

UNIT 1 INTRODUCTION TO HUMAN BODY SYSTEMS

Structure

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- 1.2 Human Body Systems – Structure and Functions
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- 1.4 Musculo-Skeletal System
- 1.5 Digestive System
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- 1.8 Nervous System
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- 1.12 Sense Organs
- 1.13 Let Us Sum Up
- 1.14 Answers to Check Your Progress

1.0 OBJECTIVES

After studying this unit, you should be able to:

- explain different human body system.
- explain the interrelationship between the different body organs; and
- describe the normal structure and functions of various body systems.

1.1 INTRODUCTION

The body is made up by small unit which is known as cell, like a brick. Cells form tissues, a group of similar type of tissues form organs. The body is composed of different types of organs. The group of different organs functions in different way and they carry out the essential functions of the body which is known as system (Fig. 1.1). All of the systems work together to keep the body healthy. It is just like a musical concert, each system is like a musical instrument, when played harmoniously the concert become successful like healthy body.

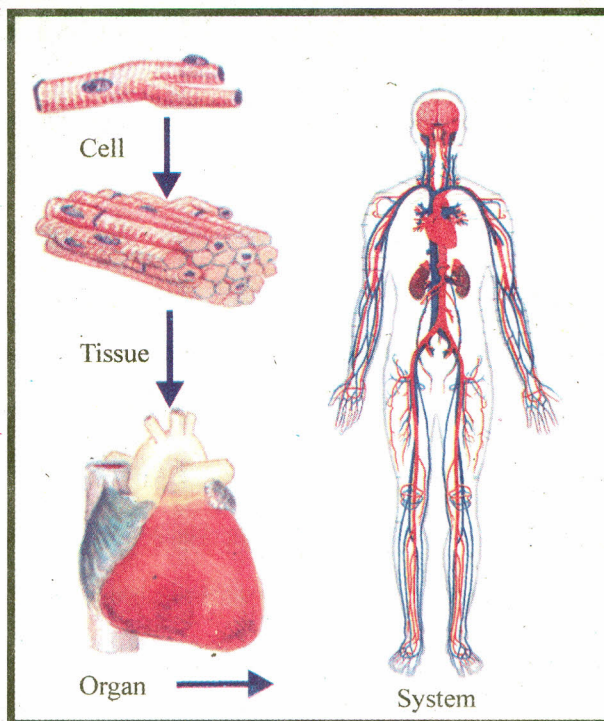


Fig. 1.1: Cell, Tissue, Organ and System

1.2 HUMAN BODY SYSTEMS – STRUCTURE AND FUNCTION

Division of the body into system is arranged as follows:

- 1) **Integumentary System:** This includes the parts concerned with sensation which refers to a state of awareness of external and internal conditions of the body.
- 2) **Musculo-Skeletal System:** This includes the part concerned in the movement of the body. The skeletal system which is made up of bones and muscular system includes muscles.
- 3) **The Digestive System:** It is long tube which starts from mouth and ends in anal canal. It consists of other accessory organs. The function of digestive system is to grind the food in small pieces in the mouth and send it to the stomach and get partially digested. Residual (left over) waste product is sent to large intestine for excretion through anal canal.
- 4) **Cardio-Vascular System:** This includes the circulatory system. Blood is pumped by heart and sent through out the body to supply oxygen from the lungs and to bring back carbon dioxide to the lungs. It also carries waste products to the kidney.
- 5) **Respiratory System:** The system is concerned with breathing. The breath in air contains oxygen is taken into lungs and included in the blood and carbon dioxide is taken from the tissues to the lungs and breathed out in the air.
- 6) **The Nervous System:** It consists of brain and spinal cord, and special sense organs. The functions of the organs are to receive information for interpretation and act accordingly.
- 7) **Endocrine System:** It consists of ductless glands. Ductless glands secrete hormones which regulate the body function.

- 8) **Urinary System:** Kidney is the main organ of urinary system, through which waste product from the body is removed and circulated in the blood and sent to the kidney for excretion. Normally the same amount of fluid is taken into the body and excreted from it. Water is normally lost from the kidney as urine.
- 9) **Reproductive System:** The organ responsible for reproduction is also known as genital tract which is related to the urinary tract. In the male two tracts are closely associated, in the female though there is close relationship with urinary tract but they are not connected.

1.3 INTEGUMENTARY SYSTEM

Let us learn about various body systems one after the other with the help of diagram, Structure and normal functions.

A) Diagram of Skin and Hair

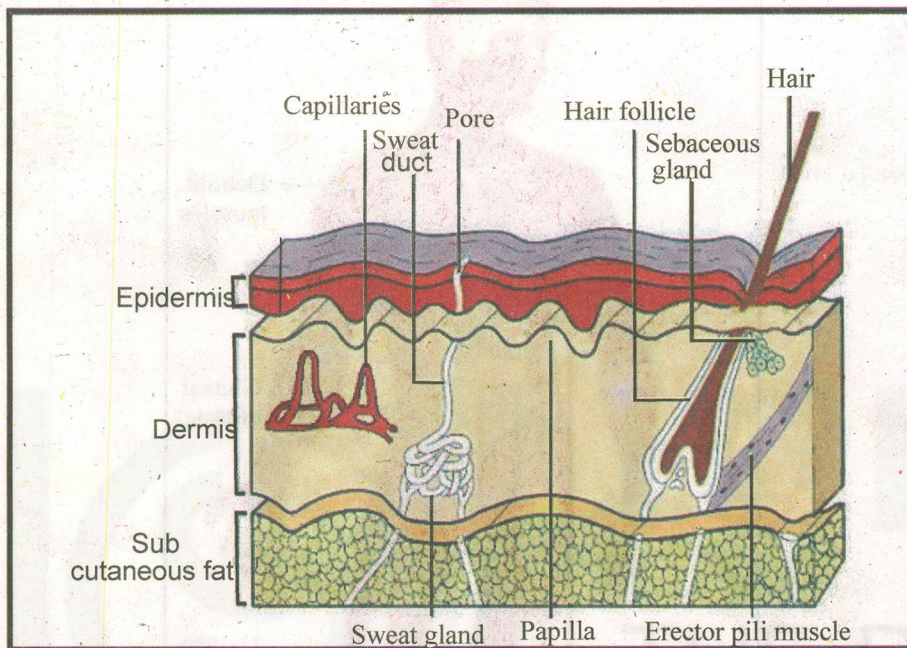


Fig. 1.2: Skin

B) Structure and functions of the Skin, Hair and Nails

Skin: The skin covers and protects the surface of the body and the skin is divided in two layers:

The epidermis and the dermis.

The epidermis (outer layer) is composed of number of layer of cells.

Dermis (inner layer) is made of fibrous and elastic tissue. The surface of the dermis is arranged in a small pocket which contain capillary of blood vessels. Sweat glands and nerve endings are in the dermis and opens on the surface of the skin.

Sebaceous (oil) glands are small glands found in the skin. These glands are found in the scalp, face, around the nose, mouth and the ear.

Hair: The hairs and nails are the appendages of the skin.

Nail: The nail is composed of modified skin. It lies on nail bed. It is well supplied with nerves and blood vessels.

Functions of the skin:

- It is heat regulating organ
- It protects the body from injury.
- It is the organ of special sense, the sensation of touch
- It acts as storage for water.

1.4 MUSCULO-SKELETAL SYSTEM

Muscles and bones constitute musculo-skeletal system. We shall see the diagram of muscular and skeletal system as given below:

A) Diagram of the Muscles

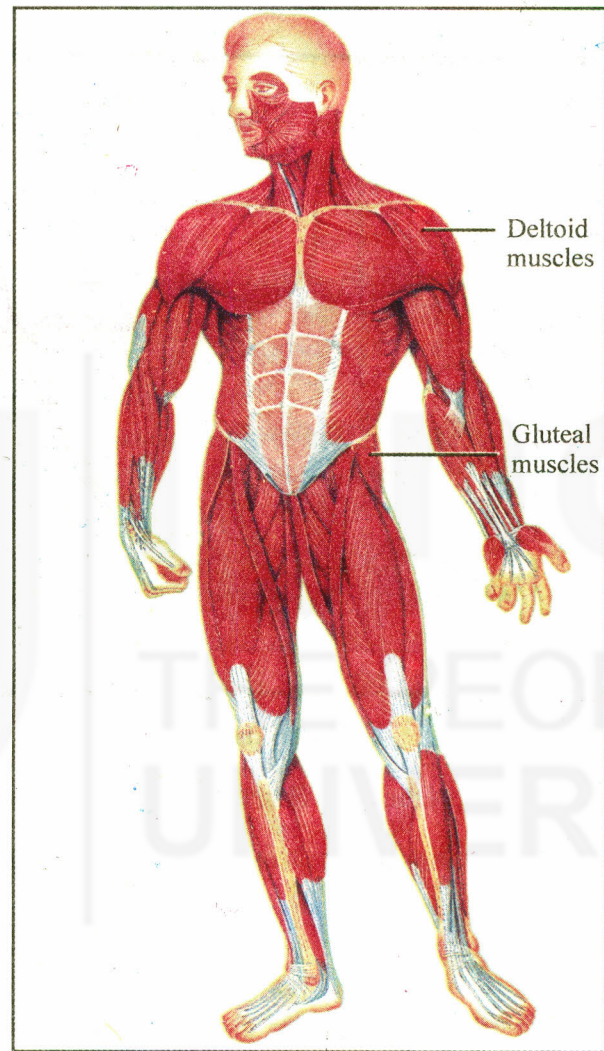


Fig. 1.3: The Muscular System

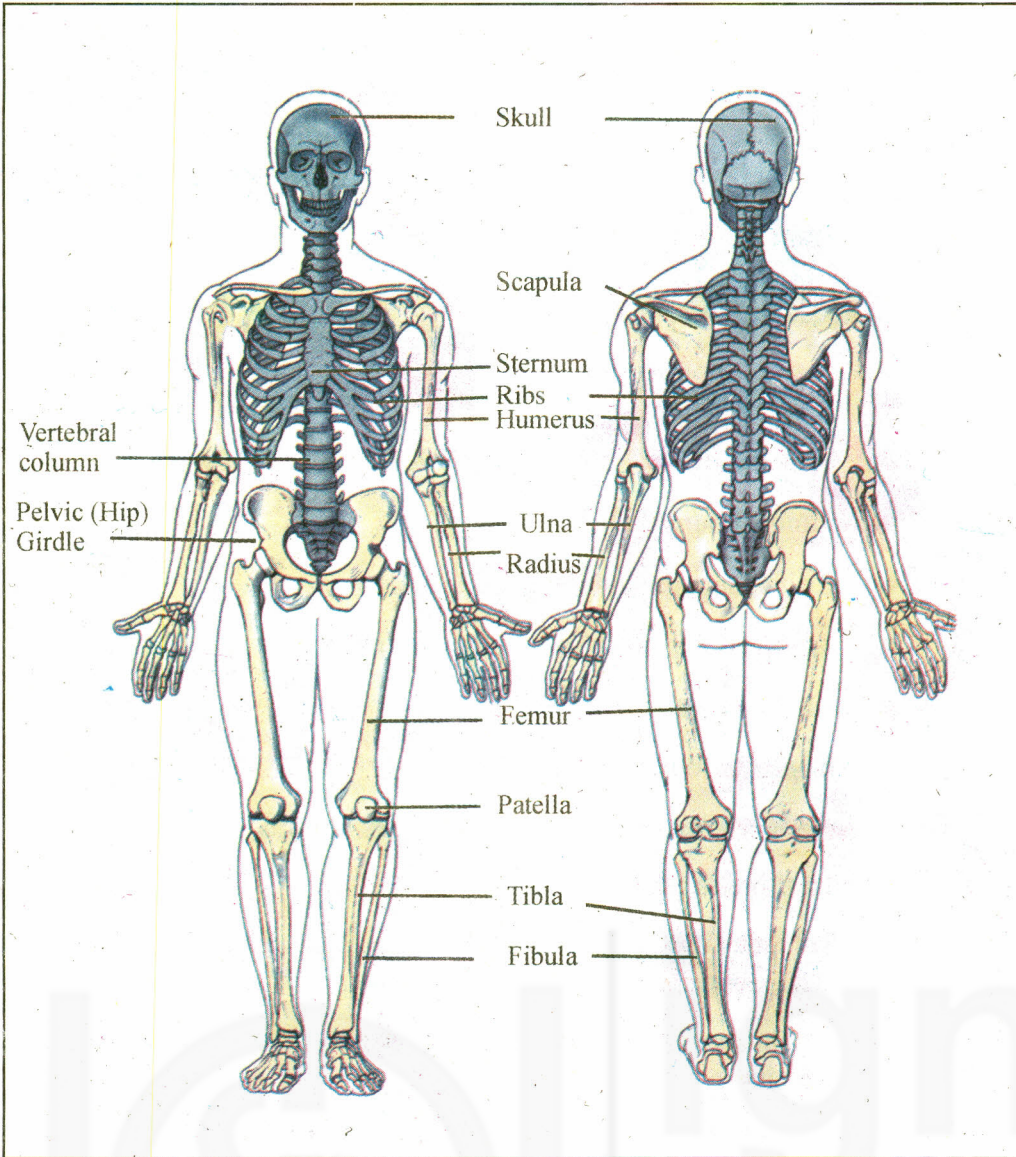


Fig. 1.4(a): The Skeletal System (Front)

Fig. 1.4(b): The Skeletal System (Back)

B) Structure and functions of the musculo-skeletal system

The musculo-skeletal system is composed of muscles and bones. Bones give structural framework to the body.

The structure is formed by 206 bones in the adult, the cartilage (small bones) and ligaments as they help to unite the bones at the joints.

1) Composition of skeletal system

	No. of Bones
a) The skull (head) made up of	= 29
b) Spine and vertebral-column (back bone)	= 26
c) Thorax – (chest bone)	= 25
d) Upper limbs – each limb has – 32×2	= 64 bones (hands)
e) Lower limbs – each lower limb has – 31×2	= 62 bones (leg)
Total	= 206 bones

2) Types of bones

Examples

- | | |
|--------------------|--|
| a) Long bones | – Upper arm (humerus), radius (thumb side of fore arm) and ulna (little finger side of fore arm), upper legs (femur) upper portion of the leg. |
| b) Short bones | – Wrists and ankles. |
| c) Flat bones | – Shoulder blades, skull (head), Chest Bones (Sternum and Ribs) |
| d) Irregular bones | – Face and Vertebral column |
| e) Sessamoid bone | – Patella – Knee cap at knee joint |

3) Functions of bones

- It gives support and shape to the body
- It protects the organ from any trauma and injury
- It helps in movement
- It helps to form blood cells.

4) Muscles are composed of fibre. Muscles help to move the body.

There are three types of muscles:

- Voluntary muscles, with the help of these muscles the body can be flexed and extended.
- Involuntary muscles, it works on its own e.g. muscles of the stomach and intestine.
- Cardiac muscles, it is the muscles of the heart. It is also governed by its own.

For Example: Some of the important muscles are :

Muscles of upper extremity : Deltoid: these muscles help in flexion of the upper arm, and also the site for giving subcutaneous injection such as insulin.

Muscles of the chest: External and internal intercostals and Diaphragm. These muscles elevate and depress ribs, enlarge thorax and cause inspiration i.e. breathing in oxygen.

Muscles of the thigh: Gluteal muscles help in extension and rotation of the leg. These muscles are also common site for giving Intra muscular injection and subcutaneous injection.

5) Muscles perform three important body functions:

- Movement of the body parts
- Maintenance of posture
- Production of body heat

A) Diagram

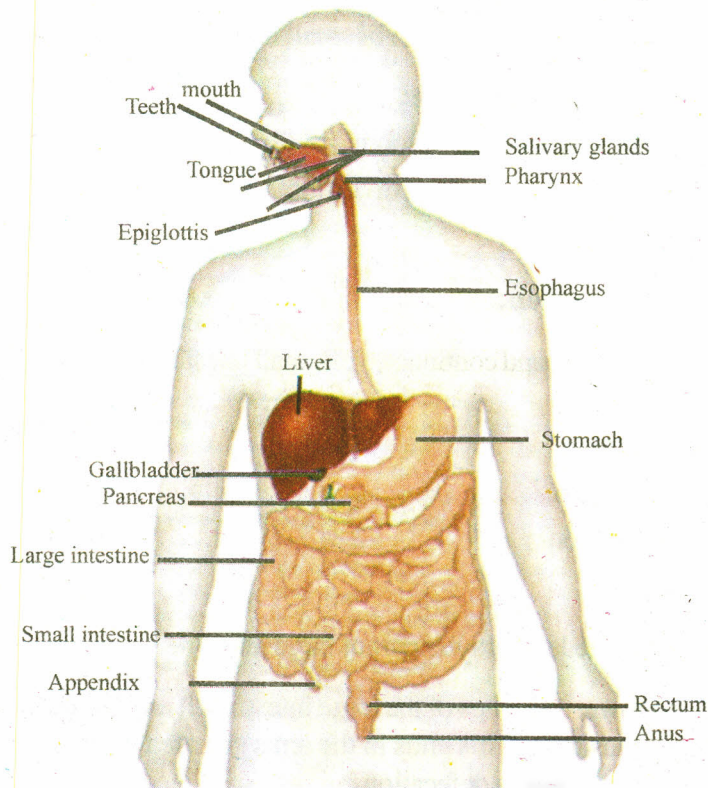


Fig. 1.5: The Digestive system

The passage through which food is ingested, digested, utilized and excreted is digestive tract.

B) Structure and functions of digestive system

Let us learn about the organs of the digestive system.

Mouth

The oral cavity is the beginning of digestive tract. It is surrounded by lips and inside the oral cavity there are teeth, gums. The hard palate is on the roof of the mouth and soft palate is the back side of the mouth. The tongue is composed by soft muscle. The movement of the tongue is inward and outward from the mouth. There are taste buds on the tongue. With the help of taste buds the taste of the food can be differentiated. The food is broken in small pieces by the teeth and the salivary juice is mixed with the grinded food. There are two types of teeth – temporary and permanent.

Pharynx

Pharynx is situated at the back of the larynx. The length of pharynx is five inches. Pharynx is divided into three parts: Nasopharynx, Oropharynx and Laryngeal pharynx. Food enters through pharynx and is transported to the oesophagus (food pipe) during the process with the help of epiglottis (cover) the nasal passage gets closed and food reaches to oesophagus.

Oesophagus (food pipe)

It is a muscular tube (9-10 inches) long, reaching from the pharynx above to the stomach.

Stomach

The stomach is the most dilated portion of the digestive system. It lies mostly in the abdominal cavity. It consists of an upper part, the main body and lower part.

Functions: It acts as a temporary storage for digested food.

Small-intestine

The small intestine lies in the abdomen and is surrounded by large intestine. It is shaped like a horse shoe. The length of small intestine is 6 meter (20-feet).

Functions of small intestine are:

- It completes the digestion of food.
- It absorbs the end products of digestion.
- It secrete hormones

Large intestine or colon:

It is about five feet long and continues with small intestine. Colon is divided into four parts:

- Ascending colon
- Transverse colon
- Descending colon
- Sigmoid colon.

Appendix is attached with lower part of large intestine.

Rectum is the lowest 5 inches of the large intestine. It ends in the anal canal which is about 1½ inches long. This ends in the anus guarded by round muscles which controls the opening during defecation.

Function of large intestine: It mainly helps in absorption of water from the end product of food and form faces which passes to the anal canal and passed out through anus.

Digestive gland (Accessory organ) organs which helps in digestion.

A) Diagram

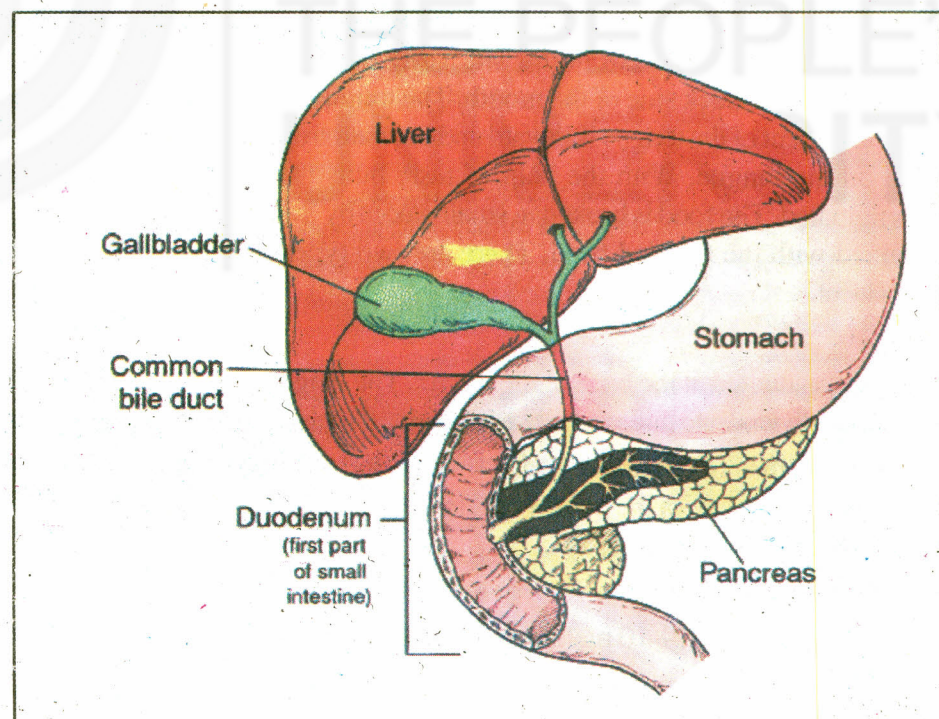


Fig. 1.6: Accessory organs of digestion

The liver: It is the largest gland in the body situated in the upper most part of the abdominal cavity on the right side below the diaphragm. Bile is formed in the liver cell and passes through the bile duct to the gall bladder. The bile is stored in the gallbladder and it takes part in the digestion of fats. Liver helps in removing toxic waste products of digestion such as urea, production of iron, clotting factor and production of heat also.

Pancreas: It is about 7 inches long. There is Islets of Langerhans which is responsible for the production of insulin and exocrine function as production of pancreatic juice which helps in digestion.

Gall bladder: It is pear shaped bag. It measures three to four inches in length and acts as a store house of bile. With the help of contraction of gallbladder the bile is poured into the middle part of the small intestines which helps in dissolving the fats during digestion.

Check Your Progress 1

1) Name human body systems.

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2) Integumentary system consists of:

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3) Explain the types of bones in skeletal system with examples.

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4) Explain the functions of bones and muscles.

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5) Name the parts of the digestive tract.

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Trachea

Trachea or wind pipe is about 4 inches long. It extends from the larynx to bronchus where bronchus divides into two parts.

Bronchi

Bronchi is formed by the division of the trachea and is similar in structure as trachea. The bronchi pass downwards and outwards towards the roots of the lung. The exchange of oxygen and carbon dioxide takes place in the lungs which is surrounded by the small blood vessels called capillaries.

Lungs

Lungs are two in numbers, and it is main organ of respiration. They are in the chest cavity and it is separated in the middle by the heart and its great blood vessels. Lungs are cone shaped organs, with the apex above and the base of the lungs lies resting on the floor of the thoracic cavity, on the diaphragms.

Inspiration and Expiration

Breathing in oxygen is known as inspiration and breathing out carbon dioxide is known as expiration and this process is known as respiration.

1.8 NERVOUS SYSTEM

Let us discuss about nervous system by means of looking at diagram and later on functions.

A) Diagram of Nervous System

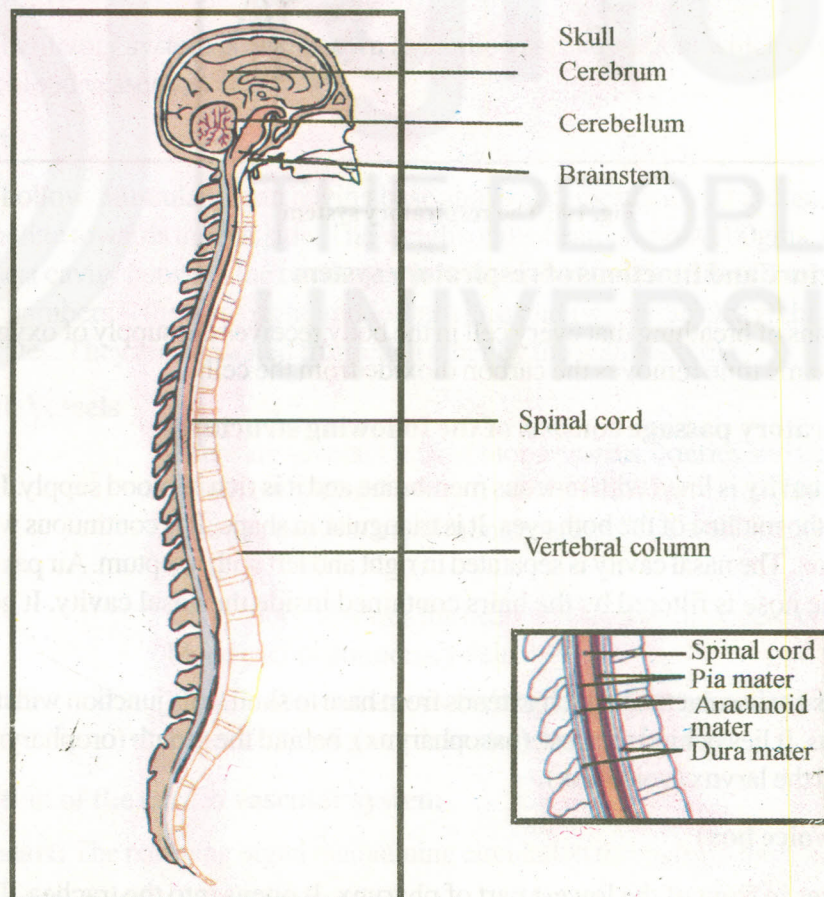


Fig. 1.9: Central nervous system

B) Structure and functions of Nervous system

The nervous system consists of central nervous system which has brain and spinal cord.

Brain

The membranes which cover and protect brain and spinal cord are called meninges.

The different parts of the brain:

- **Cerebrum (Fore brain):** Cerebrum is divided into right and left parts. It controls the mental behaviour, thought, consciousness, moral sense, will, intellect, speech, language and the special sense.
- **Midbrain :** Brainstem is composed of midbrain. Midbrain forms upper part of the brain stem. It connects the fore brain with Hind Brain. The midbrain contains the center for respiration and cardiovascular system.
- **Cerebellum (Hind Brain):** Cerebellum is the largest portion of the hind brain. It is divided into two parts right and left. The function of cerebellum is to regulate posture. It also maintains muscular co-ordination and maintenance of balance. It controls of muscle tone and posture.

Spinal Cord

The spinal cord begins at medulla oblongata and ends between the first and second lumbar vertebrae. It plays major role in communications between the brain and all parts of the body.

1.9 ENDOCRINE SYSTEM

We shall learn this system by looking at the diagram and its functions.

A) Diagram of Endocrine system

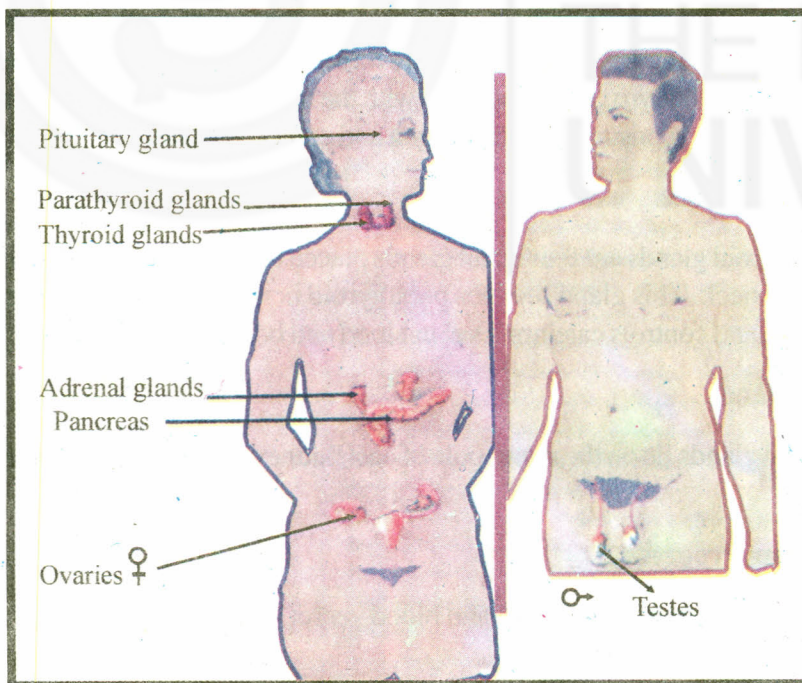


Fig. 1.10: Endocrine system

B) Structure and functions of Endocrine system

The endocrine system consists of endocrine gland or ductless gland. The secretion of the gland is known as hormone. The hormones control the activity of the body.

The endocrine glands are:

- Pituitary gland
- Thyroid gland
- Parathyroid gland
- Adrenal gland
- Pancreas (islets of Langerhans)
- Thymus
- Ovary and testes (oestrogen and progesterone)

Pituitary gland

The pituitary gland lies at the base of the skull.

Pituitary gland produces number of hormone for example:

- The growth hormone controls the growth of the body.
- It produces the hormones which control adrenal glands.
- The sex hormones help in production of sperms in male and ovum (egg) in female.
- It has function of milk production after delivery.

Thyroid gland

The thyroid gland consists of two lobes, places one on each side of the trachea, connected together by strip of thyroid tissue called isthmus of the thyroid which lies across, in front of the trachea. This gland secretes a hormone known as thyroxin, containing iodine. Thyroxin is concerned with the metabolic activities of the body, it takes active part in consumption of oxygen and carbon dioxide.

Parathyroid gland

The parathyroid glands are four small glands placed two on each side of the thyroid gland in the neck. This gland secretes parathyroid hormone, regulates the calcium metabolism and controls calcium level in blood and bone.

Adrenal glands

The adrenal glands lie on the upper pole of each kidney, which help during stress of the body.

Check Your Progress 2

- 1) Explain the structure of heart and blood vessel.

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2) Name the organs of respiratory system.

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3) Explain the structure and function of central nervous system.

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4) Name the glands of endocrine system.

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1.10 URINARY SYSTEM

Let us discuss about the urinary system with the help of diagram and later on its functions.

A) **Diagram of Urinary system**

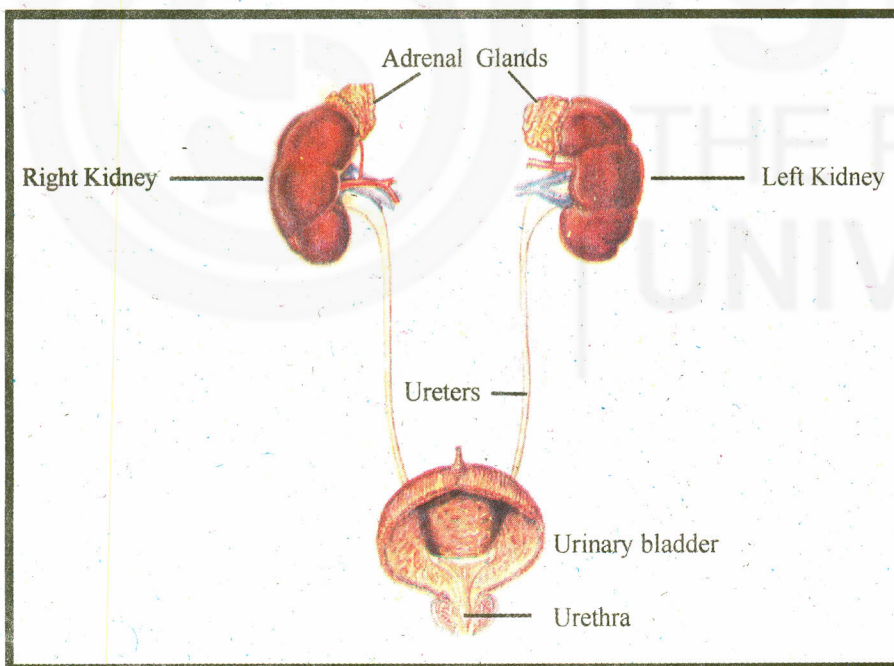


Fig. 1.11: Urinary System

B) **Structure and functions of Urinary system**

The urinary system consists of:

- The kidneys which forms urine
- Ureters, from kidney to bladder

- Bladder, which acts as a reservoir
- Urethra, to urine from bladder

The kidneys

Kidneys lie in the abdomen mainly in the lumbar region, one on each side of the vertebral column, each kidney measures 4-5 inches in length, the weight of an adult kidney is about 140gm. The kidneys are bean shaped, left kidney is little higher and bigger than right kidney. There is adrenal gland on the top of each kidney.

The kidneys regulate the water and electrolyte balance. It maintains acid base balance. It excretes the waste products from the body through urine.

Ureters

Ureters are two ducts or tubes, one attached with each kidney, passing from it to the bladders. Each ureter is 14-16 inches long. The ureter passes and opens into urinary bladder to convey the urine from kidney to the bladder.

The urinary bladder

The bladder acts as a reservoir (store house) for urine, it is pear shaped muscular organ.

The urethra

It is a passage from the bladder to the external opening. Urine passes through urethra when a person has full bladder and device to pass urine.

1.11 REPRODUCTIVE SYSTEM

We shall discuss about male and female organs of reproductions in this sub-section.

A) Diagram of reproductive system

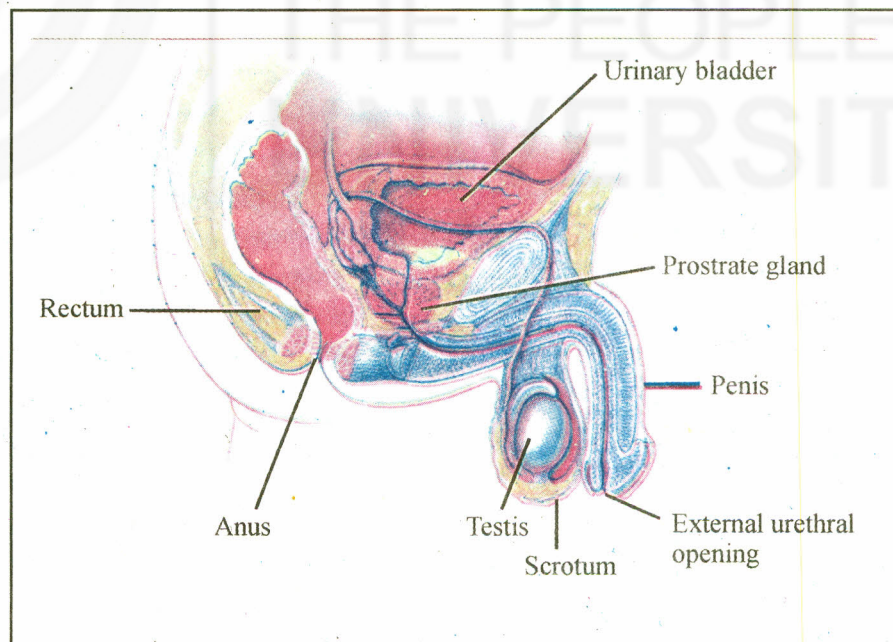


Fig. 1.12 (a): Male Reproductive System

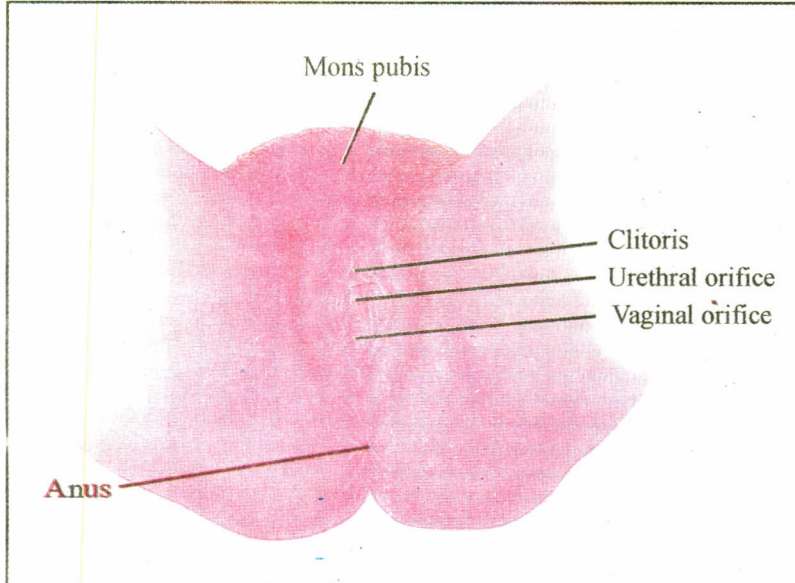


Fig.: 1.12 (b): Female Reproductive System

B) Structure and functions of reproductive system

The Male reproductive organs

Penis

The male urethra is 7-9 inches long. It starts from the bladder and passes through the perineum to the penis.

Testes

Testes are the male organs where spermatozoa are formed and the male sex hormone testosterone produced.

The seminal vesicles

These are paired tubular gland situated behind the neck of the bladder. The seminal fluid secreted by seminal vesicle helps to keep the sperm alive.

The prostate glands are about the size of a large walnut, it lies below the bladder, surrounding the urethra and composed of glands, ducts and involuntary muscles.

Scrotum is a pouch like structure. The testes lie in the scrotum.

The Female reproductive organs

The external organs are collectively known as the **vulva** and comprise the following parts.

The mons is a pad of fat lying in front of the symphysis pubis. This area is covered with hair at puberty.

The labia majora are two thick folds which form the sides of vulva.

Labia minora are two small folds of the skin situated between the upper parts of labia majora.

Clitoris is a small erectile body in between labia majora and it is most sensible part.

Vaginal orifice

Vagina is a muscular body lined with membrane composed of a special type of cell and supplied with blood vessels and nerves. The vaginal path is extended from the vestibule to uterus. It surrounds the lower part of the cervix of the uterus. It is covered with a thin membrane known as hymen. There are glands in the wall of the vagina, the secretion of gland keeps the vaginal path moist.

Uterus

The uterus is a thick, muscular, pear shaped organ, it lies in between rectum and bladder.

Functions of the uterus

The uterus retains the fertilized ovum (egg) during development, which leads to pregnancy and normally lasts about forty weeks, the uterus increases in size and the uterine wall becomes thinner but stronger during pregnancy.

Uterine (Fallopian) Tubes

The uterine tubes pass one on each side from the upper angles of the uterus. They are about 10cm long, and their uterine ends are narrow. At the end of the both side there are finger like structure known as Fimbria which is near to the ovary. The function of fallopian tube is to convey the ovum (female egg) from the ovary to the uterus, it is also site for fertilization (leading to pregnancy).

Ovaries

The ovaries are two almond shaped glands placed one in each side of the uterus, they contain large number of immature ova (egg). At each menstrual cycle, one of this ova begins to mature and if ovum is not fertilized with the male sperm then the ovum are discharged along with blood and mucus in each month and is known as menstruation. When the mature ovum gets fertilized with the sperm then it gets implanted in the uterine wall and pregnancy occurs.

The mammary gland on breast

The mammary glands on breast are necessary to the female reproductive organ that secretes milk. The weight and the size of the breast vary and enlarge during adolescent at puberty (age between 12 to 19 years) and increase in size during pregnancy and after delivery. Dark at center of the breast is nipple which has 15-20 openings for milk.

After the birth of the baby there is yellow liquid secreted from the breast known as colostrum. It is secreted for four days followed by the secretion of milk.

1.12 SPECIAL SENSE ORGAN (EYE, EAR)

Along with skin, nose and tongue which we have discussed earlier there are two more sense organs – eye and ear.

A) Diagram Lacrimal apparatus (Eye)

The eye ball is described as a globe, it is oval not circular. It is one inch in diameter, transparent in front and composed of three layers.

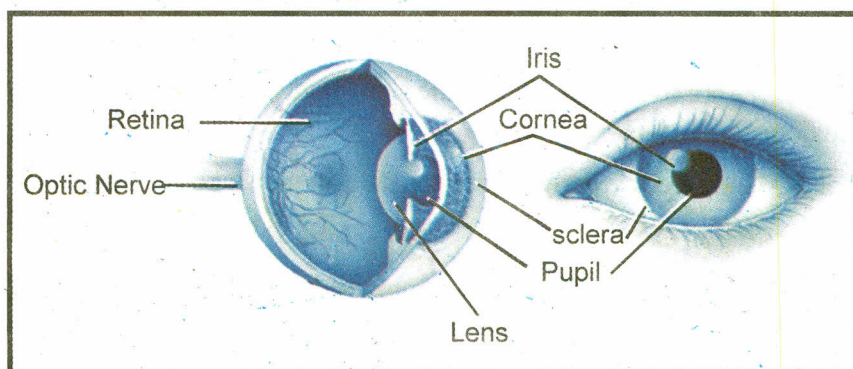


Fig. 1.13: The eye

- 1) Outer layer Sclera – Hard fibrous layer form white of eye
- 2) The choroids – Blood Vessel
- 3) Inner most The retina – Nerves

Appendages of the eye:

Eye brows are two arches of thick skin from which hair grows. It protects the eye from the great light.

Eye lids are two plates which are composed of fibrous tissue covered by skin lined with conjunctiva. Eye lashes are attached to the free margins of the lids and protect the eyes from dust and light.

Conjunctiva is the mucus membrane lying the eyelids and covering in front of the sclera. It is continuous with the lining of the lacrimal ducts, lacrimal sac (tear gland) and nasolacrimal duct.

a) Ear

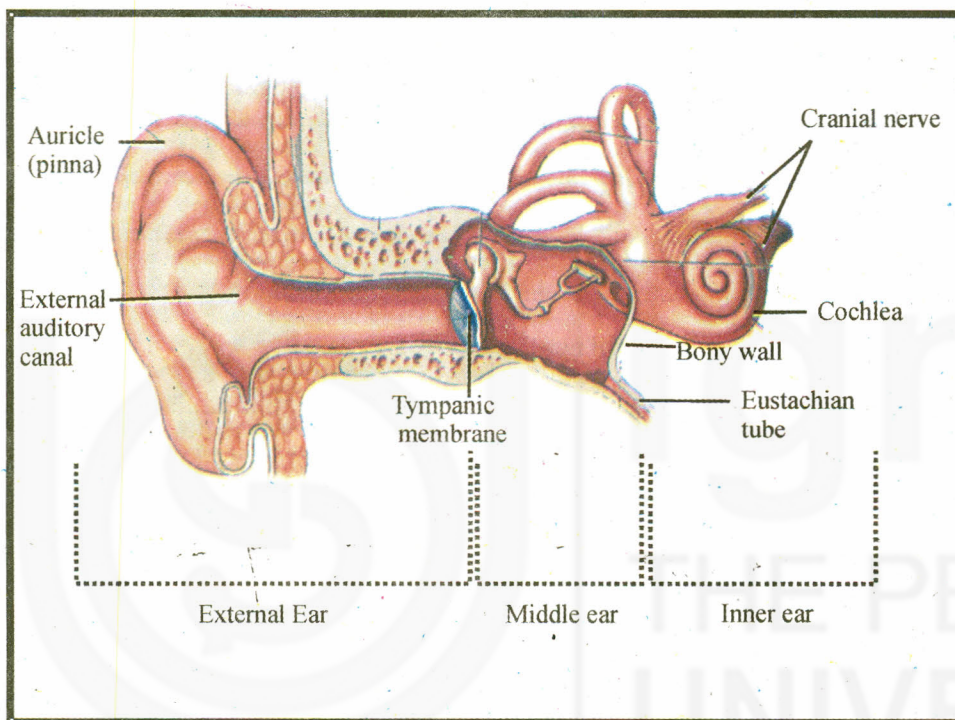


Fig. 1.14: The ear

The ear is organ of hearing. The ear is divided in three parts, external, middle and internal.

The external ear

The external ear consists of the auricle or pinna, and the external auditory meatus, which leads in from the pinna and conveys vibration of sound to the tympanic membrane.

This canal is one inch long, it is directed upwards and backwards. It can be straightened by pulling the pinna upward and back.

The middle ear

The middle ear or small chamber containing air, internal to the tympanic membrane or ear drum.

The internal ear

The internal ear consists of several cavities and channels. This channel contains fluid and nerve ending for hearing and balance.

Function of ear (Hearing)

Sound wave passes along with external ear canal and cause tympanic membrane to vibrate. Vibration is transmitted to the internal ear and by the brain as a pleasant or unpleasant sound.

Check Your Progress 3

- 1) Name the organs of urinary system.

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- 2) Name the organs of male and female reproductive system.

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- 3) Explain the appendages of eye.

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- 4) How does hearing take place.

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1.4 LET US SUM UP

In this Unit you have learnt the structure of human body system. This also describes the interrelationship of different systems, organs and normal functions of various body systems by knowing about normal functions. It will be easy for you to find out what can happen in case disease occur in a particular system that will help you to have more understanding with the patient and his illness.

1.5 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) ● Integumentary System
● Musculo-skeletal system

- The digestive system
- Cardio-vascular system
- Respiratory system
- The nervous system
- Endocrine system.
- Urinary system
- Reproductive System

- 2) ● Skin
- Hair
 - Nails

3) **Examples**

- Long bones – Upper arm (humerus), radius (thumb side of fore arm) and ulna (little finger side of fore arm), legs (femur) upper portion of the leg.
- Short bones – Wrists and ankles.
- Flat bones – Shoulder blades, skull (head), Chest Bones (Sternum and Ribs)
- Irregular bones – Face and vertebral column
- Sessamoid bone – Patella – Knee cap at knee joint

4) **Bones**

- It gives support and shape to the body
- It protects the organ from any trauma and injury
- It helps in movement
- It helps to form blood cells.

Muscles

- Voluntary muscles: with the help of these muscles the body can be flexed and extended.
- Involuntary muscles: it works on its own e.g. muscles of the stomach and intestine.
- Cardiac muscles: it is the muscles of the heart it is also governed by its own.

5) ● Mouth cavity or oral cavity

- Pharynx
- Oesophagus
- Stomach
- Small intestine
- Large intestine

Check Your Progress 2

1) Heart

It is a hollow, muscular organ having base above and apex below, it is cone shaped and incline towards the left side. The weight of the heart is about 300gms. It lies in the chest cavity between the two lungs. It is the size of the close fist:

The heart has four chambers they are right and left atrium and two ventricles right and left ventricles. They are separated from each other by the wall septum.

Blood Vessels

Artery : There are several kinds of blood vessels, arteries and arterioles, which carries blood away from the heart and carry oxygenated blood exception in pulmonary artery. The wall is thicker than vein.

Vein : Carry blood towards the heart and always carry de-oxygenated blood except pulmonary vein.

Capillaries : Are the minute vessels in which the arteries urinate and venules begins. They form a delicate network of vessels.

2) ● Nasal cavity

- Pharynx
- Larynx
- Trachea
- Bronchi
- Lungs

3) Brain

The membrane which cover and protect brain and spinal cord are called meninges.

The different parts of the brain

- **Cerebrum (Fore brain)** : Cerebrum is divided into right and left parts. It controls the mental behavior, thought, consciousness, moral sense, will, intellect, speech, language and the special sense.
- **Midbrain** : Brainstem is composed of midbrain. Midbrain forms upper part of the brain stem. It is connects the fore brain with Hind Brain. The midbrain contains the center for respiration and cardiovascular system.
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Spinal Cord

The spinal cord begins at medulla oblongata and ends between the first and second lumbar vertebrae. It plays major role is communications between the brain and all parts of the body.

- 4) ● Pituitary gland
- Thyroid gland
 - Parathyroid gland
 - Adrenal gland
 - Pancreas (islets of Langerhans)
 - Thymus
 - Ovary and testes (oestrogen and progesterone)

Check your progress 3

- 1) ● The kidneys
- Ureters
 - Bladder
 - urethra,

2) Male

- Penis Testes
- Scrotum
- Seminal Vesicle
- Prostate gland

Female

- External organs
- Uterus
- Fallopian tubes
- Ovary

- 3) **Eye brow** these are two arches of thick skin from which hair grows. It protects the eye from the great light.

Eye lids are two plates which are composed of fibrous tissue covered by skin lined with conjunctiva. Eye lashes are attached to the free margins of the lids and protect the eyes from dust and light.

Conjunctiva is the mucus membrane lying the eyelids and covering in front of the sclera. It is continuous with the lining of the lacrimal ducts, lacrimal sac (tear gland) and nasolacrimal duct.

- 4) Sound wave pass along with external ear canal and cause tympanic membrane to vibrates. Vibration is the transmitted the internal ear and by the brain as a pleasant or unpleasant sound.