CHAPTER 2

Digestive System

PERFORMANCE OBJECTIVES

At the end of this chapter, students should be able to:

â describe with appropriate illustrations different types of alimentary tracts in different animals.

â explain feeding mechanism in animals such as housefly, cockroach, tapeworm, sheet and butterfly and man.

â explain how some insectivorous plants feed.

INTRODUCTION

The alimentary tract may also be called alimentary canal. It includes the mouth, pharynx, oesophagus, stomach, small intestine, large intestine and anus. Some structures associated with the alimentary tract (of humans in particular) include pancreas and appendix. The main function of the alimentary tract digestion of food the animals consume. Digestion refers to the physical and chemical breakdown of solid food materials taken by the animals so that it can be absorbed by the cells of the organism and used to maintain vital body functions.

TABLE 2.1 Parts of the Alimentary canals of animals

	PARTS OF THE ALIMENTARY CANAL								
ANIMAL	MOUTH	PHARYNX	GULLET	CROP	STOMACH	INTESTINE	CAECUM	RECTUM	ANUS
Planaria	✓	✓				✓	✓		
Earthworm	✓	✓	✓	✓		✓	✓	✓	✓
Cockroach	✓	✓	✓	✓		✓	✓	✓	✓
Dogfish	✓	✓	✓		✓	✓		✓	✓
Frog	✓	✓	✓	✓		✓		✓	✓
Lizard	✓	✓	✓		✓	✓	✓	✓	✓
Bird	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rabbit	✓	✓	✓		✓	✓	✓	✓	✓
Cow	✓	✓	✓		✓	✓	✓	✓	✓
Human	✓	✓	✓		✓	✓	✓	✓	✓

Note: ✓ – indicates the parts of the alimentary canal each animal possesses. Only mammals have large intestine

As a collection of organs is associated with digestion of food, the structure is distinctly dif- ferent from one animal to another but follows a generalised plan. This plan includes the following:

(i) PRESENCE OF ONE OR MORE OPENINGS FOR INGESTION AND EGESTION OF FOOD

The mouth (buccal cavity) is usually situated anteriorly for ingestion of food. Digestive residue (also known as faeces are eliminated through the anus or

cloaca. In unicellular organisms, such as amoeba, no visible food-gathering opening is present. Food enters the organism by the pro- cess of engulfment. This is a process by which the cytoplasm flows out and encircles the food particles forming a food vacuole. The extended cytoplasm then forms a pseudopodium and the principle is described as phagocytosis.

Digestion occurs in the food vacuoles while absorption occurs by means of diffusion. The paramecium, for example, has an opening – the ciliated oral groove connecting its outside to the inside. This ensures that food particles are carried along with water current into the cytoplasm through the ciliated cytopharynx. The cytopharynx by their beating directs the food particles into the cytoplasm where food vacuoles are formed around them, digested and absorbed. Digestive waste is egested through the cytoproct (anal pore).

In some multicellular animals, such as sponges, more than one opening is present. The mouth is known as the hypostome and all other openings empty in the body cavity called enteron. There is no specified opening for the elimination of digestive waste. Digestive wastes are discharged into the water medium through all the openings. In the hydra, the hypostome is surrounded by a row of tentacles. The tentacles capture food particles (tiny organisms) suspended in the water current flowing past the hydra with the aid of its sting cells and directs same into its body cavity – enteron.

(ii) ALIMENTARY CANAL IS TUBULAR, MUSCULAR AND GLANDULAR

Generalised plan of the alimentary system shows that it is a tubular structure that allows for the passage of food. The passage of food through the tube is enhanced by a wave-like muscu- lar contraction of the muscles lining the tube. This muscular contraction produces a wave- like movement which causes the food to move down the tube. This movement is called peristal- sis. The walls of the alimentary tract consist of secretory cells (glands) which produce digestive mucus-like juices. The juices lubricate the food tract, reduce friction, contain digestive enzymes, and cause digestion to occur in different parts of the tube.

(iii) PRESENCE OF STORAGE ORGANS

The alimentary system must have a structure for temporary storage of ingested food before proper digestion, as well as for storage of digestive resi- due before egestion. The crop in animals, such as earthworms, insects, birds, and stomach in vertebrate animals, e.g., man, satisfy this func- tion. Faeces is stored in the rectum of animals before egestion takes place.

(iv) PRESENCE OF A MUSCULAR (END) SAC

This occurs in sponges and coelenterates. Muscular stomach and gizzard are present in higher animals such as mammals and birds; insects and earthworms, respectively.

(v) ABSORPTIVE SURFACES

For the alimentary system to function effec- tively and efficiently it must have efficient and increased absorptive surfaces to enhance the absorption of digested nutrients. This is achieved through repeated coiling of the tube or by development of outgrowths on the lin- ings of the intestinal walls. Such outgrowths are described as villi in mammalian intestines. Mammals, birds and insects have, in addition, developed extended tubular extension (end tubes) called caeca for increased absorptive ability.

(vi) DENSE VASCULARITY

The alimentary system is generally densely vascularised in all animals. This also enhances increased absorption of digested nutrients.

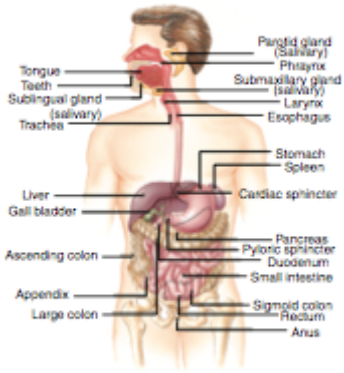
MODIFICATION OF PARTS OF THE ALIMENTARY CANAL

A typical mammalian alimentary canal con- sists of the following parts, namely, mouth, pharynx, oesophagus, stomach, small intes- tine, caecum, appendix, large intestine, rectum and anus. All these parts can be found in most vertebrates. However, there are modifications of the parts of the alimentary canal in various animals. In some animals, a structure may be educed or enlarged, whereas in others, some parts may be absent. The modifications reflect the various modes of feeding and types of diet. See Table 2.1 for parts of the alimentary canals in various animals.

MOUTH

From Table 2.1, it is evident that in most mul- ticellular animals, food is usually ingested through the mouth. In all mammals, the food is chewed (masticated or broken down into tiny bits) with the teeth in the mouth. It is mixed with saliva from the salivary glands, before it is swallowed. Other vertebrates swallow their foods whole and have no salivary glands or saliva and do not masticate their food in the mouth. This includes Planaria, earthworm, dogfish, frog, lizard and bird. The other animals have salivary glands and masticate their foods in the mouth.

The mouth is the first part of the alimentary canal. In mammals, for example, the mouth consists of two movable lips, tongue, teeth, a buccal cavity and salivary glands. In the human mouth, food is chewed with the teeth and mixed with saliva from the salivary glands. Any starch in the food is converted to maltose by the enzyme ptyalin present in saliva (Figure 2.1).



▲ FIGURE 2.1 Human alimentary canal

PHARYNX

It is next to the mouth. In some animals, such as the earthworm and planaria, it is muscular. In man, it is short and wide. Pharynx leads into the trachea and the oesophagus. It is used for passing food materials into the oesophagus or gullet.

OESOPHAGUS

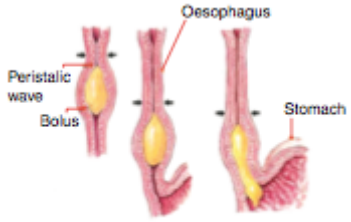
This is a narrow, straight long tube passing through the thoracic region and the diaphragm into the stomach. Digestion does not take place here. But it is used for passing food substances into the stomach by a wave-like muscular con- traction called peristalsis. This type of movement occurs throughout the human alimentary canal.

In some animals, the lower part of the oesophagus may be modified to form the crop as in insects and birds. These are storage organs for the food consumed.

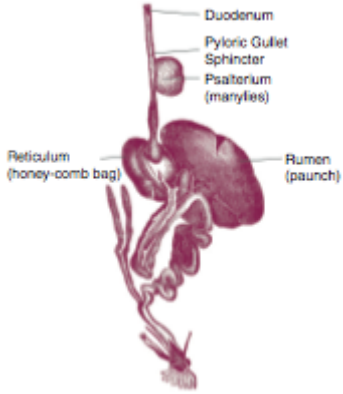
STOMACH

The stomach is primarily a storage organ. But in most mammals, it is very muscular and digestion continues in it. In birds, insects (e.g., cockroach and grasshopper), earthworm, the stomach is modified into a grinding organ called gizzard. The gizzard is normally muscular with small, sharp stones, which masticate the food before it is further digested in the intestine. Gizzard is possessed by some vertebrates (e.g., birds) and some invertebrates (e.g., insects and earthworms), which lack teeth in their mouth.

In ruminants, such as goat, cow and sheep, the stomach is modified into four compartments,



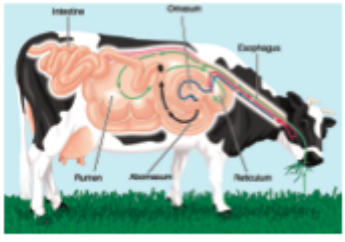
▲ FIGURE 2.2 Peristaltic movement



▲ FIGURE 2.3 Alimentary canal of a bird

namely, rumen, reticulum, psalterium and aboma- sum (Figure 2.4).

In the human stomach, the walls secrete gas- tric juice. This contains hydrochloric acid, which prevents the food in the stomach from decay, and two enzymes – rennin and pepsin. Rennin curdles milk, whereas pepsin converts proteins in the food into peptones. Food may remain in the stomach for 3–4 hours at the end of which it is converted into a semi-liquid paste called chyme. Note that food is regulated into the stomach from the gullet by a muscle called cardiac sphincter, whereas chyme is regulated into the small intes- tine by another muscle called pyloric sphincter.



▲ FIGURE 2.4 Stomach of a ruminant

INTESTINE

In mammals, the intestine is divided into two major parts: the small intestine and the large intestine (colon). In all vertebrates, the small intestine is divided into three: the first part – the duodenum, the second part – the ileum and the third part – the jejunum. In herbivorous mammals (e.g., cow and rabbit), the ileum is much longer than in carnivores and omnivores.

SMALL INTESTINE

In adult humans, the small intestine is about 7 metres long, in cows 40

metres long and a metre long in rabbits. Generally, the small intestine is the longest part of the alimentary canal and is a narrow, coiled tube. The first part of the small intestine (duodenum), which is about 25 cm long, is wider than the remaining part of the small intestine. In humans, the pancreatic duct and bile duct open into the duodenum through a common duct (Figure 2.1). Pancreatic juice (from the pancreas), which contains three enzymes (amylase, trypsin and lipase) passes through the pancreatic duct into the duodenum. Bile passes through the bile duct into the duodenum. Bile (a greenish- yellow juice) has no enzymes but emulsifies fats and oils. Amylase converts carbohydrates into maltose. Trypsin converts proteins into peptones, whereas lipase converts lipids into fatty acids and glycerol. Numerous enzymes in the ileum complete the digestion of food; such that, carbohydrates are finally converted into glucose, proteins into amino acids and lipids into fatty acids and glycerol. Absorption of food also occurs in the ileum.

LARGE INTESTINE

In mammals, the large intestine, which is wider than the small intestine, is connected to the end of the ileum at the caecum, near which lies a finger-like structure – the appendix. The caecum and colon are longer in herbivorous mammals (e.g., rabbit) than in carnivores and omnivores. Bacteria, which live in the caecum and colon of herbivorous mammals, convert cellulose to sim- ple sugar. These are absorbed through the walls of their colon and caecum.

In man, the appendix and caecum have no known functions. However, the appendix may cause a disease called appendicitis (an inflam- mation of the appendix).

COLON

The colon in man is divided into the ascending colon, transverse colon and descending colon. The walls of the colon absorb water from the undigested and indigestible food materials. The semi solid wastes left are called faeces.

RECTUM

The rectum, which is muscular, is the last organ of the alimentary canal connected to the end of the descending colon. Faeces are stored tempo- rarily in it before they are eliminated through the anus at intervals.

The cockroach is an omnivore, though it prefers starchy and sugary foods. The man- dibles in its mouth are used to chew the food, which is mixed with saliva from the salivary glands. An enzyme in the saliva called amylase converts starch in its food to maltose. By peri- stalsis, the food is pushed through the buccal cavity by the maxillae and labium into the crop. Most of the digestion takes place in the crop with the aid of enzymes. The cockroach has no stomach.

Its gizzard (proventriculus) contains sharp teeth-like structures, which further break down the food particles, and setae, which pre- vent large food particles from moving forward into the mesenteron. The cells of the mesen- teron secrete three kinds of enzymes, which complete the digestion of lipids, protein and carbohydrates.

The digested products are absorbed by the cells of the mesenteron and the digestive caeca. Water is absorbed in the rectal glands around the rectum. As a result, insect faeces are almost always dry thus conserving water. The rectum stores faeces temporarily while water is being absorbed. Faeces are eliminated through the anus.

FEEDING HABITS

Various modifications found among the alimen- tary system of some animals so far considered suggest that the parts are modified according to the type of food they eat. It has also been found that there is a close relationship between the feeding mechanism and the diet of each organism.

Animals may be categorised as carnivores, herbivores and omnivores.

CARNIVOROUS ANIMALS: These are animals that feed on flesh or bones and on other ani- mals. Examples include fishes that eat aquatic insects and other fishes, toads and reptiles (snakes, lizards, wall geckos), cats, dogs and lions. Mammalian carnivores are characterised by well-developed dentition, large canines and a pair of carnassials teeth. These are adapted for stabbing their preys, cutting and crushing meat and bones.

HERBIVOROUS ANIMALS: These are plant-eat- ing animals. Examples are grasshopper, goat and cow. They all feed on low vegetation such as grass. Giraffes and elephants feed on taller plants. Herbivores, such as rabbits and guinea pigs, use very sharp incisors to cut shoots, roots and bark. Others, such as cows, goats and antelopes, pull up grass using the lower front teeth and a pad on the front of the upper jaw. Some herbivores such as elephant use a spe- cialised organ (the trunk) to pull leaves, bark and branches off trees.

OMNIVORES ANIMALS: These are animals that feed on both plants and animals. Examples include man, wild boar, bush or domestic pig and the domestic fowl.

SCAVENGERS: These are animals that feed on the remains of dead animals, e.g., vultures and crow.

MODIFICATION OF TYPES OF FEEDING HABIT

Plants and animals feed on various food substances. Hence, they exhibit different types of feeding habits. Within a particular class of organisms, there may be modification in the mechanisms used. Hence, we have filter-feeding

and fluid- feeding adaptations in animals and saprophytic and parasitic feeding in animals and plants.

FILTER FEEDING

Some aquatic animals feed on tiny or micro- scopic organisms (planktons) in their habitat. A great number of them are gathered, filtered and consumed at the same time, from the surface of the water. Examples of filter feeders include water fleas (Daphnia); mosquito larvae; fishes, such as herring; and molluscs, such as oys- ters and mussels. Water containing suspended plankton enters the mouth of the animal, e.g., herring. Water passes between the gill rak- ers to the gills. Microscopic animals, which are retained in the pharynx, are then passed into the gullet, from where they go to other parts of the gut. Oysters and clams draw water into their shells and trap food particles on the mucus cov- ering their gills. The cilia on the gills beat and move mucus-containing food particles towards the mouth.

FLUID FEEDING

Some animals can only feed on soluble or fluid food materials from body fluids of other animals or plants or convert solid food into a liquid form before ingesting it.

Examples of fluid feeders are bees, wasps, aphids, housefly, mosquito, tsetse fly and butterfly.

(i) The housefly has a proboscis, which is flattened at its anterior end. This consists of numerous food channels (pseudotra- cheae). Whenever the fly is prepared to feed, it extends its proboscis and saliva is passed down the salivary duct through the pseudotracheae on to the food. The saliva contains enzymes, which begin to digest the food. The partially digested food, now a semiliquid, is pumped up through the pseudotracheae and gullet into the stomach by the contraction of muscles in the upper part of the proboscis. The semifluid food is normally regurgitated and vomited on any surface where the fly stands. Digestion is then completed intracellularly in the intes- tine using its proboscis.

(ii) The adult female mosquito feeds on blood. It has mouth parts, which are modified into a tube, like a hypodermic needle. It pierces the skin of a mammal with its four stylets (formed from two mandibles and two maxillae). When it reaches a blood capillary, saliva containing an anti- coagulant is passed down the hypopharynx into the capillary. This prevents the blood from coagulating when it is sucked up by the tubular labrum.

(iii) Many insects bite or chew their food. Examples are the ants, beetles, cockroach, locust, caterpillar, termites and weevils. Most of them are pests of crops. They eat crops on farms, as well as those stored in the homes. They have strong and sharp- edged maxillae. These are used to cut or bite the food

materials. The food materials are then chewed between the hard-ridged surfaces of the mandibles before they are ingested.

SAPROPHYTIC FEEDERS

Saprophytes are organisms that obtain their food materials from dead or decaying food materi- als. They are non-green and therefore carry out saprophytic feeding. Examples of saprophytes (saprophytic feeders) are many fungi, e.g., mush- room, Mucor or Rhizopus, Penicillium and yeast as well as some bacteria. Their rhizoids penetrate into the dead organic matter or substrate. These secrete enzymes into the substrate. Digestion occurs extracellularly (outside the rhizoids) on food. The digested food (soluble end products) diffuses into the rhizoids and from there to the other parts of the plant.

PARASITIC FEEDERS

Parasites are plants and animals that live and feed on or in other organisms and harm the hosts. Parasites, which live on the body surface of their hosts, are called ectoparasites, e.g., tick, mites, lice and fleas. These live on the skin or hairs of animals. Others that live and feed inside their hosts are called the endoparasites, e.g., tapeworm and roundworm. This mode of feeding is carried out by parasites.

Some parasitic plants may be called semi- parasites, e.g., mistletoe, or total parasites, e.g., dodder (Cuscuta). The parasites usually develop haustoria, which are special structures used for absorbing nutrients from the xylem and phloem tissues of the host. Tapeworm is an example of animal parasite. It is found in the small intestine of man. It has no digestive system. It is attached to its host by suckers. The digested food materials of the host diffuse into the body surface freely.

The body surface is protected against digestive enzymes by a special secretion.

FEEDING IN PROTOZOA

Amoeba proteus is an example of protozoans. It feeds on microscopic organisms. These are mainly phytoplankton, desmids and diatoms, flagellates, bacteria and decayed parts of plants in water. The presence of a food material stimu- lates the formation of pseudopodia towards the object.

Soon, the pseudopodia encircle the food materials. This is taken into the body with a drop of water and a food vacuole is formed. The cyto- plasm secretes digestive enzymes on to the food and digestion occurs. Later, the digested food materials diffuse into the plasmasol. The indi- gestible parts are left behind or allowed to pass out through the plasmagel. Ingestion and eges- tion can occur at any point of the body surface.

FEEDING IN HYDRA

Hydra is a multicellular, aquatic animal. It feeds mainly on tiny crustaceans, e.g., water fleas. The food is usually caught by the tentacles with the aid of nematocysts, which immobilise the prey. The tentacles draw the prey into the mouth and then into the enteron (digestion cavity).

The digestive enzymes in the enteron digest the food extracellularly. The absorptive cells ingest the partially digested food materials and complete digestion intracellularly. The soluble materials diffuse to various parts of the animal. The waste products are egested through the mouth because there is only one opening in the animal.

HOW SOME INSECTIVOROUS PLANTS FEED

There are some plants that feed on some ani- mals. They are called carnivorous plants or insectivorous plants. They are usually found in habitats such as thin soils, rock outpourings, fens and acid bogs – usually soils that are low in nutri- ents, especially nitrogen.

Carnivorous plants are characterised by hav- ing ability to attract, kill and digest their preys. They also benefit from absorbing the products of digestion that are mostly amino acids and

ammonium ions while most plants absorb nutri- ents from soil with their roots. Carnivorous plants absorb nitrogen from their animal preys through their leaves. These leaves are usually colourful, peculiarly shaped with different modifications. Most of them are specially modified as traps for their preys. (The traps may be pitfall, snap, fly paper, bladder, suction and lobster-pot traps.)

The preys of carnivorous plants are mostly insects and hence the name insectivorous plants. However, other preys include various invertebrates (protozoans and arthropods). The leaf traps work in different ways. They are as follows:

(i) Pitfall traps: Examples include pitcher plants. These have leaves that are folded into deep, slippery pools filled with bacteria or digestive enzymes.

(ii) Flypaper or sticky or adhesive traps:

Examples are butterwort and sundew. These plants have active leaves that are covered with stalked glands that exude sticky mucilage. The leaves undergo rapid acid growth that allows the tentacles to bend. This aids the retention and digestion of prey.

(iii) Snap or steel traps: Examples include Venus flytrap and waterwheel plants. These plants have leaves that snap shut using rapid leaf movement to close quickly whenever trigger hairs on the leaves are touched, especially by insects.

(iv) Suction traps: This is peculiar to bladder- worts. The plants have highly modified leaves in the shape of bladder with hinged door lines with trigger hairs. They suck in prey with a bladder that generates an internal vacuum.

(v) Lobster-pot traps: Corkscrew plants are examples of carnivorous plants that use this mechanism. Their leaves have twisted tubular channels that are lined with hairs and gland.

HOW SOME INSECTIVOROUS PLANTS FEED

Different insects have mouthparts that are modi- fied for different kinds of feeding. Insects are voracious feeders. They feed on diverse food items. Their

mouthparts are modified to feed on different types of food. [Some insects bite and chew their food, e.g., cockroach, grasshoppers. Others feed on fluids, e.g., adult female anoph- eles mosquitoes (on human blood), moth and butterfly (on nectar or flower juices).]

1. (i) Those that bite and chew their food include grasshoppers, cockroaches, dragonflies and beetles. Larvae of moths and butterfly have chewing mouthparts as well.

2. (ii) Insects that pierce and suck internal fluids include aphids, leaf hoppers, bugs and female anopheles mosquitoes (feed on human blood) and others feed on plant fluids.

3. (iii) Sponging insects include housefly.

4. (iv) The siphoning type includes moth and

   butterfly.

CHEWING INSECTS

They usually have two well-developed man- dibles. These are found on each side of the head in-between the labrum and maxillae. The mandibles are used for holding, biting, cutting, crushing and chewing (i.e., masticating) their food items. For plant eaters (such as grass- hoppers), they are usually quite wide and flat on their opposing faces. In soldier ants they are used for defence. Examples include grasshop- pers and cockroach.

1. (i) Maxilla: These are paired structures found beneath the mandibles. They often have hairs and also palps, which are used to sense the characteristics of their poten- tial food items. They are used primarily to manipulate food during mastication.

2. (ii) Labium: It assists manipulation of food during mastication. It is like the floor of the mouth. It is a quadrupedal structure formed from two fused secondary maxillae.

(iii) Hypopharynx: It assists swallowing, and it arises from the base of the labium.

SIPHONING INSECTS

Mandibulate moths have well-developed man- dibles as adults. The rest of the mouthparts form the proboscis. The proboscis is usually coiled (when it is not in use) under the head. It is a long feeding tube that is formed by heavily modified maxillae (the galea). During feeding, it is uncoiled and extended to reach the nectar of flowers. Examples include moths and butterflies.

SPONGING INSECTS

They typically have labium. It has at its end sponge-like labellum, tightly reduced paired mandibles and maxillae that do not function. The labium forms a proboscis, which is used to direct food to the oesophagus, e.g., housefly.

The housefly feeds by pouring out saliva on the food item. The saliva softens and dis- solves the food. The solution, thus, made is then drawn up into the mouth as a liquid. The labellum forms a tube that leads to the oesoph- agus. This tube consists of tiny food channels that draw in by capillary action the dissolved food materials.

PIERCING AND SUCKING INSECTS

This group of insects can be classified into her- bivorous (e.g., aphids) and insectivorous (e.g., female anopheles mosquito). They have their mandibles and maxillae modified into proboscis, which is sheathed into a modified labium. The labium (proboscis) is capable of piercing tissues and sucking out the liquids.

In female mosquitoes, all mouthparts are elongated. The labrum forms the main feeding tube through which blood is sucked. Paired man- dibles and maxillae are present together forming the stylet. The stylet is used to pierce an animalâ€™s skin. The labium (structure that encloses other mouthparts like a shield) remains outside the victimâ€™s skin folding away from the stylet. Saliva, which contains anticoagulants, is injected into the victim and blood is sucked out through dif- ferent tubes.

CHAPTER SUMMARY

â– Alimentary canal is found in most animals.

â– It varies in complexity from animal to animal.

â– The alimentary canal is modified according to the diet of the animal concerned.

â– Plants have no definite alimentary canal, but they digest food with the aid of enzymes.

â– Animals can be categorized (according to the food they eat) into herbivores, carni- vores and omnivores.

â– There are different types of feeding mechanisms (e.g. filter feeding, fluid feeding and chewing method).

â– The mouth parts of animals have various modifications to assist in their type of feeding.

â– Saprophytic feeding is feeding carried out by non-green organisms e.g.

fungi. They feed on dead or decaying organic matter.

â– Parasitic feeding is carried out by some plants and animals. They live and feed either in or on other organisms and in the process harm their hosts. They are modified for this purpose.

â– Protozoa and hydra are holozoic. They feed on tiny aquatic organisms.

REVISION QUESTIONS

ESSAY QUESTIONS

Choose the correct options to the following questions.

1. Pick the incorrect statement in this list.

a. Insectivorous plants are found in soils that are deficient in nitrogenous compounds and salts.

b. Insectivorous plants include sundew, pitcher plant, butterwort, Venus flytrap and bladderwort.

c. Insectivorous plant feed on arthropods especially insects.

d. Insectivorous plants absorb nitrogen compounds and salts with their roots.

2. Which of the following statements is false?

a. The crop is a modified part of the birdâ€™s gut.

b. The appendix in a manâ€™s gut performs a very important digestive function.

c. Ruminants have four compartments making up their stomach.

d. Digestion of food starts in the mouth and ends in the ileum in most mammals.

e. The small intestine is the longest part of the mammalian alimentary canal.

3. Which of the following statements is false?

a. Filter feeders sift phytoplankton from aquatic environment

b. Fluid feeders may feed on blood or plant juices.

c. All fluid feeders have mouth parts developed into long, narrow tubes for drawing in fluids.

d. Saprophytes feed on decaying or dead food materials.

e. Parasites feed on living things.

4. Which of the following statements is false?

a. Amoeba feeds on plankton with its pseudopodia.

b. Undigested food materials are released through any part of the protoplasm of Amoeba.

c. *Hydra* captures its prey with its tentacles.

d. Food is digested extracellularly only in Hydra

e. Enzymes help to digest food in all living animals

5. Identify the false statement in this list.

a. In Amoeba, food enters through engulfment.
b. Peristalsis causes food to move down the alimentary canal.
c. Stomach is absent in lizards, birds and rabbit.
d. Crop serves as temporary storage of digestive residue in earthworm, cockroach and bird

ESSAY QUESTION

1. (a) Draw and label fully the human alimentary canal.
(b) Discuss the fate of a piece of bread or yam from a personâ€™s mouth, down the alimentary canal.

2. Write short notes on the following feeding habits:

(a) Filter feeding
(b) Fluid feeding
(c) Saprophytic feeding

(d) Parasitic feeding

3. Give reasons for the modification in the digestive system of (a) dog and (b) man.

4. Discuss briefly how the alimentary canals of the following animals are modified for their different diets:

(a) Cockroach or grasshopper (diagram is not required)

(b) Bird (diagram is required)

(c) A named ruminant (diagram is required)

5. (a) Draw and label the mouth parts of

(i) butterfly and (ii) cockroach.

(b) Describe how each part performs its functions in feeding in the named insects