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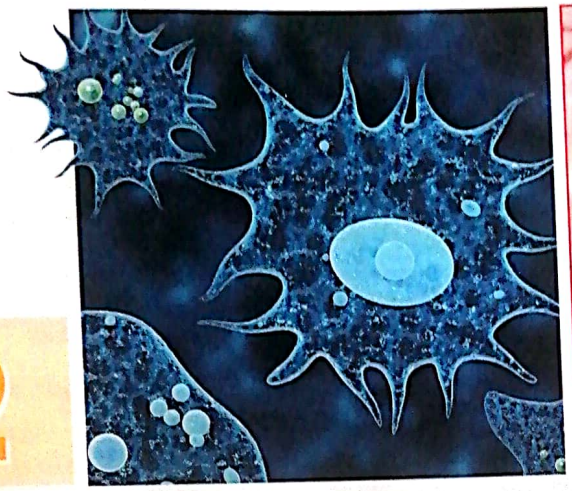

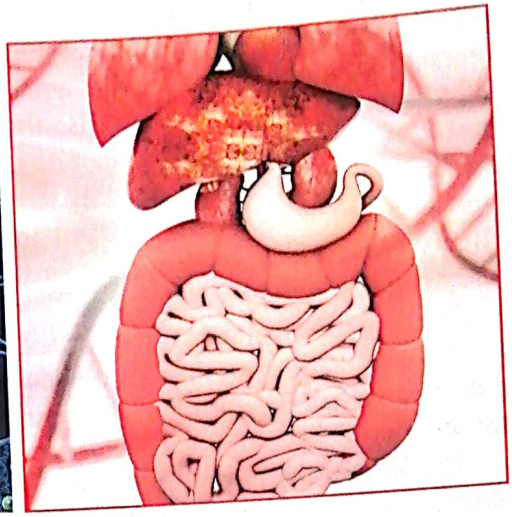

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Nutrition in Animals

All animals including humans need certain nutrients to stay alive and grow. These nutrients are obtained from food. The food you eat (feeding) is not in a form that can instantly provide you with nutrients. First, it has to be broken down into small particles. These particles must then be changed into simple, soluble forms, which the body cells can absorb. Only then can food provide nutrients. The various processes involved in nutrition, in animals that take in solid food, are as follows.

- **Ingestion** is the taking in of food. It involves taking in the food through the mouth and eating it.
- **Digestion** is the breakdown of food into a simple, soluble form with the help of digestive juices made in the body.
- **Absorption** is the process by which the food in the soluble form passes into the body fluids such as blood.
- **Assimilation** is the process by which absorbed nutrients are utilized by the body.
- **Egestion** is the process of elimination of undigested solid parts of the food.

NUTRITION IN *AMOEBA*, *HYDRA* AND FROG

The unicellular *Amoeba* engulfs tiny particles of food by throwing its false feet, known as **pseudopodia** around it. The pseudopodia join together to form a small cavity known as a **food vacuole**. The food inside the vacuole is digested by digestive juices (Fig. 2.1a). It is absorbed

IN THIS CHAPTER

NUTRITION IN *AMOEBA*, *HYDRA* AND FROG ◆ THE HUMAN DIGESTIVE SYSTEM ◆ RUMINANTS

*For detailed instructions, see inside front cover.

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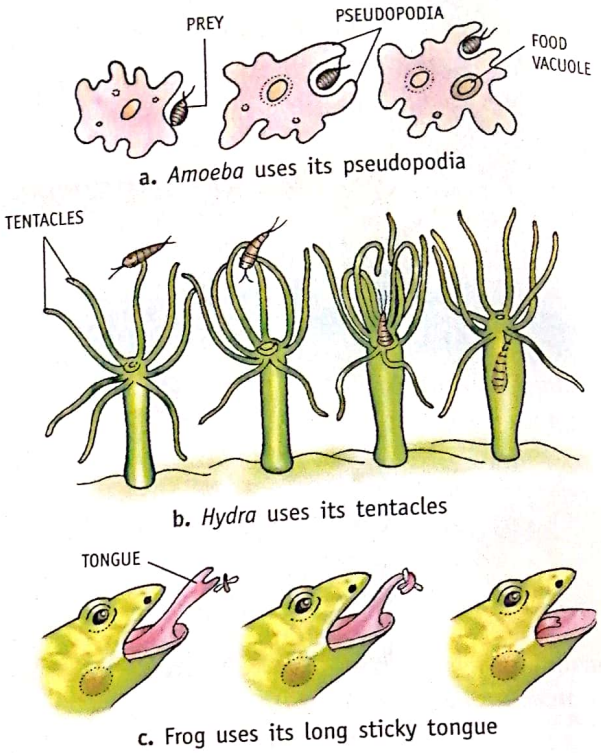
and assimilated there to provide energy and perform other functions.

Hydra is a simple, multicellular animal. It has a number of **tentacles** around its mouth, which are used for ingestion of food. The tentacles entangle small aquatic animals and kill them with their stinging cells. They then push them into the mouth (Fig. 2.1b). Inside the body cavity the digestive juices secreted by the surrounding cells help to digest the food. This is then absorbed through the cavity walls and assimilated in the cells.

The frog uses its long sticky tongue to catch insects (Fig. 2.1c). Frogs have a well-developed digestive system in which food is digested with the help of digestive juices.

The unicellular *Paramecium* has stiff hair-like structures called **cilia** all over its body, which are used for ingestion. The constant movement of the cilia pushes the food particles into the mouth-like structure of a *Paramecium*. The rest of the nutrition processes are similar to those in *Amoeba*.

A spider weaves a sticky web in which small insects get stuck. It then injects digestive juices into the body of the insect, which digest the body parts of the insect. Thus, the digestion of a spider's food actually takes place outside the spider's body. The spider then sucks up the digested food.



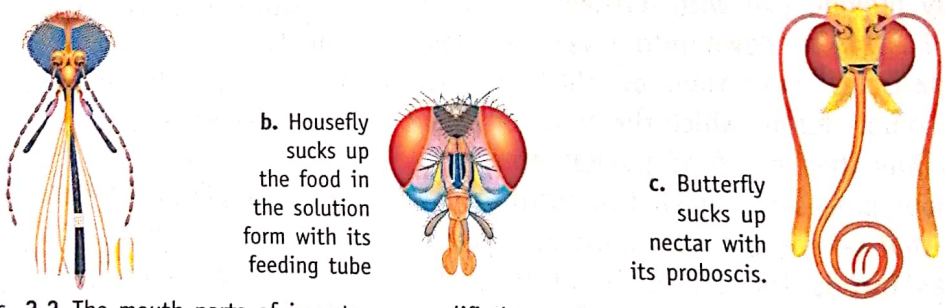
a. *Amoeba* uses its pseudopodia

b. *Hydra* uses its tentacles

c. Frog uses its long sticky tongue

Fig. 2.1 Animals ingest food using different body parts

The mosquito sucks up the blood of animals with its **proboscis** (Fig. 2.2a). The housefly also lives on liquid food. It uses its saliva to dissolve the food and form a solution. Then it sucks up the solution with the help of its feeding tube (Fig. 2.2b). The butterfly also uses its proboscis to suck nectar from flowers (Fig. 2.2c).



a. Mosquito sucks up the blood of animals with its proboscis

b. Housefly sucks up the food in the solution form with its feeding tube

c. Butterfly sucks up nectar with its proboscis.

Fig. 2.2 The mouth parts of insects are modified to suit their feeding habits.

ORAL QUESTIONS

1. Why does food need to be digested?
2. Digestion of food in all animals occurs inside the body. Do you agree? Justify your answer.
3. Name two animals that live on liquid food only.

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THE HUMAN DIGESTIVE SYSTEM

Your body performs the steps of nutrition inside a long tube, coiled in some places, called the **gut** or **alimentary canal**. Its main parts are: the **mouth**; **food pipe** or **oesophagus**; **stomach**; **small intestine**; **large intestine** ending in the **rectum**; and **anus**.

Salivary glands, liver, gall bladder and pancreas are organs that secrete digestive juices that help convert complex substances in food to simpler substances. Digestive juices are also secreted by the inner walls of the stomach and the small intestine.

Digestion in the mouth

Food is taken in or **ingested** through the mouth. Digestion begins inside your mouth when you chew the food. Think about your favourite food. Does your mouth water? The 'water' in your mouth is a digestive juice called **saliva**. It is secreted by the three pairs of **salivary glands** in your mouth. Chewing breaks down the food into small pieces and mixes it with saliva. This process is called **mastication**. Your teeth cut, tear and grind the food before you swallow it. You have different types of teeth to do these jobs.

A child has only 20 teeth—10 in each jaw. These are known as **milk teeth**. They fall off by the age of ten and are replaced by larger **permanent teeth**. This set contains 32 teeth, 16 in each jaw. There are 4 incisors, 2 canines, 4 premolars and 6 molars in each jaw (Fig. 2.3). Feel the different shapes of your teeth with your tongue.

- Your front teeth are known as **incisors**. These are chisel-shaped and are used for biting and cutting.
- Next to the incisors are the **canines**. These are pointed and are used for piercing and tearing pieces of food such as meat.
- The teeth at the back of your mouth are broad with an almost flat surface. These crush and grind the food. These are called the **premolars** and **molars**. Molars are larger than premolars.

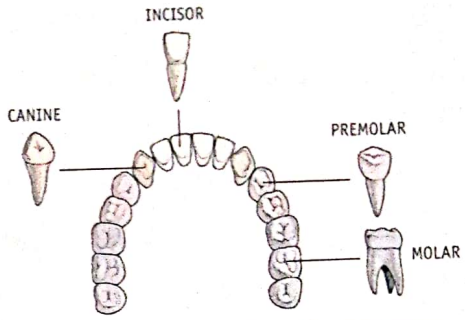

FIG. 2.3 Permanent set of teeth of humans consists of four types of teeth

The white substance that covers your teeth is called **enamel**. It is the hardest substance in the body.

The saliva in your mouth helps to break down starch of the food into sugars that are easier to digest. It also makes food easier to swallow by making it wet and slippery.

ACTIVITY 1 (Experimental investigation): To study the effect of saliva on food

You have read that saliva converts starch of food into sugar. Let us do an experiment.

You will need saliva ◆ test tubes ◆ starch ◆ glass slides ◆ iodine solution

Take a little of your saliva in a test tube. In another test tube boil some starch (you can take the starch that is used to starch our clothes). Put a drop of boiled starch on a glass slide. Add to it a drop of iodine solution. It will turn blue-black showing the presence of starch. Now add some boiled starch to the saliva. Test the resulting solution for starch. Is starch present now? Why?

Your tongue is a muscular organ that helps you to eat food. It pushes food towards your teeth. It also helps to mix the food with saliva and then enables you to swallow it.

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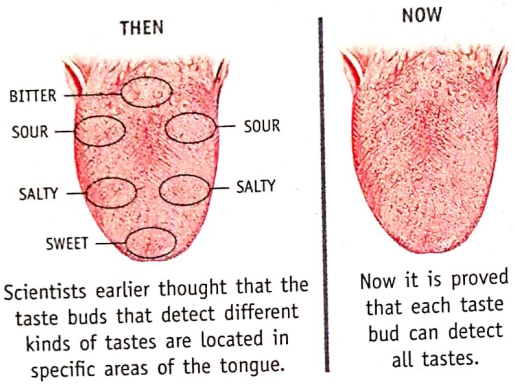

FIG. 2.4 Each taste bud can detect all tastes—sweet, salty, sour and bitter.

Your tongue does another job too. Small taste buds are spread across its surface. Each taste bud can detect all tastes—sweet, salty, sour and bitter. Scientists earlier thought that the taste buds that detect different kinds of tastes are located in specific areas of the tongue (Fig. 2.4). However, this is not considered to be true now.

The tongue also helps you to speak.

Digestion in the stomach

After the food is swallowed, it slides down the pharynx into the **oesophagus** (food pipe). The oesophagus leads from your mouth to the stomach. It is made up of muscles. These muscles gently push food down to your stomach in a wave-like action called **peristalsis** (Fig. 2.5). Actually this movement takes place throughout the alimentary canal to push the food forward.

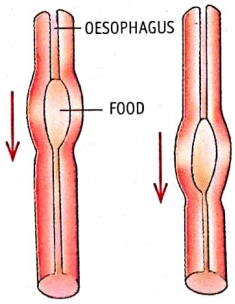

FIG. 2.5 Peristalsis: pushing down of food by muscles

Your **stomach** is a J-shaped bag made up of muscles (Fig. 2.6). It can hold up to two litres of food at a time. Food stays in the stomach from a few minutes to a few hours depending on the type of food eaten. The inner lining of the stomach secretes mucous, hydrochloric acid and digestive juices. The mucous protects the inner lining of the stomach. The acid kills bacteria that enter along with food and also helps in digestion of proteins. The stomach muscles squeeze and mix the food with digestive juices. The digestive juices break down proteins into simpler substances. Thus, food gets partly digested in the stomach. Then it goes into the small intestine where most of the digestion occurs.

Digestion in the small intestine

As the food leaves your stomach, little by little, it enters a long winding tube below it, called the **small intestine**. The last steps of digestion take place here.

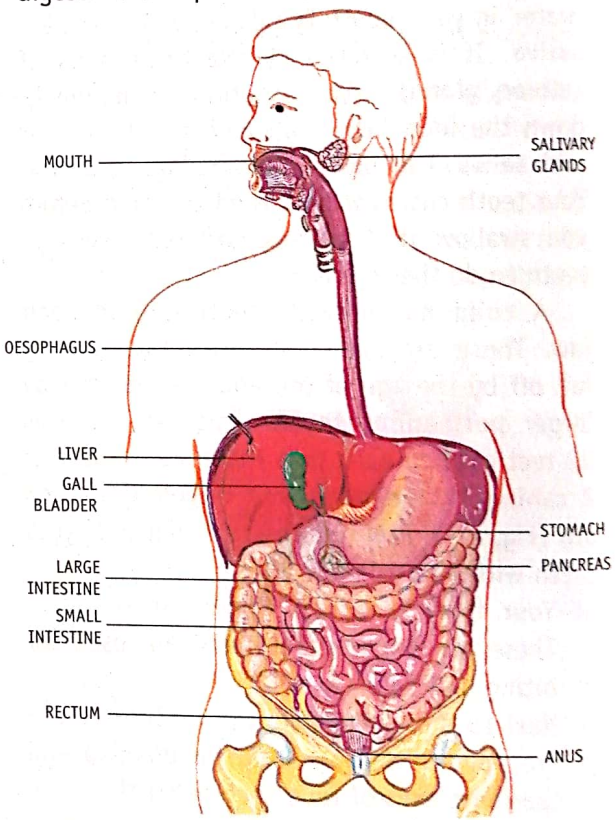

FIG. 2.6 The human digestive system

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THE STORY OF THE STOMACH WITH A HOLE

How the working of the stomach was discovered makes an interesting story. On 6 June 1822, a man called Alexis St Martin was accidentally shot in the stomach. He was treated by an American doctor, William Beaumont. Martin survived but with a hole in his stomach that never completely healed. Dr Beaumont recognized this as a unique opportunity to observe digestive processes. He began to perform experiments on digestion using Martin's stomach.

The experiments were mainly conducted by inserting a piece of food tied to a string through the hole into Martin's stomach. Every few hours, Dr Beaumont would remove the food and observe how well it had been digested. He observed that the food was being churned in the stomach. Dr Beaumont also extracted a sample of gastric juices from Martin's stomach for analysis. He used it to 'digest' bits of food in cups. This led to the important discovery that the stomach juices digest the food into nutrients the body can use; in other words, digestion was primarily a chemical process and not a mechanical one.

The muscles in the small intestine mix food with more digestive juices. Some juices are secreted by the cells of the small intestine itself. Others come from the **liver**, which is the largest gland in the body, and the **pancreas** that is located just below the stomach.

The liver secretes **bile juice** which is stored in the **gall bladder**. The bile breaks up fats into tiny droplets that can be digested and absorbed more easily. The digestive juices then act on these tiny droplets to form simpler compounds known as fatty acids and glycerol. The pancreas secretes the **pancreatic juice** that changes starch into simple sugars, and proteins into simpler compounds called **amino acids**.

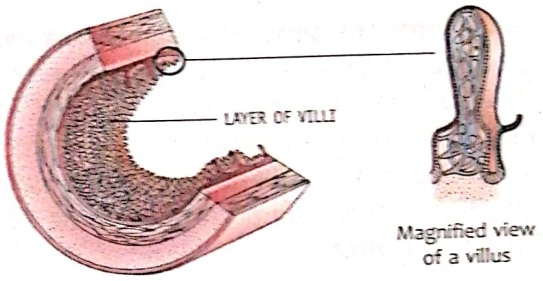

Fig. 2.7 Villi: small finger-like projections in the inner wall of the small intestine

Absorption in the small intestine

The digested food is then absorbed by the small intestine. Absorption of food occurs through thousands of small finger-like projections in the inner walls of the small intestine. These projections known as **villi** (singular: villus) increase the surface area of absorption of digested food (Fig. 2.7). Each villus has a network of fine blood capillaries close to the surface. The food absorbed on the surface of the villus passes into the blood in the capillaries.

IT'S A FACT!

During digestion, minerals and vitamins do not need to be changed. The cells are able to absorb them as they are.

Assimilation

The food absorbed into the blood is transported to different parts of the body. It is used to provide energy and materials for growth and repair of body tissues. This is the final stage in the process of digestion and is known as **assimilation**. Glucose is broken down in the cells with the help of oxygen into carbon dioxide and water, to provide energy. Amino acids are used for building and repairing of body parts. Fatty acids and glycerol are stored under the skin and act as energy reserves.

Egestion

Not all the food you eat is digested and absorbed. The food that cannot be digested

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moves from the small intestine into a wide tube called the **large intestine**. Here, most of the water present in the waste is absorbed. The waste food which is now almost solid is stored in the last part of the large intestine called the **rectum**. It is then passed out of the body through the **anus**.

IT'S A FACT!

The small intestine is smaller in diameter but longer in length (about 7 metres) than the large intestine (about 1.5 metres).

IT'S A FACT!

Sometimes a food chunk may get into the trachea instead of the food pipe, leading to a bout of coughing. This is nature's way of removing the food chunk from the trachea. If this does not remove the food, the person can choke. A method called **Heimlich Manoeuvre** can stop the person from choking. It consists of giving a sudden thrust to the abdomen just below the rib cage. The thrust forces air out of the person's lungs and blows the food from the trachea. However, the manoeuvre should be learnt properly, since it can be dangerous if wrongly applied and can even break the ribs.

RUMINANTS

Ruminants are hooved, plant-eating animals that digest their food in two steps. Some examples are cows, buffaloes, goats, sheep and bison. They have complicated stomachs consisting of four chambers.

Food that is swallowed goes into the first chamber called the **rumen**. Here it is partially digested and is called **cud**. It then goes to the second chamber from where it is returned to the mouth for thorough chewing. This process is called **rumination**. That is why these animals are called **ruminants**. After chewing, the food is swallowed for a second time and then digested further in the remaining chambers. It is finally sent to the small intestine, where the absorption of the nutrients occurs.

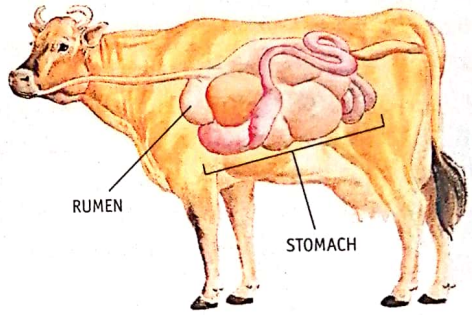

FIG. 2.8 A cow digests its food in two steps.

ORAL QUESTIONS

1. In which two organs does digestion of food in humans mainly occur?
2. Absorption of digested food occurs in the stomach. Do you agree? Justify your answer.
3. All digestive juices are secreted by cells in the stomach and small intestine. Do you agree? Give reasons.
4. What happens to food after it is digested, and absorbed by the blood?
5. In what way is the basic structure of the stomach of a cow different from the stomach of a human?

NEW WORDS

PSEUDOPODIA—false feet of *Amoeba* which it uses to engulf food

MASTICATION—chewing food to break it into small pieces

RUMINANTS—plant-eating animals that digest their food in two steps

VILLI—small projections in the inner walls of the small intestine that help in absorption of digested food

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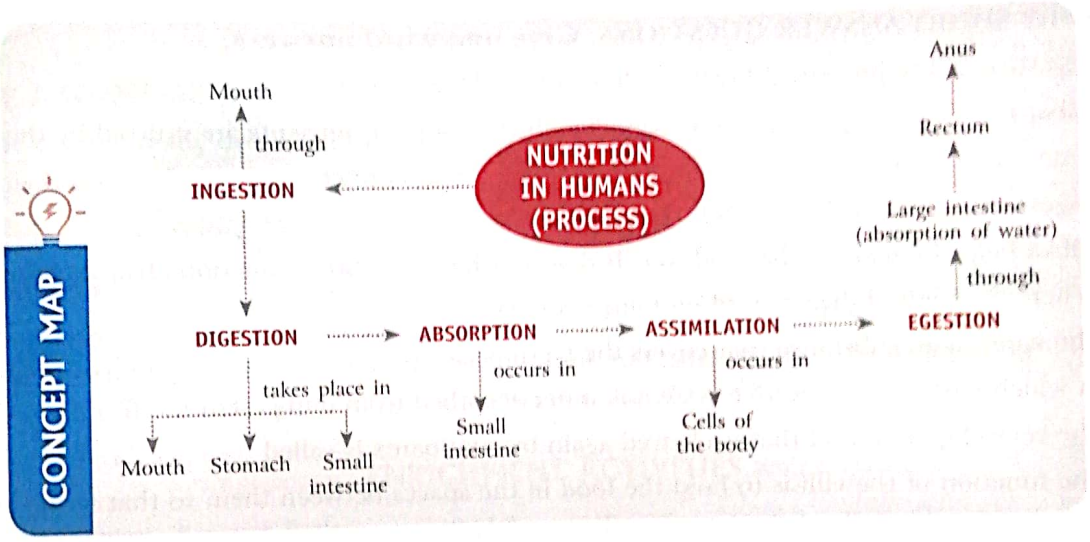
NOW YOU KNOW

- The process of nutrition in animals involves ingestion, digestion, absorption, assimilation and egestion.
- Animals get their food in different ways.
- The human digestive system consists of the mouth, oesophagus, stomach, small intestine, large intestine ending in the rectum, and anus. The salivary glands, liver and pancreas are organs that also help in digestion.
- The different types of teeth in humans are incisors, canines, premolars and molars.
- Digestion begins in the mouth and continues in the stomach and small intestine. Digested food is absorbed in the small intestine.
- Ruminants digest their food in two steps.



EXERCISES

A. Choose the most appropriate answer.

1. Which of these is not a part of nutrition?
   a. digestion b. absorption c. egestion d. excretion
2. The pointed teeth in your mouth are
   a. premolars. b. incisors. c. molars. d. canines.
3. The last part of digestion of food takes place in the
   a. stomach. b. small intestine. c. large intestine. d. oesophagus.
4. Which of the following organs does not secrete digestive juices?
   a. stomach b. small intestine c. liver d. oesophagus
5. The greatest amount of digestion of food in humans takes place in the
   a. mouth. b. stomach. c. small intestine. d. large intestine.

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6. Breaking down of food into simple soluble compounds is called
   a. ingestion. b. digestion. c. nutrition. d. egestion.
7. During digestion, fats are changed into
   a. amino acids. b. fatty acids and glycerol.
   c. sugar. d. glucose.
8. Bile is produced in the
   a. stomach. b. small intestine. c. pancreas. d. liver.
9. The teeth that are used for biting an apple are
   a. incisors. b. canines. c. pre-molars. d. molars.
10. What kind of teeth do you think are especially developed in carnivores?
    a. incisors b. canines c. pre-molars d. molars

B. VERY SHORT-ANSWER QUESTIONS: Give one-word answers.

1. Digestion is the process of breaking down of food into simple, _____ form.
2. What is the name given to the process by which absorbed nutrients are utilized by the body?
3. Name the cavity in unicellular animals in which food is present.
4. Digestion begins in the stomach. True or false?
5. Saliva helps by making the food wet. It does not have any other function. True or false?
6. Where does initial digestion of proteins take place?
7. The white hard substance that covers the teeth is called _____
8. In which part of the digestive system is water absorbed from undigested food?
9. The semi-digested food that is chewed again by ruminants is called _____
10. The function of the villi is to hold the food in the spaces between them so that food can be absorbed by the walls of the intestine. True or false?

C. SHORT-ANSWER QUESTIONS: Answer in a sentence or two.

1. How does a frog catch its prey?
2. How does a spider digest its food?
3. Name the organs that make up the human alimentary canal.
4. What is the difference between milk teeth and permanent teeth?
5. What is saliva and where is it produced?
6. What is the function of taste buds?
7. How long does food stay in the stomach?
8. How does the presence of acid in the stomach help?

D. LONG-ANSWER QUESTIONS: Answer these questions.

1. List and explain in one sentence each, the various processes involved in nutrition in animals.
2. Explain through diagrams ingestion of food in a. *Amoeba* b. *Hydra*.
3. Name the four types of teeth in your mouth. What are their functions?

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4. What is peristalsis? Explain with the help of a diagram.
5. What is the function of **a.** saliva **b.** bile juice **c.** pancreatic juice?
6. What happens to food in the **a.** stomach **b.** small intestine?
7. Explain how digested food is absorbed into the blood.
8. Briefly explain the process of digestion in ruminants.

HOTS QUESTIONS: Think and answer.

1. Which food do you think will take a longer time to get digested—sugar or beans (beans contain lot of proteins)?
2. Digestion needs the help of two more systems in the body to provide energy from food. Which are these systems and how do they help?
3. If you eat food while hanging upside down, do you think it will still go through the alimentary canal? Give reasons.

BE A SCIENTIST

We can see many overweight people but very few overweight animals. Why do you think this is so?

VALUES

Tinto loves to eat junk food. He is overweight. His friend Ayesha is very worried. She constantly advices him to cut down on junk food and eat more fruits and vegetables. Do you think she is right? What value does she show?

ENRICHMENT ACTIVITIES

In the Library—Research Project

Acid in the stomach The digestive juices in your stomach contain dilute hydrochloric acid which is a strong and dangerous acid. Find out why it normally does not damage the stomach.

Sometimes the acid does attack the inner lining of the stomach and damages it. This causes considerable pain. Find out the name given to the damaged area.

Would you like to know more about acid in the stomach?

Visit rsgr.in/lsc-7 and click on LINK 4 to read the article.

My Virtual Library—Research/Activities on the Internet

Visit rsgr.in/lsc-7 and click on LINK 5 and LINK 6 to access animated tutorials on the digestive system.

Talk to the Class—Presentation

Make a presentation on the various ways in which animals eat their food (ingestion). You can get photographs/illustrations from the Internet to include in your presentation.

In the Laboratory—Experimental Project/Making a Model

❒ **Making ORS at home** Infection, food poisoning or indigestion can lead to diarrhoea—a condition in which the patient passes watery stools. This causes loss of water from the body resulting in dehydration. In extreme cases it can even lead to death. To prevent dehydration, the patient should

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be given plenty of oral rehydration solution (ORS). You can prepare ORS at home as follows.

You will need ◆ one level teaspoon of salt ◆ eight level teaspoons of sugar ◆ one litre or five cupfuls (each cup is about 200 mL) of clean drinking or boiled and cooled water

Procedure: Add the salt and sugar to the water. Stir the mixture till the salt and sugar dissolve. Now your ORS is ready for use.

❒ **Model of a digestive system** Make a model of the digestive system using:

- clay to make the organs such as stomach, liver, pancreas and large intestine
- rubber tube to make the oesophagus and small intestine

LIFE SKILL

Looking after your digestive system

The proper functioning of the digestive system is vital to health. However, it is amazing how many people's digestive system does not function well at all. Acidity, wind, bloating and constipation are common problems.

One of the main reasons for this is that we don't take time to eat. We sit slouched over the food and gulp it down. Also, stress is the cause of many digestive complaints.

Other than eating a balanced diet, there are several very simple ways to improve matters.

- Sit with your shoulders back—allow your stomach, which is under your ribcage, room to start the digestive process.
- Chew each mouthful at least 20 times and you will be thrilled by the improvements you feel.
- Don't drink with your meal, as taking large quantities of liquid in with your food dilutes your digestive juices and makes digestion less effective.
- And most importantly, get enough roughage in your food to get the bowels moving!

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