UNIT 7

FUNDAMENTALS OF ANATOMY AND PHYSIOLOGY IN SPORTS

Content

Learning Outcomes

At the end of this unit, you will be able to:

- identify the importance of anatomy and physiology.
- recognize the functions of the skeleton.
- understand the functions of bones and identify various types of joints.
- figure out the properties and functions of muscles and understand how they work.
- understand the anatomy of the respiratory system and describe it's working.
- identify and analyse the layout and functions of Circulatory System.

Quiz

I. Tick the correct answers.

1. Muscles are connected to bones by
   a. ligaments
   b. cartilage
   c. tendons
2. A flexor
   a. decreases the angle at a joint
   b. extends a limb
   c. moves a limb towards the midline
3. Shoulder and Hip Joints are an example of
   a. ball and socket joint
   b. hinge joint
   c. saddle joint
4. Histology refers to the study of the
   a. cells of the body
   b. history of anatomy
   c. tissues of the body
5. The membrane on the surface of a lung is called the
   a. pleura
   b. pericardium
   c. mucosa

7.1.1 Definition of anatomy and physiology

Anatomy is a science that deals with the structure of the body and the relationship between the body parts. Or, Anatomy is scientific study of the structure of human body.Early physicians and scientists used to dissect the corpse to understand the relationship between various parts of the body. That's how we came with the word anatomy which is derived from the Greek words Ana which means apart and tomy meaning to cut. Hence, the word anatomy refers to dissection and it can be defined as the science of the structure of a body learned by dissection. In other words, anatomy is the study of the shape and structure of human body and body parts along with their relationship to one another.

Do you know?

Broad Categories of anatomy:

Gross anatomy/ Macroscopic anatomy: It deals with the large structures of the body which can be seen with naked eyes for example digestive system.

Microscopic Anatomy: It deals with the structure which only be seen with the help of microscope. For example, cells of human body.

7.1.2 Physiology

Physiology is scientific study of the functions of human beings. Or, Physiology is the study of responses of human body to the physical activity.

Physiology is derived from the Greek words physio which means nature and logio which means the study of. The detailed functioning of the body and its part and the responses of the body to a given stimulus are the topics that are covered in physiology.

It can further be understood by the example that when we walk, we can see how our body and its part work in a synchronized fashion or how our heart is continuously working to supply oxygen and others nutrients of our cells.

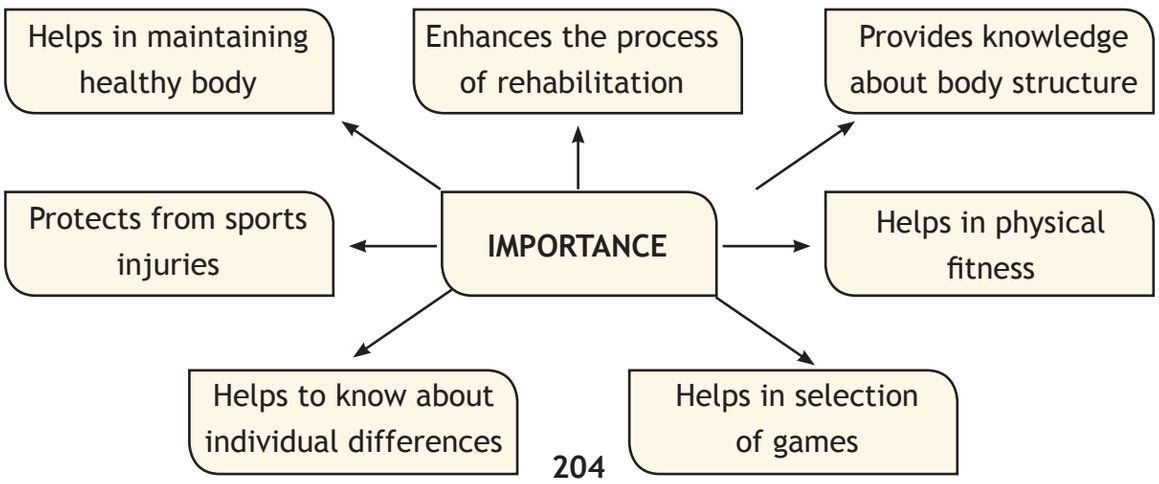
We can also say physiology is the detailed study of life, including the functioning of the smallest of cells, tissues, and other organisms.

Physiology is further divided into sub parts which are as follows:

Human physiology: This branch of physiology refers to the study of a specific organism, i.e., the human being.

Cellular and systemic physiology: Cellular physiology is the study of the function of cells while systemic physiology is the study of the function of the body's systems.

7.1.3 Importance of Anatomy and Physiology



1. **Helps in physical fitness:** Understanding the principles of anatomy and physiology can help a person learn about the body and its functioning which can further help a person to acquire a fit and healthy body. For example, building muscle strength, muscle endurance through appropriate exercises.

2. **Provides knowledge about body structure:** Every individual desires to have a fit body with strong muscles. With the help of anatomy and physiology we can assess our strengths and weaknesses and can work on improving our body. For example, designing an exercise routine based on the requirements and body structure of an individual.

3. **Provides knowledge about the functions of various organs of body:** Knowledge of anatomy and physiology equips us with important knowledge about our body and its systems which can help us train our body in a way that it functions at the optimal level and helps us to lead a healthy and active life. For example, knowledge of cardiovascular system can help us to understand the value of our heart and the importance of physical activity to keep it strong.

4. **Helps in selection of games:** Based on the knowledge of body structure, one can choose a game/sport. For example Basketball or volleyball is a good choice for a tall person and kho-kho is more appropriate for a person who has a short height.

5. **Protects from sports injuries:** Injuries related to sports such as sprain, contusion, fracture, dislocation of joints, etc., are common on the sports field. Sports equipment, based on knowledge of anatomy, is designed to ensure safety. Designing protective equipment in games and sports to provide protection to the soft and delicate organs requires appropriate knowledge about the functions of bones, muscles, tendons, and ligaments. For example, cricket leg pads or helmets are designed based on an understanding of the anatomy and physiology of a cricketer.

6. **Helps in the process of rehabilitation:** Many people suffer from injuries on the sports field, whether it is soft tissue injury or hard tissue injury and due to lack of knowledge of their body. It takes them a long time to recover from these injuries, and in many cases, people may not even recover fully. Anatomy and physiology help us to recover from injuries and attain the preinjury level. For example, suppose your friend twists his ankle while running, and you have a proper knowledge of the anatomy, can administer first aid, like applying ice on the ankle, before taking your friend to the doctor.

7. **Helps in maintaining healthy body:** By making some lifestyle changes and having knowledge about our body, we can attain an ideal weight and a healthy body. For example, knowledge of anatomy provides information about good and bad posture while sitting, standing, lying down, running.

8. **Helps to learn about individual differences between male and female athletes:** Understanding the basic physiological differences between the body of male and female sportspersons is essential because games and sports equipment is designed differently based on these differences. For example, the difference in the structure of shoulders among males and females is the reason for difference in the weights of sports equipment such as shotput, discus, hammer and javelin for males and females.

7.2.1 SKELETAL SYSTEM

The human skeletal system is the internal framework of the body which consists of bones, cartilages, joints, and ligaments. A human body has around 300 bones at the time of birth which decreases to 206 bones in a full-grown human as some bones get fused together.

What makes up the Skeleton

Skeleton system is an amalgamation of bones, joints, cartilages, tendons, and the ligaments

1. Bones are the rigid part of the skeleton. They provide support to the body and their different shapes help in different type of functions. For example, Metacarpals and phalanges helps your hand to form a fist.
2. Cartilage is more flexible than the bones. It gives shape and flexibility to the body to perform various kinds of movement. For example, it gives shape to our ears and nose, it also helps us to expand our chest while breathing.
3. Tendons and Ligaments are strong bands of fibrous connective tissues. Tendons connect muscles to bone, whereas ligaments connect one bone to another bone.

Do you know?

joint: a point where two or more bones are connected in the body in a manner that permits movement.

cartilage: a form of connective tissue that is semi-rigid yet flexible. It is found in the joints and other places such as the nose, throat, and ears.

tendon: a strong piece of tissue in the body connecting a muscle to a bone

ligament: fibrous cords that bind the bones together at joints

7.2.2 Functions of the SKELETAL SYSTEM

The human skeleton is divided into two functional parts:

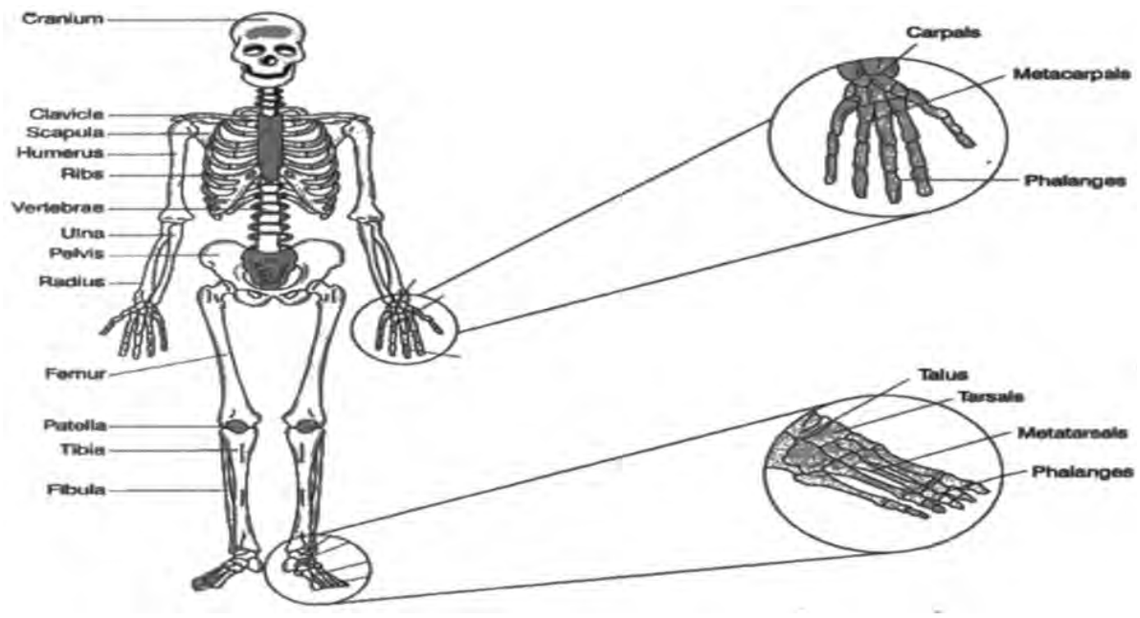
Axial skeleton - consists of the vertebral column, the rib cage, the skull, and the vertebra.

Appendicular skeleton - is attached to the axial skeleton. It is formed by the shoulder girdle, the pelvic girdle, and the bones of the upper and lower limbs.

Functions of the Skeleton

The functions of the skeleton include the following.

1. This skeletal system provides shape and support to the body.
2. It allows the body to create movement by forming the framework of the body, to which the muscles are attached. The movement of the body happens due to the contraction and relaxation of the muscles.
3. Skeletal system provides protection to the soft internal organs. For example, our ribcage protects our heart and lungs, same way our skull protects our brain.
4. The hard substance of the bones also serves as a store house of minerals.
5. Blood cells are also formed within the cavitation of the skeleton which is known as haemopoiesis.



Extension Activity

Working in groups of five draw and label the bones of the following parts:

1. Skull
2. Clavicle
3. The kneecap
4. Bones of the fingers and of the palm
5. Bones of the toes and of the feet.

7.2.3 CLASSIFICATION OF BONES

Bones can be classified based on different categories:

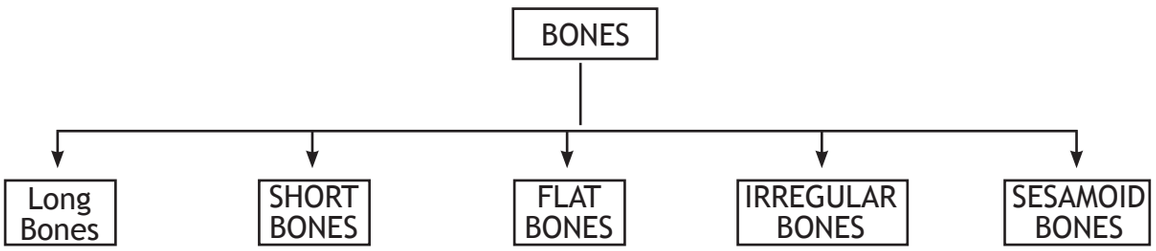
- Classification is based on bone tissue.
- Classification is based on shape and size.

Classification based on bone tissue.

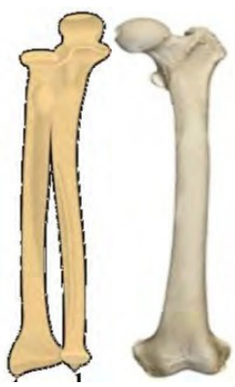
There are 2 Basic types of bone tissue

Compact Bone	**Spongy Bone**
It is dense, smooth small and homogenous	Compound of needle like pieces of bone

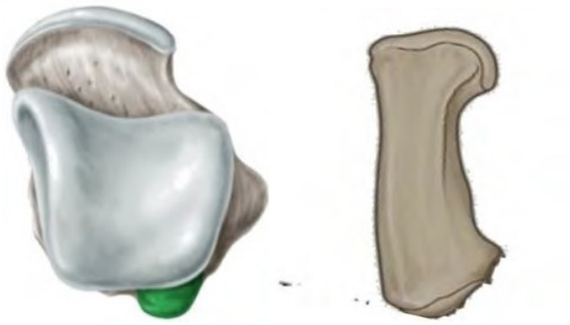
Classification of bones based on shape and size.



1. **Long Bones:** Long bones are hard, dense bones that provide strength, structure, and mobility to the body. They are named for their shape bone and not their size. These bones are cylindrical in shape and they have more length than width. The long bone is covered with a fibre sheet except where it joins with another bone. Where the long bone joins with other bone it is covered with a thin sheet of cartilage. Examples of long bones are: upper and lower arm (Humerus, Radius and Ulna), thigh and leg (Femur, Tibia and Fibula), metacarpals and phalanges in toe and fingers. Long bones contain both yellow bone marrow and red bone marrow, which produce blood cells.

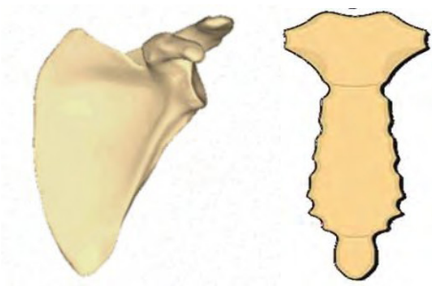


2. **Short Bones:** Short bones have a cube like shape with equal length, width and thickness. A short bone is composed of central spongy bone which is covered with a thin layer of compact bone. The motion of short bones is limited, and they glide on one another. The carpals in the wrist and the tarsals in the ankles are examples of short bones.



Capital (carpal) Bone Talus

3. **Flat Bones:** Flat bones are thin and usually curved. They are composed of a central layer of spongy bone between two outer layers of compact bone. They form a bony cage and help in the protection of soft internal organs. Flat bones are found in cranial bones, ribs, sternum, scapula, and hipbone.



Scapula Sternum

4. **Irregular Bones: Irregular bone**s vary in shape and structure and therefore do not fit into any other category (flat, short, or long). They often have a complex shape, which helps protect internal organs. e.g., the vertebrae. Irregular bones of the vertebral column, protect the spinal cord. Some bones of the skull are also irregular bones.

Vertebra

5. **Sesamoid bones**

- Small and round bones embedded in the tendons. Its shape looks like a sesame seed.
- Its number varies from person to person.
- There is only one type of sesamoid bone known as patellae.

Extension Activity

Working in groups of five draw and complete the following table:

Bone	Type	Where it is found in the body
Radius		
Patella		
Metatarsal		
Femur		

Do You Know?

The shortest Bone in the human body is the STAPES found in the middle ear.

7.2.4 JOINTS

A joint or articulation (articular surface) is the point where the two or more bones meet and muscles act on them to cause movement.

Though a joint is usually considered movable, but it's not necessary in all the cases. There are many joints which show limited movement and some that are completely immovable.

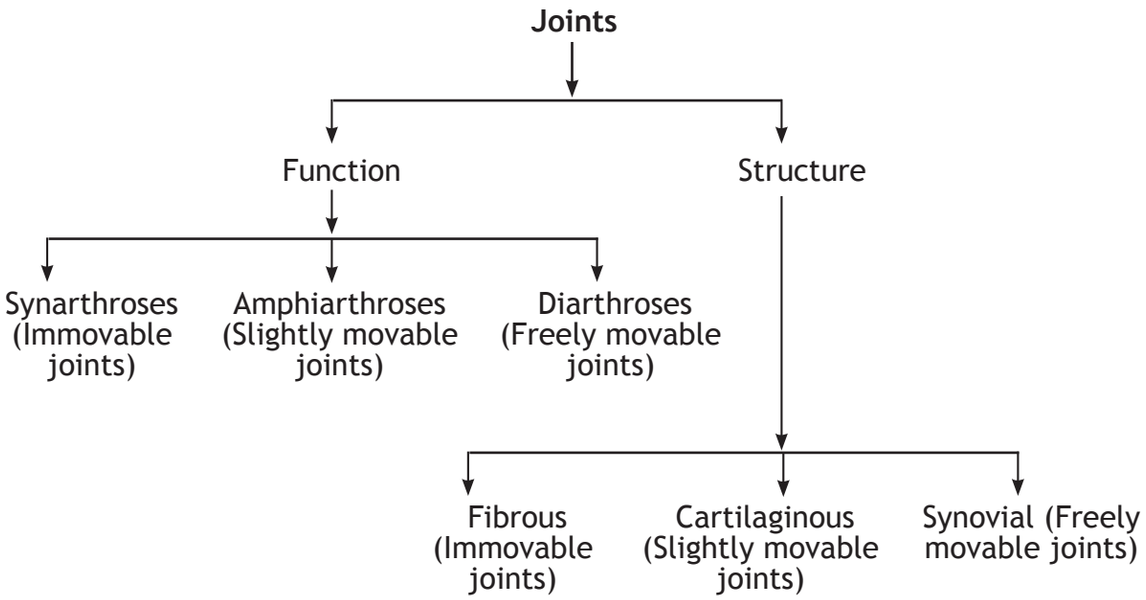
Joints are further classified on the basis of their functions and structure.

Extension Activity

Working in pairs, locate the joints in your

- Shoulder
- Arms
- Wrist
- Fingers
- Hip
- Legs
- Toes

Can you identify the movement in these joints?



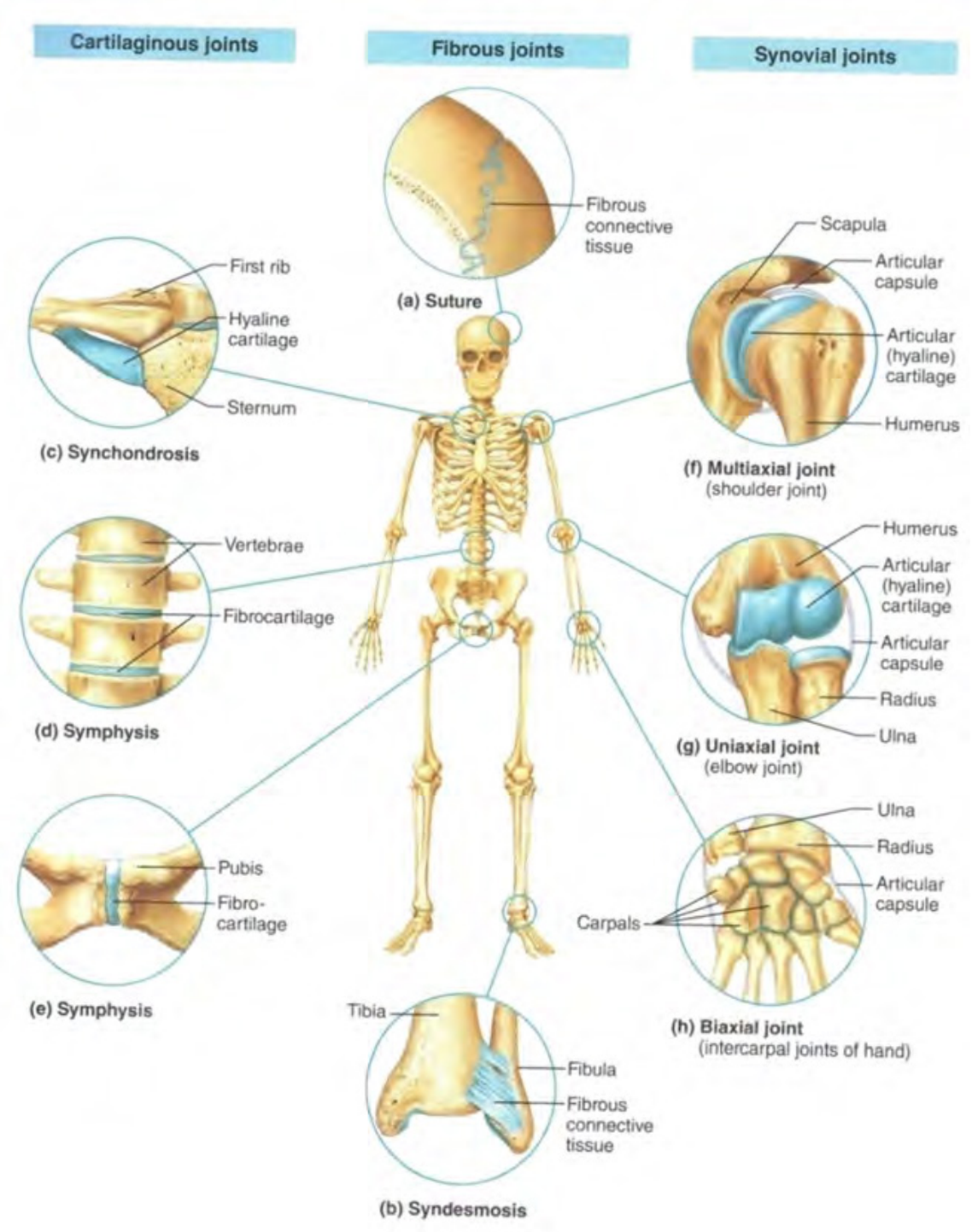
The functional classification of joints focuses on the amount of movement permitted by the joint. Based on this:

- Synarthroses or they may be called immovable joints
- Amphiarthroses which are also known as slightly movable joints
- Diarthroses or the freely movable joints.

The freely movable joints are majorly found in the limbs, where movement and mobility are of utmost importance. The immovable or slightly movable joints are mostly found in the axial skeleton where the priority is protection of internal organs and firm attachments.

In the structural classification mainly there are fibrous, cartilaginous, and synovial joints. This type of classification is based on whether fibrous tissue, cartilage, or a joint cavity separates the bony regions at the joint.

Fibrous joints are generally immovable and, synovial joints are freely movable joints. Cartilaginous joints have a combination of both immovable and slightly movable joints.

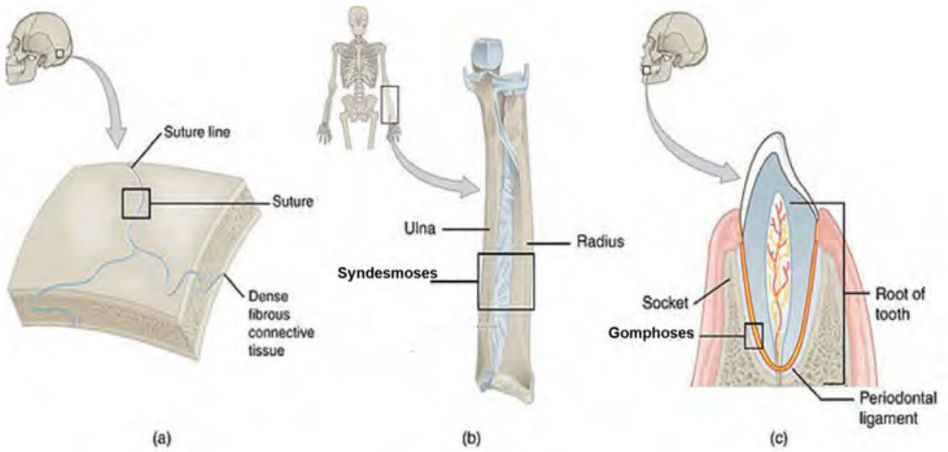


1. **Fibrous Joints** - In this type of joint, the bones are united together by fibrous tissue and show little or no movement. They are again further classified based on structure of the sutures, syndesmoses and gomphoses.

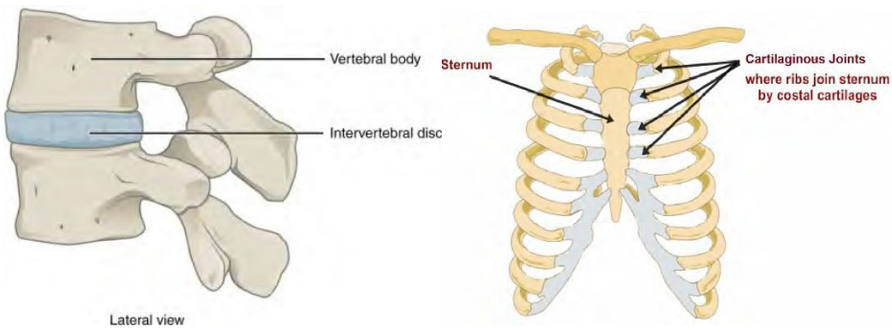
   i. **Sutures** - A suture is a type of fibrous joint forming a tight union between the bones that prevents any movement between them. Sutures are only found between the bones of the skull or the cranium. The skull bones of a foetus are unfused but after birth, the bones slowly begin to fuse to become fixed, making the skull bones immovable to protect the brain from impact.

ii. **Syndesmoses** - Syndesmosis is a fibrous joint in which the bones are separated by some distance and united together with the help of ligaments. e.g., fibrous membrane connecting maximum distal parts of the radius and ulna. Due to the lack of flexibility in these joint structures, ligament injuries in syndesmoses joints are common, particularly at the wrist and ankle.

iii. **Gomphoses**- Agomphosis mostly consists of a peg attached into a socket and held by ligaments. The best example of this is the joint between a tooth and its socket.

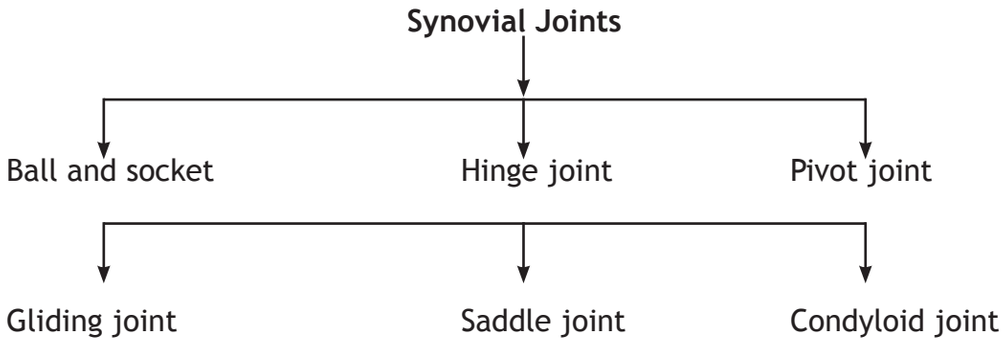


2. **Cartilaginous Joints** - This type of joint unites two bones by the help of a cartilage. Very slight movement can occur at these joints. Another characteristic of this type of joint is that the articulating bone surfaces are connected by pads (discs) of fibrocartilage. For example, cartilage of the growing long bones and the cartilage between the ribs and the sternum.



3. **Synovial Joints -** These are freely movable joints. These joints contain synovial fluid. They are mostly found in the limbs.

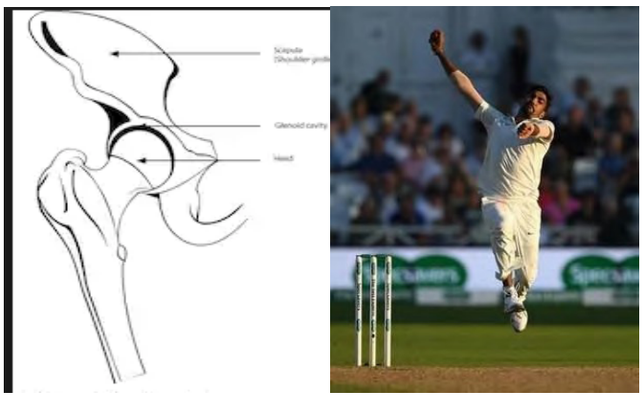
- All synovial joints consist of four distinguishing features.
- Articular cartilage
- Articular capsule
- Joint cavity
- Reinforcing ligament



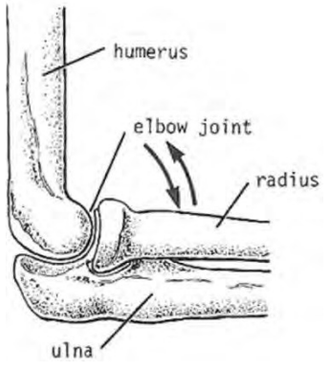
Types of synovial joints:

Synovial joints are classified according to the shape of the articulating surface. As you know, they can further be subdivided into the following categories.

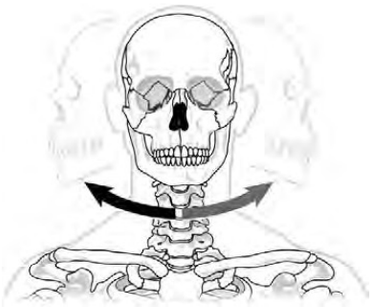
i. **Ball and socket joint:** The ball and socket joint is a type of synovial joint. It is formed when the ball-shaped head of one bone fits into the cup-like socket or depression of another bone. The ball and socket joint allows the greatest range of movement. These multiaxial joints permit movement in all axes including rotation. e.g., hip joint and shoulder joint. This joint allows movement like an overhead clear in badminton or bowling in cricket.



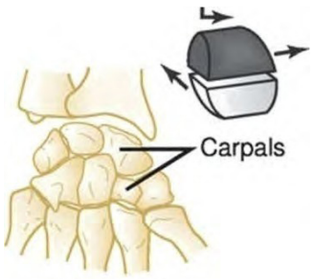
ii. **Hinge joint:** The cylindrical end of one bone fits into a rough shaped surface of another bone. It allows a back-and-forth movement like a hinge in the door. The bones are restricted to do an angular movement. For example, movement of elbow and knee is the example of hinge joint. The extension and flexion movement are essential for building biceps, triceps and quadricep muscles.



iii. **Pivot joint:** Pivot joint, also called rotary joint, is a freely moveable joint that allows only rotary movement around a single axis. The moving bone rotates within a ring that is formed by a second bone and adjoining ligament. For example, the joint between the first and the second cervical vertebrae which allows the turning of the head from side to side.

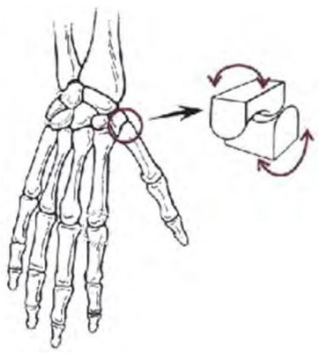


iv. **Plane or Gliding joint:** A gliding joint, also known as a plane joint, is a type of synovial joint that is formed between bones that meet at flat or nearly flat articular surfaces. Gliding joints allow the bones to glide past on one another in any direction along the plane of the joint — up and down, left and right, and diagonally. The movement in this joint is nonaxial which indicates that gliding does not allow rotation around any axis. For example, inter carpals or joints of the wrist.



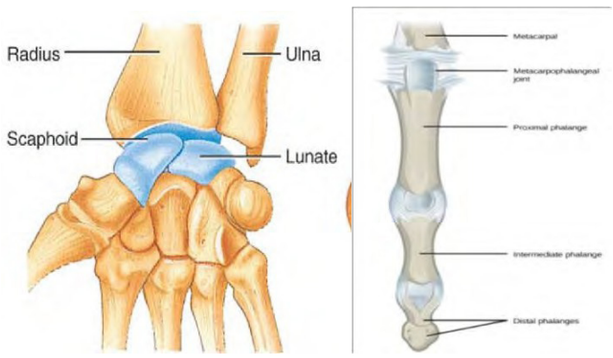
Plane joint

v. **Saddle joint:** In the saddle joint, the articulating surface is shaped like a saddle, having both convex and concave areas. The bones in a saddle joint can rock back and forth and from side to side, but they have limited rotation. These biaxial joint sallow very limited movement like the condyloid joints. For example, thumb joint.



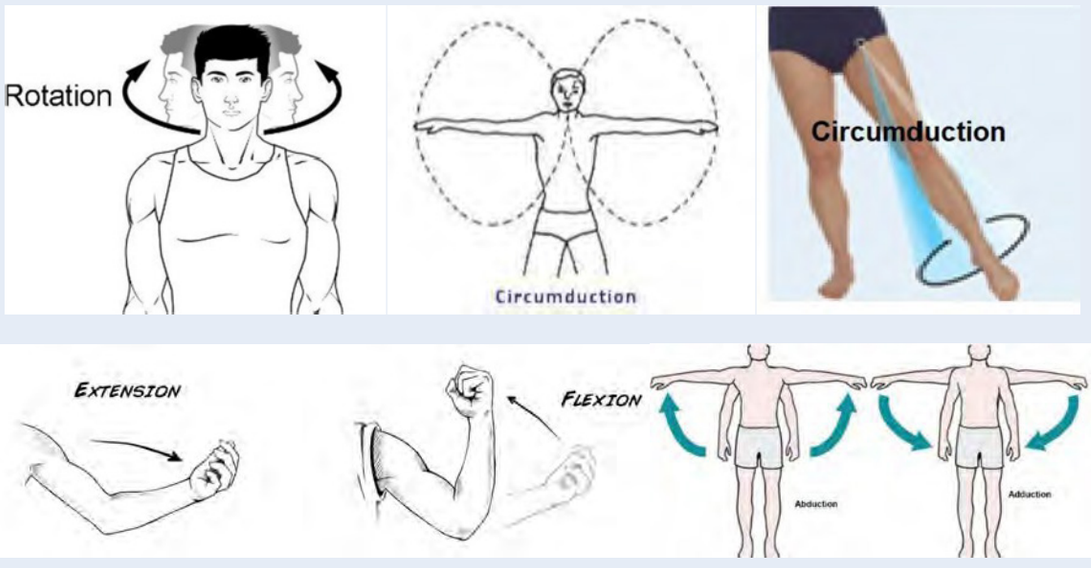
Example of a saddle joint used in sport is in a thumb war. The thumb moves side to side and back and for a thumb war.

vi. **Condyloid joint:** Condyloid joints are a type of synovial joint where the egg-shaped articular surface of one bone fits into an oval cavity in another. This joint allows the moving bone to travel from side to side, back and forth but it does not allow it to rotate. Movement occurs only around two axes so they may be also called biaxial. For example, wrist joint, metacarpal, phalangeal joint. This joint is useful when players use their wrist for dribbling the ball in basketball.



Extension Activity

Practice the following movements. Can you identify the joint used?



I. **Tick the correct option.**

1. The short bones are generally
   - i. flat
   - ii. cube-shaped
   - iii. curved
   - iv. thin

2. One of the functions of the skeletal system includes haematopoiesis which refers to

   i. provision of support to the body

   ii. formation of blood cells

   iii. production of minerals

   iv. protection of delicate organs

3. A child has_____bones.

   i. 206

   ii. 213

   iii. 270

   iv. 300

4. Bones serves as a store house for

   i. potassium

   ii. phosphorus

   iii. calcium

   iv. nitrogen

5. According to the functional classification of joint which focuses on the amount of the movement of the joint, synarthroses are also known as:

   i. immovable joints

   ii. slightly movable joints

   iii. freely movable joints

   iv. combination of immovable and slightly movable joints

6. The sutures of the skull are the best examples of:

   i. cartilaginous joints

   ii. synovial joints

   iii. fibrous joints

   iv. freely movable joints

7. The synovial joints in which angular movement is allowed in just one plane is called

   i. hinge joint

   ii. saddle joint

   iii. plane joint

   iv. pivot joint

II. **Answer the following questions briefly.**

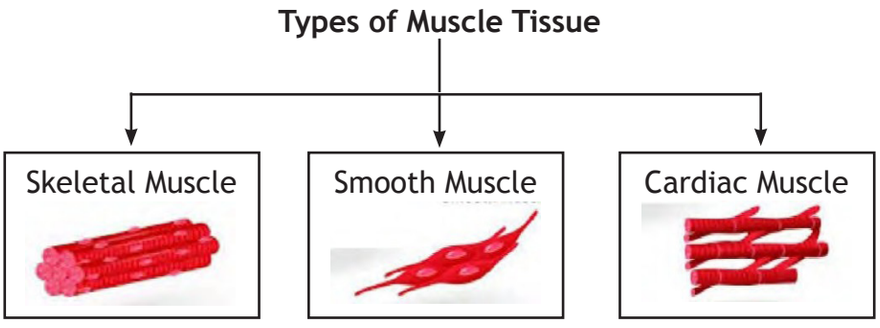
1. Name the longest and the shortest bones in the body.
2. List at least two functions of the skeletal system.
3. Name the four main classification of bones.
4. What are the two basic classifications of a joint?
5. What is the major difference between a fibrous joint and a cartilaginous joint?
6. Name two ball and socket joints of the body.

III. **Answer the following questions in 150-200 words.**

1. Elaborate the functions of the skeletal system.
2. Describe the types of bones found in the human body and discuss their functions.
3. Write about the types of synovial joints in details with suitable examples

7.3.1 PROPERTIES AND FUNCTIONS OF MUSCLES

Muscles in our body are responsible for all movement as the movement in our body is either done by the relaxation or the contraction of muscles. The movement of the muscles can be voluntary or involuntary. The pumping of blood by heart is an example of involuntary movement and running or walking is an example of voluntary movement.



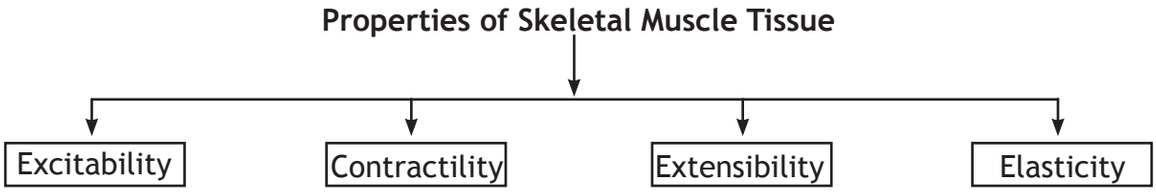
1. **Skeletal Muscles**- Skeletal muscles comprise 40% of the body weight. These muscles are attached to the skeletal system with the help of tendons. These muscles have the ability to exert force. They are also called striated muscles as their striations can be seen when observed under the microscope. These muscles are voluntary in nature which means we can control them at will. For example, walking, running, smiling, eating etc. These muscles can contract most rapidly but not for a long periods, as that results in tiring of the muscle.

2. **Smooth Muscles**- Smooth muscles have elongated, slender, spindle shaped cells. These muscles do not have striations. They are also called involuntary muscles as their expansion or contraction is not under our control. These muscles contract much more slowly as compared to skeletal muscles and cardiac muscles. They are found mostly in hollow organs such as stomach, urinary bladder, and respiratory passages. Smooth muscles are also present in the eyes, where their function is to change the size of the iris and alter the shape of the lens; and in the skin where they cause hair to stand erect in response to cold temperature or fear.

3. **Cardiac Muscles**- Cardiac muscles are found only in the heart where they form the walls of the heart. They are long and striated but not as clearly striated as skeletal muscles. The rate of contraction of cardiac muscles is intermediated between smooth and skeletal muscles. Cardiac muscles are involuntary in nature.

8.3.2 PROPERTIES OF SKELETAL MUSCLES

Skeletal muscles have four major functional properties:



Excitability is the ability to respond to a stimulus, which may be delivered from a motor neuron or a hormone.

Contractility is the ability of muscle cells to forcefully shorten themselves, or the ability for self- contraction.

Extensibility is the ability of a muscle to stretch or the capacity to lengthen themselves.

Elasticity is the ability to recoil or bounce back to the muscle's original length after being stretched.

8.3.3 FUNCTIONS OF MUSCLES

1. **Movement:** Muscles gives strength to the body which helps in contraction and relaxation of the muscle for any kind of movement. Movement can be largely divided into two categories gross movement like walking or fine movement like writing.

2. **Maintenance of posture:** Muscles helps us to maintain our body posture whether it is a sitting posture or a walking posture. Good and strong muscles help us to have a good posture and weak muscles don't have the strength to hold a good posture.

3. **Heat generation:** Our muscles help us to maintain the body temperature. Whenever the body heat falls, skeletal muscles start contractions to bring it to normal. For example, when we shiver the body's mechanism brings our temperature to normal.

4. **Respiration:** Our lungs have a muscle called diaphragm where exchange of gases takes place. When it contracts our chest cavity gets bigger and fills with air and then our diaphragm muscles relax our chest cavity pushes the air out.

5. **Constriction of organs and blood vessels:** Nutrients move through our digestive tract, urine is passed out of the body, and secretions are propelled out of glands by contraction of smooth muscles.

6. **Pumping blood:** Our heart pumps the blood and the smooth muscles in our veins and arteries bring the blood to heart from the cells and vice versa.

Do You Know?

The gluteus maximus is the largest muscle in the human body as it has the job of keeping the trunk of the body in an erect posture.

I. **Tick the correct answer.**

1. How many types of muscle tissue are there?

   i. 1

   ii. 2

   iii. 3

   iv. 4

2. Locomotion and facial expression are one of the important responsibilities of

   i. Cardiac muscles

   ii. Skeletal muscle

   iii. Smooth muscle

   iv. cardiac and skeletal muscles

3. The ability of a muscle to shorten forcefully is known as

   i. extensibility

   ii. contractility

   iii. elasticity

   iv. excitability

II. **Answer the following questions briefly.**

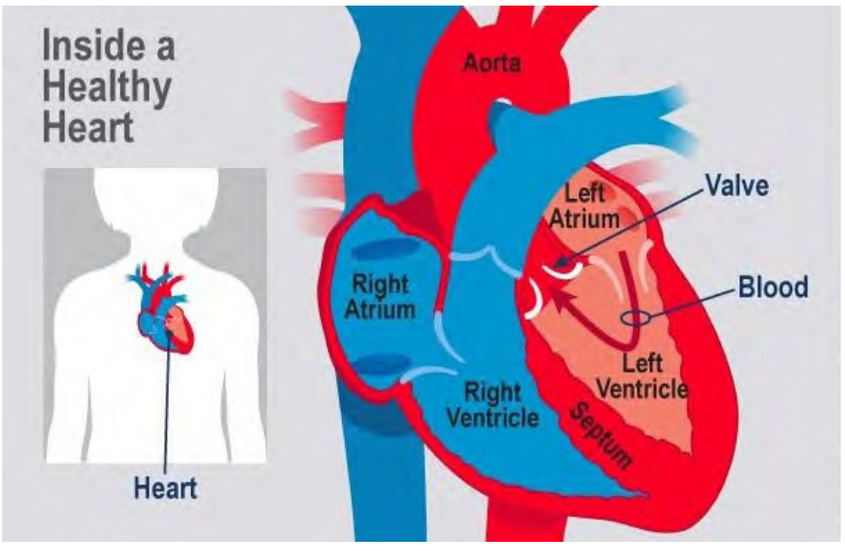
1. What is a muscle? List the major types of muscles.
2. Enlist the four major functional characteristics of the skeletal muscles.
3. Write down the properties of cardiac muscles.
4. How are smooth muscles different from cardiac muscles?
5. Where are smooth muscles found?
6. How do cardiac muscles differ from skeletal muscles?

III. **Answer the following questions in 150-200 words.**

1. What do you understand by the muscular system? Explain the structural classification of muscles.
2. Write down the functions of muscles in detail.

8.4.1 STRUCTURE AND FUNCTIONS OF THE CIRCULATORY SYSTEM AND HEART

The circulatory system is responsible for the transportation of the gases i.e., oxygenated blood from heart to the body cells and deoxygenated blood back to the heart, and then deoxygenated blood from heart to lungs and oxygenated blood back to the heart with the help of arteries and veins.



The Circulatory system consists of.

1. **Heart:** It is divided into four parts i.e., two pumping chambers known as ventricles and two receiving chambers known as atria. The two sides of heart is separated by a thick muscular wall called the septum.

2. **Blood vessels:** Blood vessels include veins, arteries, and capillaries. Veins brings deoxygenated blood from the cells to the heart. Arteries take the oxygenated blood from heart to the cells. Capillaries are the thin blood vessels where exchange of nutrients and oxygen takes place.

3. **Blood:** Blood is the bodily fluid which carries all the nutrients and oxygen which have to be transported throughout the body. It consists of red blood cells, white blood cells, plasma and platelets. Blood has red colour because of a red pigment called as Haemoglobin present in it.

There are two parts of circulatory system:

1. **Pulmonary circulation:** In the pulmonary circulation the heart pumps deoxygenated blood from its first pumping chamber i.e., left ventricle through pulmonary artery towards the lungs. The blood flows by touching the diaphragm of the lungs where exchange of gases takes place. After the exchange, the oxygenated blood comes back to the heart in its first receiving chamber i.e., right atrium through pulmonary veins. In the entire body there is only one artery which carry deoxygenated blood – the pulmonary artery and there is only one vein that carries oxygenated blood – the pulmonary vein, and they both are the part of pulmonary circulation.

2. **Systematic circulation:** Once the right atrium receives the oxygenated blood, it sends it to the heart's second pumping chamber i.e., the right ventricle and from their it is pumped to the entire body through aorta which is the body's biggest artery, it looks like a tree supplying water to every branch. At each body part there is a network of thin blood vessels known as capillaries which connect arteries and veins. Capillaries have a very thin layer which helps in exchange of gases and other nutrients. The waste product and deoxygenated blood goes to smaller veins, and then to bigger veins and finally reaches back to the heart. From the heart, blood is pumped into the lungs where it is re-oxygenated and returned to the heart. where it is received by the heart in its second receiving chamber i.e., leftt atrium. And then the cycle is completed. Both the circulations happen simultaneously and the heart controls the whole movement depending upon the requirements of the body. For example, you may have experienced when you run fast your heart beats very fast. That is because your heart is trying to meet the oxygen requirement of your body.

3. **Coronary circulation:** The heart works tirelessly from the day we are born till we die. It also needs oxygen to carry out its function. There are coronary arteries that transport the oxygenated blood to the heart and coronary veins takes the deoxygenated blood back to the right atrium.

THE HEART:

The heart is a cardiac muscle which does an alternating movement of contraction and relaxation. When the heart contracts, the term used is systole and when the heart relaxes, the movement is known as diastole. Systole is that movement when the ventricles pump the blood out of the heart and the atrium is ready for the movement of diastole. Whenever blood overflows in the atrium it gives an electronic signal to the brain and the ventricles pump the blood outside the heart and atrium pumps the blood into the ventricles. The amount of blood pumped out of the ventricle in each contraction is known as stroke volume and the amount of blood pumped out in one minute is known as the cardiac output.

Do you know?

Arteries - blood vessels that carry oxygenated blood from the heart.

Arterioles - a small branch of an artery leading into capillaries.

Capillaries - any of the fine branching blood vessels that form a network between the arterioles and venules.

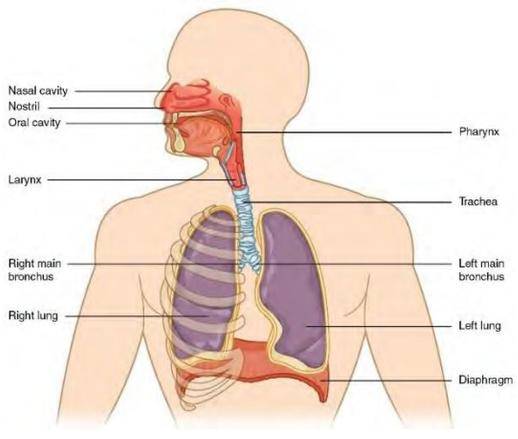
Venules - a very small branch of a vein, especially one collecting blood from the capillaries.

Veins - blood vessels that carry deoxygenated blood back to the heart

7.5.1 STRUCTURE AND FUNCTIONS OF THE RESPIRATORY SYSTEM

Respiration is made up of two phases called inspiration and expiration: You inhale (breathe in) oxygen during inspiration. You exhale (breathe out) carbon dioxide during expiration. Respiration includes the following processes

- Ventilation, the movement of air into and out of the lungs
- Gas exchange between the air in the lungs and blood, sometimes called external respiration
- Transport of oxygen and carbon dioxide in the blood.
- Gas exchange between the blood and the tissues, sometimes called internal inspiration.



Structure of Respiratory System:

The respiratory system consists of

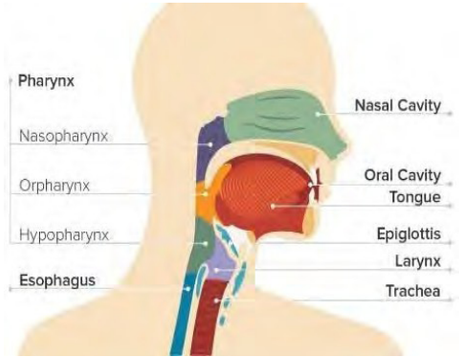
- The nose
- The nasal cavity
- The pharynx

- The larynx
- The trachea
- Bronchi
- The lungs
- Bronchioles
- Alveoli
- Diaphragm

The Nose: The term nose usually refers to the visible structure that forms a prominent feature of the face and refers to the internal nasal cavity.

The Nasal Cavity: It extends from the external opening in the nose to the pharynx, and it is divided by the nasal septum into right and left side.

Pharynx: The pharynx is the common passageway of both the digestive and respiratory systems.



The pharynx can be divided into three regions

The nasopharynx: It is the superior part of pharynx and extends from the internal nares of nasal cavity to the level of uvula.

The oropharynx: The oropharynx is a passageway for both air and food. It extends from the uvula to the epiglottis. The oropharynx is bordered superiorly by the nasopharynx and anteriorly by the oral cavity.

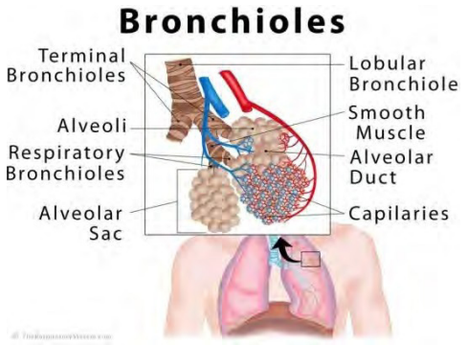
The laryngopharynx: The laryngopharynx extends from the epiglottis to the lower margin of the larynx. It continues the route for ingested material and air until its inferior end, where the digestive and respiratory systems diverge.

Larynx: The larynx consists of an outer casing of nine cartilages that are connected to each other by muscles and ligaments. It is also known as Voice box.

Trachea: The trachea, also known as the windpipe, is a membranous tube that consists of connective tissues and smooth muscles.

Bronchi: The trachea divides into the left and right primary bronchi. The main function of the bronchi, like other conducting zone structures, is to provide a passageway for air to move into and out of each lung. In addition, the mucous membrane traps debris and pathogens.

Bronchioles: Bronchioles, which are about 1 mm in diameter, further branch until they become the tiny terminal bronchioles, which lead to the structures of gas exchange. There are more than 1000 terminal bronchioles in each lung.



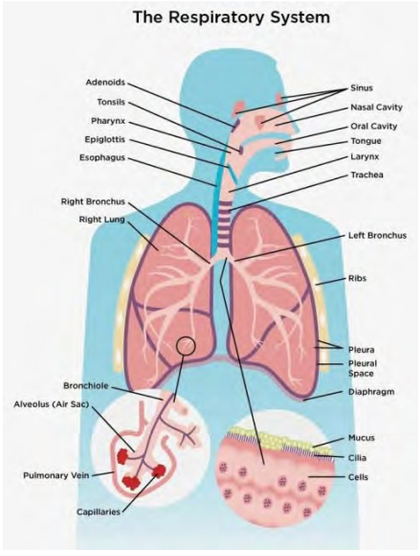
The muscular walls of the bronchioles do not contain cartilage like those of the bronchi. This muscular wall can change the size of the tubing to increase or decrease airflow through the tube.

Alveoli: An alveolar duct is a tube composed of smooth muscle and connective tissue, which opens into a cluster of alveoli. An alveolus is one of the many small, grape-like sacs that are attached to the alveolar ducts.

Lungs: The lungs are the principal organs of respiration. These spongy, pinkish organs look like two upside-down cones in your chest. Lungs are divided into two parts

Right lung: The right lung is made up of three lobes

Left lung: The left lung has only two lobes to make room for your heart.



Diaphragm: The diaphragm is a thin skeletal muscle that separates the abdomen from the chest. It contracts and flattens when you inhale. This creates a vacuum effect that pulls air into the lungs. When you exhale, the diaphragm relaxes, and the air is pushed out of lungs.

I. **Tick the correct answer.**

1. Trachea is also known as
   a. Windpipe
   b. Voice box
   c. Pharynx
   d. Nose
2. The movement of air into and out of the lungs
   a. External respiration
   b. Ventilation
   c. Internal respiration
   d. Respiration
3. The principal organ of respiration is
   a. Nose
   b. Larynx
   c. Trachea
   d. Lungs
4. The heart is made up of
   a. Connective tissue
   b. Epithelial tissue
   c. Cardiac tissue
   d. Muscle tissue
5. The heart has_____chambers
   a. Three
   b. Four
   c. Five
   d. Six

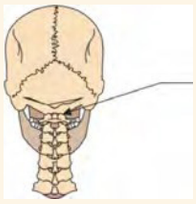
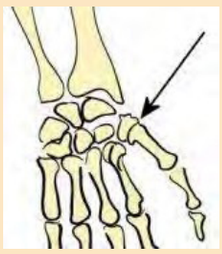
II. **Answer the following questions briefly.**

1. Define respiration.
2. Write a short note onpharynx.
3. Explain the function of the diaphragm in breathing.
4. Define circulatory system
5. Write a brief note on the heart.
6. What is the difference between Arteries and Veins?

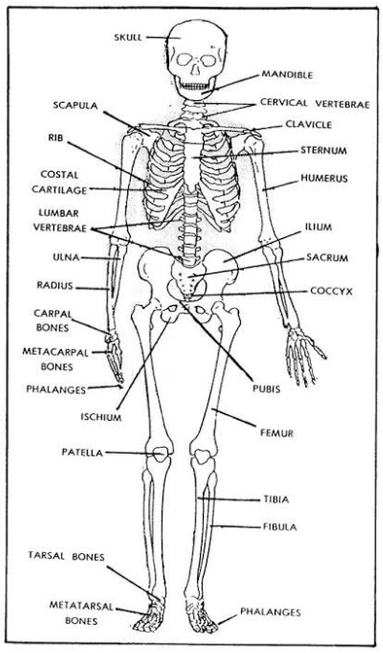
III. **Answer the following questions in 150-200 words.**

1. What are the functions of respiratory system?
2. What are the functions of the heart?
3. Describe the circulatory system.

IV. **Identify the bones given below and mention the type of Joint that is formed by them. Also mention its function.**

Bones	Type of Joint	Functions
		
		
		
		

V. Case Study



On the basis of given picture answer the following questions:-

a. Name any four long bones?

b. How many bones are there in the vertebral column?

c. Scapula is an example of _____.

d. How many carpals are there?

e. Shoulder joint is an example of _____ joint.

VI. ART INTEGRATION

Working in groups, prepare a 3D model of any one of the systems of the human body that you have studied.

Suggested Readings :

- Dhananjay Shaw (2000), Mechanical Basis of Biomechanics, Sports Publication, Delhi,
- Lutlegen, & Nancy, H. (1997). Kinesiology: Scientific Basis of Human Motion. Mc Graw Hill.
- Physical Education and Yog (373). (n.d.). Retrieved 11 25, 2020, from National School of Open Learning:
- https://www.nios.ac.in/online-course-material/sr-secondarycourses/physical- education-and-yog-(373).aspx
- Thompson, & Floyd. (2017). Manual of Structural Kinesiology. Mc Graw Hil.