. I depend on plants for food.

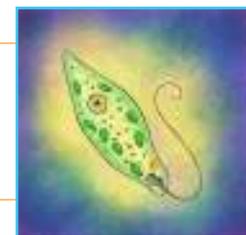


Let us study the following flow chart.



Do You Know ?

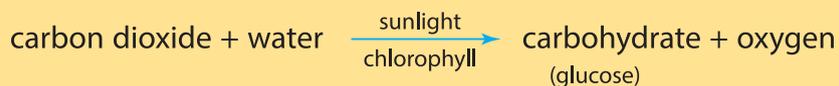
Euglena is an organism that shows both autotrophic and heterotrophic modes of nutrition. It has both plant and animal-like features.



► | Photosynthesis—Food Making Process in Plants

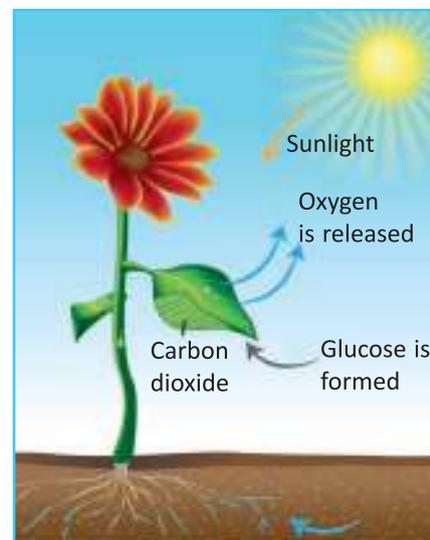
The synthesis of food in plants occurs in their leaves. Hence, leaves are called the **food factories** of the plants. The leaves have a green pigment called **chlorophyll**. It helps leaves to capture the energy of the sunlight. This energy is used by the plants to synthesise their food using carbon dioxide and water. This process is called **photosynthesis**

(**photo** = light, **synthesis** = to combine) as it takes place in the presence of sunlight. This process can be written in the form of the following equation:



Raw Materials for Photosynthesis

From the above equation, it is clear that carbon dioxide and water are the raw materials for photosynthesis. For this process, chlorophyll and presence of sunlight/light are also necessary. Since food is synthesised in leaves, all the raw materials need to reach there.



Photosynthesis

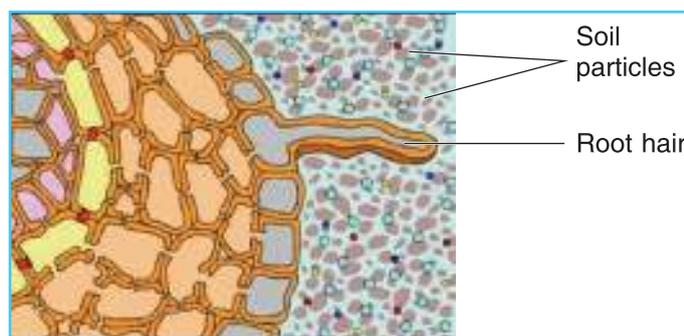
Water and minerals
(From soil)

Raw materials for
photosynthesis

Carbon dioxide
(From air)

Water and Minerals

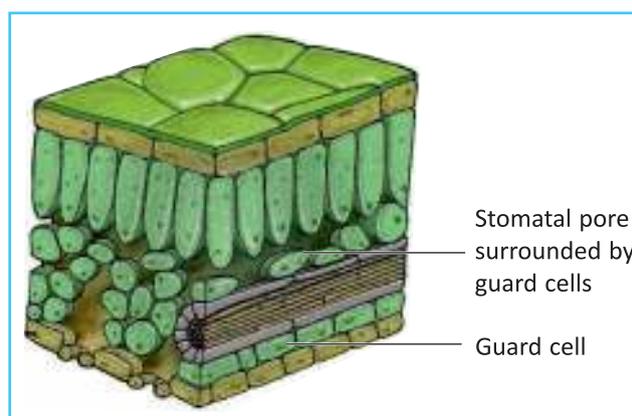
These are absorbed by the roots from the soil. From here, water and minerals are transported to other parts of the plant by the 'vessels'. **Vessels** are tubes that run throughout the root, the stem, the branches and the leaves. You will learn more about this in Chapter 8.



Roots absorb water and minerals from soil

Carbon dioxide

Plants take carbon dioxide from the atmosphere. Carbon dioxide enters the leaves through tiny pores present on the surface of leaves. Such pores are called **stomata**. The stomata are surrounded by special cells called **guard cells**.



Enlarged portion of leaf epidermis showing stomata

Activity 1

Take a potted plant. Apply a thin coat of vaseline on both sides of a leaf. Observe the plant for a few days. While all the other leaves remain green, the one, coated with vaseline, becomes yellow and falls off. This happens because the stomata of such a leaf get blocked. Such a leaf, cannot, therefore, take gases (like carbon dioxide and oxygen) from the atmosphere.

- **Sunlight**

Sunlight is the light and energy that comes from the Sun. During photosynthesis the plants use the energy of sunlight to prepare food. That is why the food making process, in plants, is called **photosynthesis**. (Photo = light, synthesis = to combine)

- **Chlorophyll**

The leaves are green due to the presence of a pigment—chlorophyll. It helps the leaves to capture solar energy. This energy is used to prepare food from carbon dioxide and water.

Do You Know ?

Some plants have leaves that are not green in colour. Such leaves contain chlorophyll but the green colour is masked due to the presence of other coloured pigments. The presence of additional pigments causes other leaf colours, such as red in coleus and purple in red cabbage. However, such leaves can still perform photosynthesis.

However, some variegated leaves have yellow patches. Such yellow areas on the leaf do not contain any chlorophyll and hence, cannot perform photosynthesis.



Photosynthesis is a unique process. It is this process that supplies food, directly or indirectly, for all living organisms. The energy of the sun, thus, gets passed on to all organisms through plants. Plants also provide oxygen, needed by all living organisms, for respiration. Can you imagine life on earth in the absence of photosynthesis?

Do You Know ?

Both deer and lion depend on plants. If there were no plants, deer would not survive and if there were no animals, like deer, the lions, too, would die. Plants, in turn, depend on solar energy. Hence, solar energy is the ultimate source of energy for all living organisms.

■ Products of Photosynthesis

The initial product of photosynthesis is a carbohydrate—glucose. It next gets converted to starch whose presence, in the leaves, indicates the occurrence of photosynthesis. Carbohydrates contain carbon, hydrogen and oxygen. Some carbohydrates are also converted to proteins and fats. Besides carbon, hydrogen and oxygen, proteins also contain nitrogen. Now where does this nitrogen come from? Nitrogen is present in the air but plants cannot use this nitrogen directly. Some bacteria, present in the soil, convert gaseous nitrogen into its usable form which is soluble and is, therefore, absorbed by roots along with water. Roots are also able to absorb nitrogenous compounds, present in fertilisers, that are added to the soil.

► | Other Modes of Nutrition in Plants

Some plants cannot synthesise their own food because they do not contain chlorophyll. Such plants depend on food produced by other plants. Their mode of nutrition is, therefore, **heterotrophic**. One such plant is *Cuscuta* (*amarbel*, dodder). It can be observed as a yellowish thread-like structure, without leaves, growing on other plants. *Cuscuta* is a **parasite** since it derives its nutrition from some other living organism and causes harm to that organism. The plant, on which it grows, is known as 'the **host**.'



Cuscuta-Dodder growing on a bush



Pitcher plant

Have you heard of insect-eating plants? There are plants that feed on insects for their nitrogen requirements. Some parts of such plants get modified to trap insects. For example, the leaf, of the pitcher plant, gets modified to form a pitcher with a lid. The lid is able to open and close the mouth of the pitcher. The pitcher is lined with downward-pointing hairs. When an insect enters, it cannot climb back out against the hairs and ultimately falls to the bottom of the leaf, and gets digested by the juices present there. Such insect-eating plants are called **insectivorous plants**.

▶ Modes of Nutrition for Other Organisms

■ Saprotrophic Mode of Nutrition

'Sapros' means rotten and 'trophic' means food. **Saprotrophic nutrition** is the process in which the organisms feed on dead and decaying matter. The food gets digested outside the cells, or sometimes, even outside the body of the organism. This type of digestion is called **extracellular digestion**. The organism secretes digestive juices directly onto the food. These digestive juices make the food soluble; the organism then directly absorbs it. Some organisms, which have saprotrophic nutrition, are *Rhizopus* (bread mould), *Mucor* (pin mould), Yeast, *Agaricus* (mushroom) and many bacteria.

Do You Know ?

You must have observed (i) a white cottony growth on leather articles in humid weather (ii) mushrooms growing on rotting wood and (iii) greenish-blue patches on rotting fruits. A cottony growth, developing into coloured patches, is a common occurrence on stale bread. These organisms belong to the group of fungi and bacteria, and they exhibit the saprotrophic mode of nutrition.



■ Symbiotic Relationship

Sometimes two organisms live in close association and develop a relationship that is beneficial to both. This is called **symbiotic relationship**. (In Greek, *symbion* = "to live together"). Some algae and fungi live in the roots of trees. They receive shelter and nutrition from the tree; in return, they help the trees to absorb water and minerals more efficiently.

Lichen is a living partnership between a fungus and an alga. The fungus absorbs water and provides shelter. The alga prepares food by photosynthesis.



Lichens growing on rock

Rhizobium is a bacterium that lives in the roots of leguminous plants. It converts nitrogen, from the atmosphere, into a usable form that can be utilised by the plants. The plants, in turn, provide food and shelter to the bacterium.



Leguminous plant showing root nodules

▶ How are Nutrients Replenished in the Soil?

Plants remove nutrients from the soil as they grow. These nutrients need to be reintroduced into the soil so that the soil remains productive. Farmers usually enrich the soil by adding manures and fertilisers; these are materials that contain one or more of the nutrients that plants need. In a forest, where no one goes to add fertilisers, the decomposition of dead leaves, and other plant and animal matter enriches the soil with nutrients. As we discussed just above, bacterium like *Rhizobium*, also help in making the soil rich in nitrogen.



Keywords

autotrophic nutrition	mode of nutrition in which organisms prepare their own food.
chlorophyll	green pigment present in the leaves of plants.
heterotrophic nutrition	mode of nutrition in which organisms do not prepare their own food; they derive their food from plants, or animals, or both.
host	the living organisms from which a parasite derives its food.
insectivorous plants	insect-eating plants.
nutrition	the process, of obtaining, and utilising, food by a living organism.
parasitic nutrition	mode of nutrition in which non-green plants live on other living organisms and obtain their food from them.
photosynthesis	the process through which green plants prepare their own food.
saprotrophic nutrition	mode of nutrition in which some plants feed on dead and decaying matter.
stomata	tiny pores that are present on the surfaces of leaves; useful for exchange of gases.
vessels	channels, to transport water and minerals, to different parts of the plant.

You Must Know

1. The process of obtaining, and utilising, food is known as nutrition.
2. There are two types of nutrition—autotrophic and heterotrophic.
3. Autotrophic nutrition is the mode of nutrition in which green plants synthesise their own food by the process of photosynthesis.
4. Photosynthesis is the process by which green plants make their own food. The plants use simple chemical substances, like carbon dioxide, water and minerals, for synthesising their food, in the presence of sunlight/light.
5. During photosynthesis plants take in carbon dioxide and release oxygen; this released oxygen is utilised by living organisms for their survival.

6. Heterotrophic nutrition is the mode of nutrition used by some plants and practically all animals. It is used by all organisms that cannot synthesise their own food and depend on other sources for their food.
7. Heterotrophic nutrition has been sub-divided into three categories: saprotrophic, parasitic and holozoic nutrition.
8. Organisms, which derive nutrition from the body of other living organisms (host), are called parasites; for example, *cuscuta* (*amarbel*) and insect-eating plants.
9. Insect-eating plants are called insectivorous plants. Pitcher plant is an example of an insectivorous plant.
10. Saprotrophic nutrition is the process by which the organisms feed on dead and decaying matter.
11. In symbiotic relationship two organisms live in close association and develop a relationship that is beneficial to both.
12. The soil needs to be continuously replenished to remain productive. This is because the plants growing on it, and the small organisms living in it, keep on depriving it, of the nutrients present in it.

Something To Know

A. Fill in the blanks.

1. Animals are _____ as they cannot synthesise their own food.
2. The _____, of a plant, absorb water and minerals from the soil.
3. During photosynthesis plants take in _____ and release _____.
4. _____ are the tiny pores through which leaves exchange gases.
5. Insect eating plants are called _____ plants.
6. An essential raw material needed for the process of photosynthesis, and
 - (a) available in the soil is _____.
 - (b) available in the air is _____.

B. Match the following:

- | | |
|-------------------|----------------------------|
| 1. Chlorophyll | (a) Autotrophs |
| 2. Lichens | (b) Saprotrophs |
| 3. Fungi | (c) Symbiotic relationship |
| 4. <i>Amarbel</i> | (d) Leaf |
| 5. Plants | (e) Parasite |

C. Tick (✓) the correct option.

1. Green plants, that can synthesise their own food, are known as—

<input type="checkbox"/> heterotrophs	<input type="checkbox"/> parasites
<input type="checkbox"/> autotrophs	<input type="checkbox"/> saprotrophs
2. The food factory, of the plant, is its—

<input type="checkbox"/> root	<input type="checkbox"/> flower
<input type="checkbox"/> stem	<input type="checkbox"/> leaf

3. Which of the following is an insectivorous plant?
- | | |
|--|---|
| <input type="checkbox"/> pitcher plant | <input type="checkbox"/> leguminous plant |
| <input type="checkbox"/> green plant | <input type="checkbox"/> <i>amarbel</i> |
4. Mushroom is an example of a/an—
- | | |
|-------------------------------------|--|
| <input type="checkbox"/> saprotroph | <input type="checkbox"/> parasite |
| <input type="checkbox"/> autotroph | <input type="checkbox"/> insectivorous |
5. An organism, that fixes nitrogen in the soil, is—
- | | |
|---|---|
| <input type="checkbox"/> mushroom | <input type="checkbox"/> <i>mucor</i> |
| <input type="checkbox"/> <i>rhizobium</i> | <input type="checkbox"/> <i>cuscuta</i> |

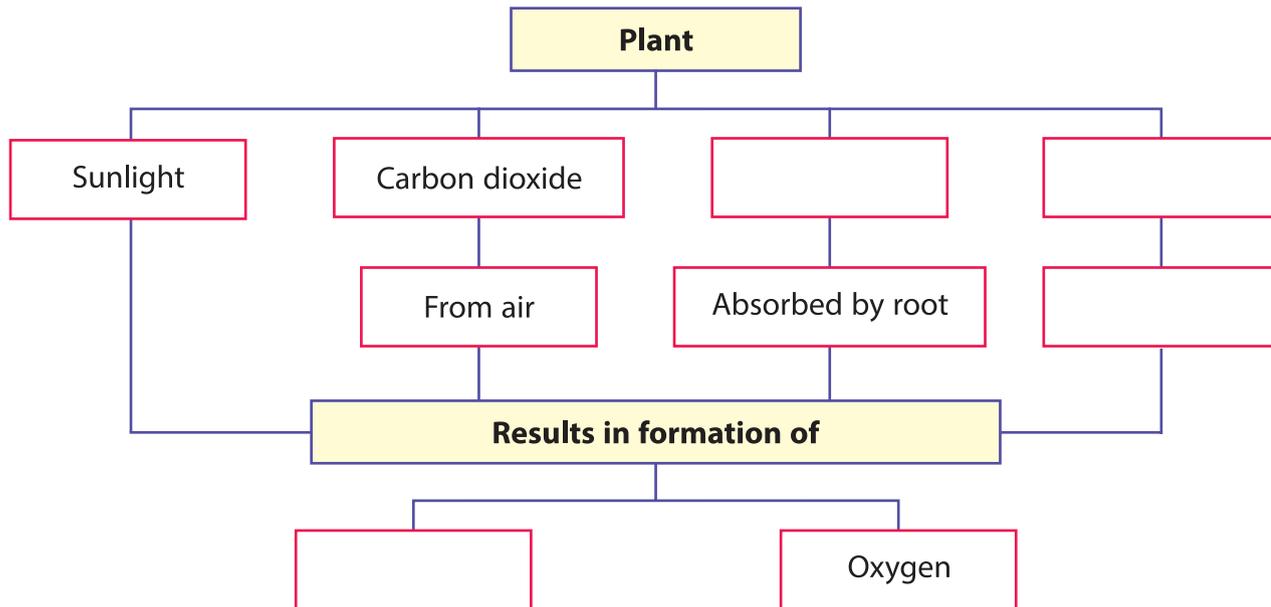
D. Answer the following questions in brief.

1. Why is nutrition important for a living organism?
2. How do green plants synthesise their food?
3. State the role of 'vessels' present in a plant.
4. Define the following terms:
 - (a) Symbiotic relationship
 - (b) Nutrients
 - (c) Saprotrophic mode of nutrition
 - (d) Photosynthesis
5. When some wheat dough was left in the open for a few days, it started emitting a foul smell. State, why?

E. Answer the following questions.

1. Why would life not be possible on the earth in the absence of photosynthesis?
2. Give reasons for the following:
 - (a) Mushroom is a saprotroph.
 - (b) Sun is the ultimate source of energy for all living organisms.
 - (c) The leaf of a plant 'dies out' if its stomata are blocked.
 - (d) Leaf is known as the food factory of the plant.

- (e) Lichen is a 'living partnership' between a fungus and an alga and this 'partnership' is beneficial to both.
- Why do some plants feed on insects? How does a pitcher plant catch insects?
 - How do *rhizobium* bacteria and leguminous plants help each other in their survival?
 - Complete the web chart.



Value Based Question

The teacher told her students the story of the film *Dost*. She told them that, in that film, the friendship, between a visually challenged boy and a lame boy, helps them both to face, and overcome, the very many challenges of their day-to-day life. She went on to compare their friendship with the 'symbiotic relationship' between two organisms.

- Suggest any two 'values' that, according to you, must have been there in the two friends of the film *Dost*.
- In what way is the friendship, between the two boys, similar to the 'symbiotic relationship' between two organisms?
- Give one example of a 'symbiotic relationship' between two organisms.

Something To Do

- Compose a few lines/poem on the 'utility of plants'.

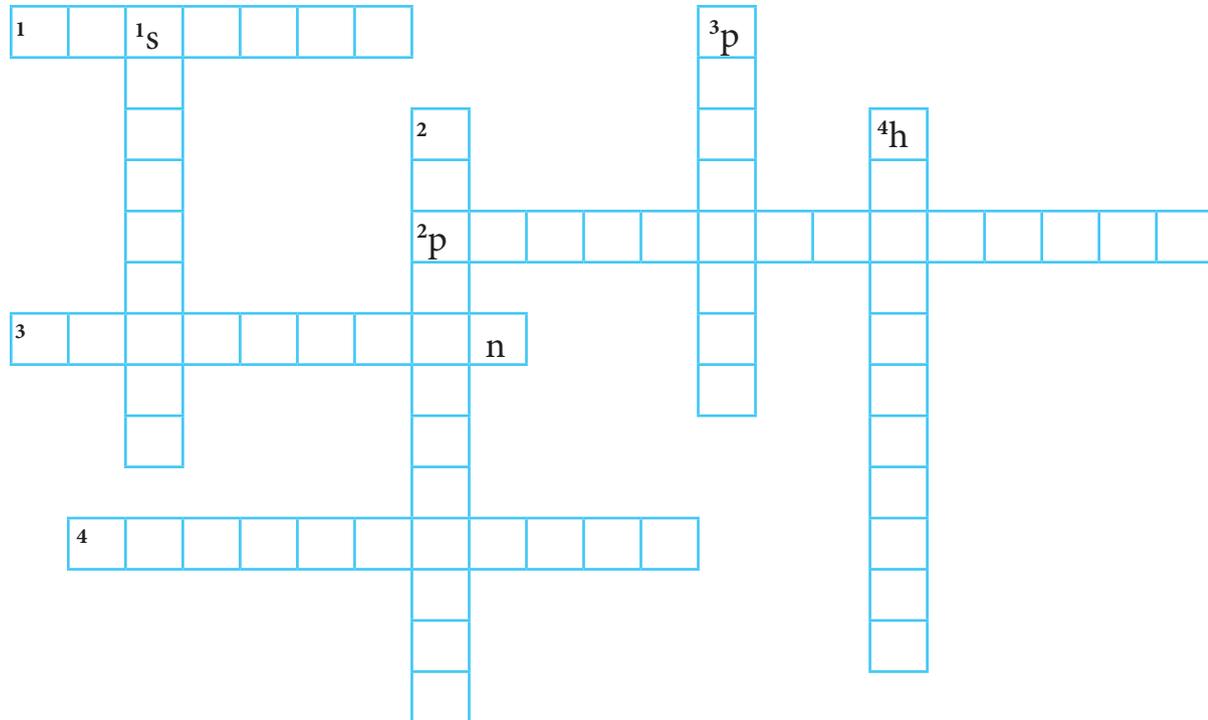
2. Why is it important to increase the 'forest cover'?
3. Keep a stale, moist piece of bread in a warm corner of the kitchen and observe it for 3-4 days. Can you identify the organism growing on the piece of bread? Identify its mode of nutrition.
4. Solve the crossword puzzle with the help of the clues given below.

ACROSS →

1. A plant parasite.
2. The process by which green plants prepare their food.
3. The process of obtaining, and utilising, food.
4. Green pigment present in the leaves of plants.

DOWN ↓

1. Two different organisms that live together and thereby, benefit from each other.
2. Organism feeding on dead matter.
3. An organism deriving food from another living organism.
4. Organism that cannot prepare its own food.



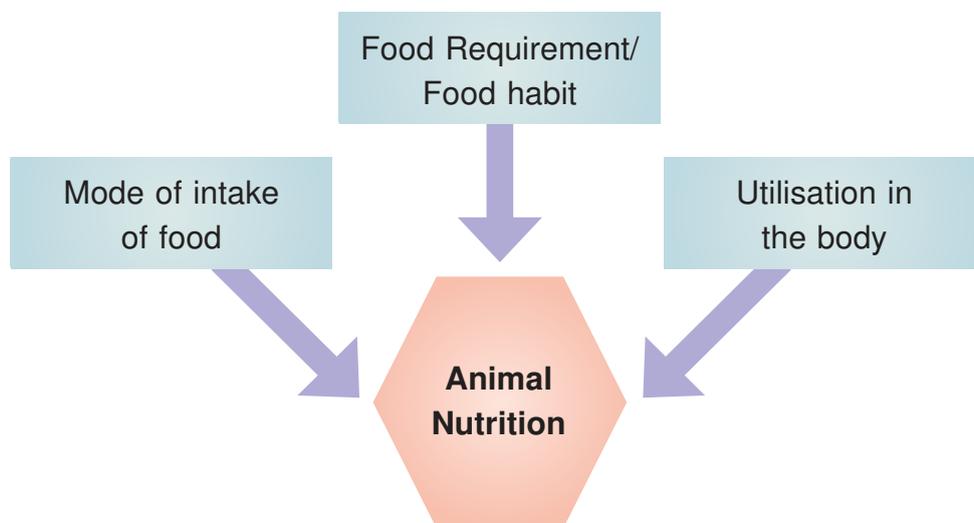


CHAPTER

2

Nutrition in Living Organisms—Animals and Man

You have already learnt in Chapter 1 that plants can prepare their own food and are called **autotrophs**. Animals cannot prepare their own food and are called **heterotrophs**. Animals eat complex food materials but break it down into simpler forms in their bodies. Their body gets the required nutrition through the three main steps shown below—



Three main steps in Animal Nutrition

▶ | Modes of Intake of Food

The method of taking in food is different in different organisms. The relevant parts of their body get modified in a manner that makes it easy for them to eat their food. A sparrow has a short beak to pick up seeds and worms. The long, tubular beak, of the humming bird, helps it to suck nectar from the flowers. The cow has sharp incisors and flat molar teeth that help it to cut and grind plant materials. The jaws of many snakes enable them to swallow animals that may be much larger than the size of their head.



Sparrow



Humming bird



Cow



Snake

Mode of intake of food differs in different organisms

▶ | Food Habits of Animals

On the basis of their food habits, animals have been categorised into three different categories.

The animals, like cow and deer, that eat only plant materials, are called **herbivores**.

The animals, like lion and tiger, that eat only other animals, are called **carnivores**.

Animals, like bear and human beings, that eat both animals and plant materials, are called **omnivores**.

▶ | Modes of Nutrition

It is their food that provides animals their required nutrition. As we have mentioned in the previous chapter, the nutrition requirements of heterotrophs, i.e. heterotrophic nutrition, are met by them in three different ways. These three modes of nutrition are:

- Saprotrophic nutrition
- Parasitic nutrition
- Holozoic nutrition

■ Saprotrophic Nutrition

We have already learnt in the previous chapter that, the mode of nutrition, in which an organism obtains its (required) nutrients, from dead and decaying plant and animal matter, is known as **saprotrophic nutrition**. Such an organism secretes enzymes outside, digests the organic food and absorbs the soluble organic compounds.

Most fungi and some bacteria are saprotrophs.

■ Parasitic Nutrition

The mode of nutrition, in which an organism (known as a parasite) obtains food from some other living organism (known as the host), of a different group, is known as **parasitic nutrition**. Parasites may live on, or in, the body of another living organism. In this mode of nutrition the parasite is benefitted while the host gets harmed.

Roundworms, head louse, body louse and tapeworm are parasites.

■ Holozoic Nutrition

This is a mode of nutrition, in which organisms, like *Amoeba* and human beings, eat food that may be in solid or in liquid state. This food is taken into the body (or eaten), and then it is broken down (or digested) to provide the required nutrition to the body.

Having understood the three different modes of nutrition, used by heterotrophs, let us now talk, in detail, how the human body gets its required nutrients.

▶ | Nutrition in Humans

The food that we eat passes through a long muscular tube (called the alimentary canal) present inside our body. This canal begins at the mouth and ends at the anus. The food is broken down into tiny molecules that are carried, by blood, to all parts of the body. The sequence of steps, involved in this process, are as follows:

- **Ingestion**

The act of getting, and eating, food is called **ingestion**. In humans, it takes place through the mouth where the teeth help in chewing the food.

- **Digestion**

The process of breakdown, of complex molecules into simple soluble ones, is called **digestion**. This digestion of food gets done, with the help of certain chemicals, called the **enzymes**. The process of digestion starts in the buccal cavity and gets completed in the small intestine.

- **Absorption**

The digested food is absorbed by the walls of the small intestine from where it gets passed on to the blood.

- **Assimilation**

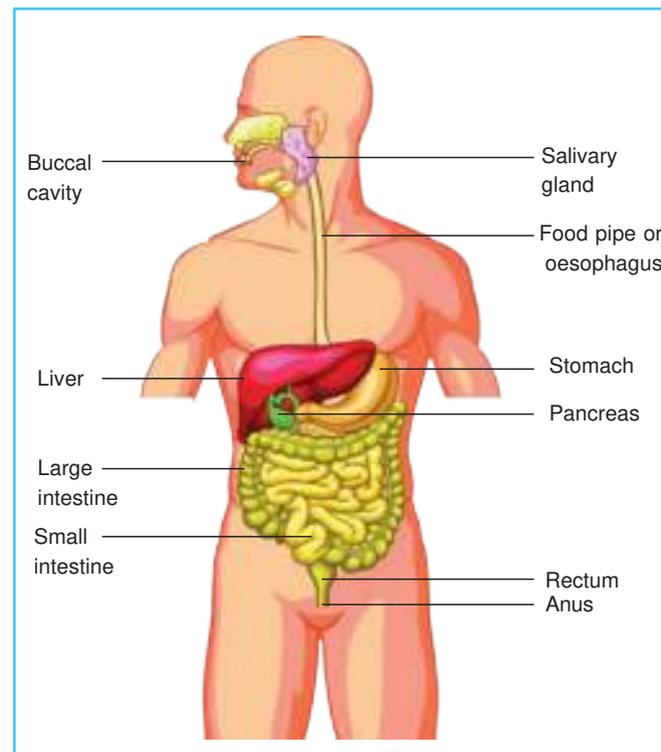
The absorbed food is utilised by the body, for growth and formation, of body parts. This process is known as **assimilation**.

- **Egestion**

The elimination, of undigested food, from the alimentary canal, is known as **egestion**.

The alimentary canal is made up of the following (body) parts:

- (a) Buccal cavity
- (b) Food pipe (or Oesophagus)
- (c) Stomach
- (d) Small Intestine
- (e) Large Intestine
- (f) Rectum
- (g) Anus



Human Digestive System

Besides these parts, there are a number of glands, associated with the alimentary canal, which play their roles in the process of digestion of food. The salivary glands, pancreas and the liver, are the three main such glands.

The Alimentary canal, along with these associated glands, form the overall **digestive system**. We now look at the specific function/role of the different parts of the digestive system.

■ Mouth and Buccal Cavity

In humans, the food is taken in through the mouth from where it goes into the buccal cavity. Our buccal cavity contains the teeth and the tongue. The Salivary glands, present here, release saliva into the buccal cavity.

Activity 1

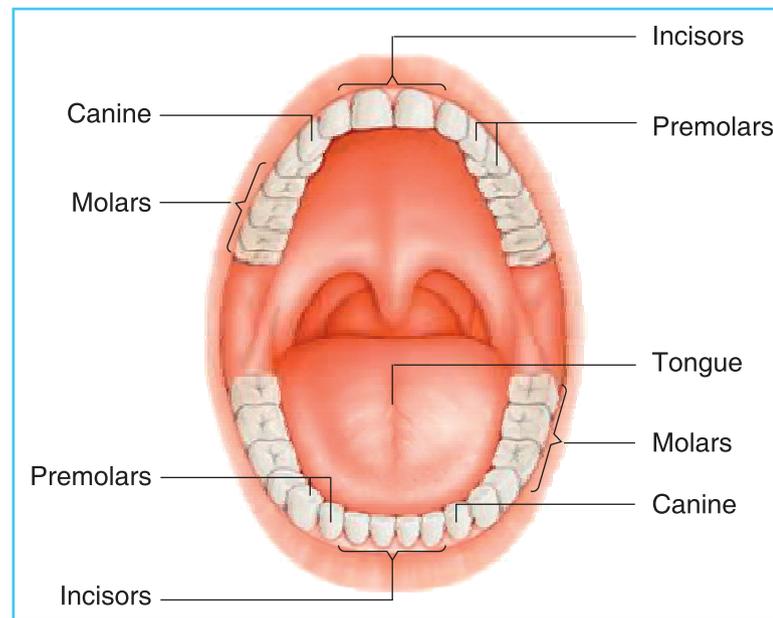
Chew a piece of bread for 3-4 minutes. Note the change in taste as you chew it.

Describe the observed change in taste. Why is there a change in taste?

The saliva contains digestive juices that break down starch to form sugar. Hence, a starchy substance (that is tasteless), when chewed for sometime, tastes sweet.

● The Teeth

Teeth, are rooted in the sockets of the bones of the jaw. These are covered by a white, strong, shining, protective material, called the **enamel**. Teeth help in cutting, tearing and grinding of food.



A view of buccal cavity

Adult humans typically have 32 teeth—16 in upper jaw and 16 in the lower jaw—that fit together and help them to chew food. Humans develop two sets of teeth during their life. The first set of teeth are 20 small teeth, also known as **baby teeth** or **milk teeth**. They start appearing, above the gumline, when a baby is six, or seven, months old. By the time a child is (around) six years

old, a second set of 32 larger teeth, called **permanent teeth**, 'come out' from the gums and (eventually) replace the milk teeth.

Humans have four different types of teeth that perform different functions.

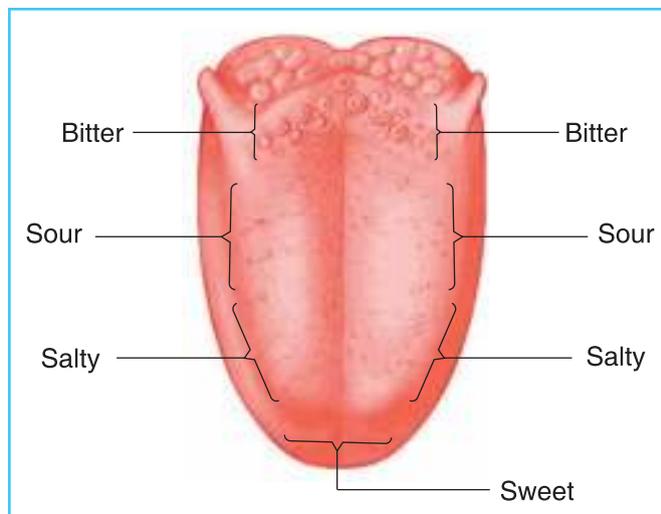
- **Incisors** are used for cutting of food.
- **Canines** are used for tearing of food.
- **Premolars** are used for grinding of food.
- **Molars** are also used for grinding of food.

Do You Know ?

Enamel is the hardest substance in the human body and covers the outer portion of the teeth. It is made up of mineral salts (of calcium and magnesium) and keratin (a protein). It can withstand quite high pressures.

● The Tongue

Tongue is a muscular organ attached to the floor of the buccal cavity. It is free to move at its front end where it can move in all directions. The tongue helps in mixing up of saliva with food; it also helps in swallowing food. It has four types of taste buds which help us to know about the sweet, sour, bitter and salty tastes, associated with different types of items, in our food.



Taste buds on tongue

Do You Know ?

Tongue is a busy organ. The tongue serves as an organ of taste, with taste buds scattered over its surface. During chewing, the tongue holds the food against the teeth; in swallowing, it moves the food back into the buccal cavity, and then into the oesophagus (when the pressure of the tongue closes the opening of the trachea, or windpipe).

Activity 2

Take some water that has been obtained after boiling rice. This water has some starch dissolved in it. Add 2-3 drops of this water to four glass bowls (or small transparent *katories*, or glasses), and label them as A, B, C and D. Add a teaspoon of plain water to each glass bowl. Now add a teaspoon of your saliva to bowl B. Heat another teaspoon of your saliva, over a flame, for about 20 seconds and add this to bowl C. After about 10 minutes, add 4-5 drops of iodine in each bowl, except bowl D. Tabulate your observations in the following table.

Glass Bowl	Quantity of water with starch	Quantity of saliva	Colour change observed after 10 minutes
A			
B			
C			
D			

Presence of blue-black colour, after the addition of iodine drops, shows the presence of starch. What happened to the starch in bowl B? Why did the blue-black colour not appear in bowl B and bowl D?

For the Teacher

The blue-black colour does not appear in bowl B because the saliva 'breaks' the starch into simpler sugars which do not undergo a colour change with iodine.

There is, however, a colour change in bowl C. This is because the saliva loses its property of 'breaking' starch after heating. The starch, therefore, stays as such. Hence, the addition of iodine causes a colour change.

Note: While doing this activity, teacher must ensure hygiene.

The Food Pipe (or Oesophagus)

The **food pipe** is a long, narrow and muscular tube that connects the buccal cavity to the stomach. Food, that has been chewed in the mouth, is pushed downward into the oesophagus. From here, the onward movement of the food is due to the movement of the muscles, present in the wall of the oesophagus.

Do You Know ?

Epiglottis is a flap-like structure present at the top of the wind pipe. It closes the wind pipe when we swallow food and prevents the food from entering our lungs.

■ The Stomach

The **stomach** is the widest part of the alimentary canal. It is a thick-walled, sac-like muscular organ. It receives food, from the oesophagus, and passes it into the small intestine. The inner lining of the stomach secretes gastric juices, which have mucus, hydrochloric acid and enzymes present in them.

Mucus protects the inner lining of the stomach. Hydrochloric acid kills bacteria. It also provides the acidic medium, needed for digestion of food, by the enzymes in the stomach. The enzymes, in the stomach, break down proteins to simpler substances, like amino acids.

Do You Know ?

Stomach with a hole

On June 6, 1822, a person named Alexis St. Martin, was accidentally shot in the stomach. Dr. Beaumont treated his wound. Despite his best efforts, Dr. Beaumont could not close the hole in his stomach that never fully healed.

Dr. Beaumont recognised that he had, in St. Martin, the unique opportunity to observe digestive processes. He began to perform experiments, on digestion, in the stomach of St. Martin. Most of these experiments were conducted by tying a piece of food to a string, and inserting it, through the hole, into St. Martin's stomach. Every few hours, Dr. Beaumont would remove the food and observe how well it had been digested. Dr. Beaumont also extracted a sample of gastric acid (digestive juice) from St. Martin's stomach for analysis. He also used samples of this stomach acid to "digest" bits of food in cups. This led to the important discovery that the stomach acids help to digest the food (into simple and soluble) nutrients, that the stomach can use. It was, thus, realised that digestion is primarily a chemical process, and not a mechanical one.

■ The Small Intestine

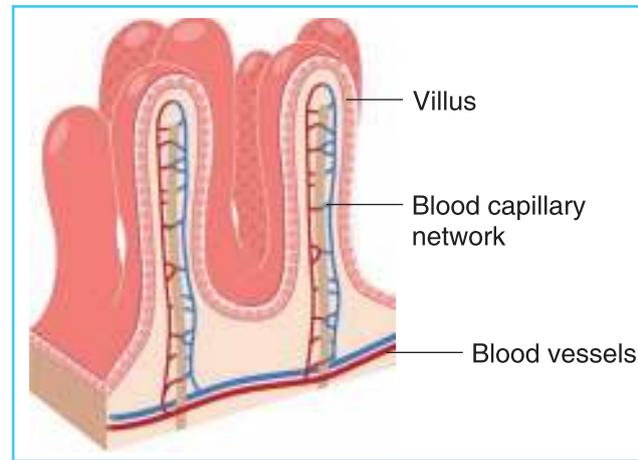
The small intestine is not all that small. It is about 6–7 metres long. It helps in digestion by using three types of secretions.

1. Secretions from liver—The Liver is the largest gland in the human body. It is present slightly below the stomach, on the right side. It secretes bile juice, that is stored in a bag-like structure, called the **gall bladder**. This bile juice plays an important role in digestion of fats.
2. Secretions from pancreas—**Pancreas** is a yellow, leaf-shaped, gland, located just below the stomach. It secretes pancreatic juice; this juice acts on carbohydrates, proteins and fats and breaks them into simpler forms.
3. Secretions from the small intestine—The inner wall, of the small intestine, itself secretes the intestinal juice. This juice digests carbohydrates, proteins and fats.

The small intestine, uses the bile, pancreatic and intestinal juices to complete the process of digestion of food in itself. Here (i) carbohydrates are digested to simple sugars like glucose (ii) proteins are broken down to amino acids and (iii) fats are broken down into fatty acids and glycerol.

- **Absorption of digested food in the small intestine**

The inner wall, of the small intestine, absorbs the digested food. It has a large number of finger-like projections, called **villi**. The villi increase the effective surface area for absorption of digested food. This absorbed food is passed to blood vessels, present in the villi. The 'food', thus, get transported to all parts of the body via the blood. It is used to produce energy and to build complex substances required by the body. This whole process is called **assimilation**.



Parts of small intestine showing villi

- **The Large Intestine**

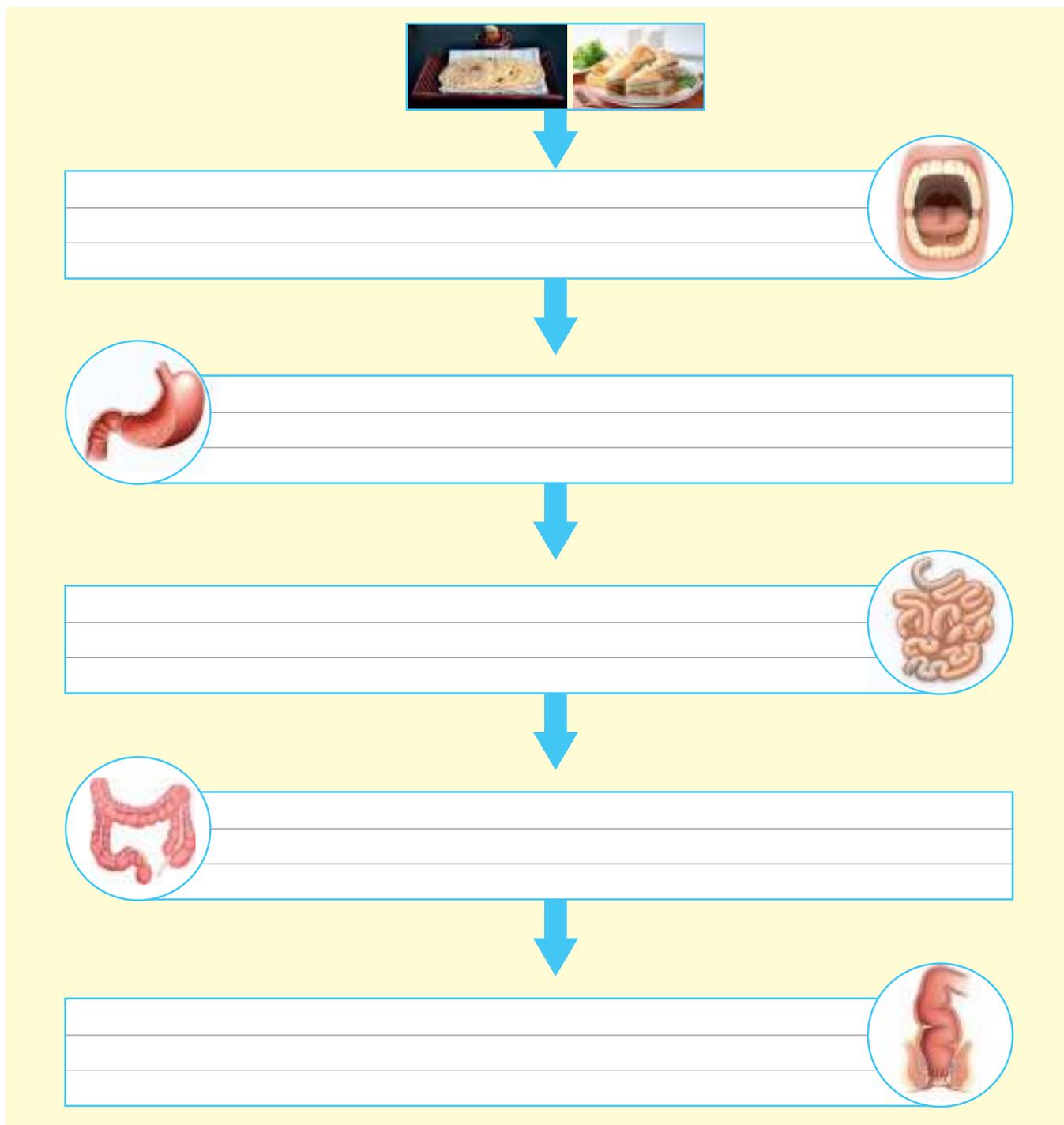
Large intestine is wider and shorter than the small intestine. It is about 1.5 metres in length. The undigested, and unabsorbed, food enters the large intestine. Here, the excess of water and some minerals are absorbed from the undigested food. The left over waste part of food passes to the rectum and is stored there as faecal matter. The faeces are eliminated through the anus. This process is called **egestion**.

Activity 3

Tracing the journey of a *chappati*/sandwich.

We all eat a *chappati*, or a sandwich, quite often. Our digestive system 'breaks down' this food item into simpler forms. It, thus, helps it to provide the energy and nutrients our body needs for its maintenance and growth.

Use the flow chart, given on the next page, to trace the journey of a *chappati*/sandwich to show how it goes from just being a 'food item on your plate' to 'energy for life'. Write just one/two sentence/s, in the space provided, to highlight the role of, each of the indicated parts, in this eventful journey.

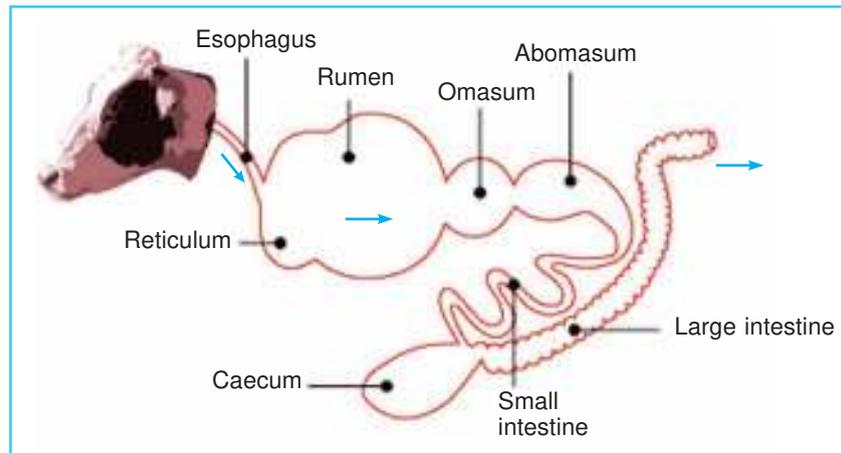


► Nutrition in Cud Chewing Herbivore Animals

Cud chewing herbivore animals are called **ruminants**. Cow, deer, camel, buffalo, sheep and giraffe are some of the well-known **ruminants**. They have a special four-chambered stomach.

The first chamber is the largest and is called **rumen**. These animals first swallow the food quickly and store it in their rumen. The rumen has some micro-organisms

that help in partial digestion of the cellulose of the plant materials. This food is now called **cud**. The ruminants, later on, bring this cud back to their mouth and chew it thoroughly. This process is called **rumination**. The thorough chewing of food during rumination, helps to break down the rich cellulose content of the plant materials. This 'breaking down' makes it easy, for these animals, to digest the cellulose content.



Digestive system of a cow

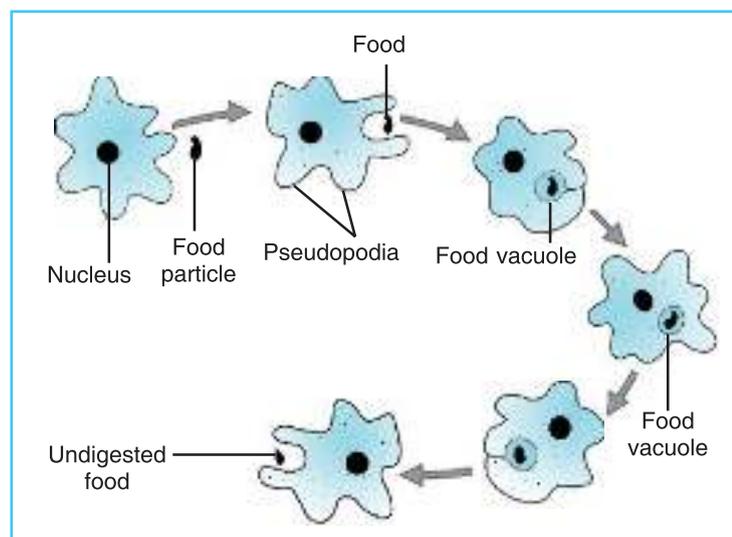
Ruminants also have a spacious bag-like structure, between their small intestine and the large intestine. This is called **caecum**. The bacteria, present in the caecum, help in further digestion of the cellulose of the food.

It is interesting to note here that such bacteria are not present in the human digestive system. Human beings cannot, therefore, digest the cellulose, which goes on to form roughage. Roughage helps in the bowel movement in the human body.

► Nutrition in Amoeba

Amoeba is a microscopic, unicellular, organism found in moist soil, ponds and lakes. It is surrounded by a cell membrane. It constantly changes its shape and moves with the help of pseudopodia (*pseudo* = false, *podia* = feet). Pseudopodia also help it in capturing food.

Amoeba feeds on small microscopic organisms like bacteria and algae. When *Amoeba* comes in contact with food, it produces pseudopodia



Nutrition in Amoeba

around the food particle. As the cell membranes of the pseudopodia fuse, the food gets trapped in a food vacuole.

Digestive juices are secreted into this vacuole to digest the food. The digested food is absorbed and used for production of energy, movement and maintenance of the organism. The undigested food, present in the food vacuole, is expelled, from the *Amoeba*, by the process of **egestion**.

Keywords

absorption	process by which digested food passes into the blood.
alimentary canal	the long muscular tube in the human body through which food passes after its ingestion.
assimilation	process of using the absorbed food for growth and for producing energy.
buccal cavity	oral cavity located at the upper end of the alimentary canal.
caecum	bag-shaped part, at the beginning of the large intestine, present in ruminants.
canines	pointed teeth used for tearing of food.
digestion	breaking down of complex food into simple soluble forms with the help of digestive juices.
enamel	white substance that covers the teeth.
egestion	process of elimination of undigested food.
ingestion	process of 'taking in' of food.
incisors	front teeth used for cutting and biting.
molars	last teeth, that are larger and flat, and are used for crushing and grinding food.
oesophagus	food pipe.
premolars	teeth situated next to canines, and used for crushing and grinding food.
pseudopodia	false feet of amoeba which it uses to (i) trap its food and (ii) for its movement.
ruminants	cud chewing herbivore animals.
villi	small projections, in the inner walls of the small intestine of human beings; these help in absorption of the digested food.

You Must Know

1. Animal nutrition includes nutrient requirement, mode of intake of food and its utilisation in the body.
2. Heterotrophic nutrition is of three types—saprotrophic nutrition, parasitic nutrition and holozoic nutrition.
3. The process of nutrition in animals involves ingestion, digestion, absorption, assimilation and egestion.
4. The human digestive system consists of the mouth, oesophagus, stomach, small intestine and large intestine; ending in the rectum and anus.
5. The main digestive glands, which secrete digestive juices, are the salivary glands, the liver and the pancreas. The stomach wall and the wall of the small intestine also secrete digestive juices.
6. The different types of teeth, in humans, are—incisors, canines, premolars and molars.
7. Digestion begins in the buccal cavity and continues in the stomach and small intestine. The digested food gets absorbed, in the blood vessels, from the small intestine.
8. The absorbed substances are transported to different parts of the body. Water, and some salts, are absorbed from the undigested food in the large intestine.
9. The undigested, and unabsorbed residue, are expelled out of the body as faecal matter through the anus.
10. Cud chewing herbivore animals are called ruminants. They first, quickly swallow food and store it in their rumen. Later on, the food returns to the mouth and the animals chew it on thoroughly.
11. Amoeba ingests its food, with the help of its false feet, called pseudopodia. The food is digested in the food vacuole.

3. Animals, that eat both plant materials and animals, are called—
- | | |
|-------------------------------------|------------------------------------|
| <input type="checkbox"/> herbivores | <input type="checkbox"/> omnivores |
| <input type="checkbox"/> carnivores | <input type="checkbox"/> ruminants |
4. Which one of these is not a part of the alimentary canal?
- | | |
|----------------------------------|--|
| <input type="checkbox"/> stomach | <input type="checkbox"/> anus |
| <input type="checkbox"/> liver | <input type="checkbox"/> large intestine |
5. Bile juice is released by the—
- | | |
|--|--|
| <input type="checkbox"/> salivary glands | <input type="checkbox"/> pancreas |
| <input type="checkbox"/> liver | <input type="checkbox"/> large intestine |

D. Answer the following questions in brief.

1. Define the following terms:
 - (a) Holozoic nutrition
 - (b) Alimentary canal
2. Give the meaning of the terms:
 - (a) Assimilation
 - (b) Rumination
3. Name the organs that make up the human alimentary canal.
4. State two differences between milk teeth and permanent teeth.
5. Name the four types of teeth in the human mouth.
6. State the function of the (a) incisor teeth (b) premolar teeth.
7. State the role of acid in the human stomach.
8. State the function of (a) bile juice and (b) pancreatic juice in the human digestive system.

E. Answer the following questions.

1. Draw a neat, well labelled diagram of the human digestive system.
2. Justify the following statements:
 - (a) Crow is an omnivore.
 - (b) It is said that the mode of nutrition, in human beings and *Amoeba*, is quite similar.
3. Give reasons for the following:
 - (a) Ingestion of food is difficult without teeth.
 - (b) If we chew rice, or bread, for a few minutes, it starts tasting sweet.
 - (c) Bacteria are present in the caecum of ruminants.
4. Explain how digested food gets absorbed into the blood.
5. State, in one/two sentence/s each, the various processes involved in nutrition in ruminant animals.
6. Explain ingestion of food, in *amoeba*, through a diagram.

Value Based Question

The biology teacher, who was also the coach of the school cricket team, would often compare his team members with the different ‘organs’ of their digestive system. He would tell them to concentrate on their respective roles and to work as a team in a selfless and dedicated way. This, he would say, would enable them to succeed in winning matches in the same way as the ‘team’, of the organs of the digestive system, ‘succeeds’ in digesting, and using, the ‘ingested food’.

1. State two of the values that the teacher wanted his students to ‘have in them’.
2. Try to make a list of ‘eleven names’ that are a part of the ‘team’ that makes up the human digestive system.
3. Have a group discussion on the importance of ‘Team work’ in day-to-day life.

Something To Do

1. Make a PowerPoint presentation on the various ways in which animals ingest their food. For example—
[Herbivores–Cow; Carnivores–Lion; Blood suckers–Leech; Fruit eating–birds; Fluid feeders–Butterflies, moth, earthworm; Insectivore–Frog]
2. Collect data, from the parents of your five classmates, about their milk teeth. Tabulate your data as given below.

S.No.	Name	Age at which first tooth fell	Age at which last tooth fell	No. of teeth lost	No. of teeth replaced

Use the collected data, to estimate the average age at which children lose their milk teeth.

3. Make a model of the digestive system (using clay/plasticine to make the organs) and rubber pipes/ribbons to make the food pipe and small intestine.
4. Activity—Assign a particular organ of the digestive system to each student and ask them to enact the role of it. The students need to follow the given guidelines. They should introduce themselves as a particular organ, explain its structure and function, its importance and significance in the human body and name some diseases, associated with the ‘organs’, represented by them.
The teacher can judge their role play by considering their presentation, content, visual aid used, clarity of the concepts, etc.