Based on National Curriculum of Pakistan 2022-23

Textbook of

# Biology

## Grade 10

National Curriculum Council
Ministry of Federal Education and Professional Training

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as
Federal Textbook Board
Islamabad

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**Textbook of Biology for Grade 10**
based on National Curriculum of Pakistan (NCP) 2022-23

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# PREFACE

This Textbook for Basic Medical Sciences: Biology Grade 10 has been developed by NBF according to the National Curriculum of Pakistan 2022-2023. The aim of this textbook is to enhance learning abilities through inculcation of logical thinking in learners, and to develop higher order thinking processes by systematically building the foundation of learning from the previous grades. A key emphasis of the present textbook is creating real life linkage of the concepts and methods introduced. This approach was devised with the intent of enabling students to solve daily life problems as they grow up in the learning curve and also to fully grasp the conceptual basis that will be built in subsequent grades.

After amalgamation of the efforts of experts and experienced author, this book was reviewed and finalized after extensive reviews by professional educationists. Efforts were made to make the contents student friendly and to develop the concepts in interesting ways.

The National Book Foundation is always striving for improvement in the quality of its textbooks. The present textbook features an improved design, better illustration and interesting activities relating to real life to make it attractive for young learners. However, there is always room for improvement, the suggestions and feedback of students, teachers and the community are most welcome for further enriching the subsequent editions of this textbook.

May Allah guide and help us (Ameen).

**Murad Ali Mohmand**
Managing Director

# UTILITY OR PRACTICAL APPLICATIONS OF THE SUBJECT

1. **Digestive system:** The digestive system has several practical applications in daily life that directly impact out health, energy levels, and over all wellbeing. It includes: energy for physical and mental activity, healthy eating habits, weight management, hydration, stress management, probiotics (like yogurt etc.) and gut health, preventing digestive disorders, healthy aging. The digestive system is important for converting the food we eat into the nutrients and energy needed for everyday task.

2. **Circulatory system:** The circulatory system plays a crucial role in our daily lives by supporting various physiological processes essential for health and survival. The practical applications include: oxygen transport, nutrient delivery, waste removal, body temperature regulation, immune response, wound healing, hormonal distribution. The circulatory system is fundamental to keeping us alive and enabling our bodies to adapt to different conditions and needs throughout the day.

3. **Respiratory system:** The respiratory system plays a vital role in daily life, as it is responsible for gas exchange, ensuring that oxygen enters the body and carbon dioxide is expelled. Here are some practical applications of respiratory system in daily life. These include: breathing for energy, physical exercise, speaking and singing, managing stress, sense of smell, maintain blood pH, immune defense. These everyday functions highlight the essential role of the respiratory system in keeping the body functioning properly.

4. **Urinary system:** The urinary system plays a vital role in maintaining homeostasis and overall health in our daily lives. Some of its practical applications are: waste elimination, water balance, electrolyte balance, blood pressure regulation, pH balance, detoxification and vitamin D activation. In daily life, the urinary system's continuous filtering and balancing functions are critical to keeping the body in optimal working condition and preventing issues like dehydration, kidney stones or electrolyte imbalance.

5. **Nervous system:** The nervous system is critical in regulating and coordinating nearly all bodily functions, enabling us to interact with and respond to our environment. Some of the practical applications of the nervous system in daily life are: reflexes and quick reactions, coordination of movement, learning and memory, sensory perception, communication, emotional regulation, automatic bodily function, focus and attention, sleep regulation. The nervous system is central to almost every action and experience in daily life, from basic survival reflexes to complex emotional response and intellectual activities.

6. **Animal Reproduction:** The reproductive system's primary function is to enable reproduction, but it also plays roles in hormonal regulation and overall health. Here are some practical applications of the reproductive system in daily life. It includes: reproduction, sexual health and immunity, hormonal balance, puberty and development. In everyday life reproductive system is essential not only for reproduction but also for overall health, influencing physical, emotional and hormonal balance across different stages of life.

7. **Inheritance:** Inheritance can be compared to many real-life situations where traits, behaviors, or properties are passed from one entity to another. Here are a few application of inheritance in daily life: family and genetic trait, educational system, business hierarchies,

vehicles, software development. These examples highlight how inheritance helps to reuse common functioning of specific needs, making it an efficient approach in both real-world and programming contexts.

8. Diseases: Knowledge of diseases plays a crucial role in daily life, helping individuals make informed decisions to maintain health, prevent illness and manage existing conditions, Here are some practical applications: preventing health practices e.g., COVID 19, knowing risk factors e.g., diabetes heart diseases etc., early detection and screening, managing chronic conditions, infection control at home, mental health awareness, travel and disease awareness, emergency situation, caring for vulnerable population. Awareness of diseases helps in making proactive health quality of life and potentially preventing complications or the spread.

9. Immunity: Immunity plays a crucial role in protecting our bodies from infections and diseases. Understanding and apply knowledge of immunity in daily life has several practical benefits, which help maintain health and promote well-being. The some of the practical applications of immunity are: vaccination, healthy lifestyle to boost immunity, understanding autoimmune diseases, allergy management, hygiene and immune function, breastfeeding and infant immunity, exposure and immune system strengthening, travel and immunity. By understanding how immunity works, people can make informed decisions to enhance their immune system's functionality, avoid harmful overreactions and reduce risk of infections. This proactive approach helps maintain overall health and wee-being in daily life.

10. Biotechnology: Biotechnology has numerous practical applications that impact daily life, ranging from health and agriculture to environmental sustainability. Here are some keys ways biotechnology is applied in daily life: vaccines and therapeutics, personalized medicine e.g., (insulin production), agriculture,( genetically modified organisms ,bio-fertilizers and bio-pesticides, disease-resistant plants), food and beverage industry (fermentation technology, food preservatives, plant-based and cultured meat) environmental sustainability (bioremediation, biofuels, biodegradable plastics), household products (enzymes and detergents, personal care products e.g., skin and hair care products), forensic and law enforcement (DNA fingerprinting, paternity testing),animal health and breeding genetic engineering in livestock, veterinary vaccines, health monitoring, genome sequencing, water treatment. Biotechnology has a profound impact on daily life by improving health care, food production, environmental sustainability and even the products we use in our homes.

11. Biostatics and data analysis: Biostatistics has several practical applications in daily life, often related to health, medicine and public policy. Here are some ways it is applied: medical research and treatment (clinical trials, epidemiology), health risk assessments (disease risk prediction, survival analysis) , Public health Policy ( vaccination programs, healthcare resource allocation), nutrition and diet studies, insurance and risk calculation, environmental health. Biostatistics impacts many aspects of health, disease prevention and policy decision-making in ways that influence daily life outcomes and wellbeing.

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بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

اللہ کے نام سے شروع جو بڑا مہربان، نہایت رحم والا ہے

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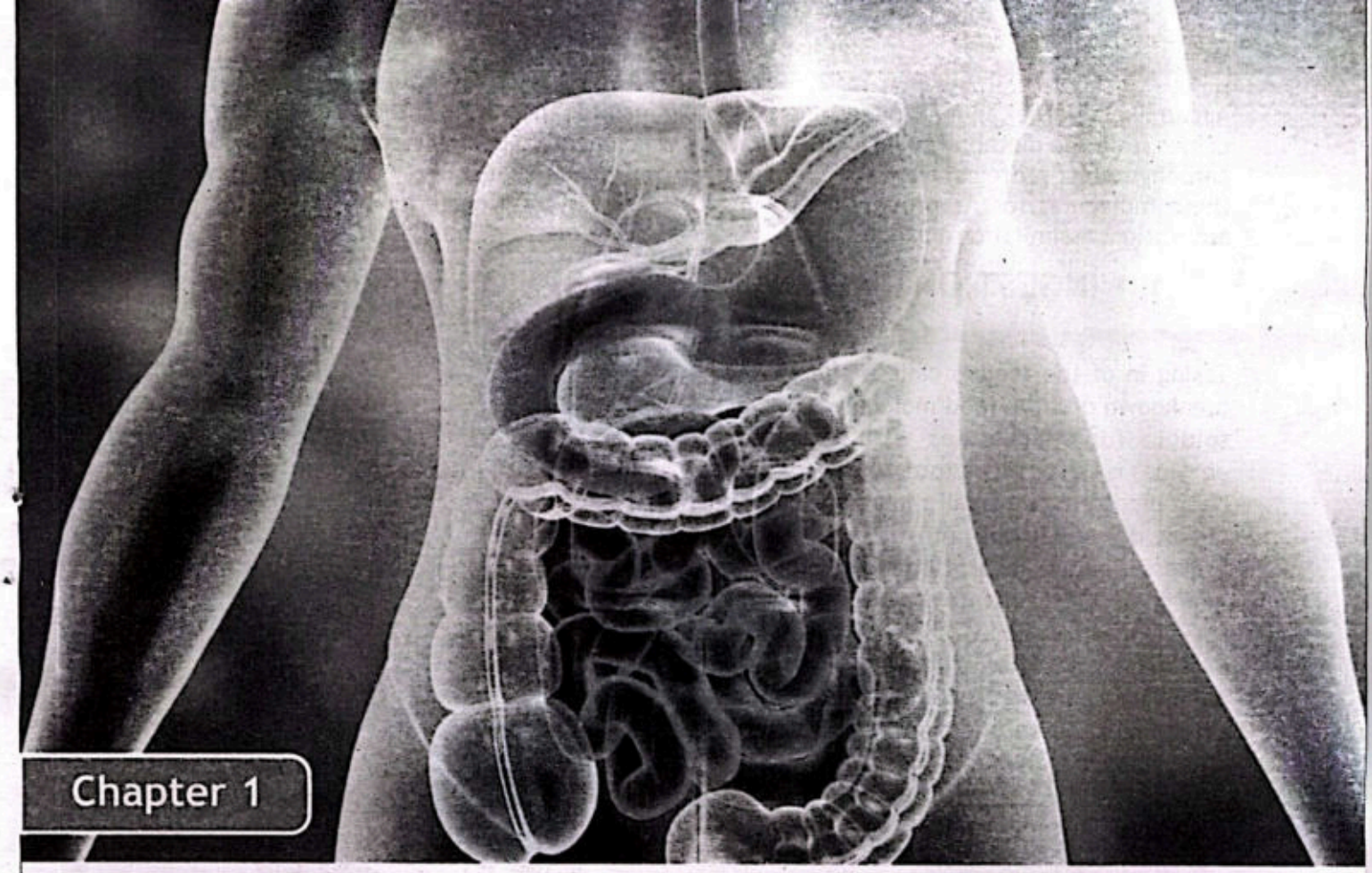


Chapter 1

# DIGESTIVE SYSTEM

SLOs: After completing this lesson, the student will be able to:

1. [B-10-R-01] Describe the needs of ingestion, digestion, absorption, assimilation and egestion.
2. [B-10-R-02] Identify and describe the structures of the main regions of the alimentary canal and associated organs.
3. [B-10-R-03] Describe swallowing and peristalsis.
4. [B-10-R-04] Sort out the actions of enzymes in specific regions of alimentary canal, with respect to their substrate and products.
5. [B-10-R-05] State the role of liver.
6. [B-10-R-06] Describe the structure of villus, including the role of capillaries and lacteal.
7. [B-10-R-07] State sign and symptoms, causes, treatments and prevention of the disorders of gut i.e., diarrhea, constipation and ulcer.

A man like all other animals needs energy for the maintenance of his life processes. The energy comes from the metabolism of food substances which need to be digested. Our food consists of carbohydrates, proteins, and fats. These are very large molecules. Every cell of the body needs these molecules for its proper functioning. Digestive system performs ingestion, digestion, absorption, assimilation and egestion.

## 1.1 INGESTION, DIGESTION, ABSORPTION, ASSIMILATION AND EGESTION

Taking in of the food is called **ingestion**. The breakdown of large food molecules, into small soluble food molecules with the help of enzymes is called **digestion**. When the food has been digested, the small molecules must pass out of digestive tube into the blood and the process is called **absorption**. From blood these molecules are taken into the cells and are used for various purposes by a process called **assimilation**. The process by which the undigested part of the food is removed out of the body is called **egestion**. Digestive system cannot work alone. It is helped by transport system to take digested food from digestive tube to all parts of the body.

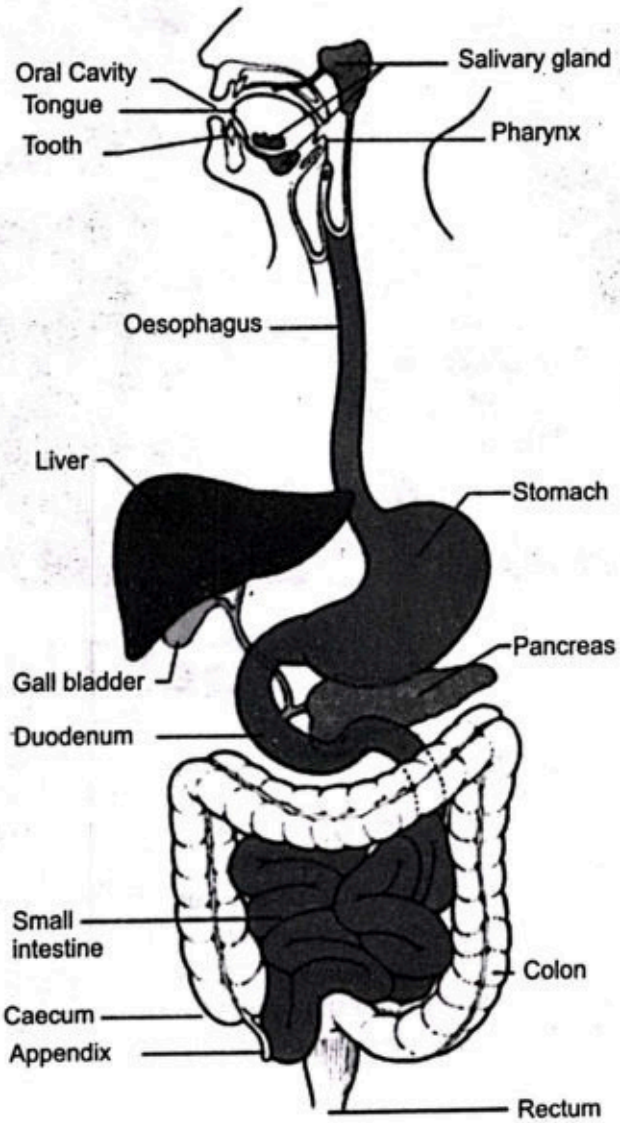



Fig. 1.1: The Human digestive system

## 1.2 HUMAN ALIMENTARY CANAL

The organs, which take part in the process of digestion, make the digestive system. The human digestive system consists of two sets of organs.

1. The **alimentary canal** is concerned with ingestion, digestion, absorption and egestion of undigested food. The parts of the alimentary canal are mouth, oral cavity, pharynx, oesophagus (esophagus), stomach, small intestine and large intestine.
2. The **digestive glands** are associated with the alimentary canal and help in digestion.

The digestive glands are, salivary glands, gastric glands, intestinal glands, liver and pancreas.

### 1.2.1 Alimentary Canal

Alimentary canal is also known as gut or digestive tract or gastrointestinal tract. It is a continuous tube. The tube is about 9 meters long in adult. It is specialized at various points along its length. It's each region is designed to carry out a different function in the overall process of digestion, absorption and egestion. Alimentary canal begins from the mouth and ends at the anus. It is lined internally by mucous membrane.

**Mouth:** It is the external opening that leads into the oral cavity or mouth cavity.

**Oral Cavity:** Around the sides and front of the oral cavity are the upper and lower jaws. The upper jaw is fixed while the lower is movable. The oral cavity contains teeth and tongue.

**Pharynx:** It leads from the mouth and nasal cavity to the oesophagus and to the trachea. The pharynx is a common passage for food and air.

**Oesophagus:** It is muscular tube, about 25 cm long. It leads from pharynx to the stomach. In oesophagus no digestion takes place.

**Stomach:** The stomach is the dilated part of the digestive tube. It is roughly J shaped and somewhat transversely placed on the left of the abdomen just beneath the diaphragm. It has two openings, which are guarded by valves.

The opening between oesophagus and stomach is called **cardiac opening**, which is guarded by cardiac sphincter. The region of the stomach around the cardiac opening is the **cardiac end**. The opening of stomach into the duodenum is called **pyloric opening** which is guarded by muscles called **pyloric sphincter.**

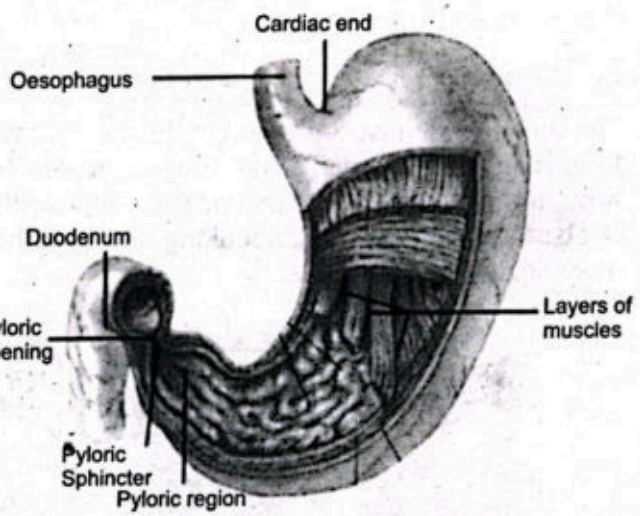



Fig. 1.2: Structure of Stomach

**Small Intestine:** The small intestine is small in diameter. It is divided into three parts: duodenum, jejunum and ileum. **Duodenum** is about 20-25 cm long. Bile duct from gall bladder, hepatic duct from liver and pancreatic duct from pancreas empties its secretions, in the duodenum. **Jejunum** is about 2.5 meters long and **ileum** about 4 meters long.

**Large Intestine:** The large intestine is a tube leading from the small intestine to the anus. It is 1, 5 meters in length. It is larger than small intestine in diameter. The **large intestine** is made up of three parts the colon, the rectum and the anus. The **colon** can also be divided into parts. The caecum is the first part of the colon. The ileum enters it from the side. The **caecum** has a pouch like end to its base **appendix** is attached which is 10 cm long. The rest of the colon is divided into segments:, the **ascending colon** (right) , the **transverse colon** (across) , the **descending colon** (left) , and the **sigmoid colon**, which connects to the **rectum**. The rectum is a straight, 8-inch chamber that connects the large intestine to the anus. The rectum temporarily stores the feces. The **anus** is the last part of the digestive tract. It is a 2-inch long canal. The anus is surrounded by sphincter muscles that are important in allowing control of stool.

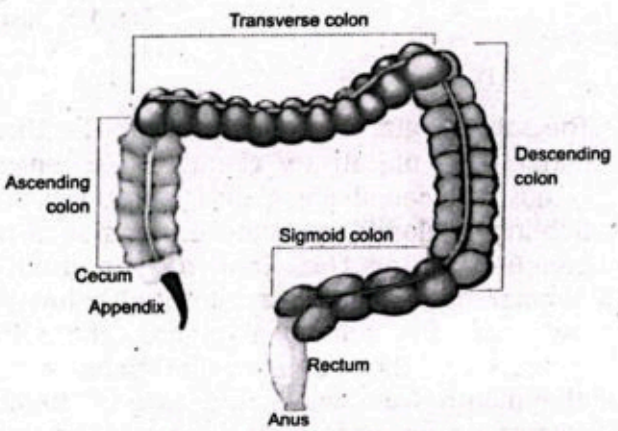



Fig. 1.3: Large intestine

## 1.2.2 Associated Organs

It includes teeth, tongue, salivary glands, liver, gallbladder and pancreas.

### 1. Teeth

The four types of teeth are **incisors**, canines, premolars, and molars. Incisors bite into food and cut it into smaller pieces. **Canines** are used to tear food. **Premolars** help to chew and grind up food. **Molars** chew food and grind it up.

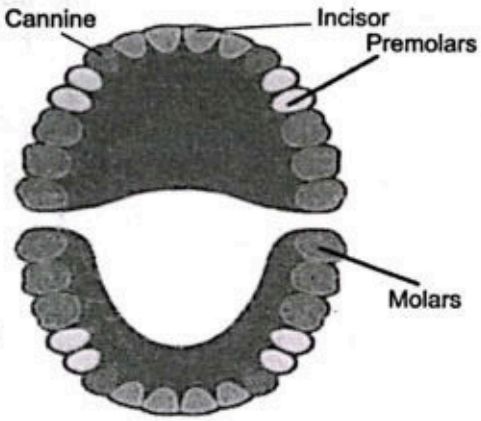



Fig. 1.4: The four types of human teeth

### 2. Tongue

The tongue is a muscular organ in the mouth cavity. It is a digestive organ. The tongue moves food around the mouth to help mastication and swallow. It also helps in chewing, speaking and breathing. The tongue has taste buds.

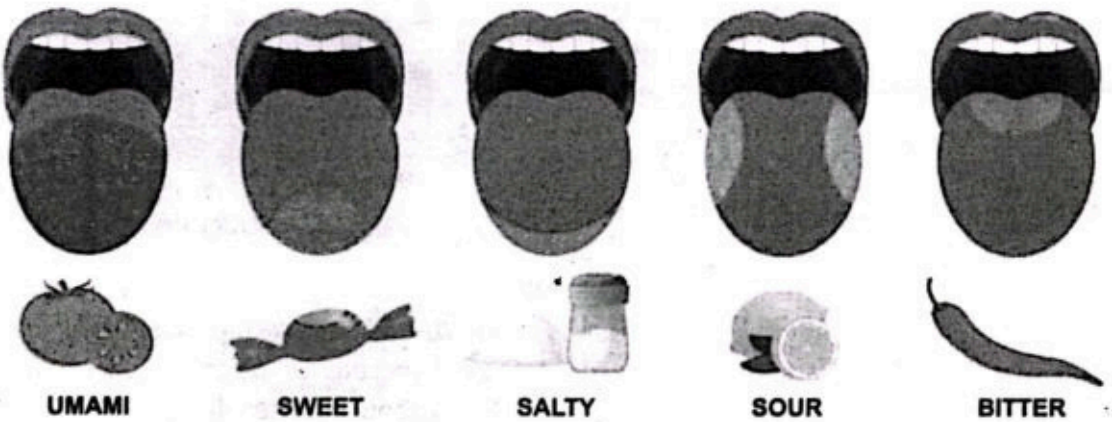



Fig. 1.5: Taste buds on tongue

### 3. Salivary glands

The salivary glands produce saliva. The three major pairs of salivary glands are sublingual glands, submandibular glands, parotid glands. **Sublingual glands** are below either side of the tongue, under the floor of the mouth. **Submandibular glands** are located below the jaw. Like the sublingual glands, the saliva produced in the submandibular glands enters the mouth from under the tongue. **Parotid glands** are just in front of the ears. The saliva produced by the parotid glands enters the mouth from small ducts near the upper molars.

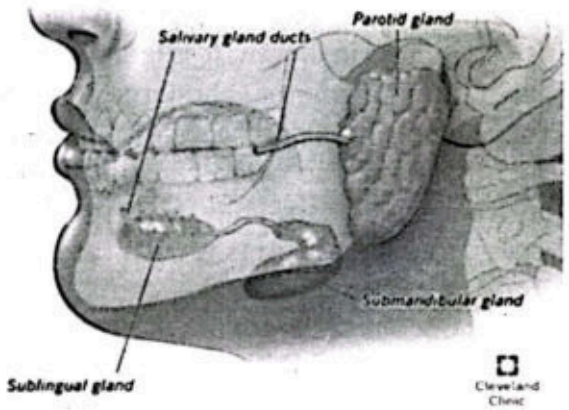



Fig. 1.6: Salivary glands

### 4. Liver

The human liver is an organ and gland in the human body. It is spongy, wedge-shaped, and reddish-brown in color. The liver is located on the right side of the body, under the ribs. Liver secretes **bile**. The liver has two main parts: the larger right lobe and the smaller left lobe. The lobes contain many blood vessels.

Blood travels through the liver. The lobes also contain thousands of small lobes i.e., lobules. These lobules connect with many bile ducts. These ducts transport bile from the liver to the duodenum.

## 5. Gallbladder

The gallbladder is just below the liver. Bile is stored in the gallbladder and flows through the **cystic duct** and the **common bile duct** into the small intestine when food is being digested.

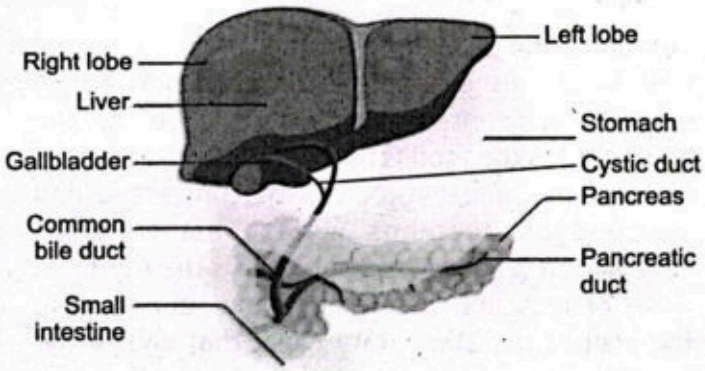



Fig. 1.7: Liver, gallbladder and pancreas

## 6. Pancreas

The pancreas is behind the stomach and in front of the vertebral column. It is surrounded by gallbladder, liver and spleen. The head of the pancreas is on the right side of the body. It is tucked beside the curve of the duodenum. The tail of the pancreas extends over to the left side of the body, near spleen.

# 1.3 SWALLOWING AND PERISTALSIS

The two main processes that take place in the digestion of food are **Swallowing** and **Peristalsis.**

## 1.3.1 Swallowing

In swallowing the following actions take place: (a) The tongue presses upwards and back against the roof of the mouth forcing bolus, to the back of the mouth. (b) The soft palate closes the nasal cavity at the back. (c) The larynx cartilage around the top of the trachea is pulled upwards so that glottis (opening of trachea) lies under the back of the tongue. (d) The epiglottis (a flap of cartilage) helps to prevent the food from entering glottis instead of oesophagus.
The beginning of the swallowing action is voluntary, but once the food reaches the back of the mouth, swallowing becomes an automatic or involuntary action. The food is forced into and down the oesophagus by peristalsis.

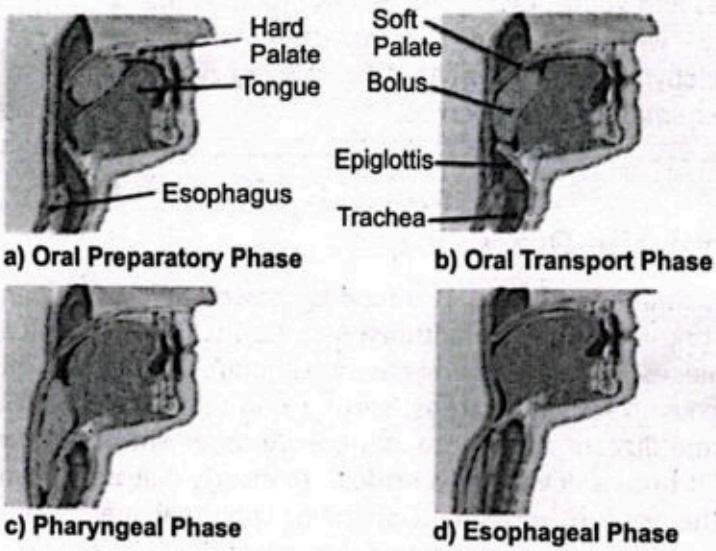



Fig. 1.8: The process of swallowing in man

## 1.3.2 Peristalsis

The alimentary canal has layers of muscle in its wall which pushes the ingested food forward. A contraction of circular muscles just behind the bolus pushes the food forward into the next region where longitudinal muscles are contracted and oesophagus becomes wide. This wave of contraction is called peristalsis. It is the rhythmic wave of muscular contraction and relaxation in the wall of the alimentary canal that causes the food to move through the alimentary canal.

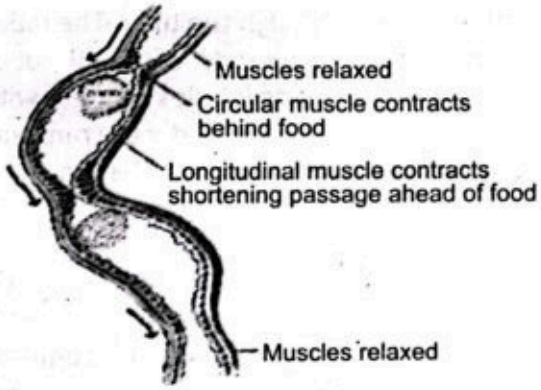



Fig. 1.9: Peristalsis

## STEAM ACTIVITY 1.1 PERISTALSIS

**Materials needed:** Clear, flexible plastic straw, about 20 cm in length and about 6 mm in diameter. Round bead about 5-6 mm in diameter (You may use a seed, pebble etc., for the bead).

**Procedure**

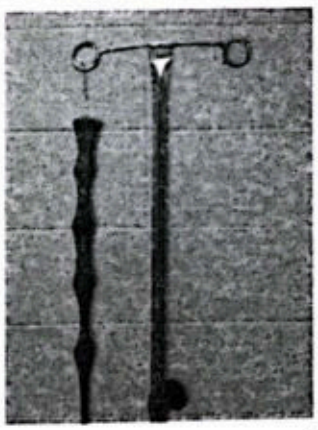
1. Obtain a clear, flexible plastic straw.
2. Hold the straw vertically and insert a small bead, into the top of the straw. The bead should fit tightly into the straw.

**Caution:** Do not put the straw in your mouth or blow into the straw.

3. Pinch the straw above the bead so the bead begins to move down the length of the tubing.
4. Repeat the step 3 until the bead exits the straw.

Q. How does this action compare with peristalsis?

Q. What do the bead and straw represents.



### Science Titbits

Mucus is secreted in large amount by duodenal glands, intestinal glands, and goblet cells. The mucus provides the wall of intestine with protection against the irritating effects of acidic chyme and against the digestive enzymes that enter duodenum from the pancreas.

## 1.4 CHEMICAL DIGESTION

### 1.4.1 Digestion in the Oral Cavity

Here food is tasted, smelled and felt. The food is chewed by crushing and grinding. The teeth, cheeks and tongue take part in these actions. As a result, food is physically and quickly broken down into smaller pieces. Food in the oral cavity stimulates the salivary glands to secrete saliva. The water and mucous in saliva moistens, softens and lubricate food. Saliva contains **salivary amylase**. This enzyme digests starch into maltose. Another enzyme, **lipase**, is produced by the cells in the tongue. It breaks down triglycerides, to mostly diglyceride and free fatty acids. The food is rolled by the tongue into small, slippery, spherical mass called **bolus**. The bolus is swallowed and enters the oesophagus through the pharynx.

## 1.4.2 Digestion in Stomach

On the peristaltic reflex the cardiac sphincter relaxes to allow food in the stomach.

**Gastric Juice:** The food in the stomach stimulates the gastric glands to secrete gastric juice. It consists of mucous, HCl, pepsin and rennin.

**Mucous:** Mucous forms a coating over the stomach. It prevents the digestion of stomach wall by the enzyme pepsin.

**Hydrochloric Acid:** HCl performs the following functions: (a) Stops the action of salivary amylase. (b) It converts the inactive form of enzyme (pepsinogen) to active form (pepsin). It provides acidic medium suitable for the action of enzymes. (c) It kills many microorganisms.

**Pepsin:** It is secreted as inactive **pepsinogen**. HCl or already activated pepsin converts pepsinogen to **pepsin**. Pepsin digests proteins to polypeptides (chain of many amino acids) and peptides (chain of few amino acids).

**Renin:** Rennin is secreted only in infants. It helps in the digestion of milk protein.

By the churning action of stomach wall, the food gets mixed into a soupy mixture called **chyme**. When the chyme reaches a certain degree of acidity the pyloric sphincter relaxes and a little food passes into the duodenum.

## 1.4.3 Digestion in the Small Intestine

Starch, proteins and fats all are enzymatically broken down in the small intestine. When food enters the duod enum, the chyme stimulates:

(a) The gall bladder to release bile. (b) The pancreas to secrete pancreatic juice.

(c) The intestinal glands to secrete intestinal juice.

All these secretions are alkaline and neutralize the acidic chyme. The pancreatic and intestinal enzymes can work only in this alkaline medium.

### Bile

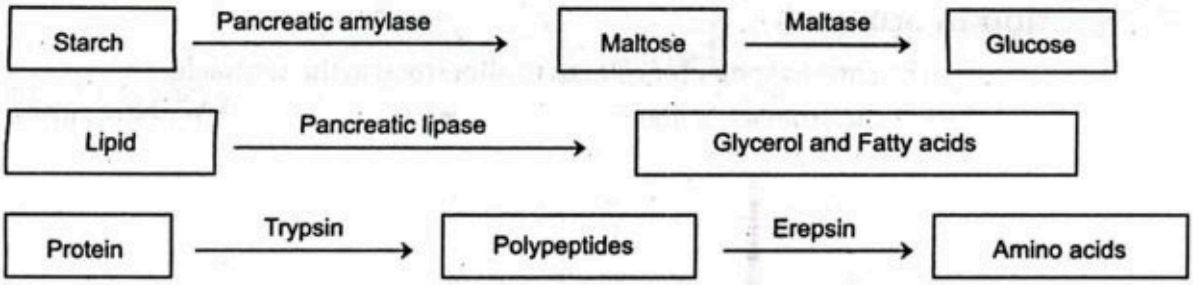
Bile is a greenish yellow liquid manufactured in the liver. Bile is stored in the gallbladder and is released as soon as food enters the duodenum. Bile emulsifies fats causing them to breakdown into small droplets called emulsion. Emulsification provides relatively large surface areas of lipid for the action of lipase enzymes.

### Pancreatic Juice

The secretion of pancreas is called pancreatic juice. It contains enzymes amylase, lipase and trypsinogen. **Pancreatic amylase** is the starch-digesting enzyme. It converts polysaccharides to maltose and even to glucose. **Pancreatic lipase** converts neutral fats (i.e. triglyceroids) into glycerol and fatty acids. **Trypsin** converts proteins into polypeptides.

### Digestion in Jejunum and Ileum

The lining of the jejunum and ileum secrete several enzymes such as erepsin which converts peptides into amino acids. It also secretes Enterokinase which activates pancreatic trypsinogen into its active form trypsin. Lactase converts lactose to glucose. Maltase converts maltose to glucose etc. In the ileum digestion process is complete.




### 1.4.4 Absorption in the Small Intestine

The internal lining of small intestine is modified to make tiny finger like projections called **villi**. Simple sugars and amino acids pass through the wall of the villi into the blood capillaries of villi. Mineral salts and vitamins also pass in the blood capillaries of villi. Absorption occurs by a combination of diffusion and active transport. Glycerol and fatty acids are absorbed by the lacteal and ultimately will be poured into the blood.

The absorbed food in the blood capillaries of the villi passes into the blood stream. They are then carried away in the capillaries, which join up to form veins. These veins unite to form one large vein called the **hepatic portal vein**. This vein carries all the blood from the intestine to the liver, which may store or alter any of the digestion products.

### 1.4.5 Absorption in large intestine

From large intestine water and some vitamins are absorbed into the blood.

### 1.4.6 Assimilation

The products of digestion are carried round the body by the blood. These are absorbed by the body cells. The body cells use glucose, amino acids and fats. This uptake and use of food is known as assimilation. All the cells use glucose during cellular respiration to produce ATP.

### Defecation

The semi solid waste, the faeces or stool is passed into the rectum by peristalsis and is expelled at intervals through the anus. The removal of undigested matter from the body is called **egestion** or **defecation**.

## 1.5 ROLE OF LIVER

The liver has many functions. Some of the most vital roles of liver are:

1. The liver cells manufacture bile.
2. Excess quantity of glucose is stored by the liver as glycogen.
3. Liver converts glycerol and amino acids to glucose molecules.
4. Liver removes amino group from amino acids. It is called deamination.
5. Ammonia is converted into urea in the liver.
6. Majority of the plasma proteins are synthesized in the liver.
7. It destroys old red blood cells.
8. It stores fat-soluble vitamins (A, D, E and K) and mineral ions such as iron.

## 1.6 STRUCUTRE OF VILLUS

Villus (plural: villi) are found in small intestine. Each villus is covered by simple **columnar epithelium**. It contains a **blood capillary** network and a lymph capillary called a **lacteal**.

Crypt means small cavity. Interstitial crypts are small tubular glands formed in the small intestine in between the bases of the villi. Crypt cells of the small intestine provide stem cells for renewal of the intestinal epithelium. The villi increase surface area for absorption. A villus also has goblet cells. The primary function of goblet cells is to secrete mucin and create a protective mucus layer.

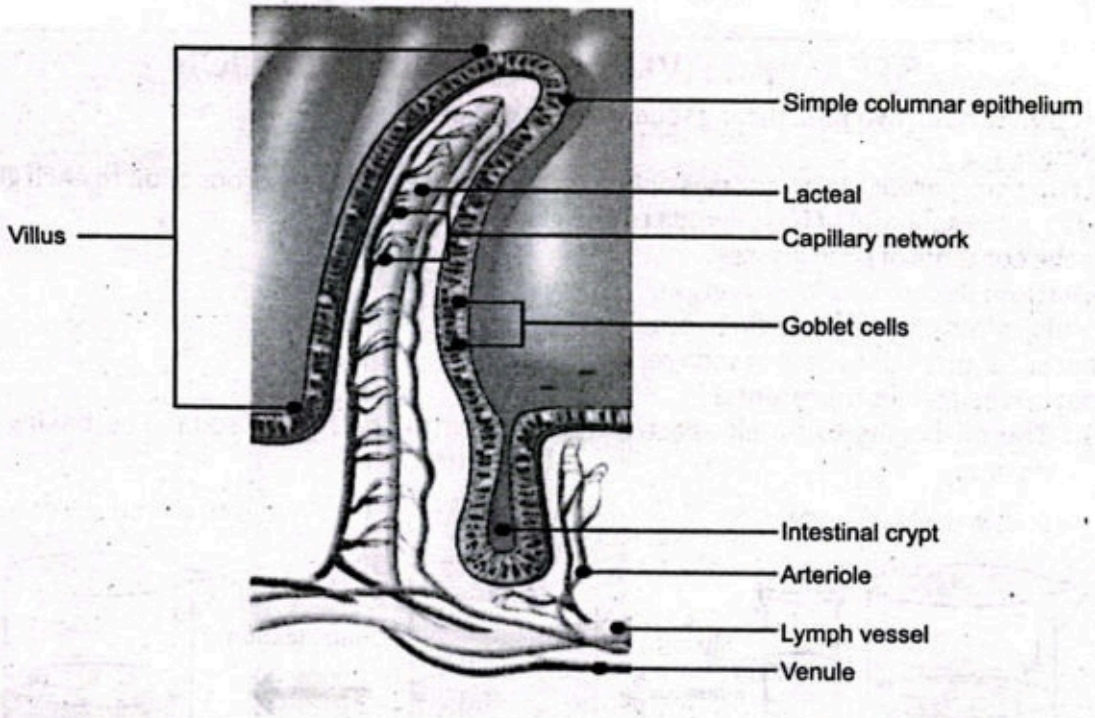



Fig. 1.10: Structure of villus

## 1.7 DISORDERS OF GUT

Here we will discuss the causes, prevention, and treatment of the disorders of related to digestive system e.g., diarrhoea, constipation, and ulcer.

### Diarrhoea

The symptoms of diarrhoea are that the stools becomes watery. There is an increased frequency of defecation. The major causes are infection of the lower GI tract and nervous stimulation. In case of infection such as food poisoning caused by eating contaminated food the intestinal wall becomes irritated and peristalsis increases. Diarrhoea may result in dehydration, so ORS (oral rehydration solution), or mixture of salt and sugar solution is given to the patient.

### Constipation

The symptoms of constipation include decrease in frequency of daily stools, or difficulty in defecation which may result in abdominal pain. The faeces move too slowly along the large intestine. As a result, more water is absorbed from the faeces than usual. The faeces become so hard that defecation becomes difficult and painful. Some of the most common causes of constipation are: medications, lack of exercise, not enough liquids, and not enough fiber in the diet such as fruit, vegetables and cereals, a change in your routine or lifestyle, such as a change in your eating habits. For the treatment of constipation laxative is taken to make the faeces soft for easy discharge. Constipation is called the mother of all diseases. As a preventive measure one should take plenty of water or fluids and fibrous food, fruits, vegetables etc.

## Ulcer

An ulcer is an open sore in the wall of the gut caused by the gradual disintegration of the tissue. It may be gastric (stomach) ulcer or peptic (duodenal) ulcer. The main symptom of ulcer is stomach pain. The causes of ulcer are acidity, smoking, and bacterial infection. For the prevention of ulcer, (a) stop smoking, (b) avoid spicy food and food containing acids (c) avoid stress.

## STEAM ACTIVITY 1.2 EMULSIFICATION

**Materials needed:** Two jars, baking soda, stirring rod or spoon.

**Procedure**

1. Fill two transparent plastic glasses or beakers with water. Add few drops of oil to each glass.
2. Add about ¼ spoonful of baking soda to one glass.
3. Stir the contents of both glasses.

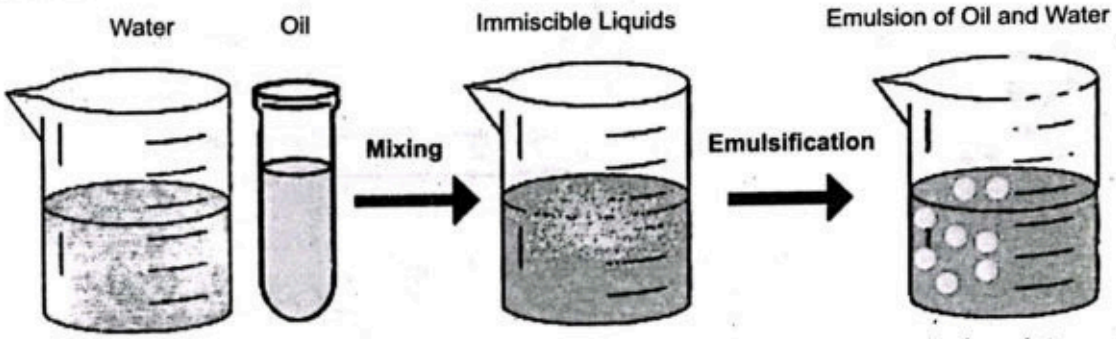
**Observation:** Record your observation.

Q. In which glass did the oil begin to break up?

Q. What substances does baking soda represents?

Q. What do the glasses represents?

**Result:** The oil begins to break apart in the glass with the baking soda. The baking soda represents bile.




Emulsificiation is the process of combining two immiscible liquids into a single mixture. It is the process of creating liquids into a single mixture. It is the process of creating phases in a liquid-liquid mixture that results in the creation of emulsion.

## SUMMARY

1. Digestion of carbohydrates begins in mouth. As food is swallowed it is propelled through the pharynx and oesophagus.
2. A bolus of food is moved through the digestive tract by peristaltic action.
3. In the stomach, food is mechanically digested by vigorous, churning.
4. Proteins are enzymatically digested by the action of pepsin present in the gastric juice.
5. Most enzymatic digestion takes place in the duodenum which receives secretions from the liver and pancreas and produces several digestive enzymes of its own.
6. The liver produces bile, which emulsifies fats.
7. The pancreas releases enzymes that digest proteins, carbohydrates, fats etc.
8. chains of glucose are digested to maltose by salivary and pancreatic amylases.
9. Maltase in the small intestine splits maltose into glucose.
10. Proteins are split by pepsin in the stomach and by enzymes in the pancreatic juice.
11. Most nutrients are absorbed through the thin walls of the intestine. The large intestine is responsible for the elimination of undigested wastes.
12. Diarrhoea, constipation, ulcer, are some of the disorders of the gut.

# EXERCISE

## Section I: Multiple Choice Questions

**Select the correct answer:**

1. Emulsification of fat will not occur in the absence of:

   A) lipase B) bile C) pancreatic juice D) gastric juice

2. Which enzyme, substrate and pH conditions are needed for the digestion of food in the stomach?

| | Enzyme | Substrate | pH |
|---|---|---|---|
| A) | Amylase | Starch | Low |
| B) | Lipase | Lipid | High |
| C) | Protease | Protein | Low |
| D) | Protease | Protein | High |

3. Bile is formed in:

   A) liver B) gall bladder C) pancreas D) duodenum

4. Glycogen is stored in:

   A) gall bladder B) spleen C) liver D) pancreas

5. Common passage for swallowing food and breathing is:

   A) pharynx B) glottis C) larynx D) mouth

6. Digestion of both starch and protein is carried out by:

   A) gastric juice B) saliva C) bile D) pancreatic juice

7. If the mucous lining covering the stomach breaks down and stomach tissues are damaged by:

   A) gastric juice B) saliva C) bile D) pancreatic juice

8. Part of the digestive system, which is not in contact with food, is

   A) small intestine B) liver C) caecum D) stomach

9. The diet component which prevent constipation is:

   A) fibre B) protein C) minerals D) vitamin

10. Fatty acids and glycerol are first absorbed by

    A) lymph vessel B) villi C) blood capillaries D) hepatic portal vein

11. Which secretion, released into the alimentary canal, contains no enzyme but speeds up fat digestion?

    A) bile B) pancreatic juice C) saliva D) gastric juice

12. Enzyme trypsinogen is changed to trypsin by

    A) gastrin B) enterokinase C) secretin D) hydrochloric acid

13. How does food move through your digestive tract?

    A) By gravity B) By wavelike muscle contractions

    C) By cilia D) by chemical absorption

14. Where the majority of the water from the indigestible food is absorbed?

A) small intestine B) large intestine C) stomach D) pancreas

## Section II: Short Answer Questions

1. Write the functions of: saliva, gall bladder, pancreas, villus, bile, gastric gland, renin, HCl in stomach, hepatic portal vein.
2. Draw and label longitudinal section of villus.
3. Name the structures that secrete enzymes necessary for human digestion?
4. Why is pepsin formed in inactive form pepsinogen?
5. Why must digested food be distributed by blood in man and other animals?
6. How is chewing important to your digestion?
7. What would happen if pancreatic juice did not reach to your small intestine?
8. Why pepsin is unable to perform its enzymatic activity in small intestine?
9. Which parts of digestive system can come in contact with bile?
10. Some cells of the stomach secrete mucous for protection of stomach wall. Suggest what the stomach wall need to be protected against.
11. Following table shows the names of three enzymes found in alimentary canal. Complete the table by writing names of substrate and product for each enzyme.

| Name of enzyme | Substrate | Product |
|---|---|---|
| Protease | | |
| Amylase | | |
| Lipase | | |

12. Write the function of each type of teeth
13. Describe digestion in oral cavity.
14. Differentiate between mechanical and chemical digestion

## Section III: Extensive Answer Questions

1. Describe the structures of the main regions of alimentary canal.
2. Describe the structures of the associated organs of alimentary canal.
3. Describe the process of swallowing of food in man.
4. Describe the process of peristalsis in man with diagram.
5. Describe the process of digestion in stomach.
6. How the process of digestion takes place in the small intestine.
7. Draw and describe the structure of villus.
8. State the role of liver.
9. Write symptoms, cause, treatment and prevention of the following disorder of the digestive system.
    a. diarrhea
    b. constipation
    c. ulcer