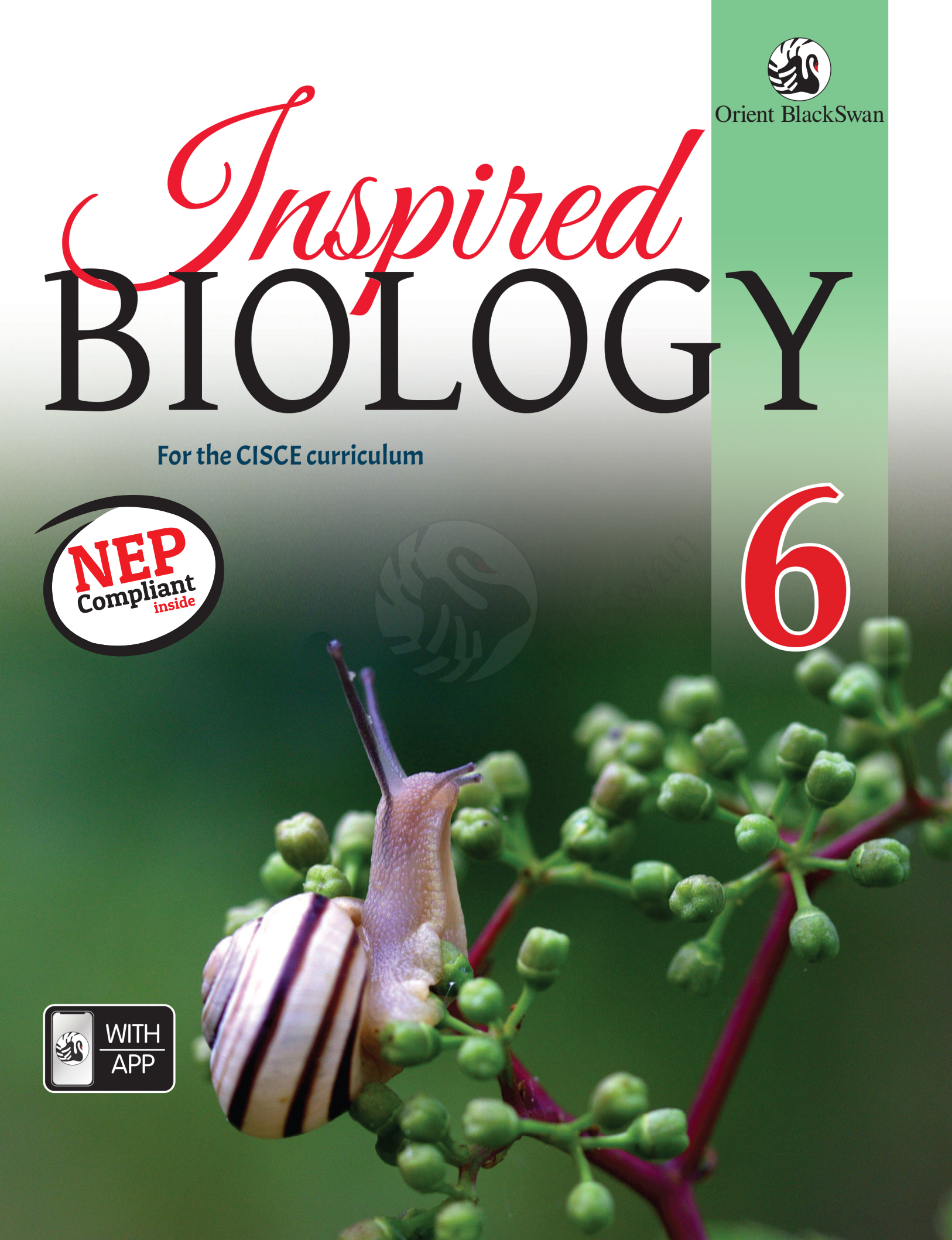
Orient BlackSwan

Inspired BIOLOGY

For the CISCE curriculum

NEP Compliant inside

6



WITH APP

Inspired BIOLOGY

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Orient BlackSwan

Inspired Biology

has been developed in accordance with the CISCE Upper Primary Science (Biology) curriculum. Its aims are:

- to enable students to relate their daily life experiences and science by following a practical, thematic approach
- to focus on the development of scientific temper through skill and process development
- to encourage knowledge construction through information collection, organisation and reflection

Students' book

- complete syllabus coverage
- carefully graded text
- appropriate, well-labelled illustrations and photographs
- appropriate activities and exercises

Let's learn

Learning outcomes
encourage students to take responsibility for their learning

Get going
helps focus and direct students' attention to the lesson

Activities
help students learn through practical exercises

Stop and check
provides checkpoints for teachers and students to evaluate progress

Spotlight
focuses on important topics in greater detail

Go further
provides additional, interesting, relevant information

SciTech
links scientific concepts with real-life occurrences and applications

Eco corner
presents issues that are an environmental concern

Let's revise

In a nutshell
is a comprehensive revision corner

Concept map
is a graphic presentation of concepts linked logically

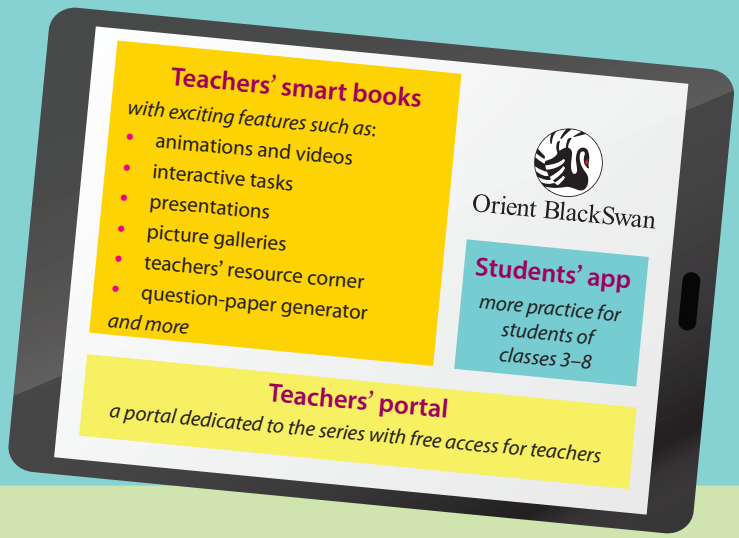
Summary
lists the main points of the lesson briefly

Keywords
lists important words and their definitions

Glossary
presents important words for quick revision at the end of the book

Teachers' resource packs

- lesson plans
- question bank with answers
- worksheets with answer key
- question papers with answer key
- answer key to the exercises in the students' book



Let's apply

Checkpoint
covers a variety of exercises (objective type, short answer and long answer)

Think and answer
encourages students to develop higher-order thinking skills necessary for the 21st century

Picture study
offers picture-based questions that encourage students to observe, identify and relate concepts to real life

Hands-on
offers a variety of projects that reinforce 21st century skills through experiments, model-making, discussion, role play, research work, report writing and so on

Subject integration
presents additional activities explicitly linking multiple subjects

Life skills and values
help children develop skills needed for everyday life and values needed to be well-adjusted members of society

Let's know more

Scientist in focus
describes the life and work of famous scientists to inspire students

Heritage corner
presents exciting and accurate information on India's scientific heritage

Internet links
provides sources for further study and research

Career watch
presents novel ideas for a career in science and technology

Let's work

- ***Worksheets*** a workbook corner with worksheets covering all lessons
- ***Test papers*** based on the ICSE pattern

CONTENTS

The Digestive System

NUTRITION AND NUTRIENTS

Think about how you have grown from a baby to the individual that you are today. This growth has been a direct result of the **nutrition** that your body gets from the food that you eat. *Nutrition is the process by which the body obtains and uses food.*

Food contains **nutrients**. *A nutrient is a substance that the body needs to maintain itself and also to grow.* The nutrients in food are useful in many ways.

- Some nutrients are used to get **energy**, which is used to carry out work and other processes.
- Some nutrients are used for the **growth and repair** of our body.
- Some nutrients are used to keep us healthy and disease-free.

The nutrients that our body needs can be broadly divided into five types.

- **Carbohydrates** are used to get energy. *Chapattis*, rice, noodles, potatoes and so on contain carbohydrates.
- **Proteins** are used for growth and repair of the body. Eggs, meat, pulses, milk, cheese and so on contain proteins.
- **Fats** are also used to get energy. They are used to keep the body warm. Oils, butter, ghee and so on contain fats.
- **Vitamins** are needed to be healthy. Fruits and vegetables contain vitamins.
- **Minerals** such as iron, calcium and phosphorus are also needed to keep the body healthy. Fruits and vegetables contain minerals too.

Carbohydrates, proteins and fats are called **macronutrients** as they are required in large quantities. Vitamins and minerals are called **micronutrients** as they are required in very small quantities.

Other than these five major nutrients, our body also needs **water** and **roughage** (fibre). Water is needed to transport substances within the body. Roughage keeps the digestive system working efficiently. Roughage is found only in foods that we get from plants.

*A diet that has all the nutrients in the right required quantities is called a **balanced diet**.* Make sure that your diet has all the nutrients your body needs to be healthy.

However, the food that you eat cannot be used as it is by your body. It has to be broken down into simpler substances which your cells can use. This breaking down of food materials is done by the digestive system.

Go further...

Carbohydrates are made of many sugar molecules linked together. Proteins are made of many **amino acids** linked together. Similarly, fats are made of many molecules of **fatty acids** and **glycerol** linked together.

THE HUMAN DIGESTIVE SYSTEM

The digestive system is essentially a single muscular tube that starts at the mouth and ends at the anus. All the food that you eat passes through this tube, which has a different structure in different parts according to the function of the part.

The digestive system consists of two parts.

- The **alimentary canal** consists of the mouth, oesophagus, stomach, small intestine, large intestine, rectum and anus.
- The **associated glands**[1] (salivary glands, pancreas and liver) help to break down nutrients but are not a physical part of the alimentary canal.

The stomach, small intestine and associated glands secrete **enzymes**. *Enzymes are substances that help chemical reactions to take place in the body.* They are essential for breaking down nutrients into simple substances that the digestive system can absorb.

The entire process of nutrition can be divided into five main steps.

- **Ingestion** (through the mouth)
- **Digestion** (in the mouth, stomach and small intestine)
- **Absorption** (in the mouth, small intestine and large intestine)

[1]**gland** an organ that produces and secretes some substance that the body needs

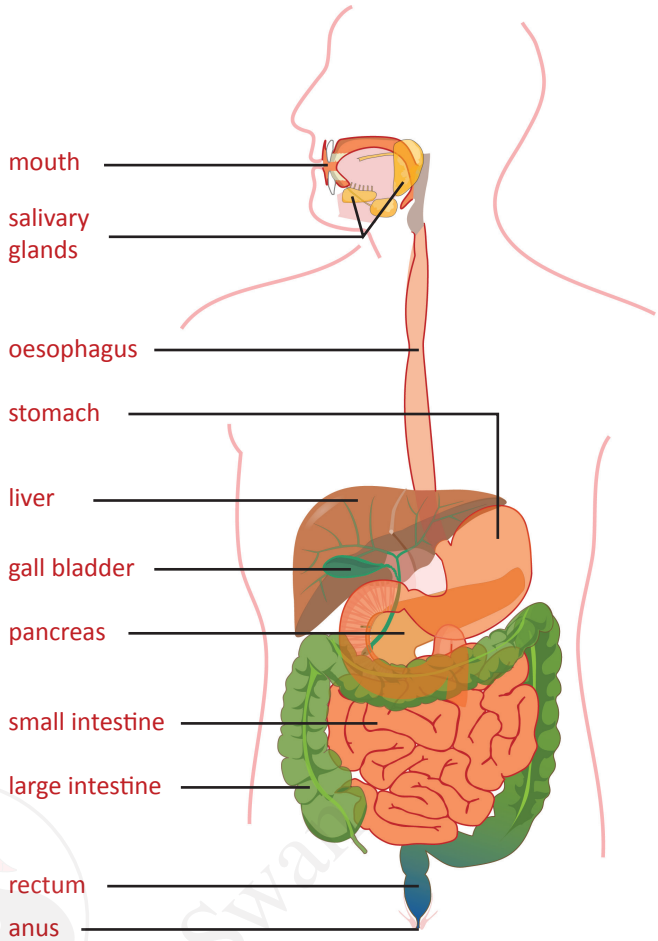


Fig. 3.1 Human digestive system

- **Assimilation** (into the cells)
- **Egestion** (through the anus)

The Mouth

The process of taking food into the body is called ingestion. Food is ingested through the mouth. The mouth has the lips, gums, teeth and tongue. The teeth break down the food into smaller particles when you bite or chew. The tongue helps in swallowing the chewed food.

Digestion is the process by which food is broken down into simple substances.

Two kinds of digestion occur in the mouth.

- Mechanical digestion by the teeth
- Chemical digestion by saliva

The Teeth

Mechanical digestion is carried out by the teeth, which crush food into smaller food particles. We have different types of teeth to make this process more efficient.

For ease of understanding, let us discuss the teeth in the upper jaw of an adult.

Incisors These teeth are found in the centre of the jaw. There are four incisors in a jaw. The incisors are flat and have a sharp edge like a chisel. They are used to cut and bite food.

Canines These teeth are present next to the incisors. There are two canines in each jaw. The canines have a pointed edge. They are used to grip and tear food such as meat.

Premolars These teeth are found next to the canines. There are two premolars after each canine, and thus there are four premolars in each jaw. The premolars have a flat surface. They are used to crush and grind food.

Molars These teeth are found after the premolars. The last molars are called the **wisdom teeth**, and they appear only around the age of 18. Molars also have a flat surface and are used to crush and grind food.

An adult human thus has 32 teeth.

However, in some adults, one or more of the wisdom teeth do not appear. So, the number of teeth in the mouth of an adult may vary.

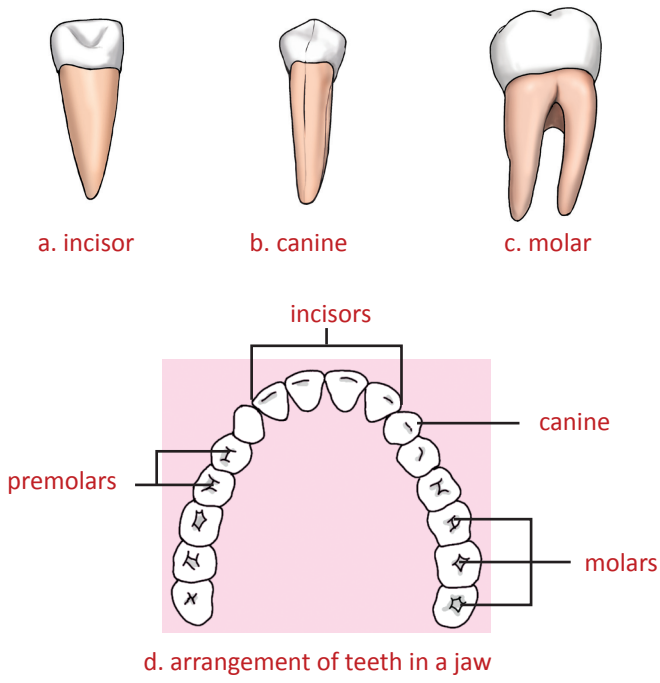


Fig. 3.2 Types of teeth in an adult human

Activity 3.1

Studying your teeth

Stand in front of a mirror with your mouth open. Study the teeth in your lower jaw.

- Do you see four similar teeth in the front? These are your incisors.
- Do you see a sharp tooth on either side of the set of incisors? These teeth are your canines.
- Do you see two teeth with a flat surface after the canines? These are your premolars. (You may not have premolars if some of your baby teeth have not fallen yet.)
- The last teeth are your molars. They look similar to the premolars but are larger than the premolars.

Count the number of teeth in your mouth. How many teeth do you have? Have your wisdom teeth emerged yet?

As a baby grows, the teeth develop in two sets. The first set consists of **milk teeth**, which are **temporary teeth**. There are no premolars in this set. The temporary teeth start to fall off by the age of about six years. By the time the child reaches about 12 years of age, the milk teeth are replaced by **permanent teeth**.

The salivary glands

The chemical digestion of food is done with the help of the salivary glands. This process begins in the mouth.
You have three pairs of salivary glands—one under the tongue, one at the base of the ear and one at the base of the jaw.

Spotlight

The structure of a tooth

A tooth is divided into the **crown** (the part seen above the **gum**) and the **root** (the part within the gum).

- The outermost layer of the crown is called the **enamel**. This is the hardest substance in the body.
- Below the enamel is the **dentine**, which forms the bulk of the tooth.
- Within the dentine is the **pulp**, which has nerves and blood vessels.

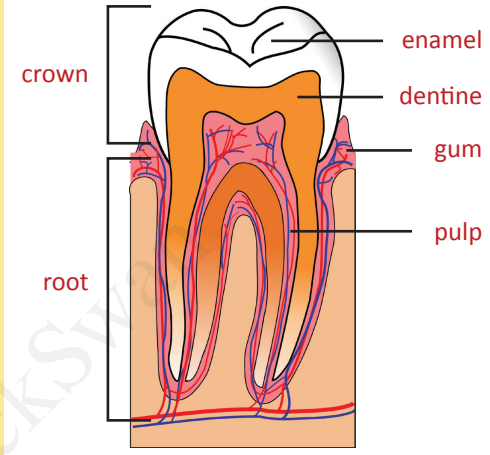


Fig. 3.3 Structure of a tooth

How are teeth damaged?

As we chew food, small food particles get stuck between the gaps in the teeth and remain there. Bacteria and these leftover pieces of food form a soft, sticky substance called **plaque**. The plaque needs to be removed from the teeth regularly by brushing. If it is not removed, the bacteria convert the food into acid. This acid corrodes or damages the enamel of the teeth, leading to **cavities** or **caries**.

As the acid continues to eat away the tooth, the caries eventually reach the pulp. This results in severe pain, as the pulp has nerves in it. If the caries progresses too far, the tooth may need to be **extracted**.

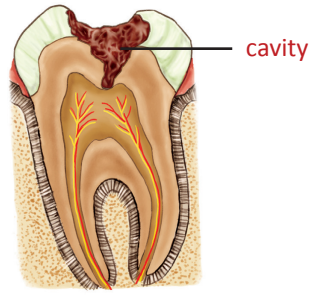


Fig. 3.4 A tooth with a cavity

Care of teeth

You should follow some steps to take good care of the teeth.

- When you sleep, saliva does not move much in the mouth and thus cannot clean it. This allows bacteria to grow and thus damage the teeth. So, brush your teeth well both in the morning and at night before you go to bed.
- Make sure that all surfaces of the teeth are cleaned while brushing.
- Do not eat or drink foods that contain large amounts of sugar.
- Always rinse your mouth well after every meal as this helps to remove most of the food that is stuck between the teeth.

The salivary glands secrete **saliva**, which is a mixture of water and an enzyme called **amylase**. Amylase breaks down starch into **maltose** (a kind of sugar).

Saliva has many functions.

- The amylase in saliva breaks down starch into maltose.
- It helps to bind food together to form a mass called the **bolus**, which is easy to swallow.
- It helps clean the mouth and teeth.
- It helps to keep the mouth moist for easier swallowing and speaking.

Go further...

There are many kinds of sugar. Glucose, fructose (found in fruits), galactose, sucrose, lactose (found in milk) and maltose are some kinds of sugar.

Activity 3.2

Observing the action of saliva on food

Place a teaspoonful of cooked rice in your mouth. Start chewing. How does it taste?

Does it start to taste sweet after some time? This is because starch has been changed to maltose, which is sweet to taste.

The tongue

The tongue is a muscular organ that is attached to the back of the floor of the mouth. The tongue has many functions.

- It moves the food around the mouth so that the food is chewed well.
- It helps to taste food with the help of taste buds found on its surface.
- It helps to mix food with saliva.
- It helps to clean the mouth by helping to remove food particles stuck between teeth.
- It helps in speaking.

Spotlight

It was earlier thought that the tongue had specific zones for each taste (**sweet**, **sour**, **salty** or **bitter**). But this has now been proved to be wrong. All the tastes can be tasted on all the parts of the tongue. (Now, a fifth taste called **umami** is recognised!)

However, the edges of the tongue are more sensitive to tastes than the middle of the tongue. Also, the back of the tongue is more sensitive to bitter tastes. This may be because it will make us spit out poisons or spoiled food before they are swallowed.

Stop and check

Say if the statements are true or false.

1. Our body uses carbohydrates and fats to get energy.
2. The stomach, liver, intestines and bladder are parts of the digestive system.
3. Nutrition takes place in four steps.
4. Two kinds of digestion happen in the mouth.
5. All adults have 32 teeth.

The Oesophagus

The oesophagus is also called the **food pipe**. It is a long, muscular tube that connects the mouth to the stomach. No digestion occurs in the oesophagus. The muscles of the oesophagus contract and relax rhythmically to push the food (bolus) down to the stomach. This contraction and relaxation is called **peristalsis**. Peristalsis is also seen in other parts of the alimentary canal.

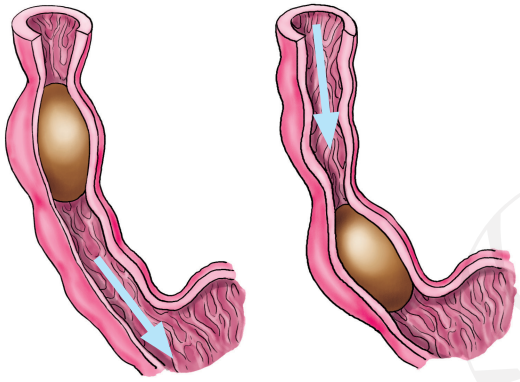


Fig. 3.5 Peristalsis

Go further...

When the stomach is irritated, as in the case of food poisoning, peristalsis occurs in the opposite direction, leading to vomiting.

The Stomach

The stomach is a bag-like muscular organ, about the size of the palm of your hand. The wall of the stomach is made of muscles, which help to mix the food and churn it to form **chyme**.

The walls of the stomach have glands that secrete **gastric juice**. The gastric juice consists of the following.

- The digestive enzyme **pepsin** breaks down proteins.

$$\text{proteins} \xrightarrow{\text{pepsin}} \text{peptides}^{2}$$

- **Hydrochloric acid** activates pepsin and also kills microorganisms.
- Water acts as a medium[3] for the action of the acid and the enzymes.

The presence of acid in the stomach inactivates amylase and thus carbohydrates are not digested here. A certain amount of fat is digested in the stomach by a type of enzyme called **lipase**.

Depending on the food eaten, chyme stays in the stomach for 1.5–3 hours. The chyme is then sent to the small intestine for further digestion and absorption.

Go further...

The stomach wall also has a layer of mucus. This protects the stomach wall from being damaged by the action of pepsin and hydrochloric acid.

The Small Intestine

The small intestine is a long, coiled tube that is about 6–7 m long. Both digestion and absorption of food take place here. The small intestine consists of three parts.

Duodenum

This is the first part of the small intestine. Digestive juices from the liver (**bile**)

[2]A peptide is a smaller length of protein and thus contains fewer amino acids linked together.

[3]**medium** a substance in which an action takes place

and the pancreas (**pancreatic juice**) are secreted into the duodenum.

The liver The liver is a reddish brown, triangular organ that lies just below the **diaphragm** on the right side of the body. It secretes green-coloured bile. Bile is stored in the **gall bladder** and released into the duodenum when needed.

Bile helps to break down large fat droplets to smaller ones. This helps the fat-digesting enzyme **lipase** to work faster and easier on them. *The breakdown of large fat droplets into smaller droplets is called **emulsification**.*

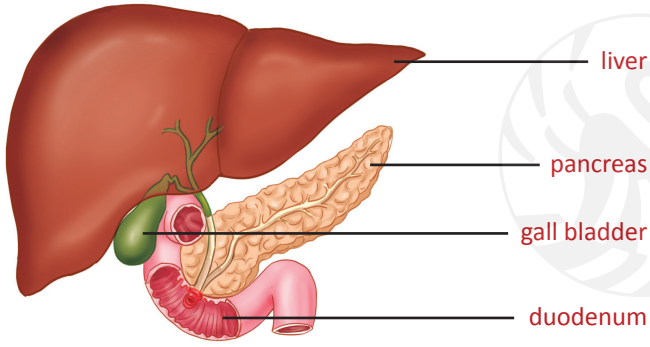


Fig. 3.6 The liver and the pancreas

The pancreas The pancreas is a small leaf-shaped organ sandwiched between the stomach and the folds of the intestine. The pancreatic juice contains the enzymes amylase, **trypsin** and lipase. These enzymes break down starch, proteins and fat respectively.

$$\text{starch} \xrightarrow{\text{amylase}} \text{maltose}$$

$$\text{proteins} \xrightarrow{\text{trypsin}} \text{peptides}$$

$$\text{fats} \xrightarrow{\text{lipase}} \text{fatty acids + glycerol}$$

Ducts (thin passages) from the gall bladder and pancreas join together and empty into the intestine.

Jejunum

This is the second part of the small intestine. The absorption of most of the digested food happens here.

Ileum

This is the third part of the small intestine. This is where the remaining food materials are digested and absorbed. Enzymes like **erepsin**, **maltase**, **sucrase** and **lactase** are secreted by the wall of the small intestine.

$$\text{peptides} \xrightarrow{\text{erepsin}} \text{amino acids}$$

$$\text{maltose} \xrightarrow{\text{maltase}} \text{glucose}$$

$$\text{sucrose} \xrightarrow{\text{sucrase}} \text{glucose + fructose}$$

$$\text{lactose} \xrightarrow{\text{lactase}} \text{glucose + galactose}$$

Thus, by the time the chyme reaches the end of the small intestine, all the nutrients would have been broken down to their simplest substances.

The inner surface of the small intestine is folded into many highly folded finger-like projections called **villi**, which are in turn

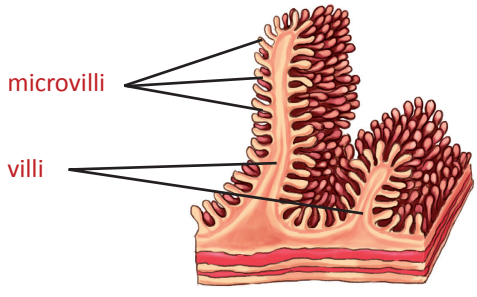


Fig. 3.7 Villi and microvilli in the small intestine

Table 3.1 Parts of the digestive system and their functions

Organ	Action on food	Enzymes	Action of the enzymes
Mouth	Digestion of starch	Amylase	Amylase breaks down starch to maltose.
Oesophagus	No digestion	—	—
Stomach	Digestion of proteins and some amount of fat	Pepsin Lipase	Pepsin breaks down proteins to peptides. Lipase breaks down fats to fatty acids and glycerol.
Duodenum	Digestion of carbohydrates, proteins and fats	Amylase Trypsin Lipase	Amylase breaks down starch to maltose. Trypsin breaks down proteins to peptides. Lipase breaks down fats to fatty acids and glycerol.
Jejunum	No digestion	—	—
Ileum	Digestion of the remaining food	Erepsin Maltase Sucrase Lactase	Erepsin breaks down peptides to amino acids. Maltase breaks down maltose to glucose. Sucrase breaks down sucrose to glucose and fructose. Lactase breaks down lactose to glucose and galactose.

made of thousands of **microvilli**. Villi help to increase the area over which absorption takes place.

The villi are richly supplied with blood vessels. This helps the villi absorb nutrients. Sugars and amino acids enter the blood, while fatty acids are passed into **lymph vessels**, which drain into the blood.

The Large Intestine

The large intestine is about 1.5 m long and is divided into three parts—the caecum, colon and rectum. Undigested food moves slowly through the large intestine; most of the water is absorbed to leave behind the semi-solid product called **faeces**.

The faeces are stored in the **rectum** till the next **bowel movement**. The rectum opens to the outside through the **anus**. The anus has a circular muscle called the **anal sphincter** which keeps the anus closed. When this muscle relaxes, the faeces are expelled out of the body. *The process by which undigested food is expelled from the body is called* ***egestion****.*

Assimilation of Nutrients

The glucose, amino acids and fatty acids that are absorbed in the digestive system are used for many functions.

- The glucose is used by cells in the body to get energy for their activities. Some glucose is stored in the liver.
- The amino acids are used for repair and to build up parts like muscles.
- Fatty acids and glycerol are used as energy reserves and insulation.

CHECKPOINT

A. Choose the correct option.

1. The part of the tooth with nerves and blood vessels is called the _____.
   a) dentine b) enamel
   c) pulp d) crown
2. The sticky substance that is formed on the teeth by bacteria is _____.
   a) plaque b) dentine
   c) pulp d) enamel
3. Saliva converts starch into _____.
   a) glucose b) maltose
   c) amino acid d) lactose
4. Bile is produced in the _____.
   a) pancreas b) stomach
   c) liver d) intestine
5. Where is the pancreas found in the body?
   a) below the stomach b) below the liver
   c) above the stomach d) above the liver
6. The enzyme _____ helps to break down proteins to peptides.
   a) maltase b) amylase
   c) erepsin d) pepsin

B. Fill in the blanks.

1. The digestive system consists of the _____ _____ and digestive glands.
2. The digestive system starts with the _____ and ends with the _____.
3. The incisors are used to _____ and _____ the food.
4. The three associated glands that help in digesting nutrients are the _____ _____, _____ and _____.
5. The tube that connects the mouth to the stomach is the _____.
6. The digestion of carbohydrates begins in the _____.
7. The digestion of proteins begins in the _____.

C. Give reasons.

1. We have different types of teeth.
2. You have to brush your teeth at night before going to bed.
3. Fats have to be emulsified.

D. Differentiate between the following.

1. Milk teeth and permanent teeth
2. Bolus and chyme
3. Amylase and lipase

E. Short-answer questions

1. What is a nutrient?
2. What are macronutrients?
3. Name the substances into which starch, proteins and fats are broken down.
4. What is an enzyme?
5. How does the oesophagus make sure that food reaches the stomach?
6. Name the muscle that keeps the anus closed.

F. Long-answer questions

1. What are the four kinds of teeth in humans? What are their functions?
2. Describe the structure of a tooth.
3. What are the roles played by saliva?
4. What are the substances secreted by the stomach wall? What are their functions?
5. How does the liver help in digestion?
6. List the enzymes found in the pancreatic juice and write their reactions.
7. What happens to undigested food in the large intestine?

Inspired BIOLOGY

For the CISCE curriculum
CLASS 6

Orient BlackSwan

The National Education Policy (NEP) 2020 emphasises certain crucial parameters based on content and pedagogy. The Inspired Biology series provides a rich range of exercises and activities for each of the parameters. Here is a quick reference guide to some of the examples in this book.

The Inspired Biology series is mapped perfectly to the National Education Policy 2020.

21st Century Skills

A broad set of skills, knowledge, work habits and character traits that are important for success in the 21st century

Experiential/ Constructivist Approach

Learners construct their knowledge, based on what they already know, through experience or by doing and reflection

Integrated Approach

An approach to teaching and learning that works by connecting knowledge and skills across the curriculum, by bringing real life examples to the classroom

The NEP parameters	Features	Page nos.
The 4Cs		
Critical Thinking	Think and Answer	22
Communication	Hands-on (1)	64
Creativity	Activity 1.1	5
Collaboration	Life Skills and Values	37
Social and Emotional Learning	Get Going	25
	Life Skills and Values	37
	Life Skills and Values (2)	63
Multiple Intelligences	Hands-on (3)	23
	Hands-on (2)	37
	Hands-on (2)	78

The NEP parameters	Features	Page nos.
Experiential/Constructivist Approach	Activities	32, 33
	Activities	43, 51, 59
	Hands-on (2)	89

The NEP parameters	Features	Page nos.
Subject Integration	Subject Integration (Geography, Language)	23
	Subject Integration (Chemistry)	65
	Subject Integration (Geography, Language)	90
Art Integration	Activity 1.3	12
	Hands-on	37
	Hands-on (1)	89
Health and Wellness	Life Skills and Values (1)	63
	Life Skills and Values (1)	78
	Subject Integration	78

Sustainable Development Goals

A framework of 17 global goals designed to be a blueprint to achieve a better and more sustainable future for all

The NEP parameters	Features	Page nos.
Values	Life Skills and Values (2)	23
	Life Skills and Values (2)	63
	Life Skills and Values (2)	89
Life Skills	Life Skills and Values (1)	23
	Life Skills and Values	37
	Life Skills and Values (1)	89

The NEP parameters	Features	Page nos.
Sustainable Development Goals	Eco Corner	5
	Eco Corner	53
	Eco Corner	79

The NEP parameters	Features	Page nos.
Know more about India	Heritage Corner	24
	Scientist in Focus	37
	Heritage Corner	90

India Knowledge

A strong focus on ancient knowledge from India, traditional values, modern developments and future aspirations

Digital Integration

The use of digital tools to enhance and support the teaching–learning process

ICT/Digital resources

Orient BlackSwan Smart App - Interactive Tasks and Games for Practice and Revision

Teachers' Smart Book - Flipbook, Animations, Videos, Presentations, Picture Galleries, Interactive Tasks, Embedded Questions, Lesson Plans, Students' Book Answer Key, Worksheets with Answer Key, Question Paper Generator

Teacher Empowerment

Teachers' Resource Pack - Lesson Plans, Students' Book Answer Key, Question Bank with Answer Key, Worksheets with Answer Key, Test Papers

Teachers' Portal - Chapter e-Book, Presentations, Picture Galleries, Animations, Videos, Students' Book Answer Key, Worksheets with Answer Key, Interactive Tasks, Lesson Plans, Question Bank with Answer Key

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