UNIT 19

# MOVEMENTS IN ANIMALS

## Learning Objectives

I6K7B7

After the completion of this lesson, students will be able to:

- know about the movements of different animals.
- differentiate between movement and locomotion.
- recall the types of movements.
- know about human body and its movements.
- summarise the significance and types of joints.
- identify the components of the skeleton.
- understand muscle movements and its types.

## Introduction

There are so many movements that happen in our bodies. Sit absolutely still and observe the movements taking place in your body. You must be blinking your eyes from time to time. There will be movements in your body as you breathe. Different parts of your body move while you remain at the same place. There are different ways how animals move from place to place. For example, a cow uses its legs to walk, a snake uses its whole body to slither or crawl, a bird uses its wings to fly, a fish uses its fins to swim and human uses legs to walk. Walking, crawling, flying and swimming - these are only few ways in which animals move from one place to another. Let us learn in detail how these movements take place.

## 19.1 Movement and Locomotion

Although both movement and locomotion sound similar in their meaning, there are few interesting differences between the two terms. Movement is generally defined "*as the act of changing the place or position by one or more parts of the body*". Movement helps to perform necessary functions such as pumping of blood to different parts of the body in an organism. Movement can be both **voluntary** and **involuntary**. For example, walking is a voluntary movement, while breathing is an involuntary movement.

The movement of an organism from one place to another is known as locomotion. Locomotion helps an organism to find food, avoid harsh weather conditions, escape from their predator etc. Walking, running and swimming are few examples for different types of locomotion. In this process, there is the action of appendages such as limbs, wings, flagella and cilia. In most of the aquatic animals such as fish, whales, and shark, the locomotion results from a series of wave-like muscle contractions. Table 19.1 gives the differences between locomotion and movement.

**Table 19.1** Locomotion and Movement.

| Locomotion | Movement |
|---|---|
| Locomotion is the movement of an organism from one place to another. | Movement is the act of changing the place or position by one or more parts of the body. |
| It is always voluntary. | It can either be voluntary or involuntary. |
| Locomotion takes place at the organism level. | A movement takes place at the biological level. |
| Locomotion doesn't necessarily require energy. | Movement requires energy. |

## 19.2 Movement in different Animals

Movement is one of the significant features of living beings. This is the basic mechanism used in majority of the vertebrates including human. Animals exhibit a wide range of movements. In this part let us study about movements in different animals.

### 19.2.1 Earthworm

The body of earthworm is made up of many rings joined end to end. It has muscles which help to extend and shorten the body. Under its body it has large number of bristles called setae which are connected with muscles. These bristles help to get grip on the ground. During movement, the earthworm first extends the front part of the body, keeping

**Activity 1**

Observe an earthworm moving on soil in the garden. Gently lift it and place it on a piece of blotting or filter paper. Observe its movement now. In which of the above two surfaces do you find that the earthworm is able to move easily?

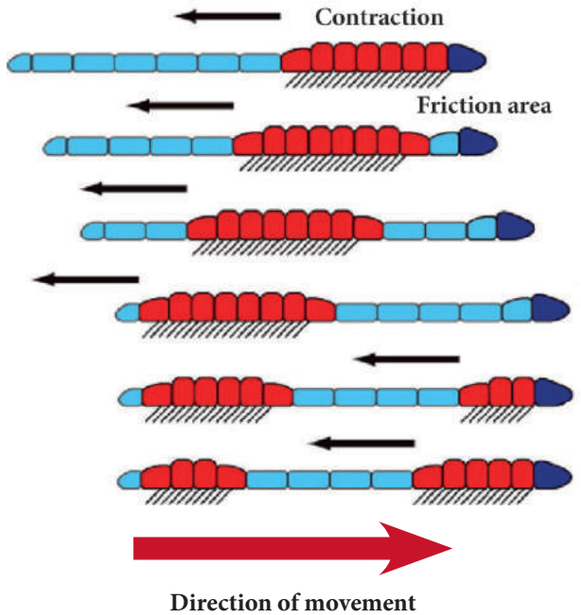


**Figure 19.1** Movements in Earthworm

the rear portion fixed to the ground. Then it fixes the front end and releases the rear end. It then shortens the body and pulls the rear end forward. This makes it move forward by small distances. Repeating such muscle contraction and relaxation the earthworm can move through soil. A slimy substance secreted by its body helps this movement.

### 19.2.2 Cockroach

A cockroach has three pairs of jointed legs, which help it to walk, run and climb. It also has two pairs of wings for flying. Large and strong muscles help in the movement of legs. The body is covered by chitin, a light protective material. Chitin is shed regularly so that the body can grow.

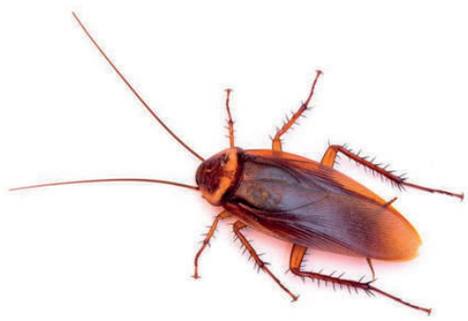

**Figure 19.2** Cockroach

### Activity 2

Observe a cockroach and identify its legs and wings. Try to know more about other parts of cockroach with the help of your teacher.

## 19.2.3 Birds

Birds can walk on the ground and fly as well. Some birds can also swim in the water. A bird has streamlined body. Its bones are light and strong. They are hollow and have air spaces between them. The lower portion of limbs are modified as claws, which help them to walk and to perch. The breast bones are modified to hold massive flight muscles which help in moving wings up and down. Birds have special flight muscles and the forelimbs are modified as wings.The wings and tail have long feathers, which help in flying. Birds show two types of flight: **gliding** and **flapping.**

During gliding the bird has its wings and tail spread out. In this movement the bird uses air currents for going up and down. Flapping is an active flight. The bird beats the air by flapping its wings. They use flight feathers for this purpose.


**Figure 19.3** Movement in birds

### Activity 3

Observe a hen and crow. How do they move? Write about the similarities and dissimilarities found among them, in your note book.

## 19.2.4 Snake

The body of snake consists of a large number of vertebrae. The adjoining vertebrae, ribs and skin are inter-connected with slender body muscles. When the snake moves, it makes many loops on its sides. The forward push of the loops against the surface makes the snake move forward. Movement of snake is called ***slithering movement***. Many snakes can swim in water also.

**Figure 19.4** Movement in Snakes


Since snakes do not have legs, they use their muscles and their scales to move.

## 19.2.5 Fish

Fish swims with the help of fins. They have two paired fins and an unpaired fin. The body of a fish is streamlined to reduce friction while moving in water. They have strong muscles, which help in swimming. When a fish swims its front part curves to one side and the tail part stays in the opposite direction. In the next move, the front part curves to the opposite side and the tail part also changes its position to another side. The caudal or tail fin helps in changing direction.

Fish have streamlined body structure which helps them to move smoothly with the flow of water. Muscles and fins on the body and the tail help to keep the balance.

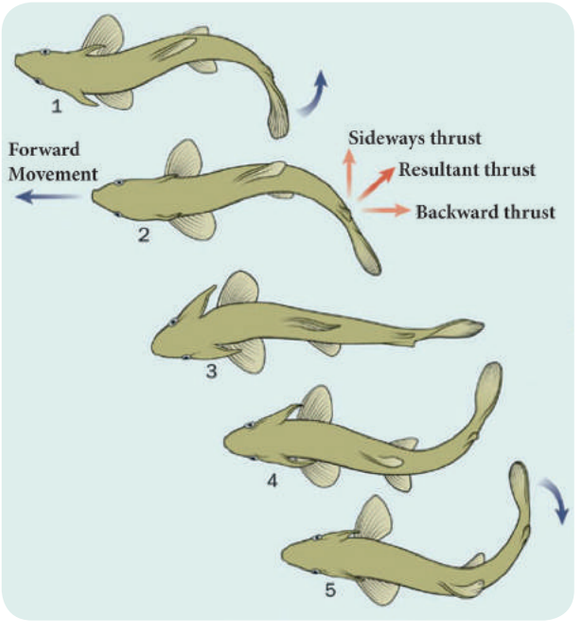


**Figure 19.5** Movement in Fish (Swimming)

### Activity 4

Make a paper boat; put it in water and push it with narrow end pointing forward. Now hold the boat sideway and push it into water from the broad side. What did you observe? In which process was it easy to move the boat? Have you noticed that the shape of a boat is somewhat like a fish?

### 19.2.6 Movements in Human body

Humans can move some parts of their body in different directions; however some body parts can be moved only in one direction. Our body is made up of a frame work of bones called **skeleton** which helps in the movement of the body. Some of the movements in body parts of human are:

a. Movement of eyelids.
b. Movement of the heart muscles.
c. Movement of teeth and jaw.
d. Movement of arms and legs.
e. Movements of head.
f. Movements of neck.

Movement of some organs happens because of the combined action of bones and muscles. In such cases, movement is possible along a point where two or more bones meet.

- Cheetah can run 76 kilometrer per hour.
- Hippopotamus can run faster than a man.
- Cockroach is the fastest animal with 6 legs covering a metre per second.
- The fastest mammal, the Dolphin can swim upto 35 miles per hours.

## 19.3 Types of Movements

When we talk about locomotion and movement, there are three types of movements.

### 19.3.1 Amoeboid movement

It is brought about by pseudopodia which are appendages which move with movement of protoplasm within a cell.

### 19.3.2 Ciliary movement

This movement is brought about by appendages called as cilia which are the hair-like extensions of the epithelium. Both these kinds of movements are seen with cells of the lymphatic system.

### 19.3.3 Muscular movement

It is a more complex movement which is brought about by the musculoskeletal system. This type of movement is seen in the higher vertebrates.

To understand more about the movements brought about by the musculoskeletal system, we need to understand the joints, skeleton and types of muscles.

## 19.4 Joints

The point at which two separate bones meet is called a joint. Depending on the type of movement they allow, joints can be of three types: fixed, slightly movable and movable joints.

### 19.4.1 Fixed or Immovable joints

In this type of joint no movement is possible between the two bones. The structures between the bones of the skull box are examples of immoveable joints.

### 19.4.2 Slightly movable joints

Here, only very little (partial) movement occurs between the two bones. The joint between a rib and the breast bone or between the vertebrae is the example for slightly movable joint.


Joints are the place where two bones meet or connect. Ligaments are short bands of tough fibrous connective tissues that function to connect one bone to another, forming the joint.Tendons are made of elastic tissues and they also play a key role in the functioning of joints.

### 19.4.3 Freely movable joints

In this type, varying degree of movements is possible between the two bones forming the joint. There are six major types of movable joints. They are given below in Table 19.2.

**Table 19.2** Types of movable joints.

| Joint | Examples | Description | Mobility |
|---|---|---|---|
| **Ball and Socket** | Shoulder<br>Hip | A ball shaped head of one bone articulates with a cup like socket of an adjacent bone. | Movement can occur in three planes. This joint allows the greatest range of movement. |
| **Hinge** | Elbow, Knee, Ankle | A cylindrical protrusion of one bone articulates with a trough-shaped depression of an adjacent bone. | Movement is restricted to one plane. This joint allows bending and straightening only. |
| **Pivot** | Spine (Atlas / Axis joint at the top) | A rounded or pointed structure of one bone articulates with a ring-shaped structure of Radius Ulna- an adjacent bone. | Movement is restricted to one plane. This joint allows rotation about its longitudinal axis only. |
| **Condyloid** | Wrist | Similar to a ball and socket joint but with much flatter articulating surfaces forming a much shallower joint. | Movement can occur in two planes. This joint allows the second greatest range of movement. |
| **Gliding** | Spine (between the bony processes of the vertebrae) | Articulating surfaces are almost flat and of a similar size. | Gliding allows movement in three planes, but it is severely limited. |
| **Saddle** | Thumb, shoulder and inner ear. | One part is concave (turned inward) at one end and looks like a **saddle.** The other end is convex (turned outward), and looks like a rider in a **saddle.** | Flexion-extension and abduction-adduction movements are seen |

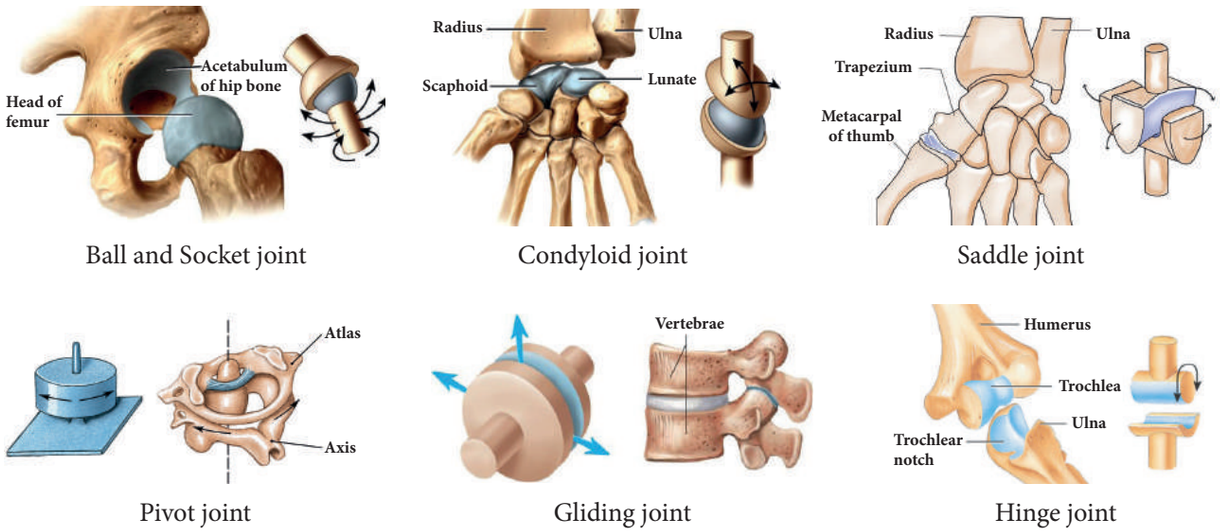


**Figure 19.6** Types of joints in human

## 19.4.4 Synovial joints

A synovial joint is a joint which makes connection between two bones consisting of a cartilage lined cavity filled with fluid, which is known as a *diarthrosis* joint. These are the most flexible type of joint between bones, because the bones are not physically connected and can move more freely in relation to each other. Synovial joints have four main distinguishing features. They are shown in Table 19.3.

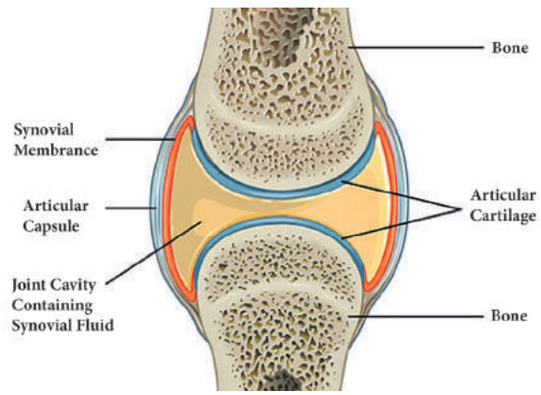


**Figure 19.7** Synovial joint in human.

DO YOU KNOW?

Inflammation of joints is a condition that usually results either due to friction of articulating cartilage or due to lack of synovial fluid in the joint. During this condition, the person feels acute pain in joints particularly while moving joints. This disease is referred to as arthritis. Arthritis is however also caused due to the deposition of uric acid crystals in the joints.

**Table 19.3** Feature of synovial joint

| Feature | Structure | Function |
|---|---|---|
| Ligament | A band of strong fibrous tissue. | To connect bone to bone. |
| Synovial fluid | A slippery fluid with the consistency of egg-whites that is contained within the joint cavity. | To reduce friction between the articular cartilage in the joint. |
| Articular cartilage | Glassy-smooth cartilage that is spongy and covers the ends of the bones in the joint. | To absorb shock and to prevent friction between the ends of the bones in the joint. |
| Joint Capsule | A tough fibrous tissue that has two layers, with the fibrous capsule lying outside the synovial membrane. | The fibrous capsule helps to strengthen the joint, while the synovial membrane lines the joint and secretes synovial fluid. |

## 19.5 Skeleton System

The skeleton system provides the hard structure or framework to the human body which supports and protects the body. It is composed of connective tissues like bones, cartilage, tendons and ligaments. If the skeleton is without joints, no movement would take place and the significance of human body will be no more than a stone. On the basis of presence in the body, skeleton is of two types.

**Exoskeleton**

It is the skeleton that is found on the exterior layer of the body and it basically originates from embryonic ectoderm or mesoderm. Like scales in the fishes, outer hard layer of the tortoise and feathers of the birds it protects and preserves the inner organs.

**Endoskeleton**

It is the skeleton that is found inside the human body and it originates from the mesoderm. These are found in almost all vertebrates and form the main body structure.

### 19.5.1 Functions of skeleton

The skeletal system serves five important functions in the human body.

1. It provides structure and shape to the body.
2. It supports and surrounds the internal organs of the body.
3. Calcium and phosphorus, the two minerals that the body needs for important regulatory functions, are stored inside the bones.
4. Red blood cells are produced in the bone marrow.
5. The bones of the skeletal system act as levers for muscular action. Muscular movement would not be possible without **tendons** (fibrous cords of tissue that attach muscle to bone) and **ligaments** (fibrous cords of tissue that attach bone to bone).

DO YOU KNOW?

- The femur or thighbone is the longest and strongest bone of the human skeleton.
- The stapes in the middle ear is the smallest and lightest bone of the human skeleton.

### 19.5.2 Constituents of skeleton

Human skeleton consists of bone, cartilages and ligaments. Bones comprise the hard framework of the body. Cartilages are the supporting and connecting structures. For example, the cartilage supports the projecting external ears and the tip of the nose. Ligaments bind the bones together. There are different types of bones in human skeletal system. They are:

**Long bones:** Found in arms and legs.

**Short bones:** Found in wrist ankle, vertebral column.

**Flat bones:** Found in skull, ribs, shoulder and hips.

**Irregular bones:** Found in spine and vertebral column, mandible, palatine, inferior nasal concha, and hyoid.

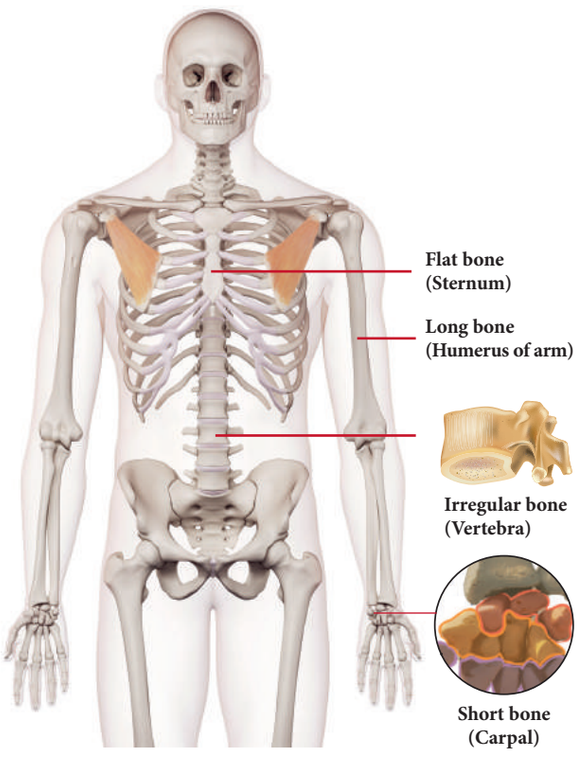


**Figure 19.8** Types of bones in human

## 19.5.3 Parts of skeleton

The skeletal system is composed of bones and the related structures that aid body movement. It is divided into two major parts: the axial skeleton and the appendicular skeleton.

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### I. Axial skeleton

The **axial skeleton** consists of the bones along the *axis*, or central line of the human body. The axial skeleton consists of the skull, facial bones, sternum, ribs, and vertebral column.

#### a. Skull

Skull is a hard structure made up of small bones. It is formed by 22 bones out of which 8 bones are fixed together to form the cranium and 14 bones fuse to form the face. The only bone which has movable joint is the lower jaw. This movable joint is supported by muscles and ligaments. Skull placed on the top of the backbone can be moved up, down and sidewards.

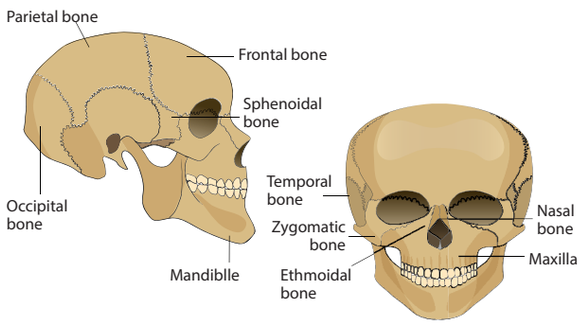



**Figure 19.9** Skull bone in human

#### b. Vertebral column

Vertebral column running at the back of the body is also called as spine or the backbone. It is in the trunk region to offer support to the upper part of the body. Vertebral column is made up of individual bones called as vertebrae. Total vertebral column consists of 7 cervical vertebrae, 12 lumbar vertebrae, 5 fused sacral and 3 fused coccygeal vertebrae. Vertebral column runs from the base of the skull to the hip bone forming a tube. Spinal cord passes through this hollow tube. Vertebrae are joined by gliding points which allow the body to be bent back, front or side wards.

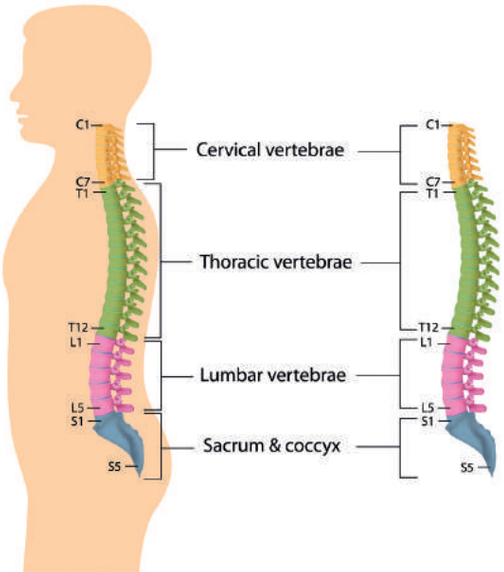
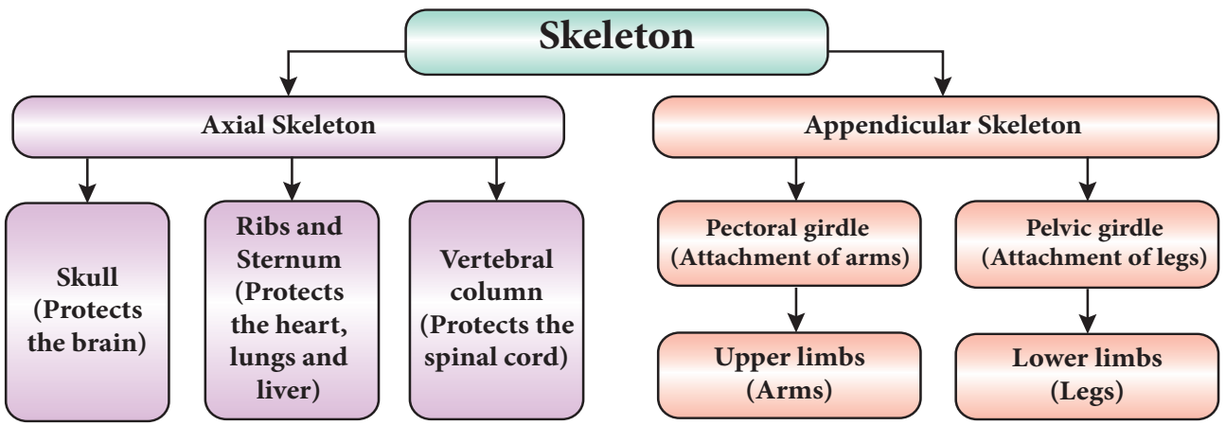



**Figure 19.10** Vertebral column in human.



The functions of vertebral column are given below.

- It protects the spinal cord.
- It supports the head.
- It serves as an attachment for the ribs.
- It provides support and place of attachment for the pectoral and pelvic girdle.
- It provides movement for the human skeleton.
- It helps in walking and standing erect with correct posture.

### c. Sternum or Rib cage

Rib cage occupies the chest region. It is a cone-shaped structure made up of Twelve pairs of ribs. Ribs are attached to vertebrae at the back which curve around to form a cage. Ten pairs of ribs are attached to the breast bone at the front. Two pairs of lower ribs are free at front. These are called as free-floating ribs. Rib cage is set up in such a way that it can contract and expand during the process of breathing. Rib cage protects the underlying lungs, heart and some part of liver.

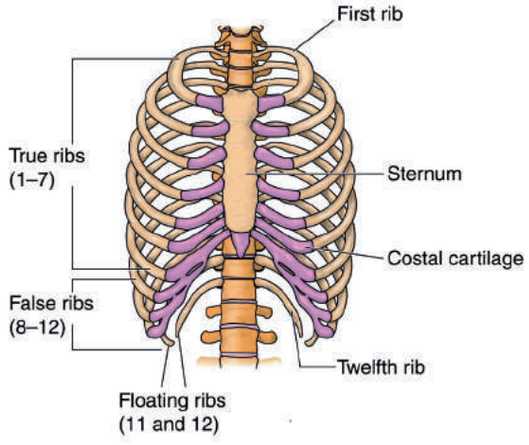



**Figure 19.11** Rib cage in human.


Humans and giraffes have the same number of bones in the necks, but the vertebrae in a giraffe's neck are much, much larger.

## II. Appendicular skeleton

The **appendicular skeleton** contains the bones in the *appendages* of the body, as well as the structures that connect the appendages to the axial skeleton. Specifically, the appendicular skeleton comprises the shoulder girdle; the arm, wrist, and hand bones; the pelvic girdle; and the leg, ankle, and foot bones.

### a. Shoulder bone or Pectoral bone

Shoulder bone is formed by collar bone at the front and the shoulder blade at the back. The collar bone is supported by breast bone at one end and the shoulder blade at the other end. The shoulder bone encloses a socket like cavity into which fixes the ball of the upper arm. This forms a ball and socket joint. This girdle is also called as pectoral girdle.

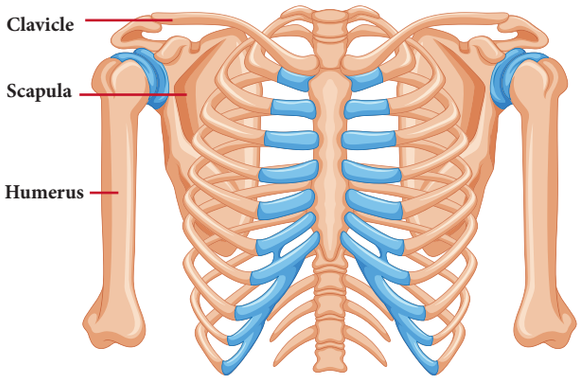



**Figure 19.12** Pectoral girdles

### b. Pelvic bone

Pelvic bone is also called as pelvic girdle. It is made up of strong bones to balance entire weight of the body. Pelvic girdle is formed by five fused vertebrae at the back and form a

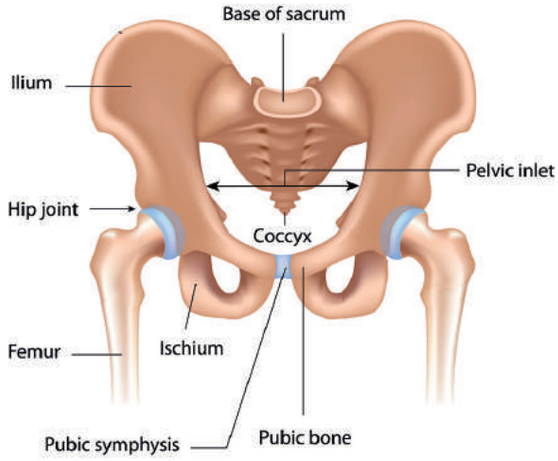



**Figure 19.13** Pelvic bones

cavity in the centre while reaching the front part. The thigh bones are attached to either side of the girdle with a ball and socket joint.

### c. Arm bone

Arm bone is the upper limb made up of humerus, radius, ulna, carpals, metacarpals and phalanges. All these bones are joined by hinge joints which allow the limb to move only in one direction. Humerus makes up the upper arm. Fore-arm is made up of radius and ulna. Wrist is made up of carpals. Palm is made up of metacarpals. Fingers are made up of phalanges.

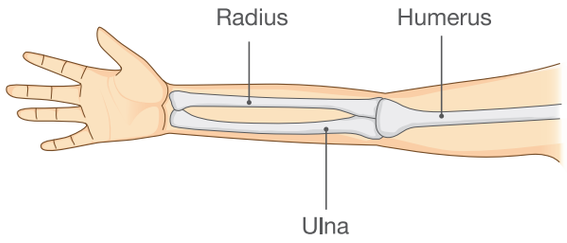



**Figure 19.14** Arm bone

### d. Leg bone

Leg bone is the lower limb made up of femur, tibia, fibula, tarsals, metatarsals and phalanges. All these bones are joined by hinge joints which allow the limb to move only in one direction. Knee is covered by a cap like structure called as patella or a knee cap. Femur makes up the thigh bone. Leg is made up of tibia and fibula. Ankle is made up of tarsals. Foot is made up of metatarsals. Toes are made up of phalanges.

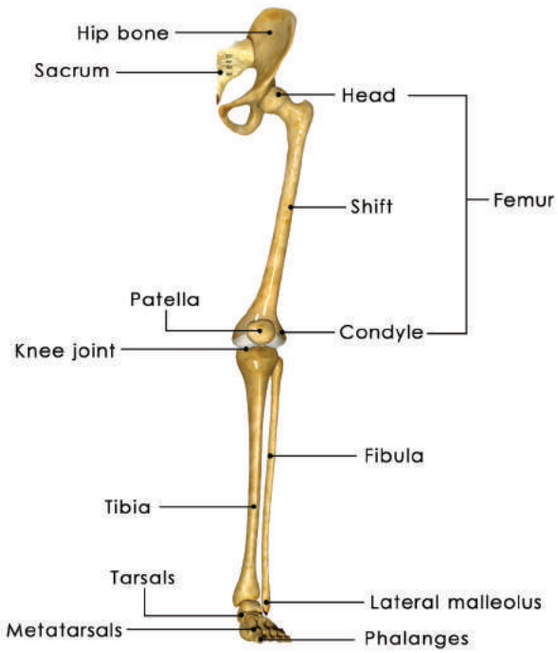



**Figure 19.15** Leg bone

## 19.6 Muscles

The muscles in the body provide the means of all movements. They cover the skeletal framework and also give shape to the body. Muscles help to maintain body posture while sitting, standing or walking. Most muscles are long bundles of contractile tissue. Each muscle usually has two ends - **a fixed end** where the muscle originates and **a movable end** which pulls some other part. This **movable end** is drawn out to form a tough structure the **tendon** which is attached to the bone. When stimulated by a nerve the muscle contracts to become shorter and thicker and thus it pulls the bone at the movable end. Muscles can only contract and relax, they cannot lengthen.

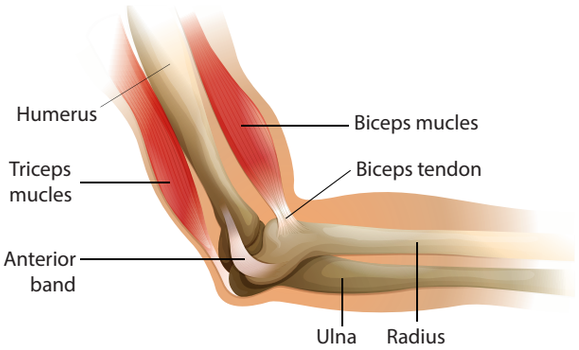



**Figure 19.16** Tendon and muscle attachment to the bone in human.

DO YOU KNOW?

- There are muscles in the root of your hair that give you goose bumps.
- It takes 17 muscles to smile and 42 muscles to frown.
- The hardest working muscle is in eye.

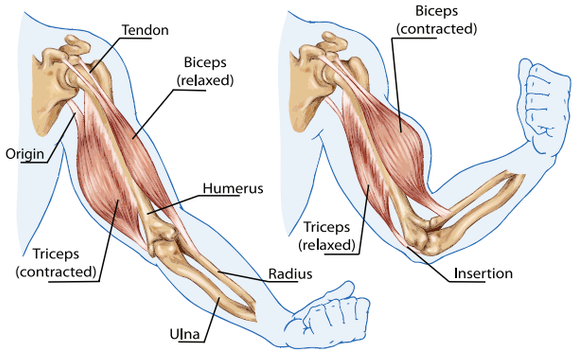



**Figure 19.17** Antagonistic pairs of muscle in human (Biceps and Triceps)

Muscles often work in pairs which work against each other. These are called *antagonistic* pairs. The muscles in the upper arm control the bending and straightening of the arm. The two muscles, the biceps and triceps are working against each other. When the biceps contracts the lower arm is raised and the arm bends. In this position the triceps muscle is relaxed. To straighten the arm the reverse happens. The triceps contracts straightening the arm, while the biceps relaxes. Antagonistic muscles can be found all over the body. In the iris of the eye there are two sets of muscle. There are radial muscles which radiate from the pupil like spokes of a bicycle and there are circular muscles. The radial muscles make the pupil of the eye wider, while the circular muscles make the pupil smaller.

### Activity 5

Measure the size of your biceps and also ask your friends to do. Take turns lifting a bottle with water as many times as you can. Record the number of lifts each student was able to do. Compare each pair's results with the rest of the class and determine whether those with larger bisceps were able to do more lifts.

## 19.6.1 Types of Muscles

Muscles found in higher vertebrates are of three types:

- Striated or skeletal muscles or voluntary muscles.
- Unstriated or smooth muscles or involuntary muscles
- Cardiac muscles

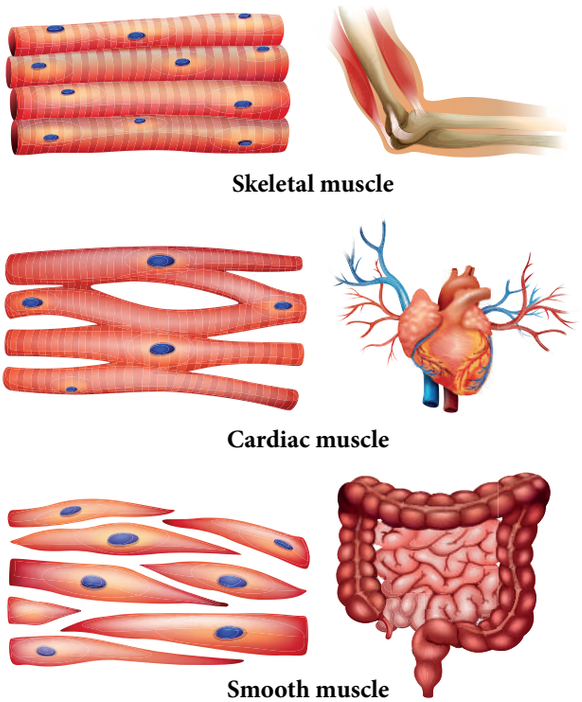



**Figure 19.18** Different types of muscle present in the human body

**Table 19.4** Types of muscles

| Muscle | Location | Characteristics |
|---|---|---|
| Striated / Skeletal / Voluntary muscle | Attached to bones. Found in arms, legs, neck. | Multinucleate, Unbranched, Voluntary. |
| Non striated / Smooth / Involuntary muscle | Attached to soft parts of the body like blood vessels, iris, bronchi and the skin. | Single, central nucleus Involuntary |
| Cardiac muscle | Heart | Branched, 1 -3 central nuclei Involuntary |

## 19.6.2 Coordination of Muscles

Most actions in our body like standing, walking, running, playing tennis etc., require combined action of several muscles. To a great extent the muscles have to be coordinated for a particular kind of movement.

Muscles move body parts by contracting and then relaxing. Muscles can pull bones, but they can't push them back to the original position. So they work in pairs of flexors and extensors. The flexor contracts to bend a limb at a joint. Then, when the movement is completed, the flexor relaxes and the extensor contracts to extend or straighten the limb at the same joint. For example, the biceps muscle, in the front of the upper arm, is a flexor, and the triceps, at the back of the upper arm, is an extensor. When you bend your elbow, the biceps contracts. Then the biceps relaxes and the triceps contracts to straighten the elbow.

## Points to Remember

- Movement helps to perform necessary functions in an organism. It can be both **voluntary** and **involuntary.**
- Strong muscles and light bones work together to help the birds fly. They fly by flapping their wings.
- Fish swim by forming loops alternately on two sides of the body.
- Snakes slither on the ground by looping sideways. A large number of bones and associated muscles push the body forward.
- The body and legs of cockroaches have hard coverings forming an outer skeleton. The muscles of the breast connected with three pairs of legs and two pairs of wings help the cockroach to walk and fly.
- Earthworms move by alternate extension and contraction of the body using muscles. Tiny bristles on the underside of the body help in gripping the ground.
- Bones and cartilage form the skeleton of the human body. They give the frame and shape to the body and help in movement. It protects the inner organs.
- The skeleton comprises of the skull, the back bone, ribs and the breast bone, shoulder and hip bones, and the bones of hands and legs.
- The bones are moved by alternate contractions and relaxations of two sets of muscles.
- The bone joints are of various kinds depending on the nature of joints and direction of movement they allow.

## A-Z GLOSSARY

| | |
|---|---|
| **Antagonist muscle** | Muscles that oppose the action of one another. |
| **Appendicular** | The arms and legs. |
| **Axial** | The trunk and head. |
| **Biceps** | Any skeletal muscle having two origins. |
| **Cardiac muscle** | Involuntary, striated muscle that constitutes the main tissue of the walls of the heart. |
| **Cartilage** | Tough elastic tissue, mostly converted to bone in adults. |
| **Femur** | The thigh bone of the human skeleton. |
| **Ligaments** | Bands of tough, elastic connective tissue that surround a joint to give support and limit the joint's movement. |
| **Pectoral girdle** | The skeletal framework which provides attachment for the forelimbs of or relating to the chest or thorax. |
| **Pelvic girdle** | Hips, a foundation for the lower limb. |
| **Skeletal muscle** | Voluntary muscles that move bones and produce movement. |
| **Sternum** | Long flat bone located in the central part of the chest. |
| **Tendon** | Tough band of fibrous connective tissue that usually connects muscle to bone and is capable of withstanding tension. |

## TEXTBOOK EXERCISES

X5B4E5

### I. Choose the best answer.

1. Which of the following parts of our body help us in movement?

   (i) Bones (ii) Skin (iii) Muscles (iv) Organs

   Choose the correct answer from the options below.

   (a) (i) and (iii) (b) (ii) and (iv)

   (c) (i) and (iv) (d) (iii) and (ii)

2. Which one of the following organisms lack muscles and skeleton for movement?

   (a) Dog (b) Snail

   (c) Earthworm (d) Human being

3. _____ joints are immovable.

   (a) Shoulder and arm

   (b) Knee and joint

   (c) Upper jaw and skull

   (d) Lower jaw and upper jaw

4. Why do underwater divers wear fin-like flippers on their feet ?

   (a) To swim easily in water.

   (b) To look like a fish.

   (c) To walk on water surface.

   (d) To walk over the bottom of the sea (sea bed).

5 External ear (pinna )is supported by

   (a) bone (b) cartilage

   (c) tendon (d) capsule

6. Cockroach moves with the help of its

   (a) leg (b) bone

   (c) muscular foot (d) whole body

7. Which one of the following categories of vertebrae are correctly numbered?

   (a) Cervical-7 (b) Thoracic-10

   (c) Lumbar - 4 (d) Sacral - 4

### II. Fill in the blanks.

1. Movement of organisms from place to place is called _____.
2. _____ refers to change in position of the part of an organism's body.
3. A structure which provides rigid frame work to the body is called _____
4. Axil skeleton in human consists of _____, _____, _____ and _____.
5. Appendicular skeleton in human consists of _____ and _____.
6. The place where two bones meet is termed as _____.
7. _____ is attached to soft parts of the body like blood vessels, iris, bronchi and the skin
8. _____ muscle makes pupil of eyes wider.

### III. State true or false. If false, correct the statement.

1. Skull in humans consists of 22 bones.
2. There are 12 pairs of ribs in human body.
3. Pelvic girdle is a part of axial skeleton.
4. Hinge joint is slightly movable joint.
5. Cardiac muscle is a voluntary muscle.
6. The flexor and extensor muscle of the arm are antagonistic muscles.

### IV. Answer very briefly.

1. What is skeleton?
2. What is cranium?
3. Why our backbone is slightly moveable?
4. Differentiate axial and appendicular skeleton.
5. What is ligament?

6. Define muscle.
7. Differentiate tendons and ligament.

## V. Answer briefly.

1. Differentiate between the following.
   a) Movement and Locomotion.
   b) Endoskeleton and Exoskeleton
   c) Pectoral and Pelvic girdle
   d) Ball and socket Joint and hinge Joint
   e) Voluntary and Involuntary muscle
2. What are antagonistic muscles? Give one example.
3. How is the skeleton of a bird well-suited for flying?
4. What are the functions of skeleton in human body?

## VI Answer in detail.

1. Name the different types of joints? Give one example for each type.
2. Write about the human axial skeleton, giving suitable labelled diagram.
3. Discuss various types of movements seen in living organisms.
4. What is a streamlined body? How does it help in the movement of animals that fly or swim in water?
5. Write a short note on different types of muscles.

## REFERENCE BOOKS


1. Guyton and Hall. J. E, (2006). Textbook of Medical Physiology- Eleventh Edition Elsevier saunders. International Edition.
2. Sembulingam.K and Prema Sembulingam., (2012). Essential of Medical Physiology 6th Edition.
3. R.L. Kotpal (2010). Modern text book of zoology: Inveretbrates. 12th Edition.


## INTERNET RESOURCES

1. https://kids.kiddle.co/Muscular_system
2. https://kidshealth.org/en/kids/muscles.html
3. https://www.innerbody.com
4. https://www.visible body.com

## Concept Map