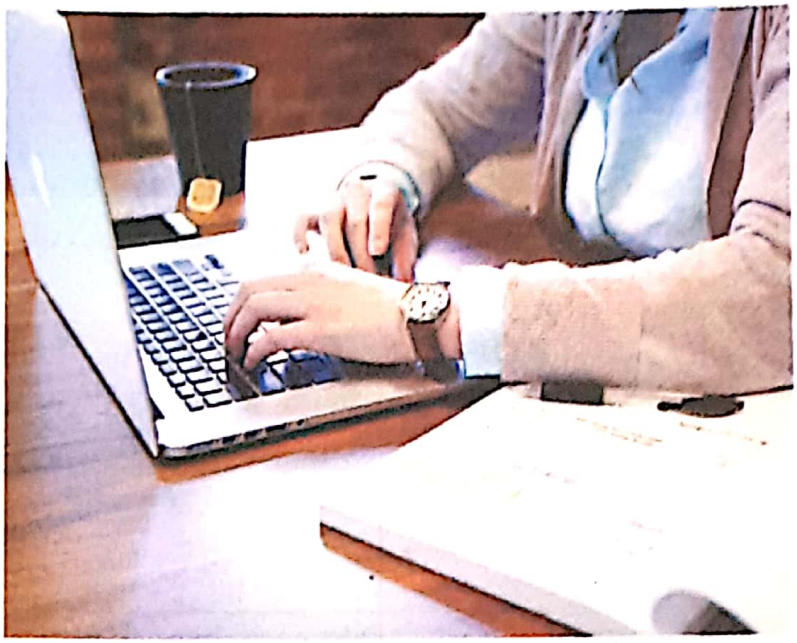
CHAPTER

4



SKELETAL AND NERVOUS SYSTEM

Learning Objectives:

- Organ systems of our body
- The skeletal system
- Functions of the skeletal system
- Different organs of the skeletal system
- Joints
- Muscles and movement
- The nervous system
- Different organs of the nervous system
- Reflex action
- Sense organs and how to take care of them

Our body is made up of many organs. The lungs, kidney, heart and brain are some of the vital organs of the body. Many organs together perform a particular function and are called the **organ system.** Some important organ systems in our body are circulatory system, digestive system, nervous system, respiratory system, etc. The important organs and functions of these organ systems are given in the table.

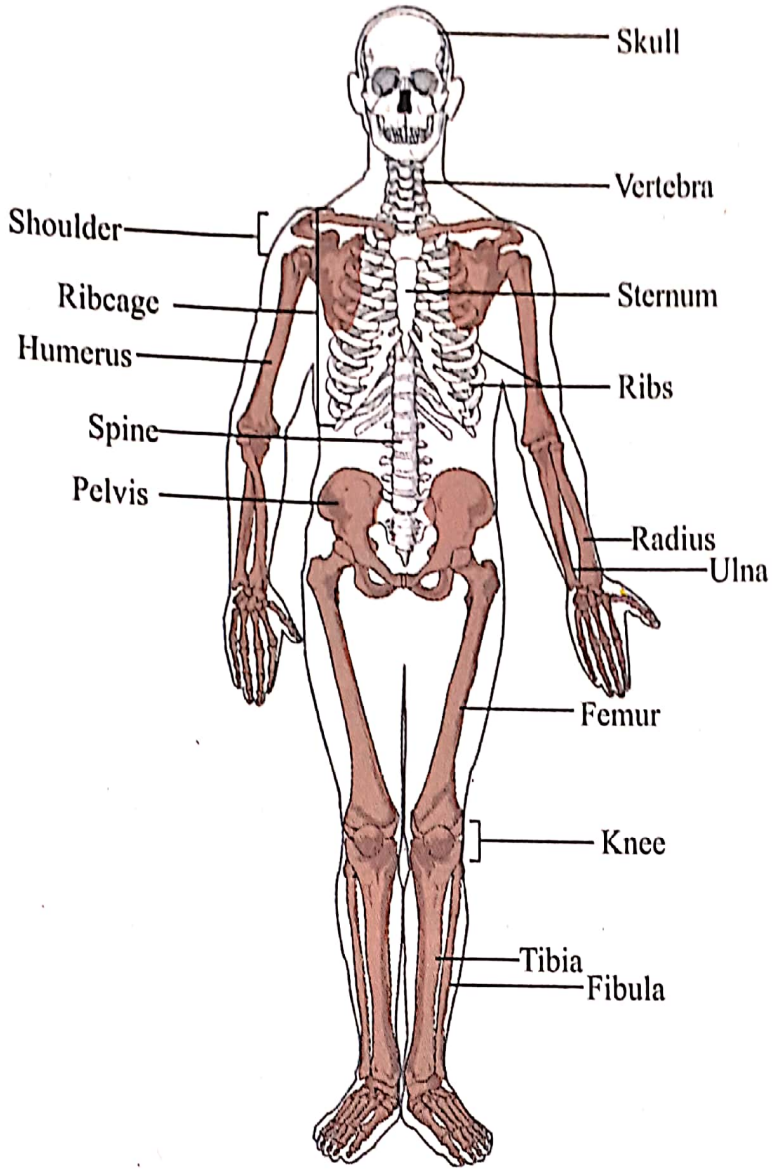
Different organ systems and their functions

SYSTEMS	ORGANS	FUNCTIONS
Respiratory	Lungs, nasal passages, bronchi, pharynx, trachea, diaphragm, bronchial tubes	• Intake of oxygen and removal of carbon dioxide from the body
Nervous	Spinal cord, brain, nerves, skin, eyes, ears, tongue, nose	• Control of body activities and the reaction to stimuli (any change in the surrounding environment)
Digestive	Stomach, liver, teeth, tongue, pancreas, intestines, oesophagus, rectum, anus	• Breakdown of food and absorption for use as energy
Excretory	Kidneys, bladder, ureters, skin	• Remove wastes from the body to outside • Controls water and salt balance
Endocrine	Pituitary gland, adrenal gland, thyroid gland, gonads	• Production of hormones and regulation of body functions
Skeletal and Muscular	Bones and muscles	• Protection of delicate body organs and movement
Circulatory	Blood, blood vessels, heart, lymph	• Transport of nutrients, metabolic wastes, water, salts and disease-fighting cells
Integumentary	Skin	• Protection of body from injury and bacteria, maintenance of tissue moisture, holds receptors for stimuli response, body heat regulation (sweating)

Let us study the skeletal and the nervous system in detail in this chapter.

SKELETAL SYSTEM

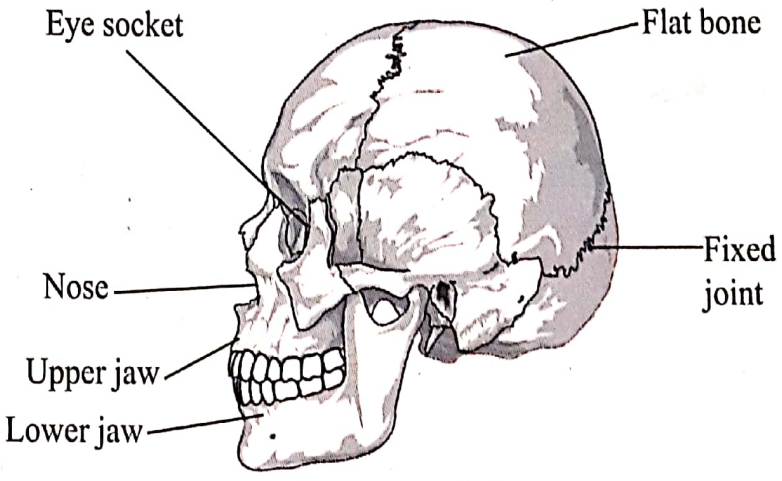
An adult human being has 206 bones in the body which form the skeletal system the body and give shape to the body. At birth there are around 304 bones in the bo which decrease to 206 bones by adulthood as some bones fuse together



The human skeletal system

Skull

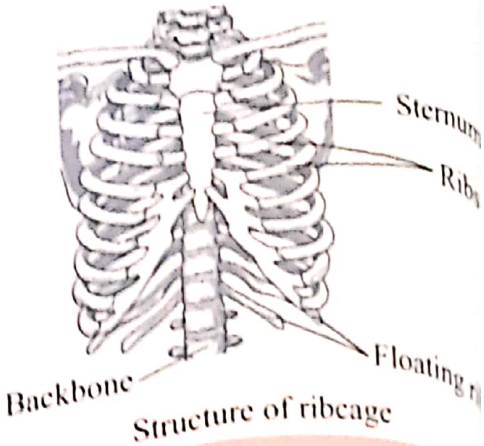
There are 22 bones in the skull which protect the most important organ – the brain. Except the lower jaw, all the bones of the skull are fixed. It is the movement of the lower jaw that helps us to eat and speak.



The human skull

Ribs

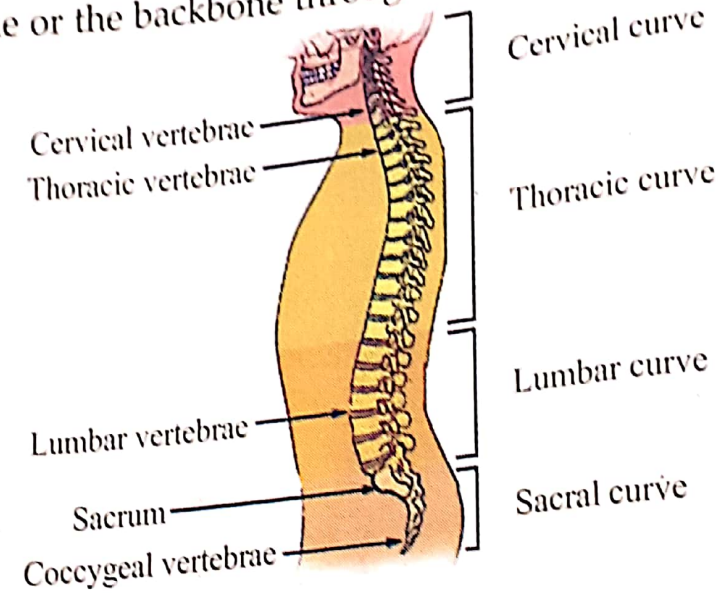
There is a cage of bones around the chest which is called the **ribcage**. The ribcage protects the heart and the lungs. It is made up of 12 pairs of thin curved bones which are attached to the backbone at the back and to a flat bone called **sternum** in the front. However, the last two pairs of ribs are not attached to the sternum, and hence are called **floating ribs.**



Structure of ribcage

Backbone

A series of small bones form the backbone of the human body, these are called t
vertebrae or the **vertebral column.** It is a strong column which is made of 33 sm
bones. The vertebrae are hollow in centre and protect the spinal cord. The skull
attached to the spine or the backbone through these vertebrae.



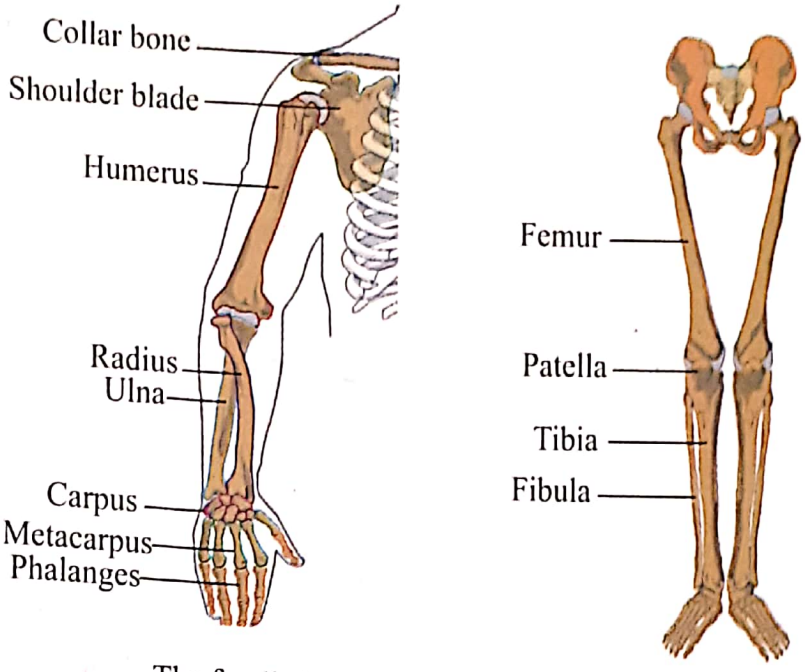
Vertebral column

Limbs

Humans have two pairs of limbs: the **forelimbs** which constitute our arms and
hindlimbs which constitute our legs. The forelimbs or our arms are joined to
spine with the help of shoulder girdles which is made up of a pair of shoulder bl
and a pair of collar bones. The arm is made up of two parts. The upper arm wh
has one long bone called the **humerus** and the lower arm which has two bones-
radius and the **ulna.**

The hindlimbs or our legs are also made up of two parts – the **upper leg** and
lower leg joined together at the knees. The upper leg has thigh bone which

powerful bone as it bears the weight of our body and is called **femur.** It is the longest bone in our body. The long bones are hollow and have a soft and fatty substance in them called **bone marrow.**



The forelimb and the hindlimb of the human body

Know more

The longest bone in our body is the thigh bone or the **femur** and the smallest bone is the **stirrup** which is present inside our ears.

JOINTS

The meeting point of bones is called a **joint.** The joints help us to bend, twist and turn. A joint has strong tissues called **ligaments** which hold the bones together. Ligaments are strong elastic tissues.

There are two types of joints – **movable** and **immovable.**

Movable Joints

The joints that help in the movement of our body are called **movable joints.** For example, arms and legs. There are four types of movable joints in our body.

Hinge joint

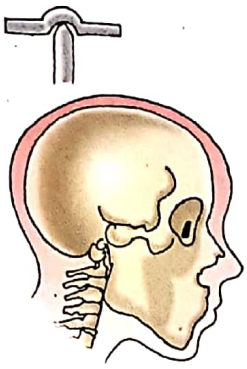
It is like the hinge of the door and helps the bones to move in one direction. The elbows, knees, fingers and toes have hinge joint. They can only move forward and backward.

Ball and socket joint

The shoulder and hip region have the ball and socket joint. They allow movement in all directions. This joint helps in the maximum movement of the body. One bone ends like a ball while the other ends like a cup. They fit into each other.

Pivot joint

The joint which joins the skull to the backbone is the pivot joint. It enables the head to move up, down and sideways.



Pivot joint

Gliding joint

Gliding joint

This joint is found in the wrist and ankle. It allows us to bend, twist and turn.

Immovable Joints

The joints that cannot be moved are called **immovable joints.** The joint of the skull the joints between the ribcage and the breast bone are immovable joints.

MUSCLES AND MOVEMENT

The soft and stretchy band of tissues are called **muscles.** There are more than 6 muscles in our body and they perform different functions. They tighten and relax and help our joints in movement of our body. Muscles are attached to the bones by strong fibres which are called **tendons.**

The different types of muscles found in our body are:

Voluntary Muscles

Our arms, neck, shoulders and legs have voluntary muscles as they are under control.

Involuntary Muscles

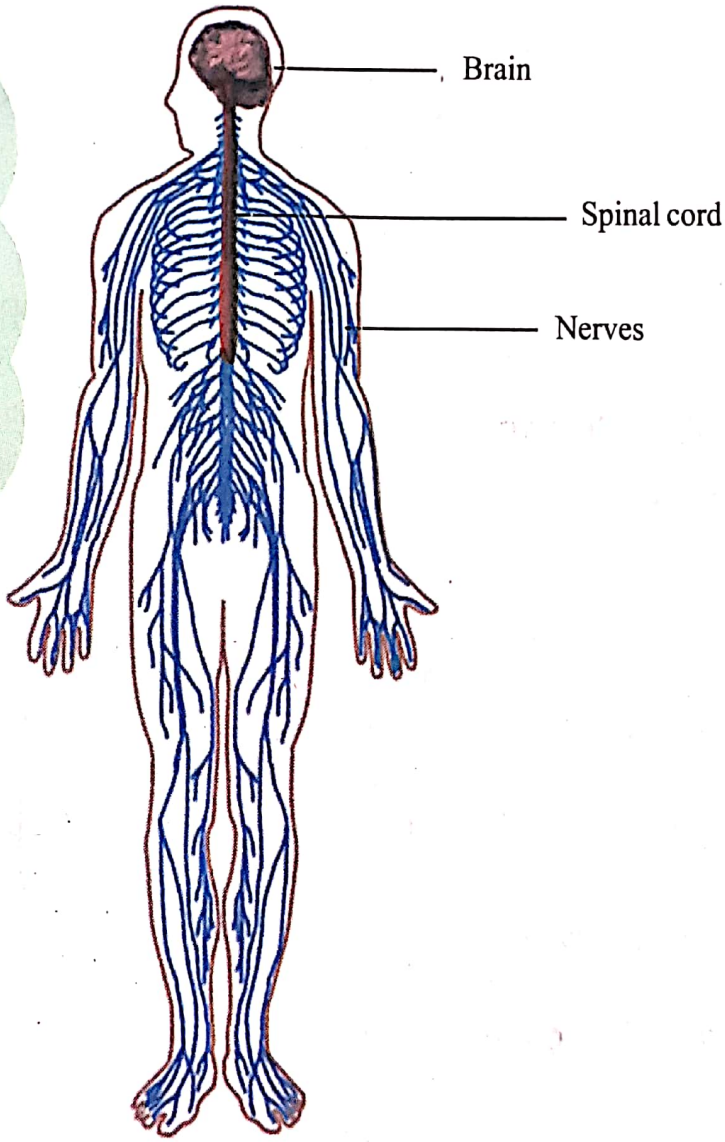
Some muscles help in our breathing, movement of food in the stomach and intestines, and flow of blood. They work on their own and so are called **involuntary muscles.** They are also known as **smooth muscles.**

Cardiac Muscles

The muscles of the heart are called **cardiac muscles.** They pump blood to all the parts of our body and are involuntary in nature.

NERVOUS SYSTEM

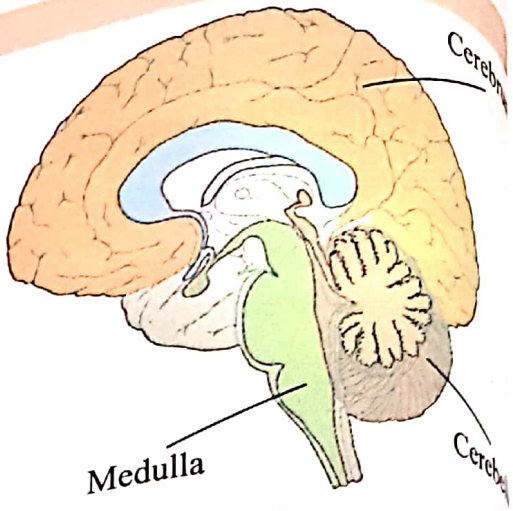
The nervous system helps all the parts of our body to communicate with each other. The brain, the spinal cord and the nerves constitute our nervous system.



Nervous system in humans

Brain

Brain is the main organ of the nervous system. It sends and receives information from all parts of the body. There are three parts of the brain:



Parts of human brain

Cerebrum

Cerebrum is the largest and the main part of the brain. It controls our sense organs and is the centre of intelligence. It controls our voice and also helps us to think, learn, remember and recall.

Cerebellum

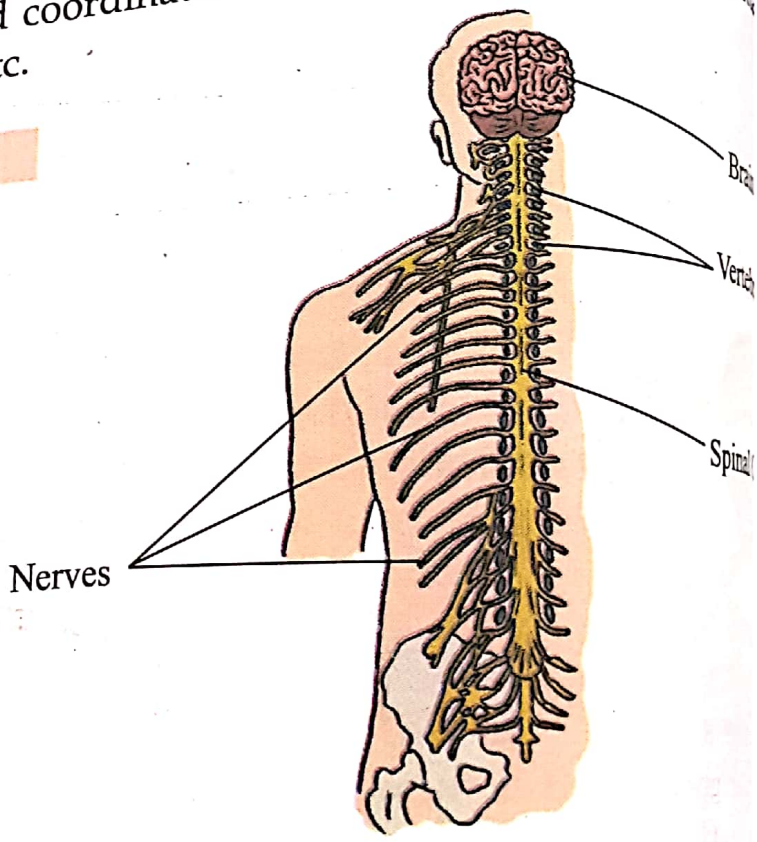
It is an egg-shaped structure situated below the cerebrum. It enables the mu coordination and the balance of our body.

Medulla

Also called as brain stem, the medulla is a stem-shaped structure which lies a bottom of the brain. It controls and coordinates the movement of the involun muscles like breathing, heartbeat, etc.

Spinal Cord

The thick cord that extends down from the brain stem to the lower end of the backbone is called the **spinal cord.** It is enclosed in the spine or the backbone and connects the brain to different parts of our body through nerves. It is responsible for the transfer of information between the brain and the rest of the body.



Spinal cord with nerves

Nerves

The long thread-like structures that carry messages between the brain and the other parts of the body are called **nerves.** The nerves that extend from the head and the neck, join the brain directly, while, the nerves from the other parts of the body are connected to the spinal cord.

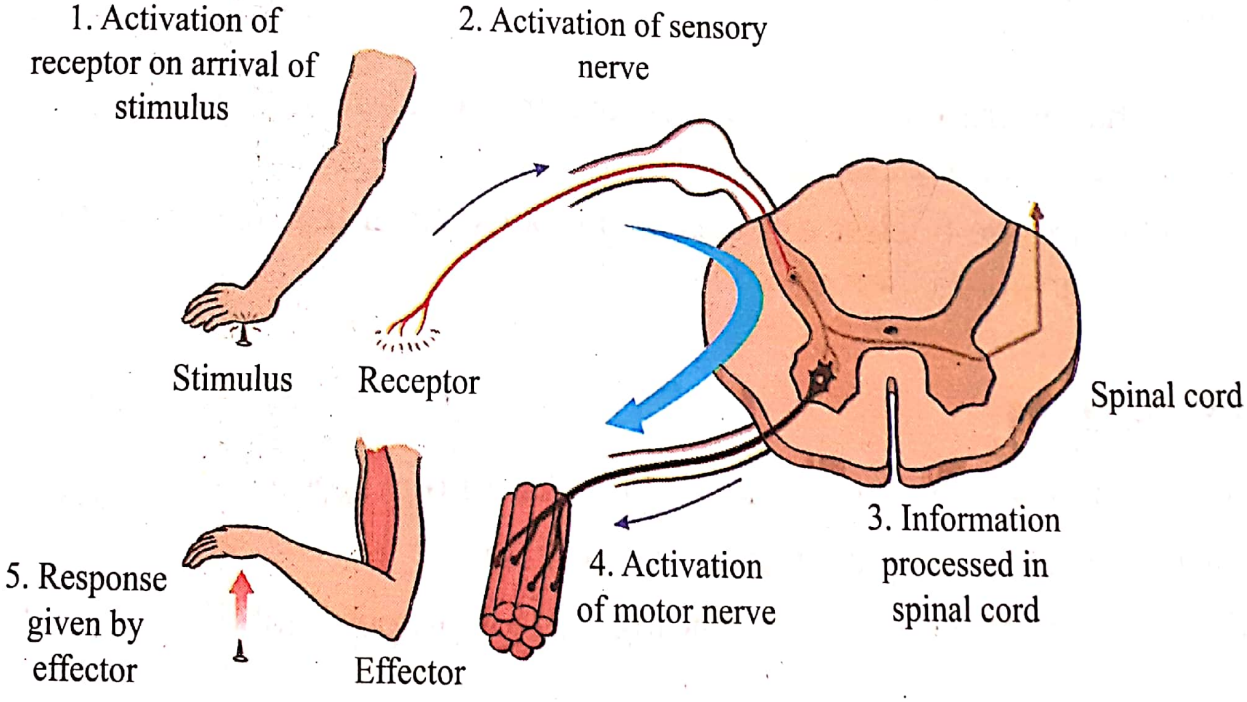
Types of Nerves

In our body, there are three kinds of nerves. These are:

- **Sensory nerves:** These nerves bring messages from the sense organs to the brain or the spinal cord.
- **Motor nerves:** These nerves carry commands from the brain to the muscles of different organs.
- **Mixed nerves:** There are some nerves that carry messages from the brain to the muscles as well as send messages from the sense organ to the brain. These are called **mixed nerves.**

REFLEX ACTION

Our body has some automatic response. For example, if we touch a hot or sharp object or boiling water, we withdraw our hand immediately. These actions are instant and does not involve the brain and are called **reflex actions.** Such actions are controlled by the spinal cord. The skin is the **receptor organ**, it sends the signal to the spinal cord and the spinal cord orders the muscles of the hand which act as **effector organ.**



Reflex action

SENSE ORGANS

Sense organs connect us to the world outside. We have five sense organs – eyes, ears, nose, tongue and skin.

Eyes

Eyes are very important sense organs. The different parts of eyes are:

Eyelid: It covers our eyes when we sleep or blink our eyes.

Eyelashes: They protect our eyes from dust.

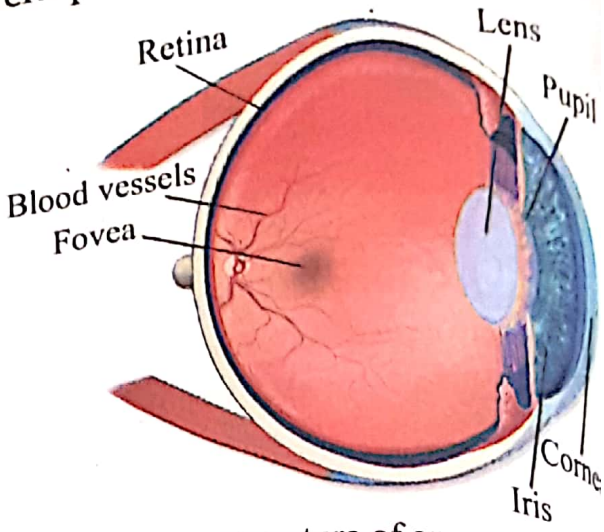
Pupil: It is the black circle that lets light into our eyes.

Iris: It is the coloured part around the pupil.

Cornea: It is the circular and transparent front portion of the eye that protects the pupil and iris.

Retina: It is the back of the eye where images are formed.

Optic nerve: It is the nerve that connects the eyes to the brain. The eyes act like a camera and the optic nerve carries the ima to the brain.



Structure of an eye

Know more

Our body has more than 600 muscles and in fact about 35–40% of our bo weight is due to muscles.

Eye muscles are the busiest muscles in the body. Scientists estimate, they m move more than 100,000 times a day.

Care of the eyes

Eyes are very delicate. We must take proper care of our eyes.

- Wash your eyes by splashing water on them.
- Make sure that when you are reading there is proper light. Do not read in light.

- Maintain a proper distance between your eyes and the book.
- Also make sure that you sit in the right posture while reading and writing.
- Do not watch too much of television but whenever you watch keep a distance of six feet from the television.
- Too much of playing computer games is also harmful to your eyes.
- Make sure never to use someone else's towel if he has eye infection.

Ears

Ears help us to hear the sounds around us and also maintain our balance.


Ear

Care of the ears

- Do not prick sharp objects in your ears. It might damage the ears.
- Do not let water enter your ears. Use a dry towel to clean them.

Nose

Nose is a prominent part on our face. We breathe and smell through the nose. There are nerve endings on the upper part of the nose. When we have cold, they get blocked and we are unable to smell. There are tiny hair inside the nose which prevent dust from entering in our nose.

Care of the nose

- Blow your nose to keep it clean.
- Do not put sharp object in your nose.
- Do some breathing exercises.

Tongue

The tongue enables us to taste the food and helps us to speak. There are tiny sensory structures on the tongue called **taste buds** which help us to distinguish the different tastes – sweet, sour, salty and bitter.

Care of the tongue

- Clean your tongue with a tongue cleaner when you brush your teeth.

Skin

The outermost covering and the largest organ of our body is skin. There are tin pores on the surface of the skin which help the body waste to come out as swea The skin protects our internal organs. It helps us to feel the heat, cold and pain.

Care of the skin

- Take a bath regularly with soap and clean water to remove the dirt from t body.
- Wear clean clothes.
- Wear dark-coloured clothes in winters and light-coloured clothes in summe
- Use an antiseptic cream if there is a cut or scratch on the skin.

SUMMARY

- The bones of our body form the framework of our body.
- The skull, ribs, backbone and the limbs constitute the skeletal system.
- The skull protects our brain and the backbone protects our spinal cord.
- There are 206 bones in an adult human body.
- A joint is a place where two bones meet. Joints help our limbs in locomotion a doing several work.
- There are four types of joints in our body – hinge joint, ball and socket joint, pi joint and gliding joint.
- Muscles hold the bones together and make movement possible.
- There are three types of muscles – voluntary muscles, involuntary muscles a cardiac muscles.
- The brain, the spinal cord and the nerves form the nervous system.
- Cerebrum is the largest part of the brain.
- The spinal cord connects the body with the brain through the nerves.
- There are five sense organs – eyes, ears, nose, tongue and skin.
- The skin is the outermost covering of our body.
- We should take proper care of our sense organs.

GLOSSARY

- **Femur:** thigh bone, the longest bone in our body
- **Bone marrow:** soft and fatty substance in the bone
- **Ribcage:** cage of bones around the chest
- **Reflex Action:** automatic response of our body
- **Tendons:** strong fibres which attach muscles to the bones

Objective Type Questions

1. Write true or false. Correct the incorrect statements.

(*a*) The images of objects are formed on the retina of our eyes.

(*b*) The vertebral column protects the delicate umbilical cord.

(*c*) The ligament are the strong tissues that hold the bones together.

(*d*) The nerves that bring messages from the brain to the spinal cord are called motor nerves.

(*e*) The ribcage protects our brain.

2. Write where do we find these joints in our body.

(*a*) The hinge joint .....

(*b*) The ball and socket joint .....

(*c*) The pivot joint .....

(*d*) The gliding joint .....

3. Give one word answer for the following.

(*a*) A cage of bones around the chest .....

(*b*) A joint that allows back and forth movement .....

(*c*) Muscles in the heart .....

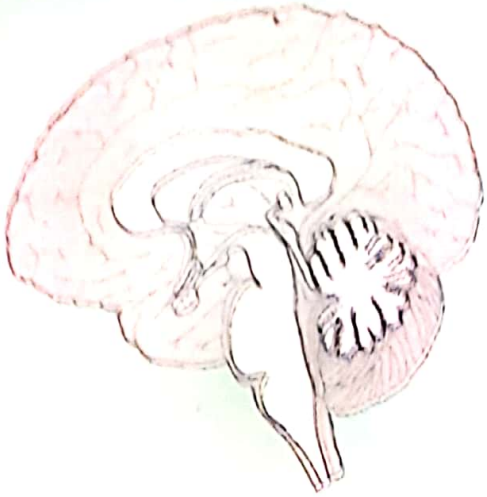
(*d*) The automatic response of our body .....

(*e*) The cord that connects the brain to the nerves .....

4. Match the following.

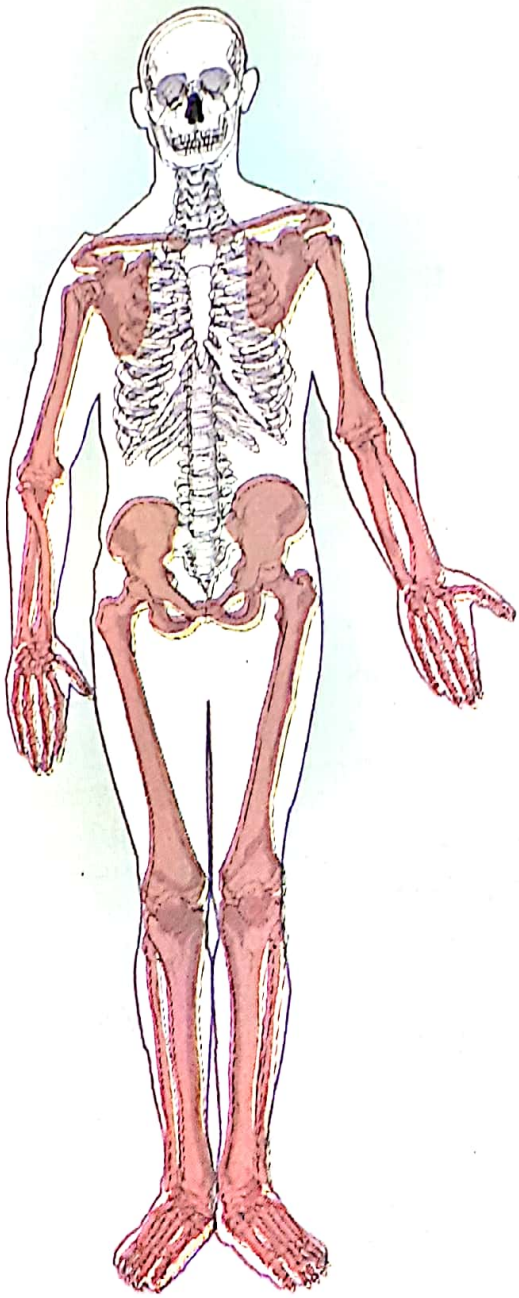
Column A	Column B
(*a*) Pumps blood to the entire body	(*i*) blood vessels
(*b*) Oesophagus	(*ii*) important parts of excretory system
(*c*) Trachea	(*iii*) forms the framework of the body
(*d*) Arteries, veins, capillaries	(*iv*) muscles that are under our control
(*e*) Brain, spinal cord, nerves	(*v*) food pipe
(*f*) Voluntary muscles	(*vi*) heart
(*g*) Skeletal system	(*vii*) wind pipe
(*h*) Kidneys, ureter, urinary bladder, urethra	(*viii*) forms the nervous system

5. **Given below is the picture of human brain. Label the different parts of the [illegible] describe their role.**



6. **Label the diagram**

Ribcage, skull, limbs, backbone, ball and socket joint, pivot joint, hinge joint an gliding joint



Subjective Type Questions

7. Answer the following.

(*a*) What is the skeletal system? Write all the parts of the skeletal system.

(*b*) What are the different kinds of muscles and what are their functions?

(*c*) Differentiate between sensory nerve and motor nerve.

(*d*) Differentiate between movable and immovable joints.

(*e*) What are reflex actions?

Multiple Choice Questions (MCQs)

8. Tick (✓) the correct options.

(*a*) A framework of bones that give shape and support to our body.

(*i*) muscle (*ii*) skin (*iii*) heart (*iv*) skeleton

(*b*) It is the control centre of the human body.

(*i*) nerves (*ii*) spinal cord (*iii*) brain (*iv*) kidneys

(*c*) Our nervous system consists of

(*i*) brain, spinal cord and nerves

(*ii*) brain, spinal cord and lungs

(*iii*) brain, spinal cord and kidneys

(*iv*) brain, muscles and nerves

(*d*) The coloured part around the pupil in the eyes is

(*i*) retina (*ii*) eyelash (*iii*) iris (*iv*) eyelid

(*e*) The egg-shaped part in the brain is

(*i*) cerebellum (*ii*) medulla (*iii*) cerebrum (*iv*) skull

Questions Based on Higher Order Thinking Skills (HOTS)

9. Give reasons for the following.

(*a*) Radha was having severe cold, she could not smell the different types of flowers.

(*b*) There is pain when the wrist twist or while slipping down if you support your body on the wrist.

ANSWERS

1. (*a*) T (*b*) F (*c*) T (*d*) F (*e*) F **2.** (*a*) Elbows, knees, fingers and toes (*b*) Shoulders and hips (*c*) Neck (*d*) Wrist and ankle **3.** (*a*) Ribcage (*b*) Hinge joint (*c*) Cardiac muscles (*d*) Reflex action (*e*) Spinal cord **4.** (*a*)(*vi*); (*b*)(*v*); (*c*)(*vii*); (*d*) (*i*); (*e*)(*viii*); (*f*)(*iv*); (*g*)(*iii*); *h*(*ii*) **8.** (*a*)(*iv*); (*b*)(*iii*); (*c*)(*i*); (*d*)(*iii*); (*e*)(*i*)