

10 Science Chapter 6 Life Processes Notes:

Introduction

Life

Earth happens to be the only known planet having a life. There are beings who live, die and become part of nature again. The living organism can be differentiated from the inanimate entities on various parameters of life processes.

Life Process

- Maintenance of living organism is essential even if they are moving, resting or even sleeping.
- The processes which together perform the function of maintenance of 'life' are called as life processes.
- Nutrition, respiration, circulation, excretion are examples of essential life processes.
- In unicellular organisms, all these processes are carried out by that single cell.
- In multicellular organisms, well-developed systems are present to carry out the processes.

Nutrition

Nutrition

The process of acquiring food that is needed for nourishment and sustenance of the organism is called nutrition.

- There are two main modes of nutrition, autotrophic and heterotrophic.
- Heterotrophic nutrition has subtypes as holozoic, saprophytic and parasitic nutrition.

Autotrophic Nutrition

If an organism can nourish itself by **making its own food** using sunlight or chemicals such mode of nutrition is called as autotrophic nutrition.

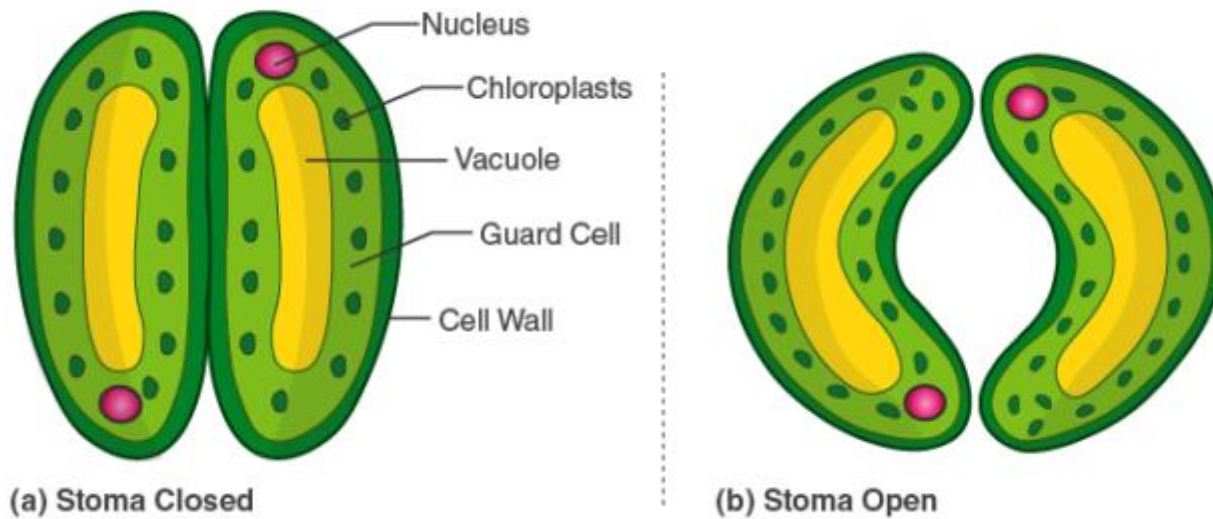
- Plants photosynthesize (use light energy) and are called photoautotrophs.
- Few bacteria use chemicals to derive energy and are called chemoautotrophs.

Photosynthesis

- Photosynthesis is an important process by which food is formed.
- The plants make food using sunlight and water, which provides nourishment to other organism and themselves.
- Chlorophyll present in the green parts absorbs light energy.
- This light energy is used to split water into hydrogen and oxygen.
- Hydrogen is then used to reduce carbon dioxide into carbohydrates, typically glucose.
- Chlorophyll is essential for photosynthesis and stomata to facilitate intake of carbon dioxide.

Stomata

- Stomata are pores on the leaves that help in exchange of gases.
- They are mostly found on the underside of the leaf.
- Each stoma is guarded by guard cells, which control the opening and closing of the pore.
- The water content of the guard cells is responsible for their function.



Saprophytic Nutrition

Some organisms feed on **dead and decaying organic matter**. This mode of nutrition is called saprophytic nutrition.

- The food is partially digested outside the body and then it is absorbed.
- E.g. Fungi are saprophytes.

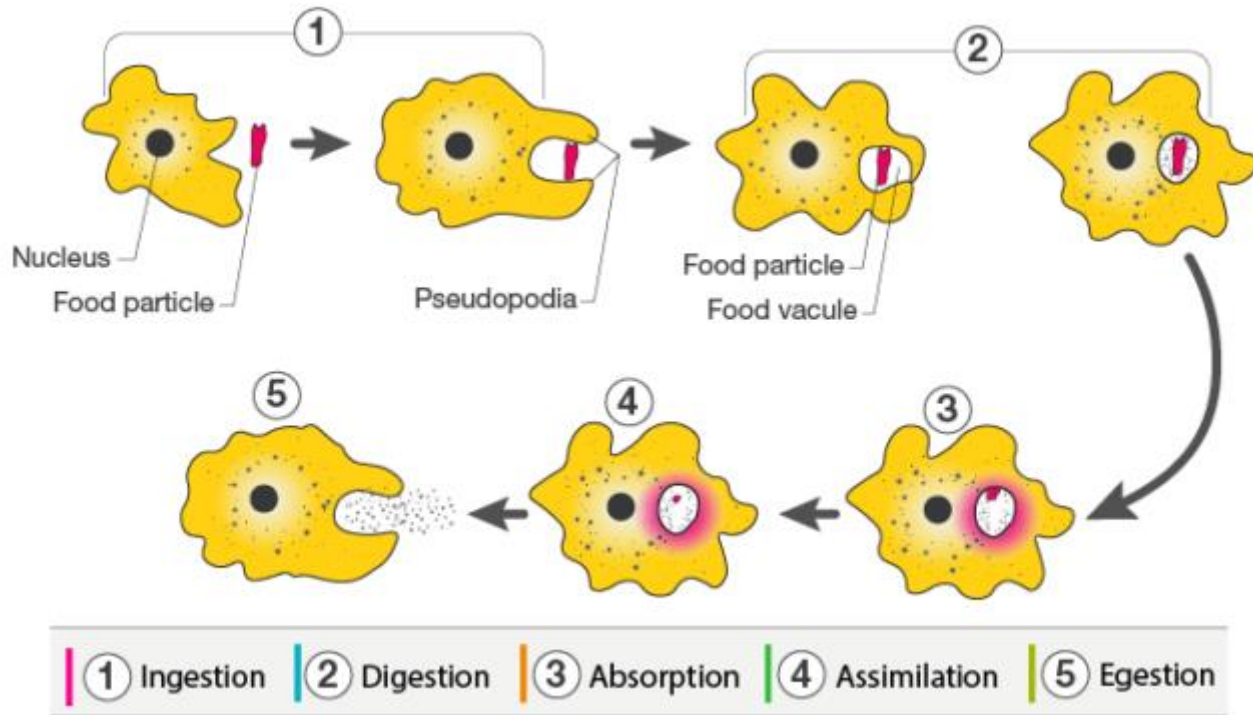
Parasitic Nutrition

Some organisms feed on the expense of another organism and in turn causing it harm. This is called parasitic mode of nutrition.

- These organisms live on the body or in the body of a host organism and derive the nutrients directly from the body of the host.
- E.g. Leech is an ectoparasite while Ascaris is an endoparasite. Cuscuta is a parasitic plant.

Nutrition in Amoeba

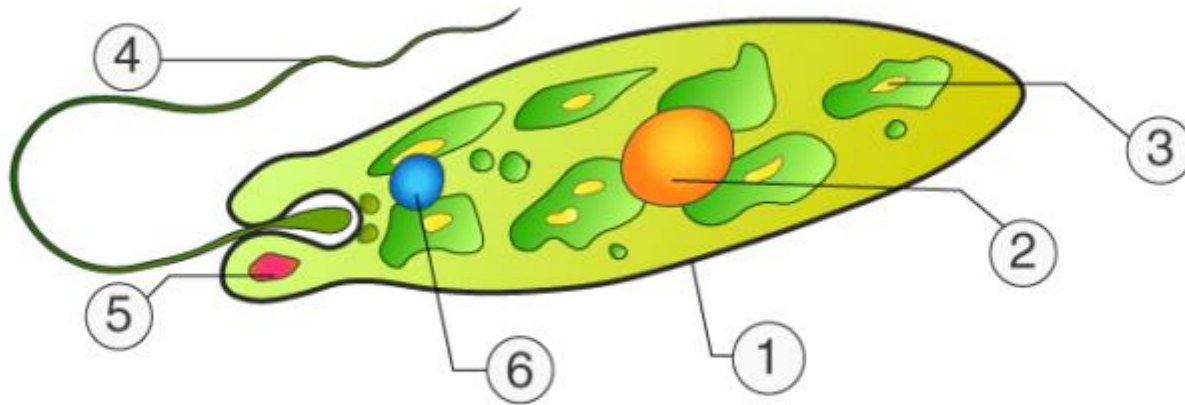
- Amoeba feeds by holozoic mode of nutrition.
- It engulfs the food particle using pseudopodia, the process is called phagocytosis.
- The engulfed food gets enclosed in a food vacuole.
- As the food vacuole passes through the cytoplasm, digestion, absorption and assimilation take place.
- When the food vacuole opens to outside, egestion of undigested food takes place.



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Nutrition in Paramecium

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- Paramecium also exhibits holozoic nutrition.
- However, they have cilia that help them to engulf the food through the oral groove.
- A food vacuole is created enclosing the food.
- It moves through the cytoplasm, the process is called cyclosis.
- Food digested in the food vacuole is absorbed by the cytoplasm.
- Undigested food is given out to a tiny pore called anal pore or cytopyge.



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|------------|-----------------------|---------------|-------------|
| ① Pellicle | ② Nucleus | ③ Chloroplast | ④ Flagellum |
| ⑤ Eyespot | ⑥ Contractile Vacuole | | |

Nutrition in Humans

- Humans are omnivores, they can eat plant-based food as well as animal-based food.
- Being more complex, humans have a very complicated nutrition system.
- The digestive system has an alimentary canal and associated digestive glands, which together function to nourish the body.
- There are five stages in human nutrition; Ingestion, Digestion, Absorption, Assimilation and Egestion.
- Four stages i.e. ingestion, digestion, absorption and egestion take place in the alimentary canal while assimilation of food takes place in the whole body.

Alimentary Canal

- Alimentary canal in humans is a long tube of varying diameter.
- It starts with the mouth and ends with the anus.

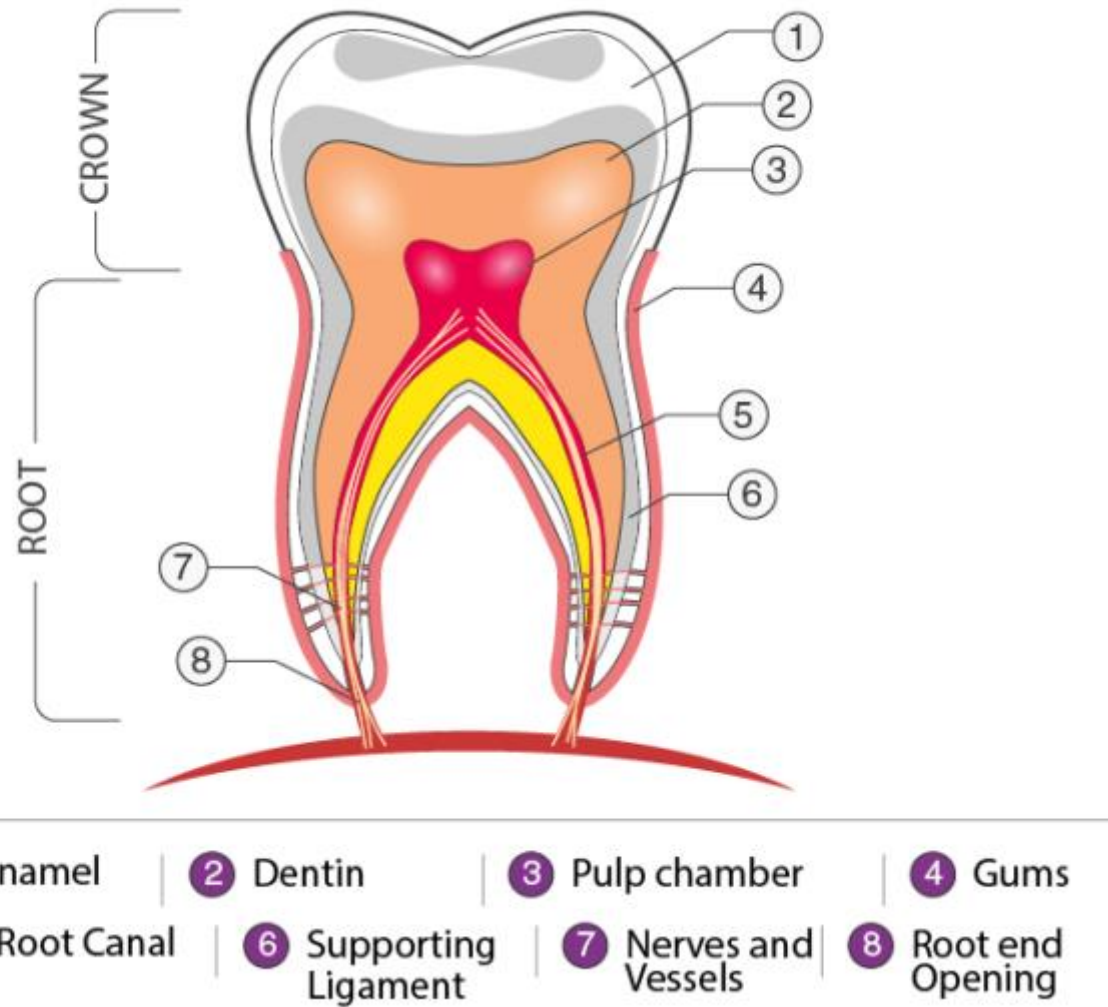
- Oesophagus, stomach, small intestine and large intestine are the parts of the alimentary canal.

Mouth

- It is the opening of the alimentary canal and helps in ingestion of food.
- The buccal cavity which is present behind the mouth is also commonly referred to as the mouth.
- The buccal cavity has teeth and tongue.
- The set of teeth helps in the mastication of food.
- The tongue has taste buds on it and thus helps in tasting the food.
- The salivary glands open also in the buccal cavity and pour saliva which initiates the process of digestion.

Teeth

- Teeth are the hard structures present in the buccal cavity.
- They help us to cut, shear and masticate the food we eat.
- Vertical section of a tooth shows four layers as enamel, dentine, cement and dental pulp.
- Enamel is outermost, shiny, highly mineralized and hardest part of the human body.
- Dentine makes the bulk of the tooth and contains 70% inorganic salts.
- Cement is present at the lining of a tooth and bony socket.
- The dental pulp is the central soft part of a tooth and contains nerve endings, blood and lymph vessels along with connective tissue.
- There are four types of teeth in humans, Incisors, canines, molars and premolars, each with a specific function.
- Incisors cut the food, canines tear the food while molars and premolars crush it.
- The dental formula in adult humans is 2:1:2:3.



Oesophagus & Stomach

Oesophagus

- The swallowed food passes into the oesophagus.
- It is a muscular tube, about 25 cm long, with a sphincter (valve/opening) at each end.

- Its function is to transport food and fluid, after being swallowed, from the mouth to the stomach.
- Food is pushed down by peristaltic movements.

Stomach

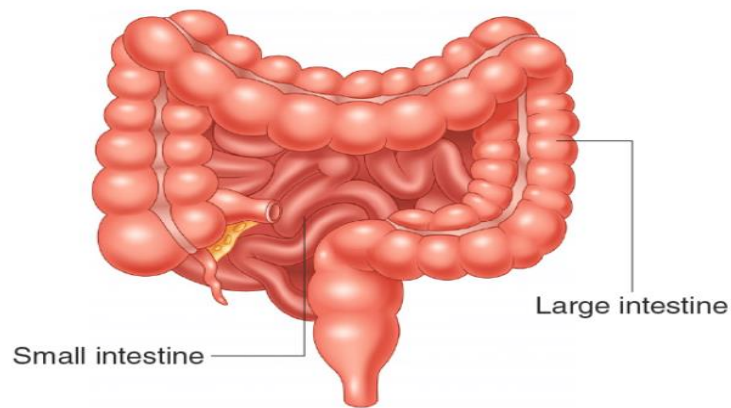
- The stomach is a thick-walled bag-like structure.
- Its receives food from the oesophagus at one end and opens into the small intestine at the other end.
- The inner lining of the stomach secretes mucous, hydrochloric acid and digestive juices.
- Food is churned into a semi-solid mass in the stomach and is called chyme.
- Enzymes present in the gastric juice break down the food.
- Hydrochloric acid helps in partial digestion of proteins and also kills harmful bacteria.
- Mucus secreted by the wall of the stomach resists the action of HCl on itself.

Small Intestine

- The small intestine is the longest part of the alimentary canal, about 20 feet long in humans.
- It has regions, duodenum, the region which follows stomach, jejunum is the middle part and ileum is the later region which continues further into the large intestine.
- The internal surface of the small intestine is folded into finger-like projections called villi.
- A common pancreatic duct from pancreas and liver opens into the duodenum.
- Most of the chemical digestion and absorption takes place in the small intestine.

Large Intestine

- The large intestine in humans is about 5 feet long.
- It has two regions, colon (about 1.5 m) and rectum (10 cm in length in the adult).
- The region of large intestine after ileum is called colon while the last part is called the rectum.
- Colon has three regions as, ascending colon, transverse colon and descending colon.
- At the base of the ascending colon, a small finger-like out-growth is seen and is called an appendix.
- It houses many useful bacteria required for digestion of food.
- Rectum opens to outside by anus.
- The anus has internal and external anal sphincters.



Peristalsis

A constant wave-like movement of the alimentary canal right from the oesophagus to the small intestine is called as peristalsis.

- Muscles present in the wall of the alimentary canal are responsible for peristalsis.
- This movement helps to push the food through the alimentary canal.

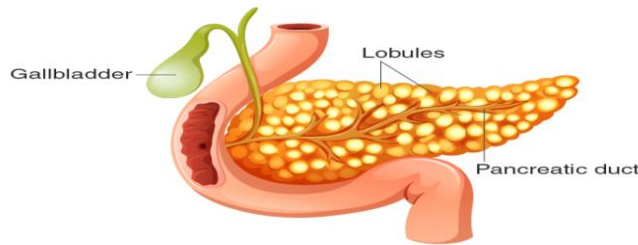
Digestive Glands

- Several glands produce digestive juices that help in digestion of the food.
- Salivary glands, Gastric glands, Liver, Gallbladder, Pancreas are few to name.
- Salivary glands secrete saliva which initiates digestion in the mouth itself.
- Gastric glands present in the wall of the stomach secrete hydrochloric acid and enzyme pepsin.
- The liver secretes bile which is stored in the gallbladder. Bile helps in digestion of fats.
- The pancreas secretes many digestive enzymes and its secretion is called as pancreatic juice.
- Enzymes like trypsin, chymotrypsin, lipase, amylase are present in the pancreatic juice.

Pancreas

- The pancreas is a long, flat gland present behind the stomach in humans.
- It is one of the major digestive glands and is of mixed nature i.e. endocrine as well as exocrine.

- As an endocrine organ, it secretes two hormones called insulin and glucagon which maintain the blood sugar level.
- As an exocrine gland, it secretes pancreatic juice which is nothing but a mixture of many digestive enzymes.
- The digestive enzymes secreted by the pancreas include trypsin and chymotrypsin and proteases which digest proteins.
- It also includes amylase which digests the starch content of the food.
- Pancreatic lipases are the pancreatic enzymes that help in digestion of fats.



Holozoic Nutrition

The mode of nutrition in which animals take their food as a whole is called as holozoic nutrition.

In holozoic nutrition, food passes through five steps as ingestion, digestion, absorption, assimilation and egestion.

Physiology of Digestion

- Mechanical digestion of food takes place in the buccal cavity where teeth masticate the food, saliva gets mixed and it turns into a bolus.
- Digestion of starch starts in the buccal cavity itself, with the action of salivary amylase present in the saliva.
- Salivary amylase converts starch into maltose.
- In the stomach, the churning of food takes place due to the muscular contraction and relaxation of its wall. It breaks down the food into simpler substances.
- Digestion of proteins starts in the stomach with the action of pepsin. Proteins are broken down into smaller fragments called peptide by the action of pepsin.
- The bolus after mixing with gastric juice, turn into a fine soluble form known as the chyme.
- Chyme enters into the small intestine where complete digestion takes place due to the action of various enzymes present in the pancreatic juice, bile and intestinal juice.
- The digested food is completely absorbed by the villi and microvilli of the small intestine.

- Undigested food then enters into the large intestine.
- The colon is responsible for absorption of water and salts whereas rectum stores the undigested food temporarily before defaecation.

Digestive System in Other Animals

- Digestive systems in different animals vary in structure and function.
- The structure of the digestive system depends on the food habits of the animal.
- Alimentary canal in herbivores is long as the cellulose content of their plant-based diet takes a long time to digest.
- On the other hand, the alimentary canal of carnivorous animals is comparatively shorter because meat gets digested faster.

Anatomy of Digestive Tract

- The alimentary canal in humans is approximately 30 feet (9m) long.
- It starts with the mouth and ends in the anus.
- Between these two openings, the alimentary canal is the tube of varying diameter.
- Oesophagus, stomach, small intestine (divided into three regions as duodenum, jejunum and ileum) and large intestine(having two regions as colon and rectum) are the parts of the alimentary canal.
- Salivary glands, pancreas and liver act as major digestive glands.
- Glands present in the wall of the stomach and small intestine also contribute towards digestion of food.

Role of HCl

- Hydrochloric acid in the stomach is secreted by the gastric glands present in its wall.
- pH of the gastric acid is usually between 1.5 to 3.5
- This acid serves the following functions:
 1. Converts inactive pepsinogen and pro-rennin into active pepsin and rennin respectively.
 2. Provides acidic medium for protein digestion.
 3. Kills bacteria entered through food and prevents infection.
 4. Prevents putrefaction of food in the stomach.
- A thick layer of mucus secreted by the mucous glands of the stomach prevent itself from the action of the gastric acid.
- Excess acid damages gastric mucosa and causes gastric and duodenal ulcers.

Salivary Glands

- Salivary glands are the exocrine glands that secrete saliva and through a system of ducts, it is poured into the mouth.
- In humans, three major pairs of salivary glands are present, parotid, submandibular and sublingual.
- In healthy individuals between 0.5 to 1.5 litres of saliva is produced per day.
- Saliva serves the following functions in the oral cavity.
 1. It lubricates and protects the soft and hard tissues of the oral cavity
 2. It also gives protection from dental caries
 3. Saliva prevents microbial growth in the oral cavity.
 4. Saliva can encourage soft tissue repair by decreasing clotting time and increasing wound contraction
 5. Saliva contains the enzyme amylase that hydrolyses starch into maltose and dextrin. Hence saliva allows digestion to occur before the food reaches the stomach
 6. Saliva acts as a solvent in which solid particles can dissolve in and enter the taste buds located on the tongue.

Heterotrophic Nutrition

When an organism depends on others for food, such a mode of nutrition is called as a heterotrophic mode of nutrition.

- These organisms depend on autotrophs for their nutritional requirements.
- E.g. Animals which eat plants as their food are called herbivores.
- Animals which eat other animals as their food are called carnivores.
- Holozoic, saprophytic and parasitic nutrition are all types of heterotrophic nutrition.

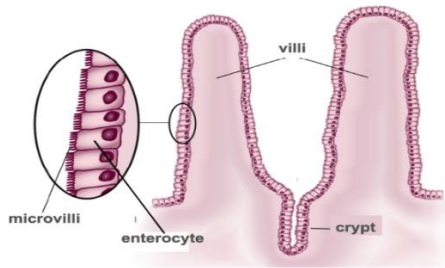
Glandular Epithelium

- Many small glands present in the inner layer of the stomach and intestine take part in the digestion of food.
- These glands are present in the epithelial lining of the stomach and intestine.
- The glands present in different regions of the stomach are called gastric glands.
- They are responsible for the secretion of mucus, hydrochloric acid and enzymes like pepsinogen.
- The glands present in the epithelial lining of the small intestine and large intestine are called intestinal glands.

- Glands of the small intestine are responsible for the secretion of intestinal juice also called succus entericus.
- Intestinal juice contains hormones, digestive enzymes, alkaline mucus, substances to neutralize hydrochloric acid coming from the stomach.
- Intestinal juice completes the digestion started by the pancreatic juice.
- Glands of the large intestine are associated with absorption of water and electrolytes.

Villi and Micro Villi

- Complete digestion and absorption of food take place in the small intestine.
- Pancreatic juice coming from the pancreas, bile from the liver and intestinal juice secreted by the intestinal glands complete the digestion of food material.
- All the digested nutrients are absorbed by the long finger-like projections present in the ileum of the small intestine.
- These small finger-like projections of the inner wall of intestine are called as villi (singular: villus).
- Each villus has its cell membrane of the lumen side again folded into microscopic processes, called microvilli.
- Villi increase the internal surface area of the intestinal walls making available a greater surface area for absorption.
- Digested nutrients pass into the semipermeable villi through diffusion.
- Villi also help in chemical digestion of food by secreting digestive enzymes.



Liver

- The liver is the largest and major digestive gland of humans
- Liver, in humans, is located in the upper right-hand portion of the abdomen.
- This organ is dark reddish-brown in colour due to an extensive blood supply.
- Some of the important functions of the liver are as follows:
 1. It secretes bile that helps in digestion.
 2. It filters the blood coming from the digestive tract before passing it to the rest of the body.

3. It detoxifies various metabolites and drugs
4. The liver makes proteins important for blood clotting and other functions.
5. It stores and releases glucose as needed.
6. It processes haemoglobin, from the dead and worn out RBCs, for the iron content (the liver stores iron).
7. Conversion of harmful ammonia to urea takes place in the liver.

Digestive Juices

- Pancreatic juice, bile and intestinal juice (succus entericus) are collectively called as digestive juices.
- A common duct from digestive glands pours the secretions into the duodenum.
- Chyme enters into the small intestine where complete digestion takes place due to the action of various enzymes.
- In the duodenum, the acidity of chyme is turned to alkalinity by the action of bile coming from the liver. This is necessary for pancreatic enzyme action.
- Bile also emulsifies the fats into smaller globules.
- Pancreatic and intestinal amylases break down the carbohydrates into glucose.
- Trypsin and chymotrypsin are the proteases responsible for the breakdown of proteins finally into amino acids.
- Lipase is the enzyme which acts on the emulsified fats and breaks them down into glycerol and fatty acids.

Water Absorption in Large Intestine

- The large intestine is not involved in the digestion of food or absorption of nutrients.
- The major function of the large intestine is to absorb water from the remaining indigestible food matter and make the stool solid.
- The large intestine also helps in absorption of vitamins made by bacteria that normally live in the large intestine.
- The innermost layer of the large intestine also acts as a barrier and protects from microbial infections and invasions.
- Rectum stores the undigested food temporarily until defaecation.

UNIT 6. LIFE PROCESSES

- 1 Why are the digestive enzymes called as hydrolases?
- 2 Bile juice does not contain any digestive enzymes, yet it is essential for digestion. Why so?
- 3 Two green plants are kept separately in oxygen free containers, one in the dark and the other in the continuous light. Which one will live longer? Give reason.
- 4 How are leaves adapted for photosynthesis?

5 Give reasons for the following:

a) Stomata of the desert plants remain closed during daytime.

b) A piece of bread taste sweet when chewed for some time.

c) Pancreas acts both as endocrine and exocrine gland.

6 What are the factors that affect the rate of photosynthesis?

7 What will happen to the rate of photosynthesis in the following situations:

a) On a cloudy day

b) When there is no rainfall for a long time in the area

c) Good manuring in the area

d) Stomata get covered due to dust