

Organ Systems in Animals

Learning Objectives



At the end of the chapter the student will

- Define the terms Digestion, Excretion and Reproduction
- Understand the various parts of the alimentary canal and the process of digestion
- Understand the role of enzymes in the process of digestion
- Identify the products of excretion and learn the related organs involved in the process of excretion
- Understand the role of skin in excretion
- Understand the parts and functions of excretory system
- Learn the mechanism of urine formation in man
- Learn the organs and functions of male and female human reproductive system

Introduction

Living organisms are evolved from the simplest form to complex level of organization such as unicellular and multicellular, tissue level, organ level and organ systems level of organization. Cells are the basic fundamental units of an organism. These are grouped to form tissues, the tissues into organs and the organs form the organ systems forming an entire organism. The different organs and organ systems of an organism function by depending on one another with harmonious coordination. When we ride a bicycle,

our muscular system and skeletal system work together to move our arms for steering and legs for pedalling. Our nervous system directs our arms and legs to work. Simultaneously, respiratory, digestive and circulatory systems work to provide energy to the muscles. All the systems work together in coordination to maintain the body in a homeostatic condition of an organism.

8.1 Organ Systems in Animals

Organ and organ systems have appeared first in the Phylum platyhelminthes and

continues till mammals. Similar groups of cells form tissues like muscle tissue, nervous tissue, etc. Tissues are organised to form organs like heart, brain, etc. Two or more organs together form organ systems and perform common

functions like digestion, circulation, nerve impulse transmission in co-ordination via digestive system, circulatory system, nervous system respectively. Division of labour is found among the various organ systems (Table 1).

Table 8.1: Organ Systems in Animals

Organ Systems	Organs	Function
Integumentary system	Skin and skin glands	Protection, Excretion, etc.
Skeletal system	Skull, Vertebral column, Sternum, Girdles and Limbs	Give support, shape and form to the body.
Muscular system	Muscle fibres	Contraction and relaxation resulting movement.
Nervous system	Brain, spinal cord and nerves.	Conduction of nerve impulse.
Circulatory system	Heart, blood and blood vessels	Transportation of respiratory gases, nutritive substances and waste products.
Respiratory system	Respiratory tract and Lungs	Breathing
Digestive system	Digestive tract and digestive glands	Digestion, Absorption, Egestion
Excretory system	Kidneys, ureters, urinary bladder and urethra.	Elimination of nitrogenous waste products.
Reproductive system	Testes and ovary	Gametes formation and development of secondary sexual characters.
Sensory system	Eyes, nose, ears, tongue and skin	Sight, smell, hearing, taste and touch.
Endocrine system	Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Pineal body, Thymus, Reproductive glands, etc.	Co-ordinates the functions of all organ systems.

In this chapter we shall learn about the structure and functions of various organ systems like digestive system, excretory system and reproductive system in human beings.

8.2 Human Digestive System

The food we eat not only contain simple substances like vitamins and minerals but

also contain complex substances such as carbohydrates, proteins and fats. The body cannot use these complex substances unless they are converted into simple substances. The five stages of nutrition process include ingestion, digestion, absorption, assimilation and egestion.

The process of nutrition begins with intake of food, called **ingestion**. The breakdown of

large complex insoluble food molecules into small, simpler soluble and diffusible particles by the action of digestive enzymes is called **digestion**. Parts of the body concerned with the digestion of food form the **digestive system**.

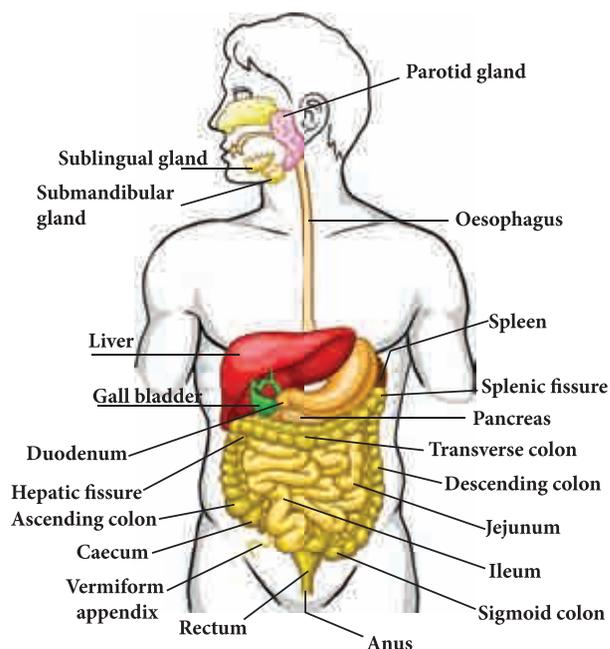


Figure 8.1 Parts of human digestive system

8.2.1 Organs of digestive system

The digestive system consists of two sets of organs. They are as follows;

Alimentary canal (digestive tract/gastro-intestinal tract) It is the passage of food starting from the mouth and ends with the anus.

The glands associated with the digestive system are the salivary glands, gastric glands, pancreas, liver and intestinal glands.

8.2.2 Structure of the Alimentary Canal

Alimentary canal is a muscular coiled, tubular structure. It consists of mouth, buccal cavity, pharynx, oesophagus, stomach, small intestine (consisting of duodenum, jejunum

and ileum), large intestine (consisting of caecum, colon and rectum) and anus.

Mouth: The mouth leads into the buccal cavity. It is bound by two soft, movable upper and lower lips. The **buccal cavity** is a large space bound above by the palate (which separates the wind pipe and food tube), below by the throat and on the sides by the jaws. The jaws bear teeth.

Teeth: Teeth are hard structures meant for holding, cutting, grinding and crushing the food. In human beings two sets of teeth (**Diphyodont**) are developed in their life time. The first appearing set of 20 teeth called temporary or milk teeth are replaced by the second set of thirty two permanent teeth, sixteen in each jaw. Each tooth has a root fitted in the gum (**Thecodont**). Permanent teeth are of four types (**Heterodont**), according to their structure and function namely **incisors**, **canines**, **premolars** and **molars**.

Table 8.2: Types of teeth and their functions

Types of teeth	Number of teeth	Functions
Incisors	8	Cutting and biting
Canines	4	Tearing and piercing
Premolars	8	Crushing and grinding
Molars	12	Crushing, grinding and mastication

Dental formula represents the number of different type of teeth present in each half of a jaw (upper and lower jaw). The types of teeth are denoted as incisors (i), canine (c), premolars (pm) and molars (m). The **dental formula** is presented as:

For **Milk teeth** in each half of upper and lower jaw:

$$\frac{2, 1, 2}{2, 1, 2} = 10 \times 2 = 20$$

For **Permanent teeth** in each half of upper and lower jaw:

$$\frac{2, 1, 2, 3}{2, 1, 2, 3} = 16 \times 2 = 32$$

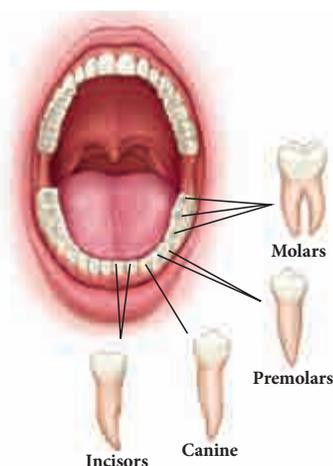


Figure 8.2 Different kinds of teeth

Activity 1

Look at the pictures given below and answer the questions that follow:



1. Are the teeth of animals similar to ours?
2. How is the shape of their teeth related to their food habit?

Salivary glands: Three pairs of salivary glands are present in the mouth cavity. They are: parotid glands, sublingual glands and submaxillary or submandibular glands

- Parotid glands** are the largest salivary glands, which lie in the cheeks in front of the ears (in Greek Par - near ; otid - ear).

- Sublingual glands** are the smallest glands and lie beneath the tongue.

- Submaxillary or Submandibular glands** lie at the angles of the lower jaw.

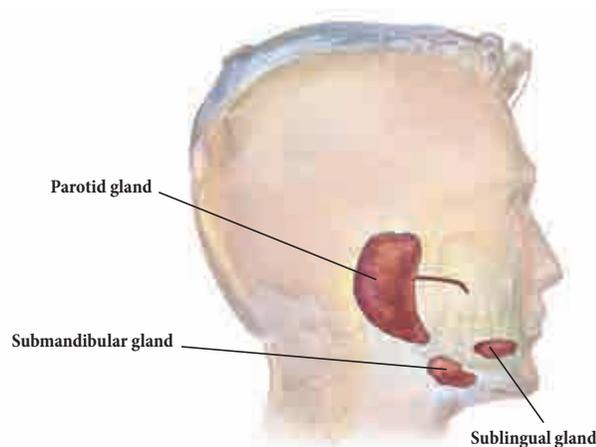


Figure 8.3 Salivary glands

The salivary glands secrete a viscous fluid called saliva, approximately 1.5 liters per day. It digests starch by the action of the enzyme **ptyalin** (amylase) in the saliva which converts starch (polysaccharide) into maltose (disaccharide). Saliva also contain an antibacterial enzyme called **lysozyme**.

Tongue: The tongue is a muscular, sensory organ which helps in mixing the food with the saliva. The taste buds on the tongue help to recognize the taste of food.



More to Know

- The tongue is connected underneath by a membrane called the **frenulum**. This runs between the tongue and the floor of the mouth. It prevents from swallowing our own tongue.

The masticated food in the buccal cavity becomes a bolus which is rolled by the tongue and passed through pharynx

into the oesophagus by swallowing. During swallowing, the epiglottis (a muscular flap-like structure at the tip of the glottis, beginning of trachea) closes and prevents the food from entering into trachea (wind pipe).

Pharynx

The pharynx is a membrane lined cavity behind the nose and mouth, connecting them to the oesophagus. It serves as a pathway for the movement of food from mouth to oesophagus.

Oesophagus

Oesophagus or the food pipe is a muscular-membranous canal about 22 cm in length. It conducts food from pharynx to the stomach by peristalsis (wave-like movement) produced by the rhythmic contraction and relaxation of the muscular walls of alimentary canal.

Stomach

The stomach is a wide J-shaped muscular organ located between oesophagus and the small intestine. The gastric glands present in the inner walls of the stomach secrete gastric juice. The gastric juice is colourless, highly acidic, containing mucus, hydrochloric acid and enzymes rennin (in infants) and pepsin.

Inactive pepsinogen is converted to active **pepsin** which acts on the proteins in the ingested food. **Hydrochloric acid** kills the bacteria swallowed along with food and makes the medium acidic while the mucus protects the wall of the stomach. The action of the gastric juice and churning of food in the stomach convert the bolus into a semi-digested food called **chyme**. The chyme moves to the intestine slowly through the pylorus.

Connecting Concepts

Rennin: Causes curdling of milk protein caesin and increases digestion of proteins

Renin: Converts angiotensinogen to angiotensin and regulate the absorption of water and Na^+ from glomerular filtrate



William Beaumont
(1785-1853)

William Beaumont was a surgeon who was known as the “Father of Gastric Physiology”. Based on his observations he concluded that the stomach’s strong hydrochloric acid played a key role in digestion.

Small intestine The small intestine is the longest part of the alimentary canal, which is a long coiled tube measuring about 5 – 7 m. It comprises three parts- duodenum, jejunum and ileum.

1. **Duodenum** is C-shaped and receives the bile duct (from liver) and pancreatic duct (from pancreas).
2. **Jejunum** is the middle part of the small intestine. It is a short region of the small intestine. The secretion of the small intestine is intestinal juice which contains the enzymes like **sucrase, maltase, lactase** and **lipase**.
3. **Ileum** forms the lower part of the small intestine and opens into the large intestine. Ileum is the longest part of the small intestine. It contains minute finger like projections called **villi** (one millimeter in

length) where absorption of food takes place. They are approximately 4 million in number. Internally, each villus contains fine blood capillaries and lacteal tubes,

The small intestine serves both for digestion and absorption. It receives (i) the bile from liver and (ii) the pancreatic juice from pancreas in the duodenum. The intestinal glands secrete the intestinal juices.

Liver: It is the largest digestive gland of the body which is reddish brown in colour. It is divided into two main lobes, right and left lobes. The right lobe is larger than the left lobe. On the under surface of the liver, gall bladder is present. The liver cells secrete **bile** which is temporarily stored in the gall bladder. Bile is released into small intestine when food enters in it. It has **bile salts** (sodium glycolate and sodium tauraglycolate) and **bile pigments** (bilirubin and biliviridin). Bile salts help in the digestion of fats by bringing about their **emulsification** (conversion of large fat droplets into small ones).

Functions of Liver

- Controls blood sugar and amino acid levels
- Synthesizes foetal red blood cells
- Produces fibrinogen and prothrombin, used for clotting of blood
- Destroys red blood cells
- Stores iron, copper, vitamins A and D.
- Produces heparin (an anticoagulant)
- Excretes toxic and metallic poisons
- Detoxifies substances including drugs and alcohol

Pancreas

It is a lobed, leaf shaped gland situated between the stomach and duodenum.

Pancreas acts both as an **exocrine gland** and

as an **endocrine gland**. The exocrine part of the pancreatic gland secretes pancreatic juice which contains three enzymes- lipase, trypsin and amylase which acts on fats, proteins and starch respectively. The gland's upper surface bears the **islets of Langerhans** which have endocrine cells and secrete hormones in which **α (alpha) cells** secrete **glucagon** and **β (beta) cells** secrete **insulin**.

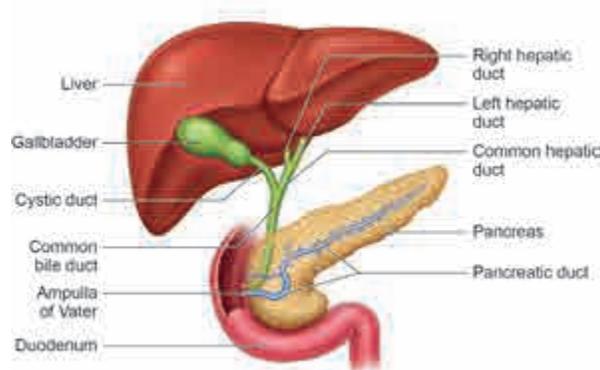


Figure 8.4 Bile duct and Pancreatic duct opening into duodenum

The intestinal glands secrete intestinal juice called **succus entericus** which contains enzymes like maltase, lactase, sucrase and lipase which act in an alkaline medium. From the duodenum the food is slowly moved down to ileum, where the digested food gets absorbed

Absorption of food

Absorption is the process by which nutrients obtained after digestion are absorbed by villi and circulated throughout the body by blood and lymph and supplied to all body cells according to their requirements.

Assimilation of food

Assimilation means the incorporation of the absorbed food materials into the tissue cells as their internal and homogenous component. The final products of fat digestion (fatty acids and glycerol) are again converted

Table 8.3: Chart showing the Digestive Enzymes

Digestive glands	Enzymes	Substrate (nutrient)	Product of digestion
Salivary glands	Ptyalin (Salivary amylase)	Starch	Maltose
Gastric glands	Pepsin	Proteins	Peptones
	Rennin (in infants)	Milk protein or caseinogen	Curdles milk to produce casein protein
Pancreas	Pancreatic amylase	Starch	Maltose
	Trypsin	Proteins and peptones	Peptides and amino acids
	Chymotrypsin	Protein	Proteoses, Peptones, Polypeptide, tri and dipeptides
	Pancreatic lipase	Emulsified fats	Fatty acids and Glycerol
Intestinal glands	Maltase	Maltose	Glucose and Glucose
	Lactase	Lactose	Glucose and Galactose
	Sucrase	Sucrose	Glucose and Fructose
	Lipase	Fats	Fatty acids and Glycerol

into fats and excess fats are stored in adipose tissue. The excess sugars are converted into a complex polysaccharide, glycogen in the liver. The amino acids are utilized to synthesize different proteins required for the body.

DO YOU KNOW? The small intestine is about 5m long and is the longest part of the digestive system. The large intestine is a thicker tube, but is about 1.5 m long

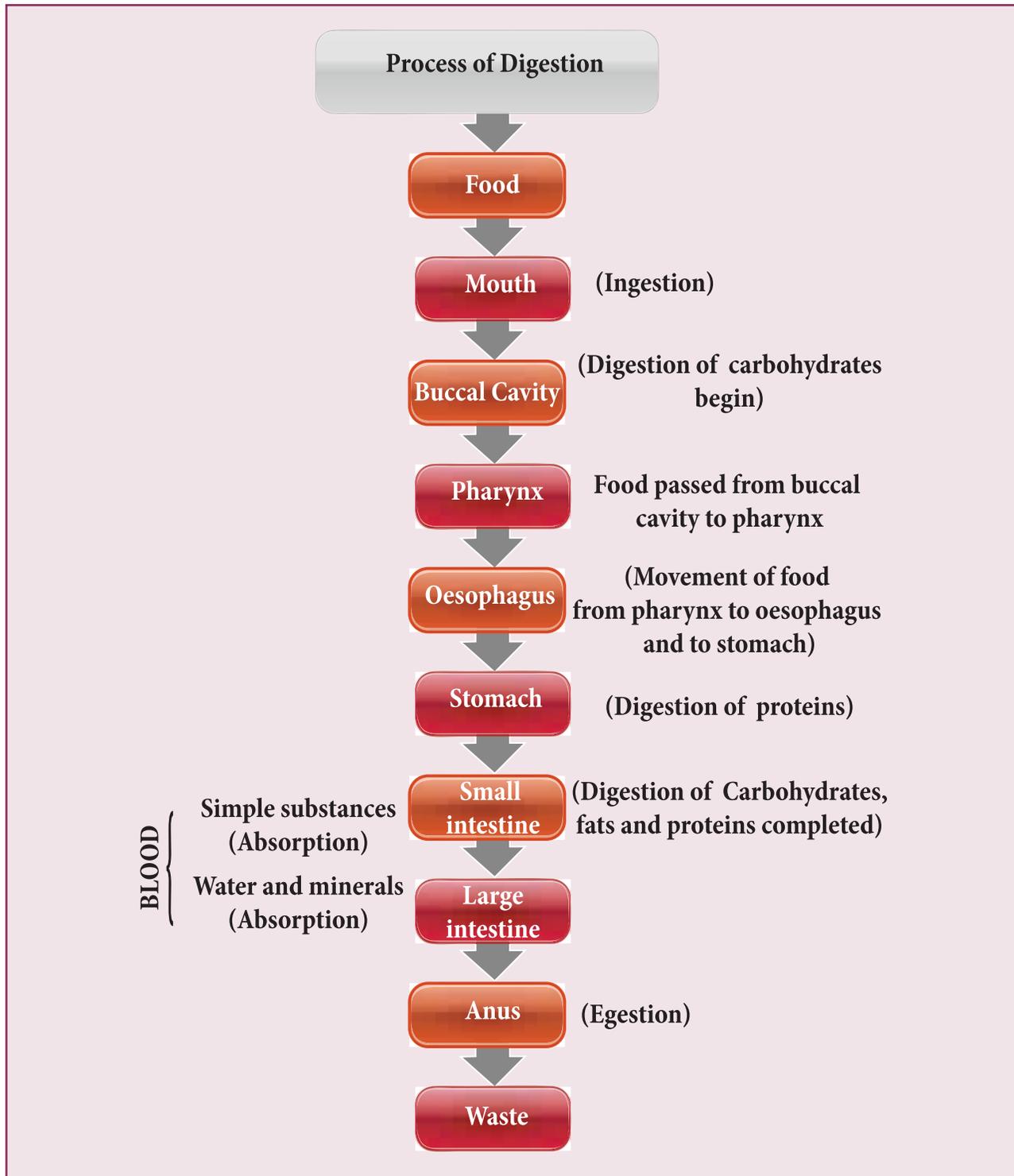
Large intestine

The unabsorbed and undigested food is passed into the large intestine. It extends from

the ileum to the anus. It is about 1.5 meters in length. It has three parts- **caecum**, **colon** and **rectum**.

The caecum is a small blind pouch like structure situated at the junction of the small and large intestine. From its blind end a finger – like structure called **vermiform appendix** arises. It is a **vestigial (functionless) organ** in human beings.

The colon is much broader than ileum. It passes up the abdomen on the right (**ascending colon**), crosses to the left just below the stomach (**transverse colon**) and down on the left side (**descending colon**). The rectum



is the last part which opens into the anus. It is kept closed by a ring of muscles called anal sphincter which opens when passing stools.

Egestion: The undigested or unassimilated portion of the ingested food material is thrown out from the body through the anal aperture as faecal matter. This is known as **egestion** or **defaecation**.

Activity 2

Construct a model of the human digestive system using simple materials like funnel, pipe, cello tape and clean bag. Label its parts and write which parts help in the various steps of digestion.





Activity 3

To know the action of saliva on starch.

Take two test tubes, one ml starch solution, one ml saliva, dilute iodine solution

1. Mark A and B on two test tubes
2. Add 1 ml of starch solution in each test tube.
3. Now add 1 ml of saliva to test tube A only.
4. Leave both the test tubes undisturbed for about 20-30 minutes.
5. Now add a few drops of dilute iodine solution in both the test tubes and observe.

Write the results.

What indicates the appearance of the blue colour in test tube B ?

Why the blue colour does not appear in test tube A ?

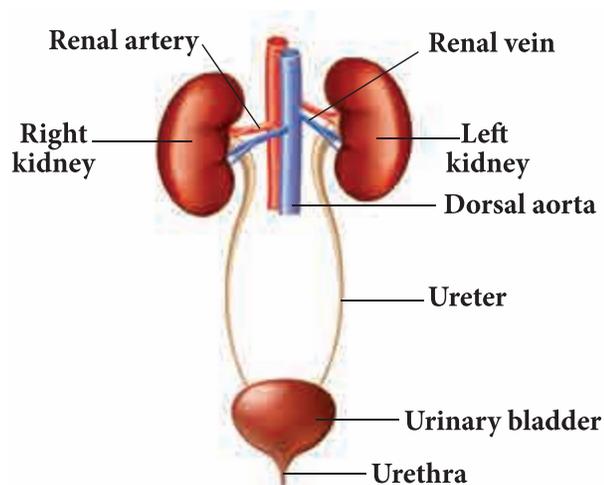


Figure 8.5 Excretory system

If the waste products are accumulated and not eliminated, they become harmful and poisonous to the body. Hence, excretion plays an important role in maintaining the homeostatic condition of the body.

Some of the excretory organs other than kidneys are **skin** (removes small amounts of water, urea and salts in the form of sweat) and **lungs** (eliminate carbon-dioxide and water vapour through exhaling).

8.3.1 Skin

Skin is the outer most covering of the body. It stretches all over the body in the form of a layer. It accounts for 15% of an adult's human body weight. There are many structures and glands derived from the skin. It eliminates metabolic wastes through perspiration.

The human body functions normally at a temperature of about 37°C. When it gets hot sweat glands start secreting sweat, which contains water with small amounts of other chemicals

8.3 Human Excretory System

Metabolic activities continuously take place in living cells. All metabolic products produced by the biochemical reactions are not utilized by the body because certain nitrogenous toxic waste substances are also produced. They are called excretory products. In human beings **urea** is the major excretory product. The tissues and organs associated with the removal of waste products constitute the excretory system.

The human excretory system consists of a pair of kidney, which produce the urine, a pair of ureters which conduct the urine from kidneys to the urinary bladder, where urine is stored temporarily and urethra through which the urine is voided by bladder contractions.

like ammonia, urea, lactic acid and salts (mainly sodium chloride). The sweat passes through the pores in the skin and gets evaporated.

8.3.2 Kidneys

Kidneys are bean-shaped organs reddish brown in colour. The kidneys lie on either side of the vertebral column in the abdominal cavity attached to the dorsal body wall. The right kidney is placed lower than the left kidney as the liver takes up much space on the right side. Each kidney is about 11 cm long, 5 cm wide and 3 cm thick. The kidney is covered by a layer of fibrous connective tissue, the renal capsules, adipose capsule and a fibrous membrane.

Internally the kidney consists of an outer dark region, the **cortex** and an inner lighter region, the **medulla**. Both of these regions

contain **uriniferous tubules** or **nephrons**. The medulla consists of multitubular conical masses called the medullary pyramids or renal pyramids whose bases are adjacent to cortex. On the inner concave side of each kidney, a notch called **hilum** is present through which blood vessels and nerves enter in and the urine leaves out.

Ureters: Ureters are thin muscular tubes emerging out from the hilum. Urine enters the ureter from the renal pelvis and is conducted along the ureter by peristaltic movements of its walls. The ureters carry urine from kidney to urinary bladder.

Urinary bladder: Urinary bladder is a sac-like structure, which lies in the pelvic cavity of the abdomen. It stores urine temporarily.

Urethra: Urethra is a membranous tube, which conducts urine to the exterior. The urethral sphincters keep the urethra closed and opens only at the time of **micturition** (urination).

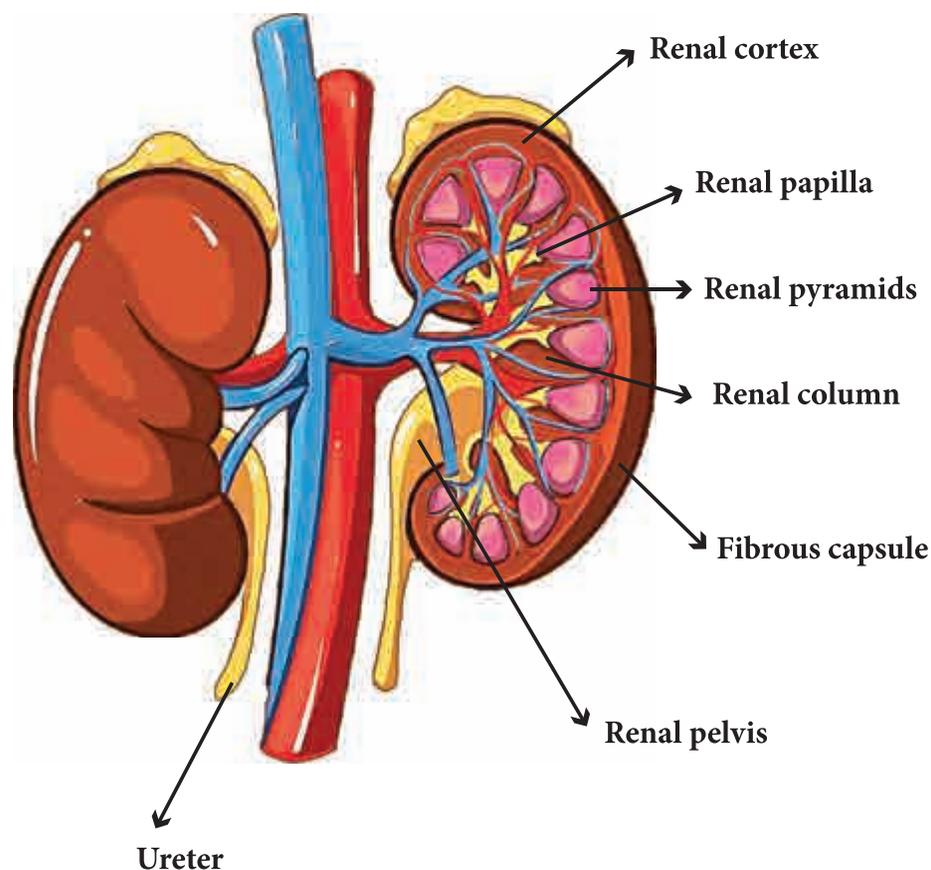


Figure 8.6 Longitudinal section of human kidney

Functions of kidney

1. Maintain the fluid and electrolytes balance in our body.
2. Regulate acid-base balance of blood.
3. Maintain the osmotic pressure in blood and tissues.
4. Help to retain the important plasma constituents like glucose and amino acids.

8.3.3 Structure of Nephron

Each kidney consists of more than one million nephrons. **Nephrons or uriniferous tubules** are structural and functional units of the kidneys. Each nephron consists of **Renal corpuscle** or **Malpighian corpuscle** and **renal tubule**. The renal corpuscle consists of a cup-shaped structure called **Bowman's capsule** containing a bunch of capillaries called **glomerulus**. Blood enters the glomerular capillaries through **afferent** arterioles and leaves out through **efferent** arterioles. The Bowman's capsule continues as the renal tubule which consists of three regions **proximal convoluted tubule**, U-shaped hair pin loop, **the loop of Henle** and the **distal convoluted tubule**. The distal convoluted tubule which opens into the **collecting tubule**. The nitrogenous wastes are drained into renal pelvis which leads to ureters and stored in the urinary bladder. Urine is expelled out through the urethra.

8.3.4 Mechanism of Urine Formation

The process of urine formation includes the following three stages.

- Glomerular filtration
- Tubular reabsorption and
- Tubular secretion

Glomerular filtration: Urine formation begins with the filtration of blood through epithelial walls of the glomerulus and Bowman's capsule. The filtrate is called as the glomerular filtrate. Both essential and non-essential substances present in the blood are filtered.

Tubular reabsorption: The filtrate in the proximal tubule consists of essential substances such as glucose, amino acids, vitamins, sodium, potassium, bicarbonates and water that are reabsorbed into the blood by a process of **selective reabsorption**.

Tubular secretion: Substances such as H^+ or K^+ ions are secreted into the tubule. Certain substances like potassium and a large number of drugs like penicillin and aspirin are passed into the filtrate in the distal convoluted tubule. This tubular filtrate is finally known as urine, which is **hypertonic** in man. Finally the urine passes into collecting ducts to the pelvis and through the ureter into the urinary bladder by urethral peristalsis (waves of constriction in the ureters). The relaxation of sphincter muscles located at the opening of the urinary bladder into the urethra. When the urinary bladder is full the urine is expelled out through the urethra. This process is called **micturition**. A healthy person excretes one to two litres of urine per day.

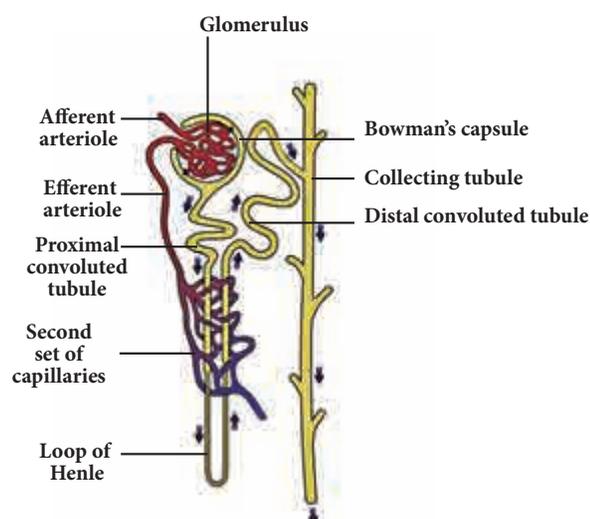
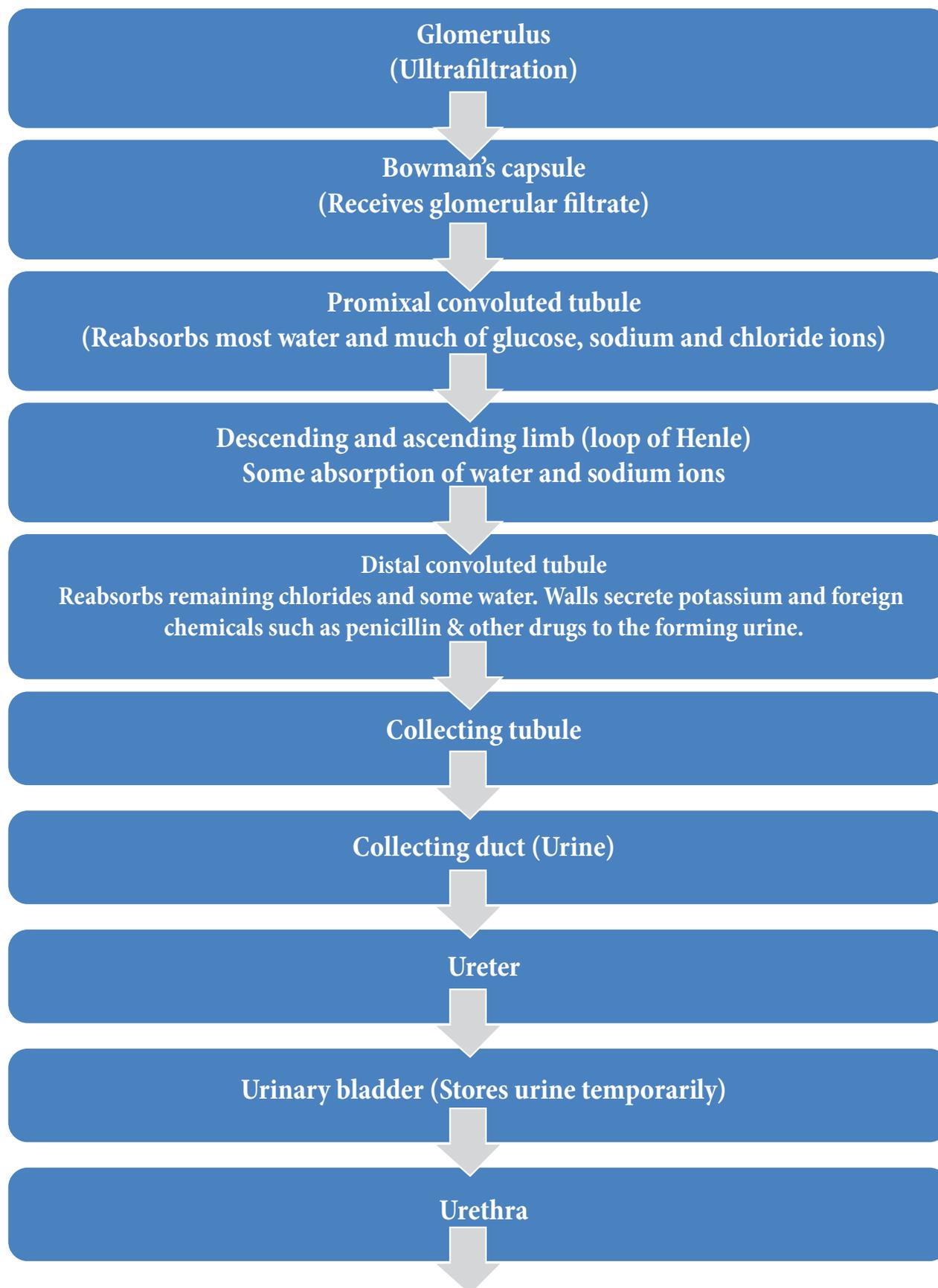


Figure 8.7 Structure of Nephron

Route of urine flow



Route of elimination of urine



Two healthy kidneys contain a total of about 2 million nephrons, which filter about 1700-1800 litres of blood. The kidneys reabsorb and redistribute 99% of the blood volume and only 1% of the blood filtered becomes urine.

Dialysis or Artificial kidney

When kidneys lose their filtering efficiency, excessive amount of fluid and toxic waste accumulate in the body. This condition is known as **kidney (renal) failure**. For this, an artificial kidney is used to filter the blood of the patient. The patient is said to be put on dialysis and the process of purifying blood by an artificial kidney is called **haemodialysis**. When renal failure cannot be treated by drug or dialysis, the patients are advised for kidney transplantation.



First kidney transplant

In 1954, Joseph E. Murray and his colleagues at Peter Bent Brigham Hospital in Boston performed first successful kidney transplant between Ronald and Richard Herrick who were identical twins. The recipient Richard Herrick died after 8 years of transplantation.

8.4 Human Reproductive System

All living organisms develop from pre-existing organisms. The capacity to reproduce is one of the most important characteristics of living beings. This process is aimed to preserve individual species and is called 'self perpetuation'.

There is a distinct sexual dimorphism in human beings i.e., males are visibly different from females in physical build up, external genital organs and secondary sexual characters. Thus, the structures associated with reproduction are different in males and females. The reproductive systems of male and female consist of many organs which are distinguished as primary and secondary sex organs. The primary sex organs are gonads, which produce gametes (sex cells) and secrete sex hormones. The secondary sex organs include the genital ducts and glands which help in the transportation of gametes and enable the reproductive process. They do not produce gametes or sex hormones.

The reproductive organs become functional after attaining sexual maturity. In males, sexual maturity is attained at the age of 13-14 years. In females, it is attained at the age of 11-13 years. This age is known as the age of puberty. During sexual maturity, hormonal changes take place in males and females and secondary sexual characters are developed under the influence of these hormones.

8.4.1 Male reproductive system

Human male reproductive system consists of testes (primary sex organs), scrotum, vas deferens, urethra, penis and accessory glands.

Testes: A pair of testes or testicles lies outside the abdominal cavity of the male. These testes are the male gonads, which produces male gametes (**sperms**) and male sex hormone (**Testosterone**). Along the inner side of each testis lies a mass of coiled tubules called **epididymis**. The **Sertoli cells** of the testes provide nourishment to the developing sperms.



Scrotum: The scrotum is a loose pouch-like sac of skin which is divided internally into right and left **scrotal sacs** by muscular partition. The two testes lie in the respective scrotal sacs. It also contains many nerves and blood vessels. The **scrotum** acts as a **thermoregulator organ** and provides an optimum temperature for the formation of sperms. The sperms develop at a temperature of 1-3°C lower than the normal body temperature.

Vas Deferens: It is a straight tube which carries the sperms to the **seminal vesicles**. The sperms are stored in the seminal plasma of seminal vesicle, which is rich in fructose, calcium and enzymes. Fructose is a source of energy for the sperm. The **vas deferens** along with seminal vesicles opens into ejaculatory duct. The ejaculatory duct expels the sperm and secretions from seminal vesicles into the urethra.

Urethra: It is contained inside the penis and conveys the sperms from the vas deferens which pass through the urethral opening.

The accessory glands associated with the male reproductive system consist of seminal vesicles, prostate gland and Cowper's glands. The secretions of these glands form seminal fluid and mixes with the sperm to form semen. This fluid provides nutrition and helps in the transport of sperms.

The Leydig cells of the testes secrete the male sex hormone testosterone which controls spermatogenesis and plays a role in the development of male secondary sexual characters like growth of beard, moustache, body hair and hoarse voice.

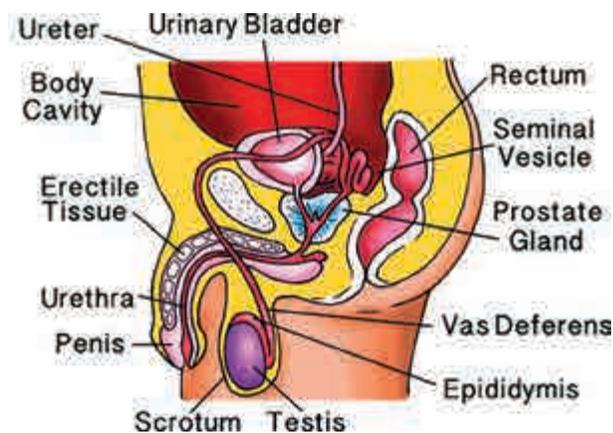


Figure 8.8 Male reproductive system



The sperm is the smallest cell in the male body. A normal male produces more than 500 billion sperm cells in his life time. The process of formation of sperms is known as spermatogenesis.

8.4.2 Female reproductive system

The female reproductive system consists of ovaries (primary sex organs), oviducts, uterus and vagina.

Ovaries: A pair of almond-shaped ovaries is located in the lower part of abdominal cavity near the kidneys in female. The ovaries are the female gonads, which produce female gametes (**eggs** or **ova**) and secrete female sex hormones (**Oestrogen** and **Progesterone**). A mature ovary contains a large number of ova in different stages of development. Only one ovum usually ripens every month. One mature ovum is released from either side of the ovary at an interval of every 28 days (**menstrual cycle**). The process of release of ovum from the ovary is known as **ovulation**.





More to Know

An ovum is the largest human cell. The process of formation of ova is known as **oogenesis**.

Fallopian tubes (Oviducts): These are paired tubes originating from uterus, one on either side. The terminal part of **fallopian tube** is funnel-shaped with finger-like projections called **fimbriae** lying near the ovary. The fimbriae pick up the ovum released from ovary and push it into the fallopian tube.

Uterus: Uterus is a pear-shaped muscular, hollow structure present in the pelvic cavity. It lies between urinary bladder and rectum. Development of foetus occurs inside the uterus. The narrower lower part of uterus is called **cervix**, which leads into vagina.

Vagina: The uterus narrows down into a hollow muscular tube called vagina. It connects cervix and the external genitalia. It receives the sperms, acts as birth canal during child birth (**parturition**) and also serves as passage for menstrual flow.

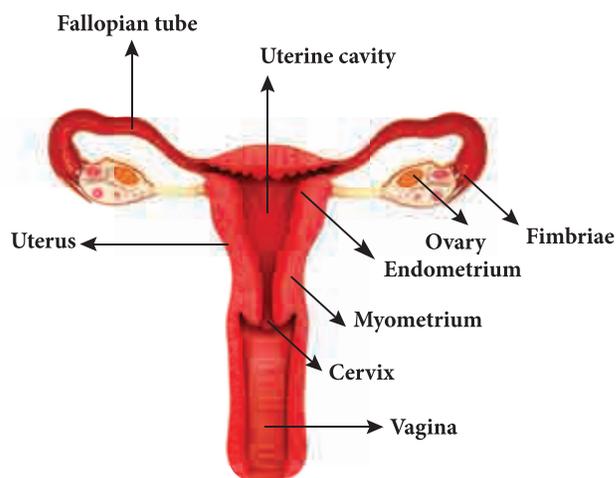


Figure 8.9 Female reproductive system

The female sex hormone **oestrogen** is secreted by the **graafian follicle** of the ovum. It controls the development of accessory sex organs and secondary sexual characters. It regulates menstrual cycle and fertility. **Progesterone** is secreted by the **corpus luteum**. It prepares the uterus for implantation of fertilized ovum, formation of placenta and for maintaining pregnancy.

Points to Remember

- All the organ systems work together in coordination to maintain the body in a homeostatic condition of an organism. Division of labour is found among the various organ systems.
- Parts of the body concerned with the digestion of food form the digestive system.
- Alimentary canal is a muscular coiled, tubular structure. It consists of mouth, buccal cavity, pharynx, oesophagus, stomach, small intestine (consisting of duodenum, jejunum and ileum), large intestine (consisting of caecum, colon and rectum) and anus.
- The five stages of nutrition process include ingestion, digestion, absorption, assimilation and egestion
- The small intestine serves both for digestion and absorption
- Absorption is the process by which nutrients obtained after digestion are absorbed by villi and circulated throughout the body by blood and lymph
- The tissues and the organs associated with the removal of the waste products constitute the excretory system.

- The human excretory system consists of a pair of kidney, which produce the urine, a pair of ureters which conduct the urine from kidneys to the urinary bladder, where urine is stored temporarily and urethra through which the urine is voided by bladder contractions
- The process of urine formation includes the following three stages. Glomerular filtration, tubular reabsorption and tubular secretion
- In condition of kidney (renal) failure, an artificial kidney is used to filter the blood of the patient. The patient is said to be put on dialysis and the process of purifying blood by an artificial kidney is called haemodialysis
- The reproductive systems of male and female consist of many organs which are distinguished as primary and secondary sex organs.
- The primary sex organs are gonads, which produce gametes (sex cells) and secrete sex hormones. The secondary sex organs include the genital ducts and glands which help in the transportation of gametes and enable the reproductive process.

A-Z GLOSSARY

Emulsification	Conversion of large fat droplets into smaller ones.
Enzymes	Substances produced by living organisms which acts as a catalyst to bring about specific biochemical reactions.
Graffian follicle	Mature follicle containing oocyte, present in the ovary. Only one Graffian follicle matures in a month and secretes the hormone estrogen.
Homeostasis	The tendency of the body to seek and maintain a balance condition or equilibrium within its internal environment, even when faced with external challenges.
Mastication (Chewing)	The process by which food is crushed and ground by teeth.
Metabolism	Sum total of all chemical and energy changes taking place in an organism.
Nutrition	The process of providing or obtaining the food necessary for health and growth.
Osmoregulation	The maintenance of constant osmotic pressure in the fluids of an organism by the control of water and salt concentrations.
Regurgitation	The act of bringing swallowed food back into the mouth.
Toxic substances	Substances that can be poisonous or cause health effects to living organisms



TEXT BOOK EXERCISES



I. Choose the correct answer

1. Which of the following is not a salivary gland?

- a. sublingual b. lachrymal
- c. submaxillary d. parotid

2. Stomach of man mainly digests _____

- a. carbohydrates b. proteins
- c. fat d. sucrose

3. To prevent the entry of food into the trachea, the opening is guarded by _____

- a. epiglottis b. glottis
- c. hard palate d. soft palate

4. Bile helps in the digestion of _____

- a. proteins b. sugar
- c. fats d. carbohydrates

5. Excretion means _____

- a. taking in oxygen from the air and giving out carbon dioxide
- b. disposal of harmful germs and worms from our body
- c. distribution of digested food to the body tissues through blood
- d. removal of nitrogenous wastes generated in the body

6. The structural and functional unit of the kidney is _____

- a. villi b. liver
- c. nephron d. ureter

7. Which one of the following substance is not a constituent of sweat?

- a. urea b. protein
- c. water d. salt

8. The common passage meant for transporting urine and sperms in male is _____

- a. ureter b. urethra
- c. vas deferens d. scrotum

9. Which of the following is not a part of female reproductive system?

- a. Ovary b. uterus
- c. testes d. fallopian tube

II. Fill in the blanks

1. The opening of the stomach into the intestine is called _____.

2. The muscular and sensory organ which helps in mixing the food with saliva is _____.

3. Bile, secreted by liver is stored temporarily in _____.

4. The longest part of alimentary canal is _____.

5. Organs which are concerned with the formation, storage and elimination of urine constitute the _____.

6. The human body functions normally at a temperature of about _____.

7. In the process of urine formation, maximum amount of water from the glomerular filtrate is reabsorbed in the _____.



8. The largest cell in the human body of a female is _____.

III. State whether the following statements are true or false. If false, correct the wrong statements:

- Nitric acid in the stomach kills microorganisms in the food.
- During digestion, proteins are broken down into amino acids.
- Glomerular filtrate consists of many substances like amino acids, vitamins, hormones, salts, glucose and other essential substances.
- Besides the normal constituents, the urine may pass out excess vitamins and not the antibiotics.
- The process of release of ovum from ovary is called gestation.

IV. Identify the following parts:

- It conducts food from pharynx to stomach by peristalsis-
- Finger-like projections which enhances the absorbing capacity of small intestine-
- The bunch of capillaries inside the Bowman's capsule-
- Thin muscular tubes which carry urine from kidney to urinary bladder-
- Small sac-like muscular structures that encloses testes-

V. Very short answer questions

- Arrange the following five steps of nutrition in correct sequence: (digestion, assimilation, ingestion, egestion, absorption)
- The stomach secretes gastric juice, which contains hydrochloric acid. What is its function?

- How is the small intestine designed to absorb digested food?
- Why do we sweat?
- State any two vital functions of human kidney.
- How is it possible to control the urge to pass urine?
- Write the names of male and female sex hormone.

VI. Short answers questions

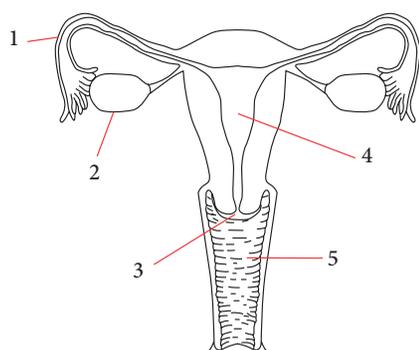
- Define the following terms:
 - Digestion
 - Osmoregulation
 - Emulsification
 - Ovulation
- Name the types of teeth present in an adult human being. Mention the functions of each.
- What are the end products of digestion of starch, proteins and fats respectively?
- Explain the structure of nephron.
- Differentiate the following terms:
 - Excretion and secretion
 - Absorption and assimilation
 - Sperm and ovum
 - Ingestion and egestion
 - Diphyodont and heterodont
 - Incisors and canines
- What are the functions of ovaries and uterus in female reproductive system?
- Match the following:

Organ	Elimination
Skin	a. Urine
Lungs	b. Sweat
Intestine	c. Carbon dioxide
Kidneys	d. undigested food

8. Give reasons for the following:
- Scrotum remains outside the body of human males.
 - The wall of the stomach is not digested by its own enzyme.
9. Complete the following table:

Enzymes	Nutrient (Substrate)	End products of digestion
Erepsin (peptidase)	proteins and peptides	-----
Maltase	-----	glucose
Sucrase	sucrose	----- --- and----- ---
Lactase		glucose and galactose
-----	fats	fatty acids and glycerol

VII. Match the parts of the given figure with the correct option.



1	2	3	4	5
a. Fallopian tube	Oviduct	Uterus	Cervix	Vagina
b. Oviduct	Cervix	Vagina	Ovary	Vas deferens
c. Ovary	Oviduct	Uterus	Vagina	Cervix
d. Fallopian tube	Ovary	Cervix	Uterus	Vagina

VIII. Long answer questions

- Describe the alimentary canal of man
- Explain the structure of kidney and the steps involved in the formation of urine

IX. Assertion and Reason

Direction: In each of the following questions, a statement of Assertion is given and a corresponding statement of Reason is given just below. Of the four statements, given below, mark one as the correct answer.

- If both Assertion and Reason are true and Reason is the correct explanation of Assertion
 - If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
 - If Assertion is true but Reason is false
 - If both Assertion and Reason are false
- Assertion: Urea is excreted out through the kidneys
Reason: Urea is a toxic substance. Excess accumulation of urea in blood may lead to death
 - Assertion: In both the sexes gonads perform dual function
Reason: Gonads are also called primary sex organs

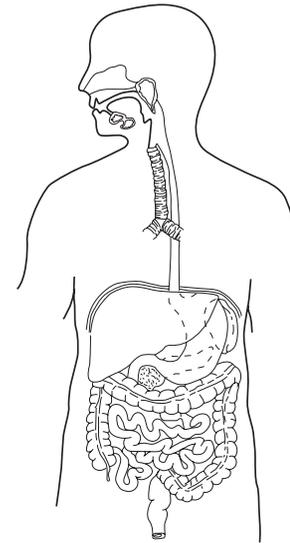
X. Thinking skills

1. If pepsin is lacking in gastric juice, then which event in the stomach will be affected?
 - a. digestion of starch into sugars
 - b. breaking of proteins into peptides
 - c. digestion of nucleic acids
 - d. breaking of fats into glycerol and fatty acids
2. Rearrange the jumbled sequence of the different parts of alimentary canal in proper sequence. (Oesophagus, Small intestine, Stomach, Large intestine, anus, mouth, rectum)
3. Select the substances given below that need to be excreted from the body. (urea, amino acids, carbon dioxide, uric acid, glucose)
4. Name the blood vessel that (a) enter malphigian capsule and (b) leaves malphigian capsule
5. Rearrange the jumbled words and fill in the blanks in the following passage to make it a meaningful description.

The human urinary system consists of a pair of _____ (nyedik), which form the urine; a pair of _____ (ertreu), which conduct the _____ (neuri) from

kidneys to the _____ (naryuri drebdal) for storage of urine and a _____ (reuhrat) through which the urine is voided by bladder contractions.

6. Label the parts of the alimentary canal of man and write any one function of each organ



XI. Discuss and answer:

1. Why do you think that urine analysis is an important part of medical diagnosis?
2. Why your doctor advises you to drink plenty of water?
3. Can you guess why there are sweat glands on the palm of our hands and the soles of our feet?



REFERENCE BOOKS

Verma P.S and Agarwal, V.K. Animal Physiology, S. Chand and Company, New Delhi



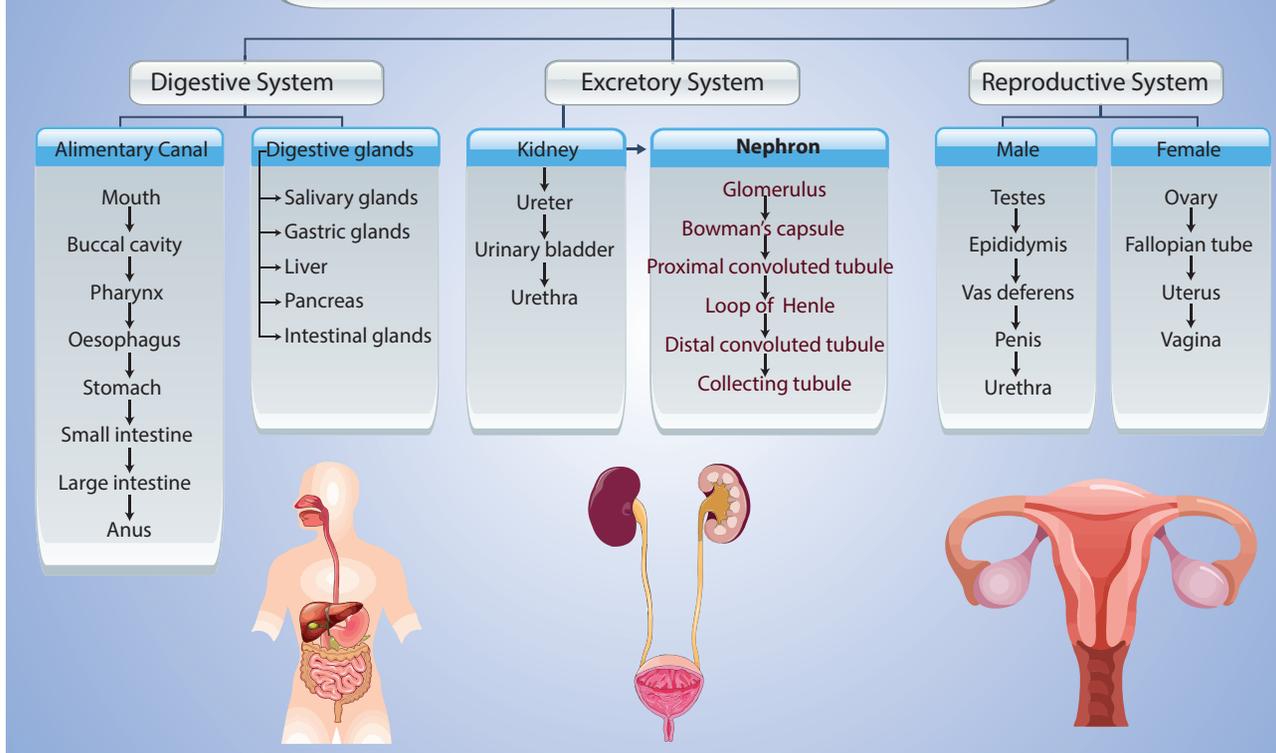
INTERNET RESOURCES

<https://www.britannica.com/science/human-digestive-system>

<https://biologydictionary.net/excretory-system/>

<https://www.britannica.com/science/human-reproductive-system>

Organ Systems Involved in Digestion, Excretion and Reproduction



ICT CORNER

Human digestive system

This activity enables to explore the functions of every part in the digestive system



Steps

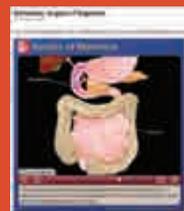
- Type the URL link given below in the browser or scan the QR code. You can view “the digestive system”.
- Click the **go to interactive mode** to explore the functions of each part you want to learn.
- Every part and its function can be learnt by clicking that particular part that we want to learn.
- Also you can see the process of digestion by clicking **go to animation mode**.



Step1



Step2



Step3



Step4

Browse in the link:

URL: http://highereducation.com/sites/0072495855/student_view0/chapter26/animation_organs_of_digestion.html



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