Model question and answer

Subject- HAP Subject Code- BP101T

B. Pharm First year Sem I

LONG QUESTIONS (10 Marks)

Unit-1

1.Write in detail about the structure and function of the cell.

A cell is the structural and fundamental unit of life. The study of cells, from their basic structure to the functions of every cell organelle, is called Cell Biology. Robert Hooke was the first biologist to discover cells in 1665. Later, Anton Van Leeuwenhoek observed cells under a compound microscope with higher magnification and noted that the cells exhibited some form of movement (motility). Cells are complex, and their components perform various functions in an organism. They are of different shapes and sizes, like the bricks of the buildings.

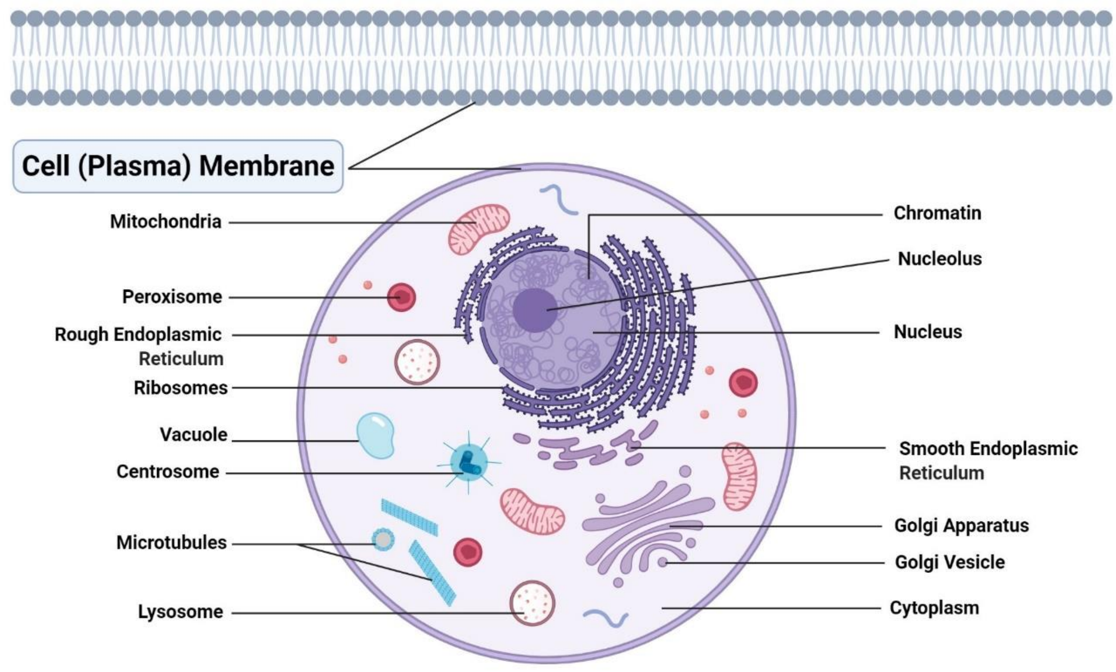


Figure: Animal Cell Structure with Cell (Plasma) Membrane, Image Copyright © Sagar Aryal, www.microbenotes.com

A cell consists of three parts: the cell membrane, the nucleus, and the cytoplasm. Within the cytoplasm lie intricate arrangements of fine fibers and hundreds or even thousands of minuscule but distinct structures called organelles.

Cell membrane

The cell membrane is a double layer of phospholipid molecules. A cell (Plasma) membrane encloses every cell in the body. The cell membrane separates the extracellular material outside the cell from the intracellular material inside the cell. It maintains the integrity of a cell and controls the passage of materials into and out of the cell.

Nucleus and Nucleolus

The nucleus is the control center of the cell, formed by a nuclear membrane around a fluid known as nucleoplasm. Threads of chromatin in the nucleus contain deoxyribonucleic acid (DNA), the cell's genetic material. The nucleolus is a dense ribonucleic acid (RNA) region in the nucleus and is the site of ribosome formation. The nucleus determines how the cell will function, as well as the basic structure of that cell.

Cytoplasm

The cytoplasm is the gel-like fluid inside the cell. It is the medium for chemical reactions. It provides a platform upon which other organelles can operate within the cell. All of the functions for cell expansion, growth, and replication are carried out in the cytoplasm of a cell. Within the cytoplasm, materials move by diffusion, a physical process that can work only for short distances.

Cytoplasmic organelles

Cytoplasmic organelles are "little organs" suspended in the cell's cytoplasm. Each type of organelle has a definite structure and a specific role in the function of the cell. Examples of cytoplasmic organelles are

i. Endoplasmic reticulum

The endoplasmic reticulum (ER) processes molecules within the cell and helps transport them to their final destinations. In particular, it synthesizes, folds, modifies, and transports proteins. Cisternae are long sacs that make the ER. There are two ER types: rough ER and smooth ER.

ii. Golgi apparatus

Once the ER processes the molecules, they travel to the Golgi apparatus.

iii. Mitochondria

Mitochondria are known as the powerhouses of cells. They help with energy formation from food that the cell can use. However, mitochondria have several other jobs, including calcium storage and a role in cell death.

iv. Lysosomes

Lysosomes are small, spherical organelles that are packed full of digestive enzymes. Their key function is to break down and recycle unwanted material for the cell, such as old cell parts or invading bacteria and viruses.

v. Ribosomes

The nucleus transcribes segments of DNA into ribonucleic acid (RNA), a molecule like DNA, which directs the translation of RNA into proteins. Ribosomes read the RNA and translate it into proteins by sticking together amino acids in the order the RNA defines. Some ribosomes float freely in the cytoplasm, while others attach to the ER.

Functions of Cell

A cell performs major functions essential for the growth and development of an organism. Important functions of the cells are as follows:

1. Provides Support and Structure.

   All organisms are made up of cells. They form the structural basis of all the organisms. The cell wall and the cell membrane are the main components that support and structure the organism. E.g., the skin is made up of many cells. The xylem in vascular plants is made of cells that provide structural support to the plants.

2. Allows Transport of Substances

   Various nutrients are imported by the cells to carry out various chemical processes going on inside the cells. The waste produced by the chemical processes is eliminated from the cells by active and passive transport. Small molecules like oxygen, carbon dioxide, and ethanol diffuse across the cell membrane along the concentration gradient.

3. Energy Production

   Cells require energy to carry out various chemical processes. This energy is produced by the cells through a process called photosynthesis in plants and respiration in animals.

4. Aids in Reproduction

   A cell aids in reproduction through the processes called mitosis and meiosis. Mitosis is termed asexual reproduction, where the parent cell divides to form daughter cells. Meiosis causes the daughter cells to be genetically different from the parent cells.

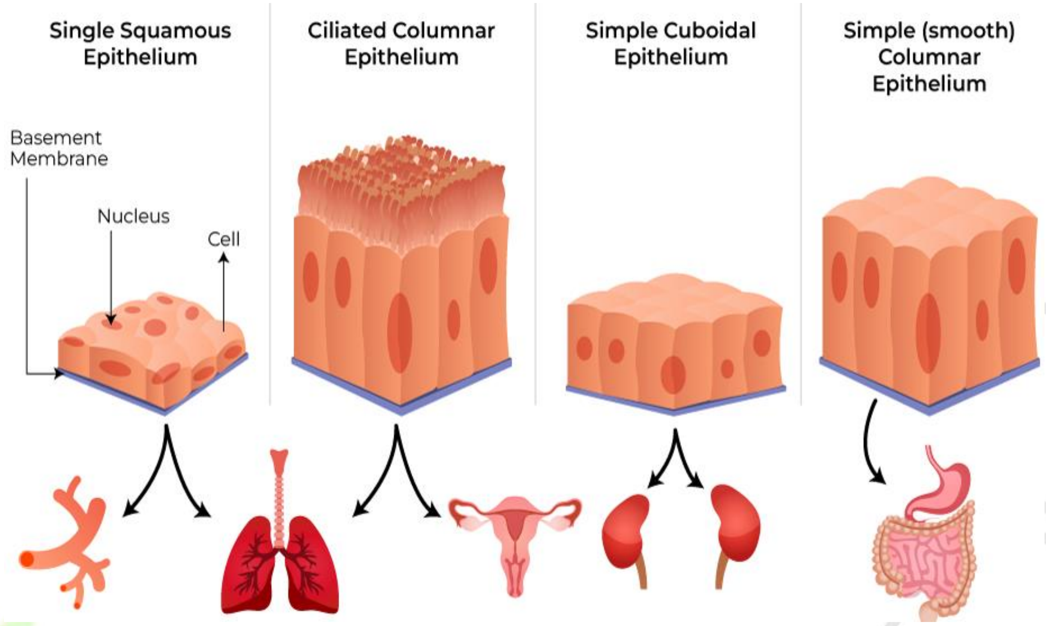
2. Write down the Classification of tissues and mention the structure, location, and functions of epithelial, muscular nervous, and connective tissues

A tissue is a group of cells near, organized to perform one or more specific functions.

Four basic tissue types are defined by their morphology and function: epithelial tissue, connective tissue, muscle tissue, and nervous tissue.

- **Epithelial tissue** creates protective boundaries and diffuses ions and molecules.
- **Connective tissue** underlies and supports other tissue types.
- **Muscle tissue** contracts to initiate movement in the body.
- **Nervous tissue** transmits and integrates information through the central and peripheral nervous systems.

Epithelial tissue



Epithelial tissue is a highly cellular tissue that overlies body surfaces, lines cavities, and forms glands. In addition, specialized epithelial cells function as receptors for special senses (smell, taste, hearing, and vision). Epithelial cells are numerous, exist in close apposition to each other, and form specialized junctions to create a barrier between connective tissues and free surfaces. Free surfaces of the body include the outer surface of internal organs, the lining of body cavities, the exterior surface of the body, tubes, and ducts. The extracellularmatrix of epithelial tissue is minimal and lacks additional structures. Although epithelial tissue is avascular, it is innervated.

Cell surfaces

The epithelial tissue cells have three types of surfaces differentiated by their location and functional specializations: basal, apical, and lateral.

Basal surface

The basal surface is nearest to the basement membrane. The basementmembranecreates a thin barrier between connective tissues and the basal layer of epithelial cells. Specialized junctions called hemidesmosomes secure the epithelial cells on the basement membrane.

Apical surface

The apical surface of an epithelial cell is nearest to the lumen or free space. Apical cell surfaces may display specialized extensions. Microvilli are small processes projecting from the apical surface to increase surface area. They are heavily involved in diffusion in the nephron tubule and the small intestines' lumen.

Cilia are small processes found in the respiratory tract and female reproductive tract. Their complex structure facilitates movement that brushes small structures through the lumen of either the trachea or Fallopian tubes. Stereocilia are similar to cilia in size and shape. However, they are immotile and more frequently found in the epithelium of the male reproductive tract, specifically in the ductus deferens and the epididymis.

Lateral surfaces

The lateral surfaces of epithelial cells are located between adjacent cells. The most notable lateral surface structures are junctions. Adhering junctions link the cytoskeleton of neighboring cells to produce strength in the tissue. Desmosomes can be thought of as spot welding for epithelial tissues. They are usually located deep to adhering junctions and in locations subject to stresses. For example, in the stratified epithelium of the skin.

Tight junctions form a solid barrier to prevent the movement of molecules between adjacent epithelial cells. Tight junctions are found in the gut tube's simple columnar epithelium to regulate nutrient absorption. Finally, gap junctions perform the opposite function. Gap junctions allow small molecules and structures to pass freely between cells. For example, gap junctions in cardiac muscle tissue allow for coordinated heart contraction.

Tissue structure

Two major characteristics of epithelial tissue divide it into subclasses: the shape of the cells and the presence of layers.

Shape of cells:

- **Squamous** – cells are flattened, can be keratinized or nonkeratinized, are involved in protection and diffusion, and are found in capillary walls and skin
- **Cuboidal** – cells are cube-shaped, can be found forming tubes in the nephrons of the kidney, involved in secretion and absorption
- **Columnar** – cells are rectangular; cilia are often present, involved in absorption, secretion, protection, and lubrication, and form the inner lining of the gut tube

Layers:

- Simple – one layer of cells
- Stratified – two or more layers of cells
- Pseudostratified – simple epithelia that appear to be stratified when viewed in cross-section, though they are only one layer of cells

Connective tissue

Connective tissue is the most abundant tissue type in the body. In general, connective tissue consists of cells and an extracellularmatrix. The extracellular matrix is made up of a ground substance and proteinfibers. So, in a more detailed way, all connective tissue apart from blood and lymph consists of three main components: cells, ground substance, and fibers.

Connective tissue cells

The cells originate from mesenchyme, a loosely organized embryonic tissue featuring elongated cells in a viscous ground substance. Connective tissue cells do not oppose each other but are separated by a large extracellularmatrix.

Cell Types:

- **Structural** – fibroblasts, chondroblasts, osteoblasts, odontoblasts
- **Immunological** – plasma cell, leukocytes, eosinophils
- **Defense** – neutrophils, mast cells, basophils, macrophages
- **Energy reservoir** – adipose cells

Connective tissue fibers

The **ground substance** of connective tissue contains structural proteins called **fibers**. There are three types of connective tissue fibers:

- **Collagen fibers** are the most abundant fiber type. They have a high tensile strength but are also flexible. Collagen fibers comprise many subunits, called **collagen fibrils**, that appear striated under electron microscopy. There are many types of collagen, and the collagen types present in a tissue give it unique characteristics. For example, **type I collagen** provides resistance to stretch in bone tissue, while **type IV collagen** makes up the superstructure of the basement membrane.
- Reticular fibers are thinner than collagen fibers. They are found in extensive networks and provide structural support and framework. Reticular fibers do not stain with regular H&E stain; a **silver stain** is needed to stain fibers black, making them visible.

- **Elastic fibers** are also thinner than collagen. They are strong but can be stretched up to 150% of their original length without breaking. When tension is released, they can return to their original shape. Elastic fibers are found in skin, blood vessels, and lung tissue.

Connective tissue classification

Classification of connective tissue is based upon two characteristics: the composition of its cellular and extracellular components and its function in the body. Tissues are either classified as proper, embryonic, or specialized.

Proper connective tissues

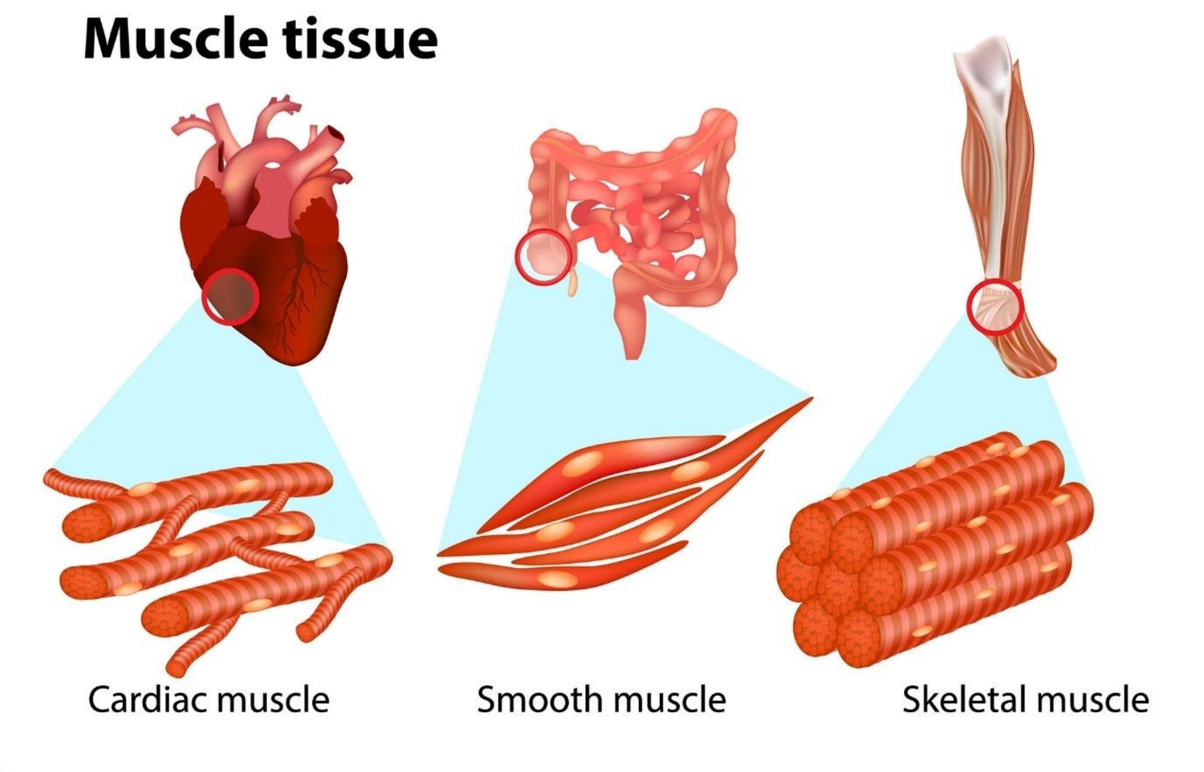
Proper connective tissues include loose connective tissue, often called areolar tissue, and dense connective tissue. **Loose connective tissue** consists of thin, loosely arranged collagen fibers in a viscous ground substance.

Dense connective tissue can be further classified into dense regular connective tissue and dense irregular connective tissue. Denseregularconnectivetissue makes up tendons and ligaments. Fibers are densely packed and organized in parallel to create a strong tissue capable of withstanding the pull of muscle and bone in movement. Denseirregularconnectivetissue also contains abundant fibers but lacks the directionality of dense regular connective tissue fibers. The high number of fibers provides strength; however, the disorganized pattern of fibers allows for flexibility. Dense irregular tissue is associated with the hollow organs of the digestive tract.

Embryonic connective tissue

Embryonic connective tissue, derived from mesoderm, is the precursor to many connective tissues in the adult body. It is categorized into two subtypes: mesenchyme and mucous connective tissue. Mesenchyme is found within the embryo. Mesenchymal cells are spindle with processes extending from either end. The cell processes connect to those of other mesenchymal cells through gap junctions. Very thin, scattered collagenfibers are present, but they are not particularly strong, reflecting the limited stress placed on the tissues of the developing embryo.

Muscular tissue



Muscular tissue is both extensible and elastic; in other words, it can be stretched and returned to its original size and shape. The muscle tissue cells are unique because they are contractile or capable of contraction. This contraction is a result of sliding actin and myosin filaments. Muscle tissue is easily distinguishable by its highly organized bundles of cells. Although there are three types of muscle tissue with unique cell morphologies, the fiberbundles of each tissue type are arranged in parallel, oriented on the long axis, and distinct from surrounding connective tissue. Muscle is classified according to the appearance of the contractile cells.

The three types of muscle tissue are skeletal muscle, cardiac muscle, and smooth muscle tissue.

Skeletal muscle

Skeletal muscle is responsible for the voluntary movement of the body. For example, movement of the limbs, skin of the face, and orbits. Contraction of skeletal muscle tissue is rapid and strong. Cells are large, cylindrical, and elongated. In embryonic development, myoblasts fuse to form one larger muscle cell, resulting in syncytial, multinucleated cells. Thenuclei of skeletal muscle cells are peripheral and ovoid. When viewed under a microscope, the arrangement of actin and myosin gives skeletal muscle a striatedappearance.

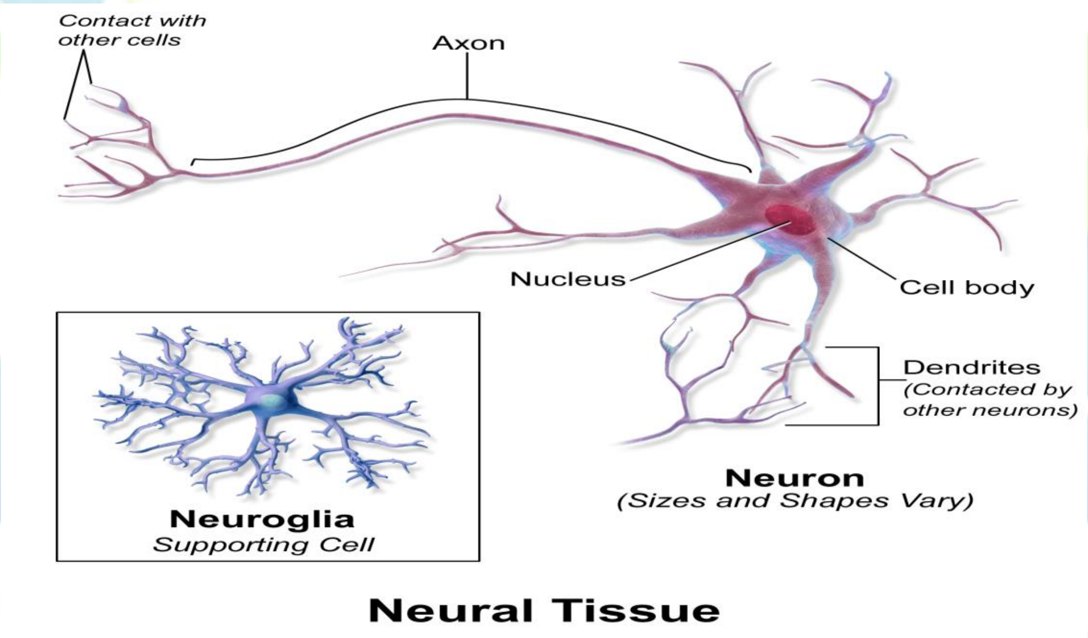
Cardiac muscle

Cardiac muscle is found in the heart wall also known as myocardium. Like skeletal muscle, actin and myosin also give cardiac muscle a striatedappearance. The cardiac muscle cells' movement is involuntary and coordinated by gapjunctions. A major defining characteristic of cardiac muscle tissue is the presence of intercalateddisks. Cardiac muscle cells are elongated and branched. Intercalated disks are present at the junctions between two cells. Although gap junctions allow this tissue to function as a syncytium, each cell has one centrally located nucleus.

Smooth muscle

Smooth muscle tissue is associated with arteries and tubular organs such as the intestinal tract. This type of tissue provides weak, slow, involuntary movements. Smooth muscle cells are spindle-shaped with one central nucleus. The contractilefibers of smooth muscle cells are arranged perpendicular to each other rather than in parallel. Therefore, smooth muscle tissue does not appear striated.

Nervous tissue



Neurons

Cells of the nervous system are highly specialized to transmit electrical impulses around the body. There are two main types of cells found in nervous tissue: neurons and glia.

Neurons tend to have a large cell body, or soma, and long projections used in transmitting information. These projections are referred to as axons or dendrites. Axons send impulses away from the soma, and dendrites carry incoming information. Neurons are most easily identified by their axons in either longitudinal or cross-sectional slides. Groups of neurons are referred to as ganglia in the peripheral nervous system and as nuclei in the central nervous system.

Glia are the supporting cells of nervous tissue and significantly outnumber neurons. These cells differ by region of the nervous system. Astrocytes support neurons, especially near synapses, and provide a protective barrier surrounding blood vessels. Oligodendrocytes are found in the white matter of the central nervous system. Large projections from these cells wrap around the axon of a neuron, insulating it to allow for faster projection of impulses.

In the peripheral nervous system, Schwann cells accomplish the same task. Oligodendrocytes and Schwann cells are useful in identifying nervous tissue because the sheathing they provide appears as a thick layer surrounding a tubular axon. Microglia are the macrophages of the nervous system. These cells constantly survey nervous tissue to destroy invaders and clear cell debris.

Nervous tissue exhibits a fluid-filledextracellularspace through which ions and neuro mediators travel to transmit impulses. Because generating action potentials requires a specific concentration of ions, the extracellular environment is highly regulated by glia. Capillaries passing through nervous tissue are surrounded by glia to form the blood brain barrier.

Unit-2

3. What is the osseous system? Write its structure and function with a neat, labeled diagram.

Osseous or bone tissue is a hard and mineralized connective tissue that forms bones. The primary function of osseous tissue is to provide attachment sites for muscles and tendons, which allows the body to move. Major functions of the skeletal system are body support, facilitation of movement, protection of internal organs, storage of minerals and fat, and blood cell formation.

Axial skeleton anatomy (80)

The adult axial skeleton consists of 80 bones. It's made up of the bones that form the body's vertical axis, such as the bones of the head, neck, chest, and spine.

Skull bones

The adult skull comprises 22 bones. These bones can be further classified by location:

Cranial bones- The 8 cranial bones form the bulk of your skull. They help to protect your brain.

Facial bones -There are 14 facial bones. They"re-found on the front of the skull and make up the face.

Auditory ossicles- The auditory ossicles are six small bones found within the inner ear canal in the skull. There are three auditory ossicles on each side of the head, known as the

Malleus (hammer),

Incus (anvil), and

Stapes (stirrup).

They work together to transmit sound waves from the surrounding environment to the structures of the inner ear.

Hyoid-

The hyoid is a U-shaped bone found at the base of the jaw. It serves as a point of attachment for muscles and ligaments in the neck.

Vertebral

The vertebral column is made up of 26 bones. The first 24 are all vertebrae, followed by the sacrum and coccyx (tailbone).

The 24 vertebrae can be further divided into the

Cervical vertebrae- These 7 bones are found in the head and neck.

Thoracic vertebrae- These 12 bones are found in the upper back.

Lumbar vertebrae- These 5 bones are found in the lower back.

The sacrum and coccyx are both made up of several fused vertebrae. They help support the weight of the body while sitting. They also serve as attachment points for various ligaments.

Thoracic cage

The thoracic cage comprises the sternum (breastbone) and 12 pairs of ribs. These bones form a protective cage around the organs of the upper torso, including the heart and lungs.

Some ribs attach directly to the sternum, while others are linked via cartilage. Some have no attachment point and are called “floating ribs.”

Appendicular skeleton anatomy (126)

There are a total of 126 bones in the appendicular skeleton. It consists of the bones that make up the arms and legs and the bones that attach them to the axial skeleton.

Pectoral girdle-

The pectoral girdle is where the arms attach to the axial skeleton. It’s made up of the clavicle (collarbone) and scapula (shoulder blade). There are two of each of these — one for each arm.

The upper limbs-Each arm contains 30 bones, known as the:

Humerus- The Humerus is the long bone of the upper arm.

Radius- The radius is one of two long bones of the forearm, found on the thumb side.

Ulna- The ulna is the second long bone of the forearm, found on the pinky finger side.

Carpals- The carpals are a group of eight bones found in the wrist area.

Metacarpals- The metacarpals are five bones found in the middle area of the hand.

Phalanges- The phalanges are 14 bones that make up the fingers.

Pelvic girdle

The pelvic girdle, commonly known as the hips, is where the legs attach to the axial skeleton. It's made up of two hip bones — one for each leg.

Each hip bone consists of three parts, known as the: Ilium-The ilium is the top portion of each hip bone.

Ischium- The ischium is a curved bone that makes up the base of each hip bone.

Pubis- The pubis is located in the front part of the hip bone.

Lower limbs Each leg is composed of 30 bones, known as the:

Femur- The femur is the large bone of the upper leg.

Tibia- The tibia is the main bone of the lower leg. It forms the shin.

Fibula- The fibula is the second bone in the lower leg, found in the outer leg.

Patella- The patella is also called the kneecap.

Tarsals- The tarsals are the seven bones that make up the ankle.

Metatarsal- The metatarsals are the five bones that make up the middle area of the foot.

Phalanges- The phalanges are 14 bones that comprise the toes.

Function

Support

The skeletal system's first and most apparent function is to provide a framework for the body. A firm bony skeleton allows the organism to have a distinctive shape adapted to a particular lifestyle. For instance, in a fast-moving animal like the cheetah, the skeleton contains long, thin limb bones and an extremely flexible spine. The structure of the skeleton also allows it to absorb the impact of running at high speeds.

The bones of birds are hollow and light and create a streamlined body adapted for flight. Many animals even have sexual dimorphism in their skeletons. While this dimorphism is fairly limited in humans, there are differences in the pelvic bones' angle to accommodate pregnancy.

Integration with the Muscular System

The skeletal system also provides an important form of attachment to the muscular system. Bones and exoskeletons are hard and do not bend or move when muscles are flexed. This means that the contraction of muscle cells will shorten muscles while the bone retains its shape**.** This basic structure allows muscles to move different body parts, using forces generated while pulling on the skeletal system.

Protection

The skeletal system's next obvious function is its rolein protecting the fragile internal organs**.** In humans, this is seen in the skull, which surrounds the brain. It is also exhibited by the ribcage, which surrounds the lungs and heart but still allows for expansion. Even invertebrates like snails and prawns often have hard exoskeletons to protect themselves from predators.

The rigid endoskeleton allows the body to rise above the ground or stand upright, bears the organism's weight, and provides the scaffolding for movement. Muscles generate the force required to move bones at joints. Muscle fibers contain actin and myosin, two protein filaments that can slide past each other to change the length of the muscle. When a nerve impulse arrives at the neuromuscular junction, it signals the muscle to contract. The force generated by the contracting muscle either pulls two bones together or apart, based on the interaction between the muscle and joint.

Blood Cell Production

The central part of a bone contains the bone marrow**,** the primary site for blood cell production in adult humans. There are two types of bone marrow in adults. Around 50% is red bone marrow containing hematopoietic stem cells and supportive tissue. The rest is yellow bone marrow made of fat; its proportion increases with age.

Bone marrow will revert to a higher proportion of red marrow if the body suffers an injury and needs to create more red blood cells. The bone marrow composition also changes during pregnancy and lactation in mammals. Over gestation, blood volume increases by about 1.5 liters and even the red and white blood cell concentrationincreases.

Production of other Cell Types

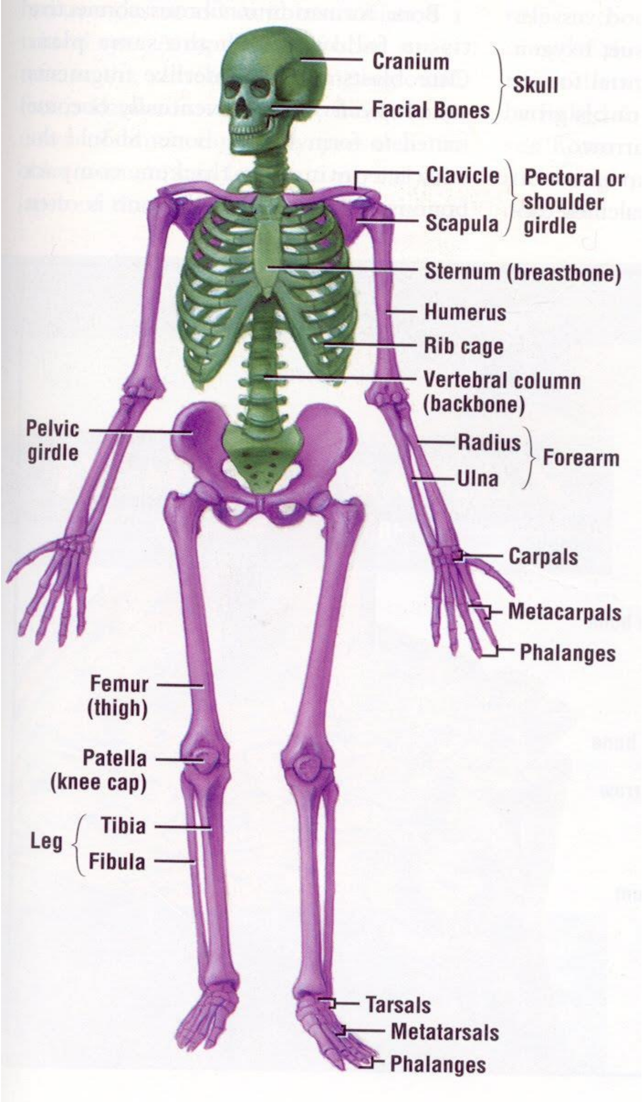
In addition to producing red blood cells, bone marrow within the skeletal system is the production site of several other cells. These include lymphocytes, which are immune cells that travel the lymphatic system. In addition to providing immune functions, the skeletal system is also responsible for hosting stem cells, which can differentiate into muscle cells, cartilage-producing cells, and cells that create bone (osteoblasts).

Osteoblasts in bone also have an endocrine function, secreting a hormone called osteocalcin. It requires vitamin K to be synthesized and is an anabolic hormone. It mediates an increase in insulin levels and increases the body's sensitivity to insulin. Osteocalcin contributes to an increase in bone mass and bone mineralization.

Storing Minerals

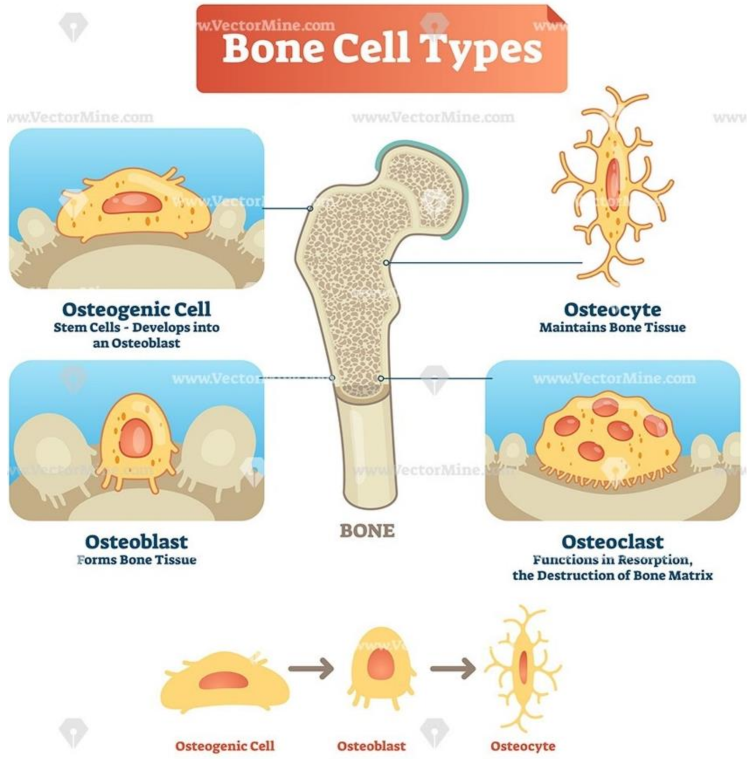
The bones of the skeletal system act as a storehouse for calcium ions, changing the quantum of mineralized deposits within bones to maintain plasma calcium ion concentration within a narrow range. Calcium ions can affect crucial sodium ion channels in the plasma membrane of every cell, thereby affecting overall homeostasis.

For this reason, changes to the concentration of calcium ions have particularly adverse effects on excitable cells in the nervous system and in cardiac, skeletal, and smooth muscle. Different interacting hormones maintain the balance of calcium ions in the plasma and bones, especially the parathyroid hormone secreted from the parathyroid glands in the neck.



4. Write different bone cells and their functions.

Bone tissue comprises four types of cells: osteoblasts, osteoclasts, osteocytes, and osteoprogenitor cells. Each of these cells has a unique function, and together, they maintain homeostasis of the bone tissue via bone remodeling (the replacement of old bone tissue with new bone tissue). In doing so, they regulate the structure and function of bone tissue.



Functions of Bone Cells

Osteoblasts

Osteoblasts are cuboidal cells arranged in a densely packed layer along the bone surface. They account for 4-6% of all bone cells, and their main function is to form new bone tissue. These cells secrete various substances, including collagen, various proteins, and calcium salts. Together, these materials form the bone matrix, a complex framework that supports the structure of the bones. The bone matrix also plays a key role in bone homeostasis, as it releases molecules that influence the activity of bone cells and, therefore, the remodeling of bone tissue.

Osteoblasts do not divide. Over time, the bone matrix grows around them and calcifies, trapping the cells in the middle. This causes the osteoblast to change its structure and become a mature bone cell called an osteocyte.

Osteocytes

Most bone cells are osteocytes, essentially osteoblasts that have become surrounded and trapped by the substances they secrete. Each osteocyte is found in a small space (called a lacuna) surrounded by bone tissue.

Osteocytes account for 90-95% of the cells in bone tissue. Like osteoblasts, they do not divide but have a long lifespan of up to 25 years.

Osteocytes have several important functions in maintaining the mineral composition of bone tissue. They can deposit and reabsorb bone and signal other osteocytes in the event of even slight damage to the bones. They regulate the activity of osteoblasts and osteoclasts and manage the bone's calcium reservoir. Therefore, osteocytes play a central role in bone remodeling.

Osteoclasts

Osteoclasts are large cells whose main function is to dissolve and reabsorb bone tissue. They are found on the surface of bone tissue and originate from white blood cells (monocytes and macrophages) rather than other bone cells. Osteoclasts constantly break down and reabsorb old bone tissue.

Osteoprogenitor cells

Osteoprogenitor cells, also known as osteogenic cells, are the stem cells found in bone tissue. Specialized bone cells (i.e., the osteoblasts and osteocytes) originate from osteoprogenitor cells in the bone marrow. Osteoclasts do not develop from osteogenic cells; they originate from blood stem cells in the bone marrow. It plays a prodigal role in bone repair and growth.

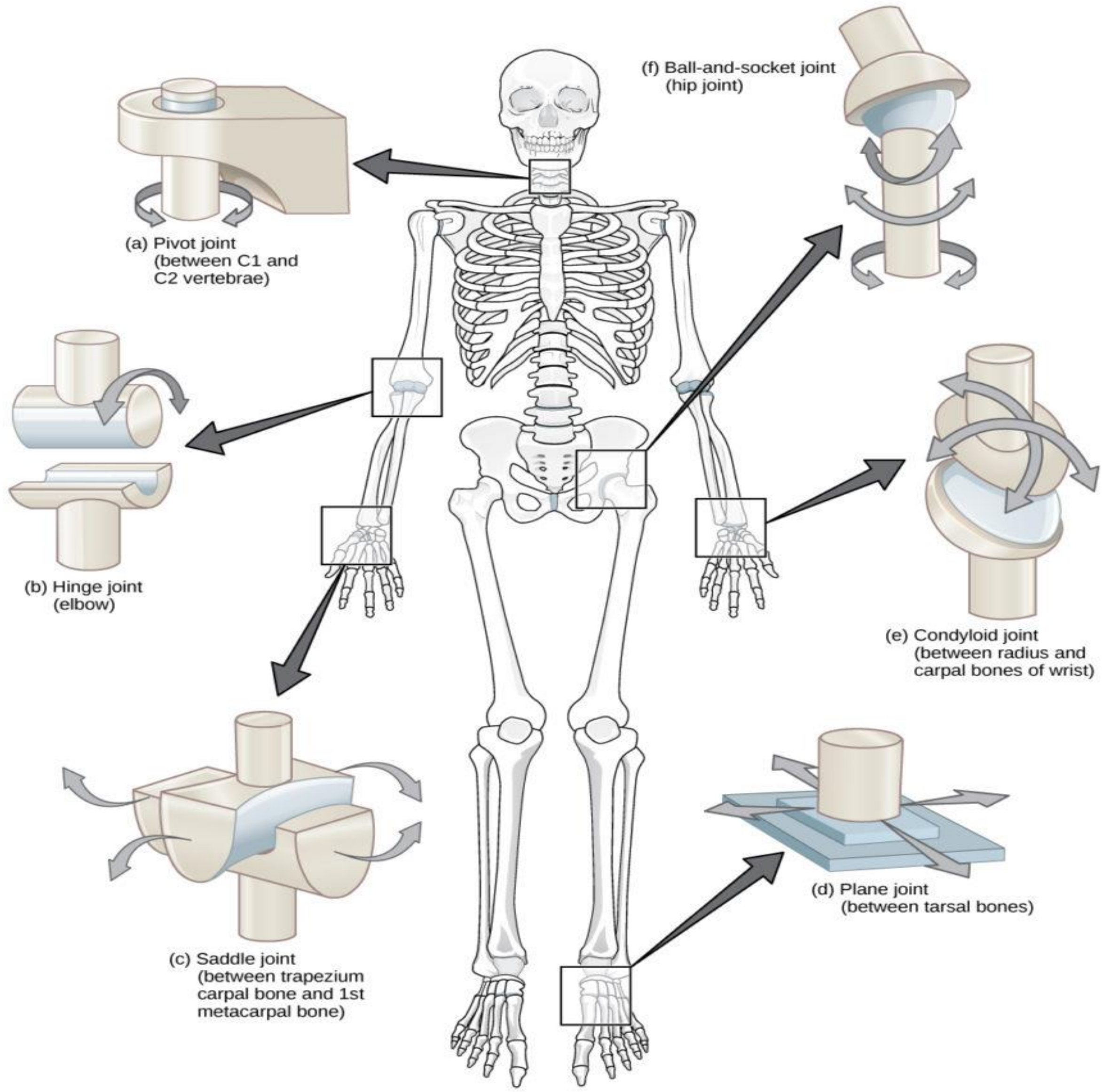
5. What is a joint? Classify them with suitable examples

A Joint is a point where two bones meet to provide a framework that permits movement. There are 3 types of Joints in our body

Fibrous Joint

Cartilaginous Joint

Synovial Joint



i.Fibrous Joint: This Joint is made up of fibrous connectivity tissue. The Joint is so tightly that it lacks any Joint cavity. They are immovable or slightly moveable. E.g., Suture, syndesmosis, Gomphosis

Suture: - Two or more Joints in the skull of an adult human are Joined with the help of a suture. EX: Sagittal Suture, coronal Suture

Syndesmosis: - bones are joined with the help of collagen Fibre. E.g. Tibia, Fibula Joint Gomphosis: - It is the peg and socket type fibrous Joint. E.g. Root of the tooth to the socket of the gum.

II. Cartilaginous Joint: - The bones are joined with the help of hyaline cartilage, which lacks any Joint cavity but provides a small degree of movement. It has two types. Synchondrosis: It is a temporary joint seen in large bones that helps during bone growth but does not help with movement. EX:- an epiphyseal plate of Humerus Symphysis is the secondary synchondrosis. It remains present even after the bone stops growing. Here, a thin layer of hyaline cartilage is present between two bones, acting as a Shock absorber and providing a point for Sudden movement. Ex: Pubis Symphysis

III. Synovial Joint:- Synovial Joint is the major type of Joint present in our body and provides great movement. Types of synovial joints are

i. Gliding Joint: - Small-sized Joints formed when flat on round surfaces articulate so that one bone can slide over the other in any possible direction. E.g., Between the wrist carpels, tarsals of the foot, etc.

ii. Hinge Joint: Unidirectional Joints that move like door hinges. E.g.:- Knee Joint, elbow Joint

iii. Ball and Socket Joint:- Joint in which the globe-like head of one bone fits into the cup-like cavity of another bone to allow free movement in all directions. E.g.:- shoulder and hip joint.

iv. Pivot Joint: - A joint in which the rounded head of one bone is surrounded by a collar-like structure of another bone made partly of bone and part of ligament. This type of Joint only provides movement in one direction. E.g.:- Atlas and axis Joint in the neck.

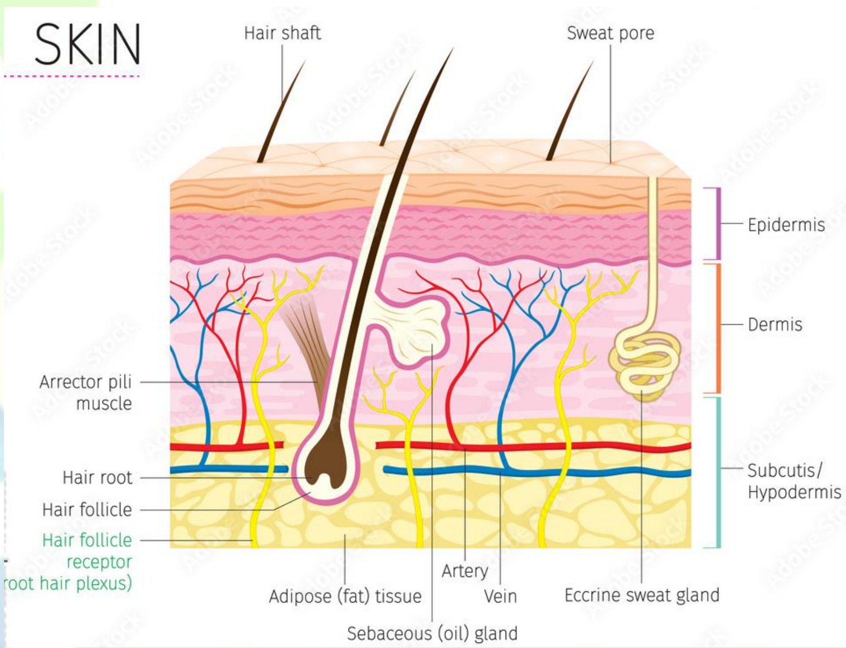
v. Ellipsoid Joint: - It is a joint in which the oval end of one bone fits into the depression of another bone. E.g., Joint between the metacarpals and Phalanges of fingers, Joint between the radius and carpals of the wrist, etc. vi. Saddle Joint: - A Joint in which the articulating bone is shaped like a saddle, and its rider allows different types of movement, straightening, bending, side to side, and rotation. E.g., joint between the carpel and metacarpal of the thumb.

6. What is the Integumentary system? Describe all the layers of skin.

The integumentary system is the set of organs that forms the external covering of the body and protects it from many threats, such as infection, desiccation, abrasion, chemical assault, and radiation damage. In humans, the integumentary system includes the skin – a thickened keratinized epithelium made of multiple layers of cells largely impervious to water. It also contains specialized cells that secrete melanin to protect the body from the carcinogenic effects of UV rays and cells that have an immune function. Sweat glands that excrete wastes and regulate body temperature are also part of the integumentary system. Somatosensory receptors and nociceptors are important components of this organ system that serve as warning sensors, allowing the body to move away from noxious stimuli.

Skin

Skin is the largest organ of our body. It covers 2m² of the body surface area. It also contains numerous glands and sensitive units. It is a multicellular organ composed of two distinct layers of tissues. Outer epidermis derived from ectoderm. Inner dermis derived from Mesoderm.



Epidermis

It is the outermost layer of skin. It protects the body from the environment and regulates water loss.

The layers of the epidermis include

- Stratum basale (the deepest portion of the epidermis)
- Stratum spinosum,
- Stratum granulosum,
- Stratum lucidum,
- Stratum corneum (the most superficial portion of the epidermis).

Stratum corneum:- It is the uppermost layer and is sloughed off constantly. It is made up of flat squamous cell. These cells are dead due to the presence of Keratin protein. It is the thickest layer and consists of 8-10 layers of cells.

Stratum lucidum:- It consists of 3-4 layers of living and flat cells, and they are enucleated and waterproof. It is called as barrier layer. It contains Elieidin protein.

Stratum granulosum: - It consists of 5-6 layers of cell.

Stratum Spinosum: - This layer provides strength to the skin and consists of many layers of branches and polyhedral cells.

Stratum Malpigh: - This layer contains melanocyte cells. Which secret melaline and it is responsible for the pigmentation of the skin.

Dermis or Corium

It is composed of fibrous connective tissue. It contains many blood vessels, capillaries, lymph vessels, muscle fibers, nerve fibers, and Elastic fibers. Fat may accumulate as reserve food in adipocytes. Sweat glands and sebaceous glands are also present in the dermis.

Function: As blood vessels in this layer. It provides nourishment and waste removal from its cells. It helps thermoregulation.

Hypodermis:

It is the innermost and thickest layer. It is made up of fat and connective tissue. It also contains fibroblasts, large nerve blood vessels, Macrophages, and Elastin protein.

Unit-3

7. Define lymph. Write details about the lymphatic system.

Lymph is a colorless fluid that circulates throughout the lymphatic system. The main role of the lymphatic system is to act as a filter against microbes, organic wastes, toxins and other debris. It carries lymphocytes throughout the body that fight against infections.

In animals and humans, extracellular fluid (fluid outside the cell) is divided into interstitial fluid (the fluid between the tissues) and plasma. It consists of small water-soluble substances which flow in between the tissue cells. Both plasma and interstitial fluid are similar due to the continuous exchange of small solutes, water, and ions across the capillary walls of the tissues.

The functions of interstitial fluid are as follows:

- It is used to transport nutrients to the cells.
- It enables intercellular communication between the cells.
- It removes the metabolic wastes from the cells.

The interstitial fluid is collected by the lymphatic system, and the rest is drained out. The drained fluid moves back to the blood vessels, and the remaining fluid is collected through the lymph capillaries, also known as lymphatic capillaries.

Let us have an overview of the composition and function of lymph in humans.

Composition of Lymph

The lymphatic system comprises lymph plasma, lymph corpuscles, and lymphoid organs. The composition of lymph is described below:

Lymph Plasma

Lymph is the interstitial fluid. It has a similar mineral content as in plasma. It has less calcium, fewer blood proteins, less phosphorus, and high glucose concentration. Globulin proteins, which are actual antibodies, are found in lymph plasma. Other substances include organic and inorganic substances. The exchange of nutrients and gases between the blood and cells of tissues occurs through the lymph.

Lymph Corpuscles

These comprise leucocytes and amoeboid cells. It contains specialized lymphocytes that elicit immune responses in the human body.

Lymphoid Organs

The lymphatic system consists of numerous lymph nodes deep inside the body. These lymph nodes are connected to lymphatic vessels circulating the lymph throughout the body. The lymph gets filtered at the lymph nodes.

The spleen, tonsils, adenoids, and thymus all form a part of the lymphatic system. The spleen is the largest lymphatic organ in the system, located under the ribcage, above the stomach, and in the left upper quadrant of the abdomen. Other parts of the lymphatic system – tonsils, adenoids, and thymus- are on either side of the throat and neck.

Other Components of Lymph in Humans

1. Carbohydrates
2. Lymphocytes
3. Creatinine
4. Water – 94%

5. Urea
6. Chlorides
7. Enzymes
8. Proteins – Albumin, globulin, and fibrinogen
9. Non-protein nitrogenous substances.

Formation of Lymph

Because lymph capillaries are permeable, lymph is formed from interstitial fluid. When blood flows through blood capillaries in the tissues, 9/10ths of the fluid flows into the venous end of the capillaries from the arterial end. The remaining one-tenth of the fluid then enters lymph capillaries, which are more permeable than blood capillaries.

As a result, when lymph passes through lymph capillaries, its composition, including protein content, is more or less similar to that of interstitial fluid. Because of their larger size, proteins found in the interstitial fluid cannot enter blood capillaries. Thus, these proteins enter lymph vessels, which are permeable to large particles.

Proteins and Fats – More protein and lipid substances are found in the liver and gastrointestinal tract tissue fluid. As a result, large amounts of proteins and lipids enter the liver and gastrointestinal tract lymph vessels. As a result, lymph in larger vessels contains more proteins and lipids.

Circulation of Lymph

Blood capillaries

↓

Interstitial fluid

↓

Lymphatic capillary

↓

Afferent lymph vessel

↓

Lymph node

↓

Efferent lymph vessel

↓

Lymphatic trunk

↓

Collecting duct

↓

Subclavian vein

Function of Lymph

The lymph performs many important functions. A few major functions of lymph are mentioned below:

1. It keeps the body cells moist.
2. It transports oxygen, hormones, and nutrients to different body parts and removes metabolic waste from the cells.
3. It transports antibodies and lymphocytes to the blood.
4. Maintaining the composition of tissue fluid and the volume of blood.
5. Absorption of fats from the small intestine occurs through lymphatic vessels.
6. Prevents invasion of microbes and foreign substances inside the lymph nodes.

8. composition & function of blood.

Blood is a fluid connective tissue. It circulates constantly around the body, allowing constant communication between tissues distant from each other. Blood is composed of a clear, strawcolored, watery fluid called plasma in which several different types of blood cells are suspended. Plasma normally constitutes 55% of the blood volume and the cell fraction 45%. Blood makes up about 7% of body weight.

Types of Blood Cells

We have seen blood consist of cells known as formed elements of blood. These cells have their own functions and roles to play in the body. The blood cells which circulate all around the body are as follows:

a. Red blood cells (Erythrocytes)

RBCs are biconcave cells without a nucleus in humans, also known as erythrocytes. RBCs contain the iron-rich protein called hemoglobin, which gives blood its red color. RBCs are the most copious blood cells produced in bone marrow. Their main function is to transport oxygen from and to various tissues and organs.

b. White blood cells (Leucocytes)

Leucocytes are colorless blood cells. They are colorless because it is devoid of hemoglobin. They are further classified as granulocytes and agranulocytes. WBCs mainly contribute to immunity and defense mechanisms.

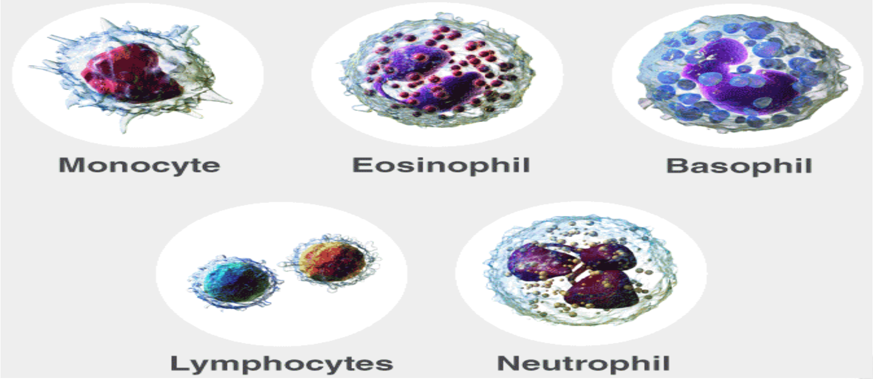
c. Platelets (Thrombocytes)

- Thrombocytes are specialized blood cells produced from bone marrow.
- Platelets come into play when there is bleeding or hemorrhage.
- They help in clotting and coagulation of blood. Platelets help in coagulation during a cut or wound.

Types of White Blood Cells

There are five types of White blood cells, and they are classified mainly based on the presence and absence of granules.

- Granulocytes
- Agranulocytes



There are **five types of white blood cells** present in the blood

Granulocytes

They are leukocytes, with the presence of granules in their cytoplasm. The granulated cells include- eosinophils, basophils, and neutrophils.

Eosinophils

- They are the cells of leukocytes, which are present in the immune system.
- These cells are responsible for combating infections in parasites of vertebrates and for controlling mechanisms associated with allergy and asthma.
- Eosinophil cells are small granulocytes produced in the bone marrow and make 2 to 3 percent of whole WBCs. These cells are present in high concentrations in the digestive tract.

Basophils

- They are the least common of the granulocytes, ranging from 0.5 to 1 percent of WBCs.
- They contain large cytoplasmic granules, vital in mounting a non-specific immune response to pathogens and allergic reactions by releasing histamine and dilating the blood vessels.
- These white blood cells can be stained when exposed to basic dyes called basophil.
- These cells are best known for their role in asthma and their result in inflammation and bronchoconstriction in the airways.
- They secrete serotonin, histamine, and heparin.

Neutrophils

- They are normally found in the bloodstream.
- They are predominant cells that are present in pus.
- Around 60 to 65 percent of WBCs are neutrophils with a 10 to 12-micrometer diameter.
- The nucleus is 2 to 5 lobed, and the cytoplasm has fine granules.
- Neutrophil helps destroy bacteria with lysosomes, and it acts as a strong oxidant.
- Neutrophils are stained only using neutral dyes. Hence, they are called so.
- Neutrophils are also the first cells of the immune system to respond to an invader such as a bacteria or a virus.
- The lifespan of these WBCs extends for up to eight hours and is produced every day in the bone marrow.

Agranulocytes

They are leukocytes, with the absence of granules in their cytoplasm. Agranulocytes are further classified into monocytes and lymphocytes.

Monocytes

- These cells usually have a large bilobed nucleus with a diameter of 12 to 20 micrometers.
- The nucleus is generally half-moon-shaped or kidney-shaped, and it occupies 6 to 8 percent of WBCs.
- They are the garbage trucks of the immune system.
- The most important functions of monocytes are to migrate into tissues and clean up dead cells, protect against bloodborne pathogens, and move very quickly to the sites of infections in the tissues.
- These white blood cells have a single bean-shaped nucleus called Monocytes.

Lymphocytes

- They play a vital role in producing antibodies.
- Their size ranges from 8 to 10 micrometers.

- They are commonly known as natural killer cells.
- They play an important role in body defense.
- These white blood cells are colorless cells formed in lymphoid tissue, called lymphocytes.
- There are two main types of lymphocytes – B lymphocytes and T lymphocytes.
- These cells are important in the immune systems and responsible for humoral and cell-mediated immunity.

Components Of Blood

There are many cellular structures in the composition of blood. When a blood sample is spun in a centrifuge machine, it separates into the following constituents: Plasma, buffy coat, and erythrocytes. Thus, blood contains RBC, WBC, platelets, and plasma.

Plasma

The liquid state of blood can be attributed to plasma, as it makes up ~55% of blood. It is pale yellow in color and when separated. Blood plasma consists of salts, nutrients, water, and enzymes. Blood plasma also contains important proteins and other components necessary for overall health. Hence, blood plasma transfusions are given to patients with liver failure and life-threatening injuries.

Components of Blood Plasma

Blood plasma has several protein components. Proteins in blood plasma are:

- Serum globulin
- Serum albumin
- Fibrinogen

The serum contains only globulin and albumin. Fibrinogen is absent in serum because it is converted into fibrin during blood clotting.

Red Blood Cells (RBC)

Red blood cells consist of Haemoglobin, a protein. They are produced by the bone marrow to primarily carry oxygen to the body and carbon dioxide away from it.

White Blood Cells (WBC)

White blood cells fight foreign pathogens (such as bacteria, viruses, and fungi) that enter our bodies. They circulate throughout our body and originate from the bone marrow.

Platelets

Tiny disc-shaped cells that help regulate blood flow when any part of the body is damaged, thereby aiding in fast recovery through clotting of blood.

Functions of Blood

Blood is responsible for the following body functions:

Fluid Connective Tissue

Blood is a fluid connective tissue comprising 55% plasma and 45% formed elements, including WBCs, RBCs, and platelets. Since these living cells are suspended in plasma, blood is known as a fluid connective tissue and not just fluid.

Provides oxygen to the cells

Blood absorbs oxygen from the lungs and transports it to different body cells. The waste carbon dioxide moves from the blood to the lungs and is exhaled.

Transports Hormones and Nutrients

The digested nutrients such as glucose, vitamins, minerals, and proteins are absorbed into the blood through the capillaries in the villi lining the small intestine.

The hormones secreted by the endocrine glands are also transported by the blood to different organs and tissues.

Homeostasis

Blood helps to maintain the internal body temperature by absorbing or releasing heat.

Blood Clotting at Site of Injury

The platelets help in the clotting of blood at the site of injury. Platelets, along with the fibrin, form clots at the wound site

Transport of waste to the Kidney and Liver

Blood enters the kidneys, where it is filtered to remove nitrogenous waste from the blood plasma. The toxins from the blood are also removed by the liver.

Protection of the body against pathogens

The White Blood Cells fight against infections. They multiply rapidly during infections.

Unit-4

9. Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system

The peripheral nervous system (PNS) is a component that connects the central nervous system (CNS) to the rest of the body. It consists of nerves and ganglia transmitting signals between the CNS, organs, limbs, and skin.

The PNS is divided into sensory and motor divisions, which carry information to and from the CNS. It is critical in bodily functions like movement, sensation, and autonomic processes.

The PNS is all the nerves that branch out from the CNS components and extend to other body parts – the sense organs, muscles, and glands. The PNS connects the CNS to the rest of the body.

Functions

The primary function of the peripheral nervous system is to connect the brain and spinal cord to the rest of the body and the external environment. The peripheral nervous system transmits information to and from the CNS.

This is accomplished through nerves that carry information from sensory receptors in the eyes, ears, skin, nose, and tongue, as well as stretch receptors and nociceptors in muscles, glands, and other internal organs.

The sense organs can detect environmental changes and relay information through the sensory nerves to the CNS. The brain can then send signals through the nerves to the muscles, resulting in the muscles moving in response.

Therefore, there is always a stream of incoming and outgoing information between the PNS, CNS, and the body through nerve impulses.

The main functions of the PNS are voluntary movements such as chewing food, walking, and facial expressions. The PNS also regulates autonomic functions such as breathing, heart rate, and digesting – the unconscious bodily behaviors.

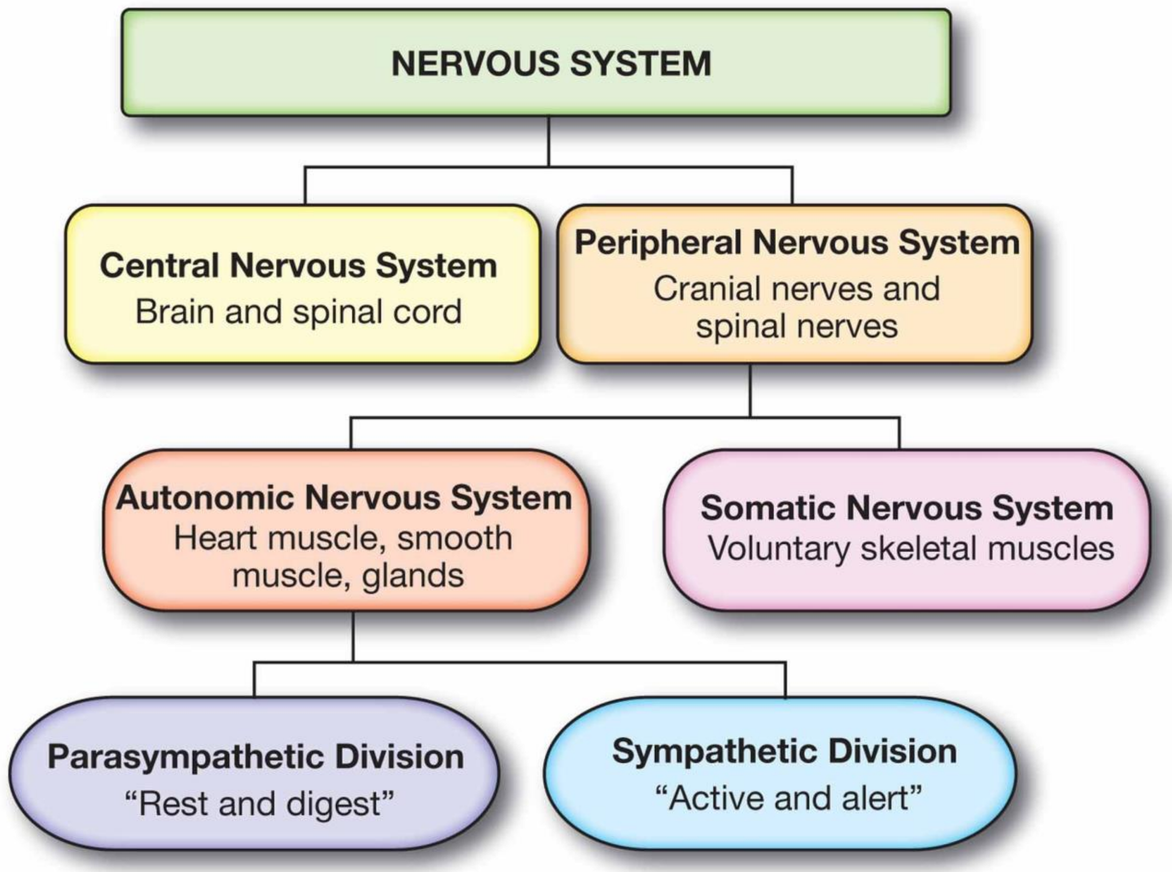
The PNS is thus especially important for humans to survive. Unlike the CNS, protected by the skull and the spine vertebrae, the nerves and cells of the PNS are not enclosed by bones. This makes the PNS more susceptible to damage by trauma.

Structures Of the Peripheral Nervous System

The PNS can be divided into two components: the somatic nervous system and the autonomic nervous system

The somatic nervous system (SNS) and the autonomic nervous system (ANS) are parts of the peripheral nervous system. The SNS controls voluntary actions such as walking.

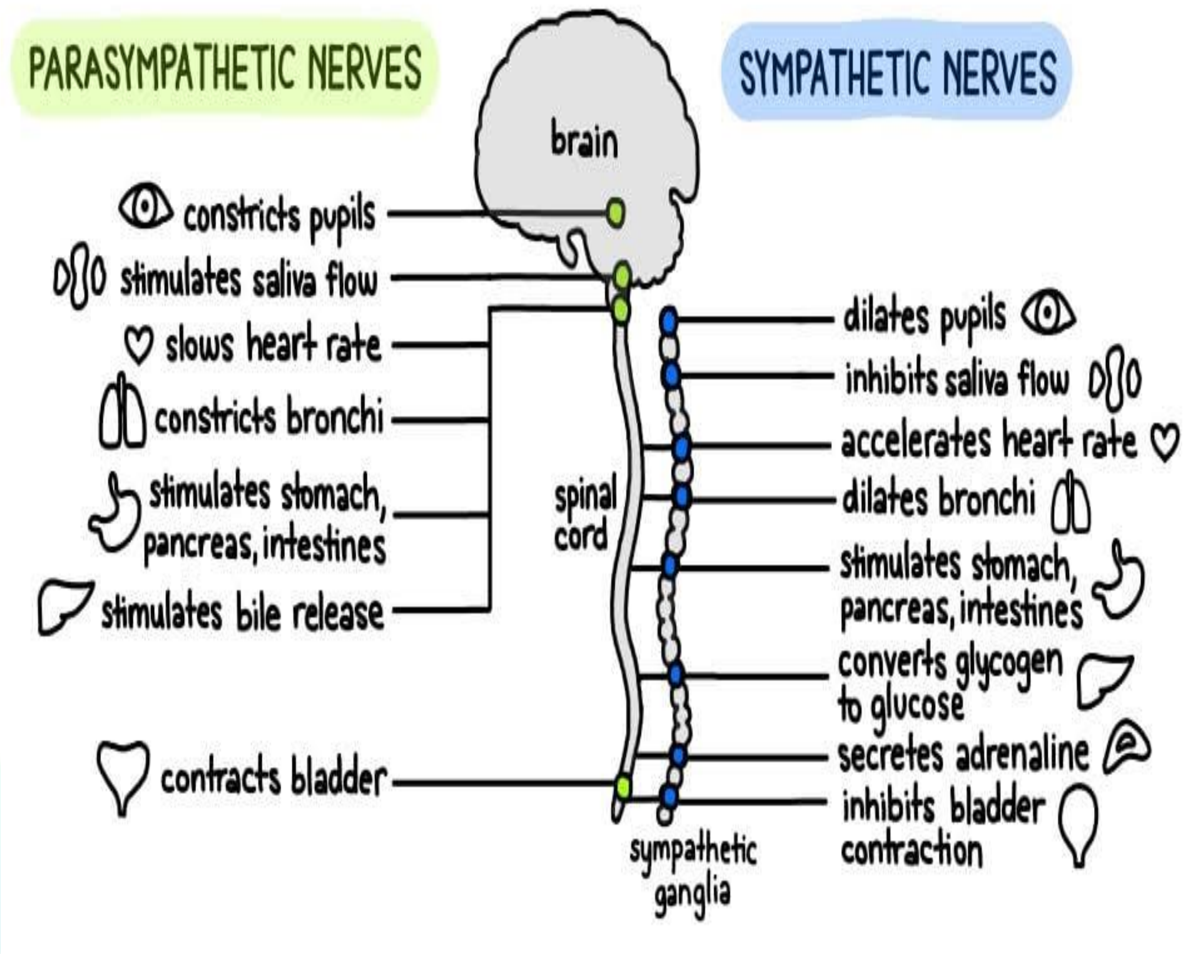
The ANS is responsible for the control of vital functions such as heartbeat and breathing. It is also involved in the acute stress response, where it works with the endocrine system to prepare the body for fight or flight.



Autonomic Nervous System

The autonomic nervous system coordinates involuntary behaviors such as heart rate, breathing, and digestion. This system allows these important functions to occur without conscious thought, so they work automatically.

The ANS is further divided into 2 components



Sympathetic Nervous System

The sympathetic nervous system mostly comes into play when the body needs to respond to threatening stimuli. This response is called the fight-or-flight response.

During a threatening situation, this system will respond by increasing heart rate, activating sweat glands, increasing blood flow, and dilating the pupils.

It slows bodily processes that are less important in emergencies, such as digestion.

Parasympathetic Nervous System

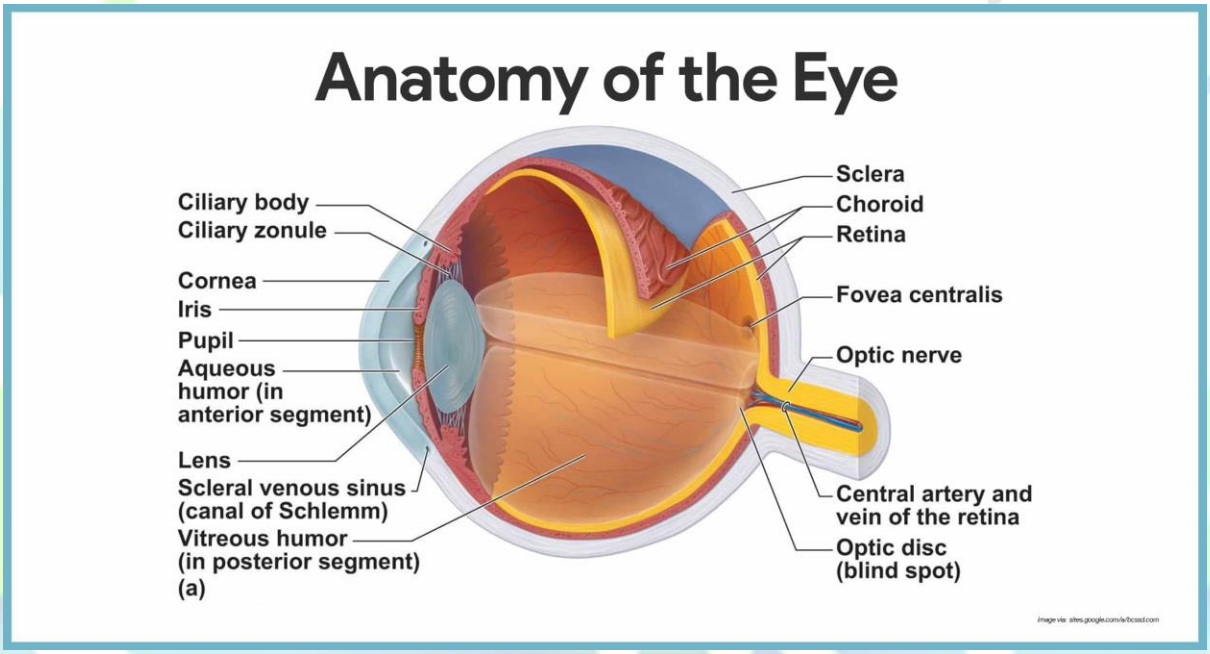
The parasympathetic nervous system relaxes the individual once the emergency has passed. The parasympathetic system aims to maintain normal bodily functions by decreasing activity/maintaining it.

When this happens, the system will reduce the heart rate, stop the body from sweating, decrease blood flow, and constrict the pupils – allowing us to reach a state of rest.

The parasympathetic ANS leads to decreased arousal.

10. Structure and functions of eye, ear, nose, and tongue

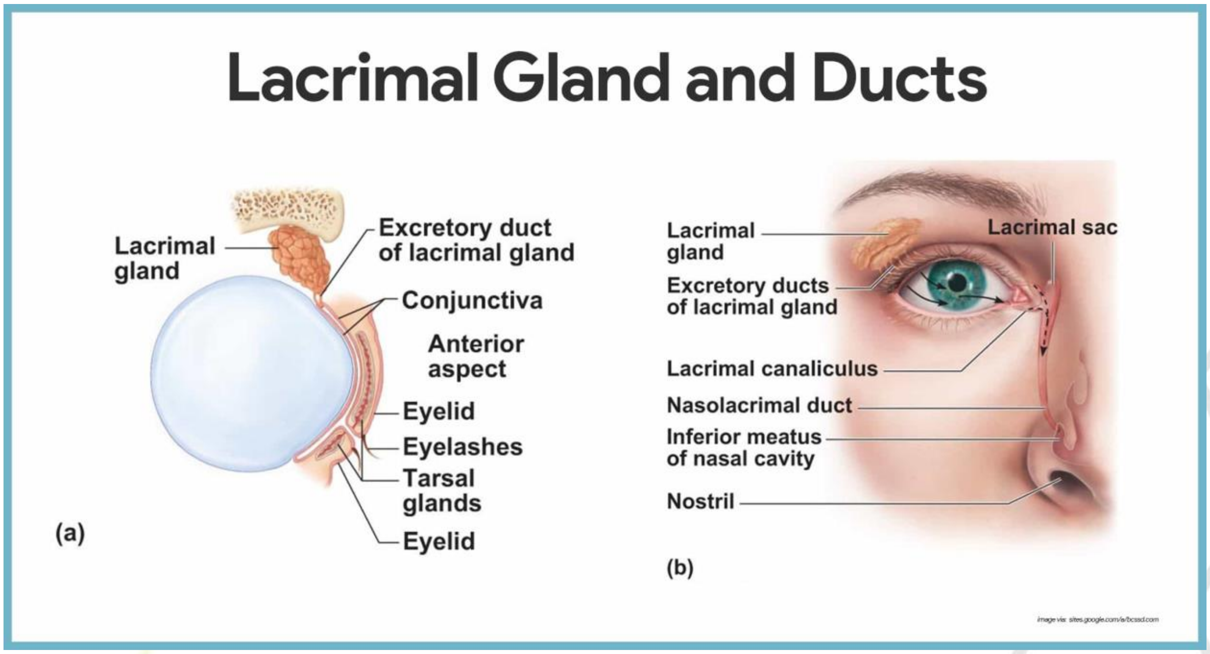
Anatomy of the Eye



External and Accessory Structures

The accessory structures of the eye include the extrinsic eye muscles, eyelids, conjunctiva, and lacrimal apparatus.

- **Eyelids.** Anteriorly, the eyes are protected by the eyelids, which meet at the medial and lateral corners of the eye, the **medial** and **lateral commissure (canthus)**.
- **Eyelashes.** Projecting from the border of each eyelid are the eyelashes.
- **Tarsal glands.** Modified sebaceous glands associated with the eyelid edges are the tarsal glands; these glands produce an oily secretion that lubricates the eye; **ciliary glands**, modified sweat glands, lie between the eyelashes.
- **Conjunctiva.** A delicate membrane, the conjunctiva, lines the eyelids and covers part of the outer surface of the eyeball; it ends at the edge of the cornea by fusing with the corneal epithelium.
- **Lacrimal apparatus.** The lacrimal apparatus consists of the lacrimal gland and several ducts that drain the lacrimal secretions into the nasal cavity.
- **Lacrimal glands**. The lacrimal glands are located above the lateral end of each eye; they continually release a salt solution (**tears**) onto the anterior surface of the eyeball through several small ducts.
- **Lacrimal canaliculi.** The tears flush across the eyeball into the **lacrimal canaliculi** medially, then into the **lacrimal sac**, and finally into the **nasolacrimal duct**, which empties into the nasal cavity.
- **Lysozyme.** Lacrimal secretion also contains antibodies and lysozyme, an enzyme that destroys bacteria; thus, it cleanses and protects the eye surface as it moistens and lubricates it.
- **Extrinsic eye** muscle**.** Six **extrinsic**, or **external**, **eye muscles** are attached to the outer surface of the eye; these muscles produce gross eye movements and make it possible for the eyes to follow a moving object; these are the **lateral rectus**, m**edial rectus**, **superior rectus**, **inferior rectus**, **inferior oblique**, and **superior oblique**.



Internal Structures: The Eyeball

The eye itself, commonly called the eyeball, is a hollow sphere; its wall is composed of three layers, and its interior is filled with fluids called humors that help to maintain its shape.

Layers Forming the Wall of the Eyeball

- **Fibrous layer.** The outermost layer called the fibrous layer, consists of the protective sclera and the transparent cornea.
- **Sclera.** The sclera, thick, glistening, white connective tissue, is seen anteriorly as the "white of the eye".
- **Cornea.** The central anterior portion of the fibrous layer is crystal clear; this "window" is the cornea through which light enters the eye.
- **Vascular layer.** The middle eyeball of the vascular layer has three distinguishable regions: the **choroid**, the **ciliary body**, and the **iris**.
- **Choroid.** Most posterior is the choroid, a blood-rich nutritive tunic that contains a dark pigment; the pigment prevents light from scattering inside the eye.
- **Ciliary body.** Moving anteriorly, the choroid is modified to form two smooth muscle structures: the **ciliary body**, to which the lens is attached by a suspensory ligament called **ciliary zonule**, and then the **iris**.

- **Pupil.** The pigmented iris has a rounded opening, the pupil, through which light passes.
- **Sensory layer.** The innermost sensory layer of the eye is the delicate two-layered **retina**, which extends anteriorly only to the ciliary body.
- **Pigmented layer.** The outer pigmented layer of the retina is composed of pigmented cells that, like those of the choroid, absorb light and prevent light from scattering inside the eye.
- **Neural layer.** The transparent inner neural layer of the retina contains millions of receptor cells, rods, and cones called **photoreceptors** because they respond to light.
- **Two-neuron chain.** Electrical signals pass from the photoreceptors via a two-neuron chain-bipolar cell and then **ganglion cells**– before leaving the retina via **optic nerve** as nerve impulses that are transmitted to the optic cortex; the result is vision.
- **Optic disc.** The photoreceptor cells are distributed over the entire retina, except where the optic nerve leaves the eyeball; this site is called the **optic disc** or **blind spot**.
- **Fovea centralis.** Lateral to each blind spot is the fovea centralis, a tiny pit that contains only cones.

Lens

Light entering the eye is focused on the retina by the lens, a flexible biconvex, crystal-like structure.

- **Chambers.** The lens divides the eye into two segments or chambers; the **anterior (aqueous) segment**, anterior to the lens, contains a clear, watery fluid called **aqueous humor**; the **posterior (vitreous) segment** posterior to the lens, is filled with a gel-like substance called either **vitreous humor** or the vitreous body.
- **Vitreous humor.** Vitreous humor helps prevent the eyeball from collapsing inward by reinforcing it internally.

- **Aqueous humor.** Aqueous humor is similar to blood plasma and is continually secreted by a special choroid; it helps maintain intraocular pressure or the pressure inside the eye.
- **Canal of Schlemm.** Aqueous humor is reabsorbed into the venous blood through the scleral venous sinus, or canal of Schlemm, located at the junction of the sclera and cornea.

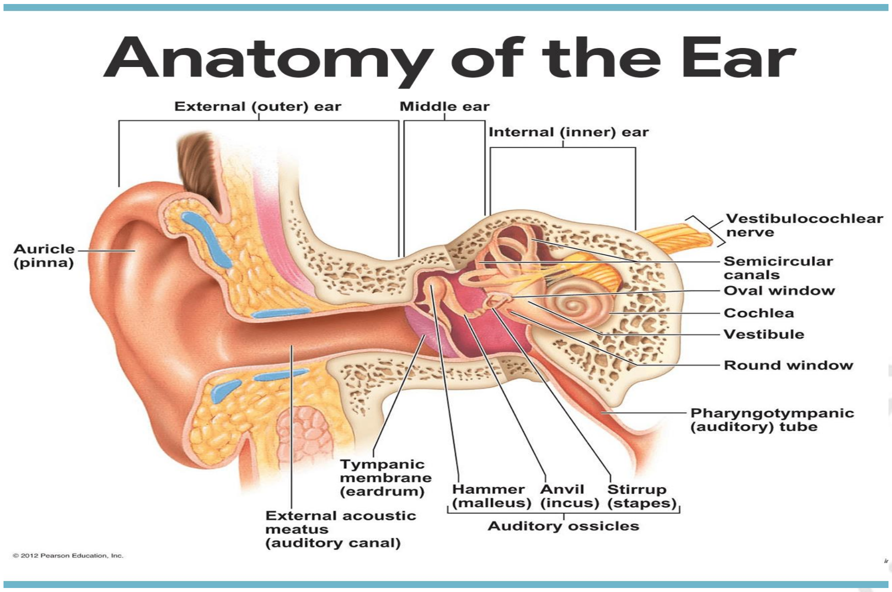
Eye Reflexes

Both the external and internal eye muscles are necessary for proper eye function.

- **Photopupillary reflex.** When the eyes are suddenly exposed to bright light, the pupils immediately constrict; this is the photo pupillary reflex; this protective reflex prevents excessively bright light from damaging the delicate photoreceptors.
- **Accommodation pupillary reflex.** The pupils also constrict reflexively when we view close objects; this accommodation pupillary reflex provides for more acute vision.

Anatomy of the Ear

Anatomically, the ear is divided into three major areas: the external or outer ear, the middle ear; and the internal or inner ear.



External (Outer) Ear

The external, or outer, ear comprises the auricle and the external acoustic meatus.

- **Auricle.** The auricle, or **pinna**, is what most people call the "ear"- the shell-shaped structure surrounding the auditory canal opening.
- **External acoustic meatus.** The external acoustic meatus is a short, narrow chamber carved into the temporal bone of the skull; in its skin-lined walls are the **ceruminous glands**, which secrete waxy, **yellow cerumen** or **earwax**, which provides a sticky trap for foreign bodies and repels insects.
- **Tympanic membrane.** Sound waves entering the auditory canal eventually hit the tympanic membrane, or **eardrum**, and cause it to vibrate; the canal ends at the ear drum, which separates the external from the middle ear.

Middle Ear

The middle ear, or tympanic cavity, is a small, air-filled, mucosa-lined cavity within the temporal bone.

- **Openings.** The tympanic cavity is flanked laterally by the eardrum and medially by a bony wall with two openings, the **oval window**and the inferior, membrane-covered **round window**.

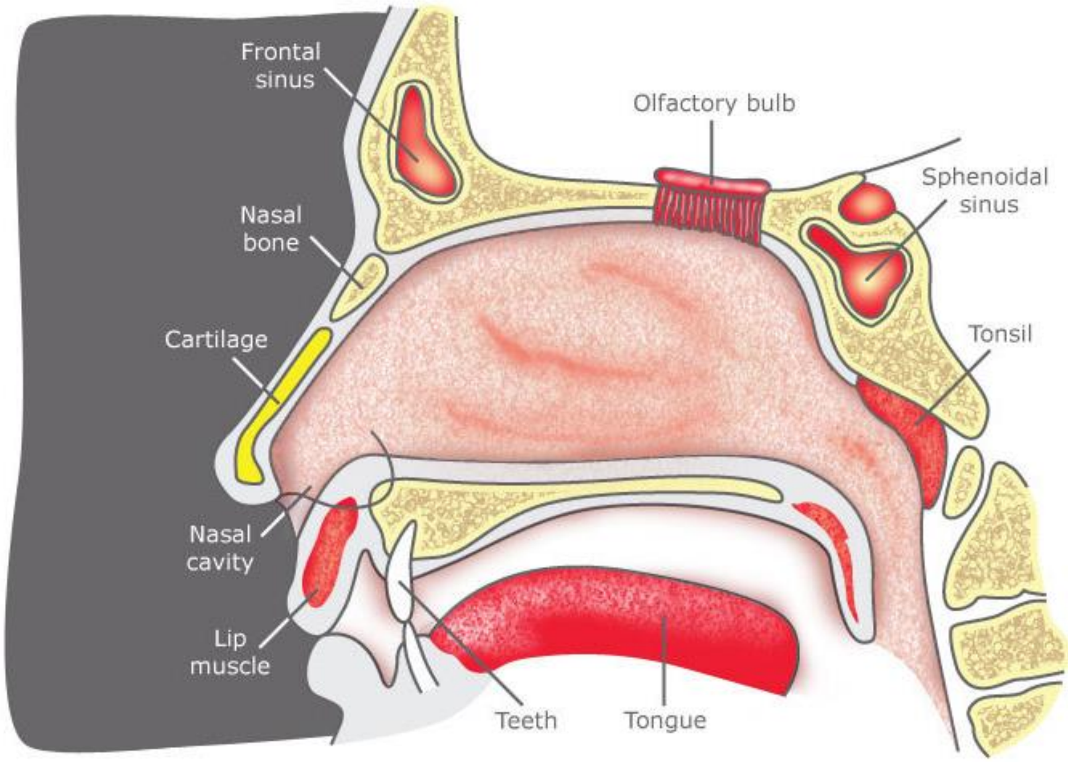
- **Pharyngotympanic tube.** The pharyngotympanic tube runs obliquely downward to link the middle ear cavity with the throat, and the mucosae lining the two regions are continuous.
- **Ossicles.** The tympanic cavity is spanned by the three smallest bones in the body, the ossicles, which transmit the vibratory motion of the eardrum to the fluids of the inner ear; these bones, named for their shape, are the **hammer**, or **malleus**, the **anvil**, or **incus**, and the **stirrup**, or **stapes**.

Internal (Inner) Ear

The internal ear is a maze of bony chambers, called the **bony**, or **osseous**, **labyrinth**, located deep within the temporal bone behind the eye socket.

- **Subdivisions.** The three subdivisions of the bony labyrinth are the spiraling, pea-sized cochlea, the vestibule, and the semicircular canals.
- **Perilymph.** The bony labyrinth is filled with a plasma-like fluid called perilymph.
- **Membranous labyrinth.** Suspended in the perilymph is a membranous labyrinth, a system of membrane sacs that more or less follow the shape of the bony labyrinth.
- **Endolymph.** The membranous labyrinth itself contains a thicker fluid called endolymph.

Anatomy of nose



The nose is the primary organ of smell and functions as an important respiratory organ in the body. Besides this, it is also involved in functions such as tasting.

The air that we breathe is filtered through the nasal hair. The inhaled air is warmed and humidified before it enters the lungs.

The shape of the nose is due to the bones and cartilage. The nasal septum separates the nostrils and divides the nasal cavity into two.

The structure and function of the nose are mentioned in detail. Read on to explore the anatomy of the nose.

Nose Structure

The structure of the nose is explained as follows:

1. **Bone:** It supports the bridge of the nose.

2. **Cartilage:** The upper cartilage supports the sides of the nose. The lower cartilage adds width and height to the nose. It provides shape to the nostrils and nose tip.
3. **Nasal Cavity:** The hollow space through which the air flows.
4. **Septum:** The septum divides the inside of the nose into two chambers. It is a thin wall made of bones and cartilage.
5. **Mucous Membrane:** The mucus membrane lines the nose, sinuses, and throat. It moistens and warms the air we breathe in. It also forms a sticky mucus that prevents dust and other small particles from the nose.
6. **Turbinates:** Each side of the nose contains curved turbinates, and the bony ridges are lined with mucous membranes.
7. **Sinuses:** The bone around the nose contains hollow, air-filled chambers known as sinuses. The mucus flows into the nasal cavity from the sinuses.

Functions of Nose

Helps in Inhalation

The process of respiration starts in the nose. The oxygen enters the nose through the nostrils and exits the same way during exhalation. The nasal cavities open into a space called choana, which further opens into the nasopharynx. The air then enters the oropharynx and finally reaches the lungs via the larynx, trachea, and bronchi.

Purification of Inhaled Air

The nasal cavity walls are covered with hair or cilia that trap the dust and harmful particles and purify the inhaled air. The back-and-forth movement of cilia helps move the dust particles to the throat, where they are swallowed or excreted through the nasal cavity.

The nose hair also moisturizes and warms the air, resembling the air temperature and moisture within the lungs. During exhalation, the heat and moisture in the carbon dioxide are absorbed by the nasal hair and then released into the atmosphere.

The nasal conchae, which are spiral in structure, keep whirling the air for a longer time within the nasal cavity so that it is humidified and purified properly.

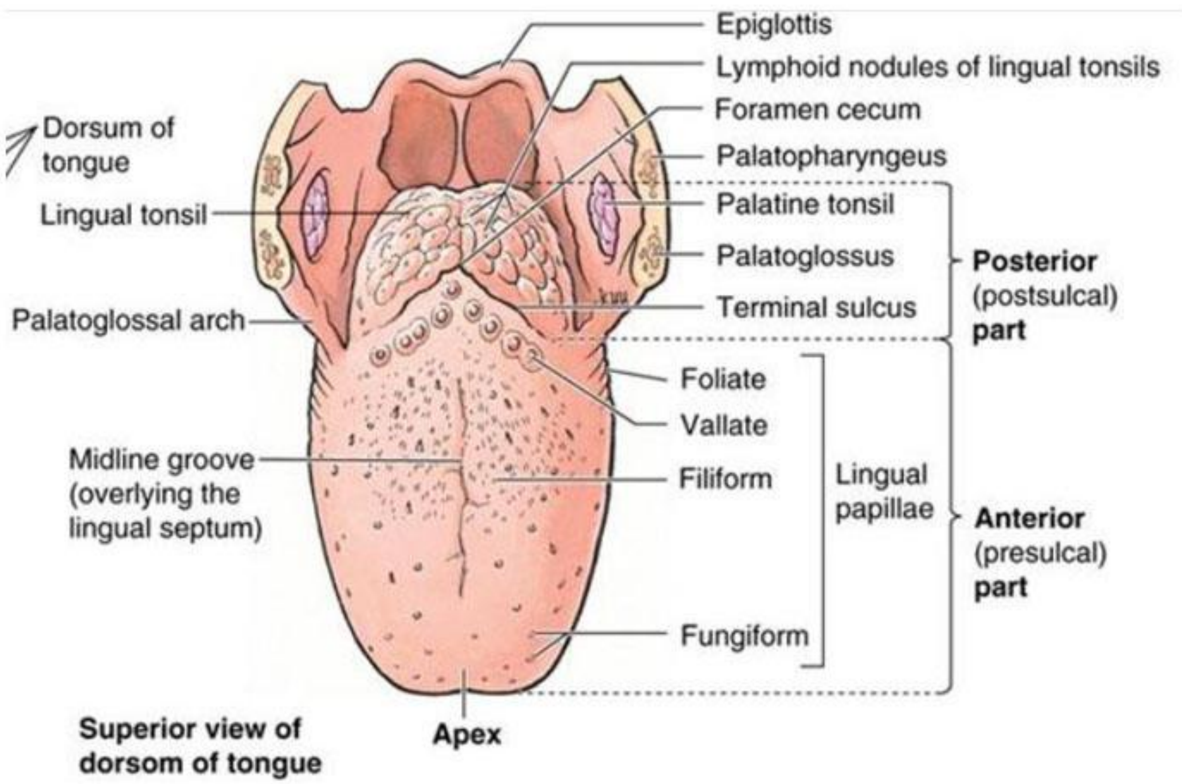
Organ of Smell

The inhaled air comes in contact with the olfactory epithelium. The nerve fibers extending from the olfactory receptors accumulate the molecules containing the odor to send the signals to the olfactory bulbs through the receptors. These signals are carried to the brain's olfactory region and are decoded so that the smell is identified.

Sense of Taste

While chewing, the food releases certain chemicals that travel up to the nose and activate the olfactory receptors inside the nose. They work in coordination with the taste buds to identify the actual flavor of the food.

Anatomy of Tongue



The tongue is a muscular organ in the mouth covered with a moist, pink tissue called the mucosa. It involves licking, tasting, breathing, swallowing, and speaking. The papillae present on the tongue give it a rough texture. It is covered by several taste buds. There are several nerves in the tongue that help in transmitting taste signals to the brain and thus help in taste sensation.

Structure of Tongue

The human tongue is about 3.3 inches in men and 3.1 inches in women. It is located in the oral cavity. The tongue is divided into three parts:

- Tip
- Body
- Base

The tongue is embryologically divided into the anterior and posterior parts. The anterior part, known as the oral or presulcal part, includes the root attached to the floor of the oral cavity. Theposterior part, known as the pharyngeal or postsulcal part, includes the base forming the ventral wall of the oropharynx.

The tongue is made up of three elements:

- Epithelium
- Muscles
- Glands

Epithelium

The epithelium comprises papillae and taste buds. The taste buds help to sense taste. They are lined by squamous epithelial tissue and have a broad bottom.

The taste cells are slender and rod-shaped, with a nucleus in the center. The free surface comprises short-taste hair. The taste cells help detect taste, which dissolves in saliva for proper sensation.

Muscles

The tongue muscles are voluntary and contain cross-striated muscular fibers.

Glands

The tongue consists of small and scattered glands. These glands are of three types:

- Mucous Glands
- Serous Glands
- Lymph Nodes

The lymph nodes are prominent at the posterior part of the tongue and are known as lingual tonsils.

Nerve Supply

The glossopharyngeal nerve and the chords tympanic branch of the facial nerve is responsible for a taste sensations. The sensations of pain, touch, and temperature are carried by the trigeminal nerve.

Tongue Functions

The following are the important tongue functions:

Mastication

The tongue helps in chewing.

Deglutition

It helps in swallowing food.

Taste

The tongue transmits taste signals to the brain and helps in sensing taste.

Speech

It is an important organ that facilitates speech.

Secretion

It secretes mucous and serous fluid, which keeps the mouth moist.

Salivary Glands

Salivary glands comprise three pairs:

- Parotid
- Submaxillary
- Sublingual

Parotid

It opens on the inner surface of the cheek by the duct of Stensen. It is located opposite the second upper molar tooth.

Submaxillary

It opens by Wharton's duct on the floor of the mouth by the sides of the frenulum of the tongue.

Sublingual

It opens by the ducts of Rivinus on the floor of the mouth by the sides of the frenulum of the tongue.

Unit-5

11.With a neat and labeled diagram, describe the anatomy and physiology of the human heart.

The human heart is one of the most important organs responsible for sustaining life. It is a muscular organ with four chambers. The size of the heart is the size of about a clenched fist.

The human heart functions throughout a person's lifespan and is one of the most robust and hardest-working muscles in the human body.

Position of the Heart in the Human Body

The human heart is located between the lungs in the thoracic cavity, slightly towards the left of the sternum (breastbone). It is derived from the embryonic mesodermal germ layer.

The Function of Heart

The heart's function in any organism is to maintain a constant flow of blood throughout the body. This replenishes oxygen and circulates nutrients among the cells and tissues.

The following are the main functions of the heart:

- One of the primary functions of the human heart is to pump blood throughout the body.
- Blood delivers oxygen, hormones, glucose, and other components to various body parts, including the human heart.
- The heart also ensures that adequate blood pressure is maintained in the body

There are two types of circulation within the body: pulmonary and systemic.

Types of Circulation

- **Pulmonary circulation** carries deoxygenated blood away from the heart to the lungs and then brings oxygenated blood back to the heart.
- **Systemic circulation** is another portion of circulation where the **oxygenated blood is pumped from the heart to every organ** and tissue in the body, and deoxygenated blood returns to the heart.

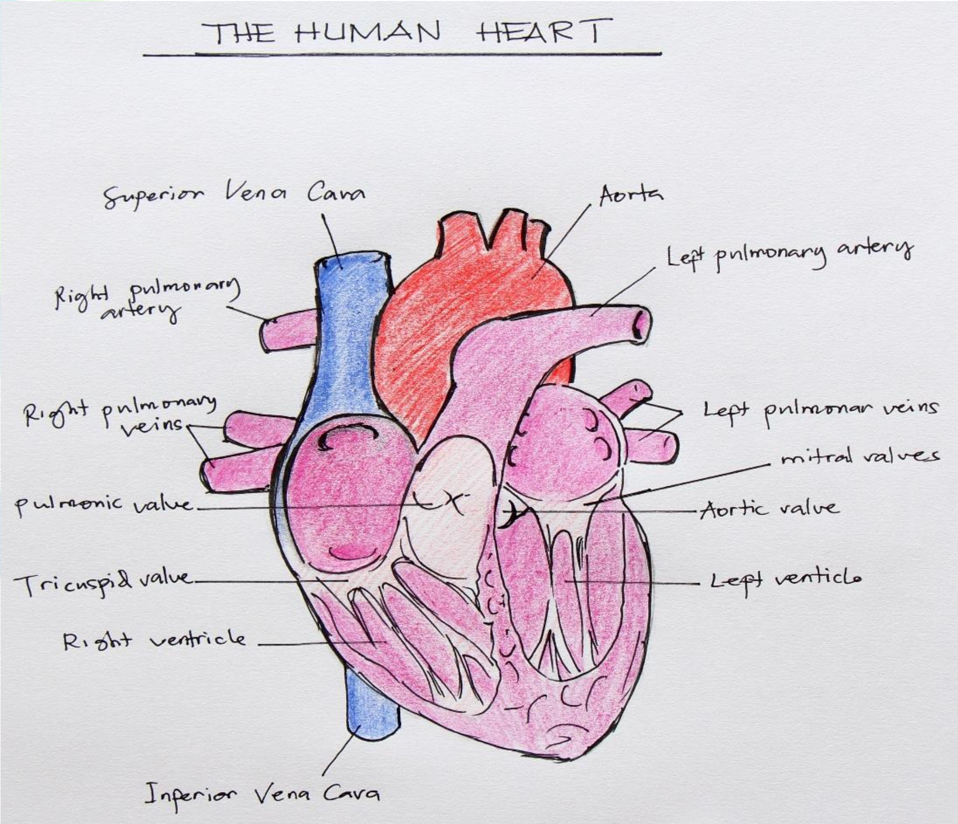
Now, the heart is a muscle and needs a constant supply of oxygenated blood. This is where another type of circulation comes into play: coronary circulation.

- **Coronary circulation** is an essential portion of the circulation, where oxygenated blood is supplied to the heart. This is important as the heart supplies blood throughout the body.

Structure of the Human Heart

The human heart is about the size of a human fist and is divided into four chambers: two ventricles and two atria. The ventricles are the chambers that pump blood, and the atriums are the chambers that receive blood. The right atrium and ventricle comprise the "right heart," and the left atrium and ventricle comprise the "left heart." The heart's structure also houses the biggest artery in the body – the aorta.

The heart's right and left regions are separated by a wall of muscle called the septum. The right ventricle pumps the blood to the lungs for re-oxygenation through the pulmonary arteries. The right semilunar valves close and prevent the blood from flowing back into the heart. Then, the oxygenated blood is received by the left atrium from the lungs via the pulmonary veins. Read on to explore more about the structure of the heart.



External Structure of Heart

One of the first structures that can be observed when the external structure of the heart is viewed is the pericardium.

Pericardium

The human heart is situated to the left of the chest and is enclosed within a fluid-filled cavity described as the pericardial cavity. The walls and lining of the pericardial cavity are made up of a membrane known as the pericardium.

The pericardium is a fiber membrane found as an external covering around the heart. It protects the heart by producing a serous fluid, which lubricates the heart and prevents friction between the surrounding organs. Apart from the lubrication, the pericardium also helps by holding the heart in its position and maintaining a hollow space to expand when it is full. The pericardium has two exclusive layers—

- **Visceral Layer:** It directly covers the outside of the heart.
- **Parietal Layer:** It forms a sac around the outer region of the heart that contains the fluid in the pericardial cavity.

Structure of the Heart Wall

The heart wall is made up of 3 layers, namely:

- **Epicardium** – Epicardium is the outermost layer of the heart. It is composed of a thin-layered membrane that lubricates and protects the outer section.
- **Myocardium** – This is a layer of muscle tissue that constitutes the heart's middle layer wall. It contributes to the thickness and is responsible for the pumping action.
- **Endocardium** – The innermost layer lines the inner heart chambers and covers the heart valves. Furthermore, it prevents the blood from sticking to the inner walls, preventing potentially fatal blood clots.

Internal Structure of Heart

The internal structure of the heart is rather intricate, with several chambers and valves that control the flow of blood.

Chambers of the Heart

Vertebrate hearts can be classified based on the number of chambers present. For instance, most fish have two chambers, and reptiles and amphibians have three chambers. Avian and mammalian hearts consist of four chambers. Humans are mammals; hence, we have four chambers, namely:

- Left atrium
- Right atrium
- Left ventricle
- Right ventricle

Atria are thin, have less muscular walls, and are smaller than ventricles. These are the blood-receiving chambers that are fed by the large veins.

Ventricles are larger and more muscular chambers responsible for pumping blood into circulation. These are connected to larger arteries that deliver blood for circulation.

The right ventricle and right atrium are comparatively smaller than the left chambers. The walls have fewer muscles than the left portion, and the size difference is based on their functions. The blood originating from the right side flows through the pulmonary circulation, while blood from the left chamber is pumped throughout the body.

Blood Vessels

In organisms with closed circulatory systems, the blood flows within vessels of varying sizes. All vertebrates, including humans, possess this type of circulation. The external structure of the heart has many blood vessels that form a network, with other major vessels emerging from within the structure. The blood vessels typically comprise the following:

- **Veins** supply deoxygenated blood to the heart via the inferior and superior vena cava, eventually draining into the right atrium.

- **Capillaries** are tiny, tube-like vessels that form a network between the arteries and veins.
- **Arteries** are muscular-walled tubes mainly supplying oxygenated blood away from the heart to all other parts of the body. The aorta is the largest of the arteries and branches into various smaller arteries throughout the body.

Valves

Valves are flaps of fibrous tissue in the cardiac chambers between the veins. They ensure that the blood flows in a single direction (unidirectional). Flaps also prevent the blood from flowing backward. Based on their function, valves are of two types:

- **Atrioventricular valves** are between ventricles and atria. The valve between the right ventricle and right atrium is the tricuspid valve, and the one found between the left ventricle and left atrium is known as the mitral valve.
- **Semilunar valves** are located between the left ventricle and the aorta. It is also found between the pulmonary artery and the right ventricle.

Short Answer Type Questions (5Marks)

Unit-1

1.What are anatomy and physiology?

Anatomy is a branch of the field of morphology. Morphology encompasses an organism's internal and outward appearance (e.g., its shape, size, and pattern) as well as the form and location of external and internal structures (e.g., bones and organs - anatomy).

The two branches of anatomy are macroscopic or gross anatomy and microscopic anatomy. Gross anatomy focuses on the body and identifying and describing body parts large enough to be seen with the naked eye. Microscopic anatomy focuses on cellular structures, which may be observed using histology and various types of microscopy.

The difference between anatomy and physiology is that anatomy is the study of the body's structures, whereas physiology is the study of the body's functions. For example, the study of the heart's anatomy shows that it is made of four chambers, and the physiology of the heart describes how it pumps blood. Studying anatomy and physiology aims to understand how the body works and help maintain health and prevent disease. Anatomy and physiology are commonly studied by doctors, nurses, other healthcare professionals, and scientists.

2. Describe cell division

Cell division happens when a parent cell divides into two or more daughter cells. Cell division usually occurs as part of a larger cell cycle. All cells reproduce by splitting into two, where each parental cell gives rise to two daughter cells.

These newly formed daughter cells could divide and grow, giving rise to a new cell population formed by the division and growth of a single parental cell and its descendants.

In other words, such cycles of growth and division allow a single cell to form a structure consisting of millions of cells.

Explore the cell division notes to learn about the types and phases of cell division.

Types of Cell Division

There are two distinct types of cell division out of which the first one is vegetative division, wherein each daughter cell duplicates the parent cell called mitosis. The second one is meiosis, which divides into four haploid daughter cells.

Mitosis: The process cells use to make exact replicas of themselves. Mitosis is observed in almost all the body’s cells, including eyes, skin, hair, and muscle cells.

Meiosis: In this type of cell division, sperm or egg cells are produced instead of identical daughter cells, as in mitosis.

Binary Fission: Single-celled organisms like bacteria replicate themselves for reproduction.

Phases of the Cell Cycle

There are two primary phases in the cell cycle:

1. **Interphase**: This phase was thought to represent the resting stage between subsequent cell divisions, but new research has shown that it is a very active phase.
2. **M Phase (Mitosis phase)**: This is where the actual cell division occurs. There are two key steps in this phase, namely cytokinesis and karyokinesis.

The interphase further comprises three phases:

1. **G0 Phase (Resting Phase):** The cell neither divides nor prepares itself for the division.
2. **G1 Phase (Gap 1)**: The cell is metabolically active and grows continuously during this phase.
3. **S phase (Synthesis)**: The DNA replication or synthesis occurs during this stage.
4. **G2 phase (Gap 2):** Protein synthesis happens in this phase.
5. **Quiescent Stage (G0)**: The cells that do not undergo further division exit the G1 phase and enter an inactive stage. This stage is the quiescent stage (G0) of the cell cycle.

There are four stages in the **M Phase,** namely:

1. Prophase
2. Metaphase
3. Anaphase
4. Telophase

3. Forms of intracellular signaling, Paracrine, Synaptic, Endocrine

Cell-cell signaling involves the transmission of a signal from a sending cell to a receiving cell. However, not all sending and receiving cells are next-door neighbors, nor do all cell pairs exchange signals similarly.

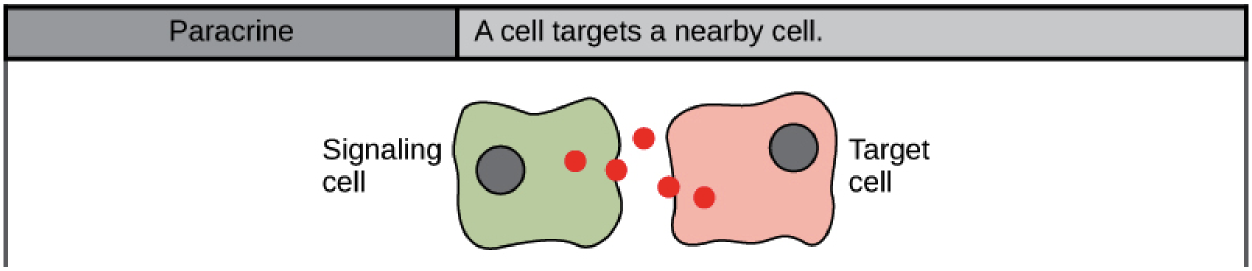
There are four basic categories of chemical signaling found in multicellular organisms: paracrine signaling, autocrine signaling, endocrine signaling, and signaling by direct contact. The main difference between the different signaling categories is the distance the signal travels through the organism to reach the target cell.

Paracrine signaling

Often, cells that are near one another communicate through the release of chemical messengers (ligands that can diffuse through the space between the cells). This type of signaling, in which cells communicate over relatively short distances, is called **paracrine signaling**.

Paracrine signaling allows cells to coordinate activities with their neighbors locally. Although they're used in many different tissues and contexts, paracrine signals are especially important during development when they allow one group of cells to tell a neighboring group of cells what cellular identity to take on.

Example: spinal cord development



Synaptic signaling

One unique example of paracrine signaling is **synaptic signaling**, in which nerve cells transmit signals. This process is named for the **synapse**, the junction between two nerve cells where signal transmission occurs.

When the sending neuron fires, an electrical impulse moves rapidly through the cell, traveling down a long, fiber-like extension called an axon. When the impulse reaches the synapse, it triggers the release of ligands called **neurotransmitters**, which quickly cross the small gap between the nerve cells. When the neurotransmitters arrive at the receiving cell, they bind to receptors and cause a chemical change inside the cell (often opening ion channels and changing the electrical potential across the membrane).

Synaptic signaling. The neurotransmitter is released from vesicles at the end of the axon of the sending cell. It diffuses across the small gap between sending and target neurons and binds to receptors on the target neuron.

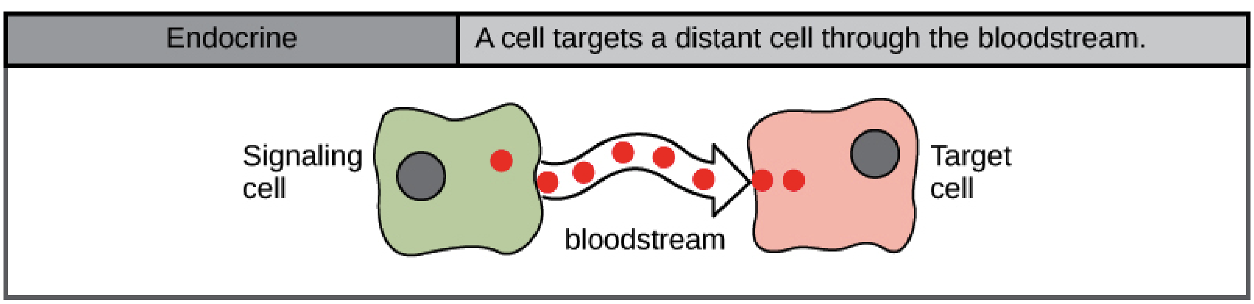
The neurotransmitters released into the chemical synapse are quickly degraded or backed up by the sending cell. This "resets" the system so the synapse can respond quickly to the next signal.

Endocrine signaling

When cells need to transmit signals over long distances, they often use the circulatory system as a distribution network for the messages they send. In long-distance **endocrine signaling**, signals are produced by specialized cells and released into the bloodstream, which carries them to target cells in distant parts of the body. Signals that are produced in one part of the body and travel through the circulation to reach far-away targets are known as **hormones**.

In humans, endocrine glands that release hormones include the thyroid, the hypothalamus, and the pituitary, as well as the gonads (testes and ovaries) and the pancreas. Each endocrine gland releases one or more hormones, many of which are master regulators of development and physiology.

For example, the pituitary releases **growth hormone** (**GH**), which promotes growth, particularly of the skeleton and cartilage. Like most hormones, GH affects many different types of cells throughout the body. However, cartilage cells provide one example of how GH functions: it binds to receptors on the surface of these cells and encourages them to divide.



4. Describe Synovial joint

The Synovial Joint is our body's major type of Joint and provides great movement. Types of synovial joints are

i. Gliding Joint: - Small-sized Joints formed when flat on round surfaces articulate so that one bone can slide over the other in any possible direction.E.g.. Between the carpels of the wrist, tarsals of the foot, etc.
ii. Hinge Joint: Unidirectional Joints that move like door hinges. E.g.:- Knee Joint, elbow Joint
iii. Ball and Socket Joint:- Joint in which the globe-like head of one bone fits into the cup-like cavity of another bone to allow free movement in all directions. E.g.:- shoulder and hip joint.
iv. Pivot Joint: - A joint in which the rounded head of one bone is surrounded by a collar-like structure of another bone made partly of bone and part of ligament. This type of Joint only provides movement in one direction. E.g.:- Atlas and axis Joint in the neck.

Ellipsoid Joint: - It is a joint in which the oval end of one bone fits into the depression of another bone. E.g., Joint between the metacarpals and Phalanges of fingers, Joint between the radius and carpals of the wrist, etc.

Saddle Joint: - A Joint in which the articulating bone is shaped like a saddle, and its rider allows different types of movement, straightening, bending, side to side, and rotation. E.g., joint between the carpel and metacarpal of the thumb.

5. Characteristics of synovial joint

The type of joints present in our body provides a great degree of movement. The smooth, hyaline cartilage covering the articulation point at the end of a bone, along with a thick fluid called the synovial fluid that lubricates the Joint, makes the joint movable. Characteristic of synovial joint:

• Hyaline cartilage- A protective layer of dense white connective tissue covering the articulating bones' ends.

• Synovial membrane-Covers joint cavity, except over the surfaces of the articular cartilages & secretes the lubrication fluid.

• Synovial fluid -Lubricates the joint.

•Capsule or may not have thickenings called intrinsic ligaments.

- Extrinsic ligaments-Support the joint and connect the articulating bones of the joint.

6. Function of the skeletal system

The skeletal system is the body system composed of bones and cartilage and performs the following critical functions for the human body:

- Supports the body.
- Facilitates movement.
- Protects internal organs.
- Produces blood cells.
- Stores and releases minerals and fat.

7. Parts of hair

Hair originates from the ectoderm and is present on most skin surfaces except the palms, feet, and nails. The base of the hair follicle is an onion-shaped structure known as a bulb. The bulb contains a nipple shape structure Known as hair papillae /dermal papillae.

Hair Papillae: It contains many blood vessels and nerves.

Hair has two regions: shafts and roots.

The shaft is a superficial portion of hair and the dead part. It has 3 regions: cuticle, cortex, and medulla.

Root: - It is the dipper portion of hair that penetrates the dermis & Divides constantly, causing the growth of the hair follicles

8. Functional classification of joints

The bones are classified based on the degrees of movement allowed to the Joints.

Synanthrosis: This type of joint is immobile and provides a strong bond between the articulating bones. Found in places where protection of internal organs is required and thus does not provide mobility. E.g., Sutures of the skull.

Amphianthrosis: This type of joint shows little movement and is made of cartilage. E.g.- Joints between the vertebrae and symphysis.

Dianthrosis: This type of joint shows free movement to provide maximum mobility to different body parts like the synovial Joints. It is of three types.

Uniaxial Joints: When the movement occurs only in one plane, E.g., Hinge Joint and pivot Joint. Biaxial Joints: When the movement occurs in two planes, E.g., ellipsoid Joint and saddle Joint. Multiaxial Joints: - When the movement occurs in many planes, E.g., gliding joint and ball and socket Joint.

9. Physiology of muscle contraction

Step 1: Muscle contraction is initiated by signals that travel along the axon and reach the neuromuscular junction or motor end plate. The neuromuscular junction is a junction between a neuron and the sarcolemma of the muscle fiber. As a result, Acetylcholine (a neurotransmitter) is released into the synaptic cleft by generating an action potential in the sarcolemma.

Step 2: Generating this action potential releases calcium ions from the sarcoplasmic reticulum in the sarcoplasm.

Step 3: The increased calcium ions in the sarcoplasm activate actin sites. Calcium ions bind to the troponin on actin filaments and remove the tropomyosin wrapped around actin filaments. Hence, active actin sites are exposed, allowing myosin heads to attach to this site.

Step 4: In this stage, the myosin head attaches to the exposed site of actin,forming cross-bridges using ATP hydrolysis energy. The actin filaments are pulled. As a result, the H-zone reduces. It is at this stage that the contraction of the muscle occurs.

Step 5: After muscle contraction, the myosin head pulls the actin filament and releases ADP and inorganic phosphate. ATP molecules bind and detach myosin and the cross bridges are broken.

Stage 6: This process of formation and breaking down of cross-bridges continues until there is a drop in the stimulus, which causes an increase in calcium. As a result, calcium ion concentration decreases, masking the actin filaments and leading to muscle relaxation.

Unit-3

10. What is hemoglobin?

Haemoglobin (Hb) is a type of globular protein present in red blood cells (RBCs), which transports oxygen in our body through blood. It is a tetrameric protein and contains the heme prosthetic group attached to each subunit. It is a respiratory pigment that helps transport oxygen as oxyhaemoglobin from the lungs to different body parts. Some amount of carbon dioxide is also transported back via hemoglobin as carbaminohaemoglobin.

The hemoglobin level is measured in g/dL of the blood. In a healthy individual, the level ranges from 12 to 20 g/dL. Generally Hb level in males is greater compared to females. The normal level in males is 13.5 to 17.5 g/dL; in females, it is 12 to 15.5 g/dL.

Haemoglobin develops in the cells of the bone marrow. Eventually, they turn into red blood cells. Hence, Haemoglobin is a hemeprotein found in only in red blood cells (RBC) or the erythrocytes of blood. They are said to occupy 1/3rd of the volume of RBCs. 90-95% of the dry weight of red blood cells is by hemoglobin.

The synthesis of Haemoglobin is initiated in the proerythroblasts and progresses into the reticulocyte phase of the RBCs. Hence, when reticulocytes exit from the bone marrow to enter the bloodstream, they continue forming trace quantities of Haemoglobin for some more time till they turn into mature erythrocytes. Iron is a major component of hemoglobin.

11. Mechanism of blood coagulation

Blood coagulation or clotting is important to prevent excess blood loss in case of injury or trauma. The blood stops flowing from a wound in case of injury. A network of fibrin threads forms the blood clot or 'coagulum'. This network traps deformed and dead-formed elements (erythrocytes, leukocytes, and platelets).

Blood Coagulation Pathway

Blood coagulation leads to hemostasis, i.e., prevention of bleeding or hemorrhage. Blood clotting involves activation and aggregation of platelets at the exposed endothelial cells, followed by deposition and stabilization of cross-linked fibrin mesh.

Primary hemostasis involves platelet aggregation and the formation of a plug at the site of injury, and secondary hemostasis involves strengthening and stabilization of the platelet plug by the formation of a network of fibrin threads. Secondary hemostasis involves two coagulation pathways, the intrinsic and extrinsic pathways. Both pathways merge at a point that leads to the fibrin activation and the fibrin network's formation.

Platelet Activation

The blood circulating in the blood vessel does not clot under normal circumstances. The blood coagulation process is stimulated when there is any damage to the endothelium of blood vessels. It leads to platelet activation and aggregation. When collagen is exposed to the platelets due to injury, the platelets bind to collagen by surface receptors. This adhesion is stimulated by the von Willebrand factor released from endothelial cells and platelets. This forms additional cross-linking and activation of platelet integrins, which facilitate tight binding and aggregation of platelets at the site of injury. This leads to primary hemostasis.

Blood Coagulation Cascade

Coagulation is a cascade of enzyme catalyzed reactions wherein the activation of one factor leads to the activation of another factor, and so on.

The three main steps of the blood coagulation cascade are as follows:

1. Formation of prothrombin activator
2. Conversion of prothrombin to thrombin
3. Conversion of fibrinogen into fibrin

1. Formation of prothrombin activator

The formation of a prothrombin activator is the first step in the blood coagulation cascade of secondary hemostasis. It is done by two pathways, viz. extrinsic pathway and intrinsic pathway.

Extrinsic Coagulation Pathway

It is also known as the tissue factor pathway. It is a shorter pathway. The tissue factors or tissue thromboplastins are released from the damaged vascular wall. The tissue factor activates the factor VII to VIIa. Then, factor VIIa activates the factor X to Xa in the presence of Ca^{2+}.

Intrinsic Coagulation Pathway

It is the longer pathway of secondary hemostasis. The intrinsic pathway begins with blood exposure to the collagen from the underlying damaged endothelium. This activates the plasma factor XII to XIIa.

XIIa is a serine protease that activates the factor XI to XIa. The XIa then activates the factor IX to IXa in the presence of Ca^{2+} ions.

The factor IXa in the presence of factor VIIIa, Ca^{2+}, and phospholipids activate the factor X to Xa.

Common Pathway

The factor Xa, factor V, phospholipids and calcium ions form the prothrombin activator. This starts the common extrinsic and intrinsic pathways leading to coagulation.

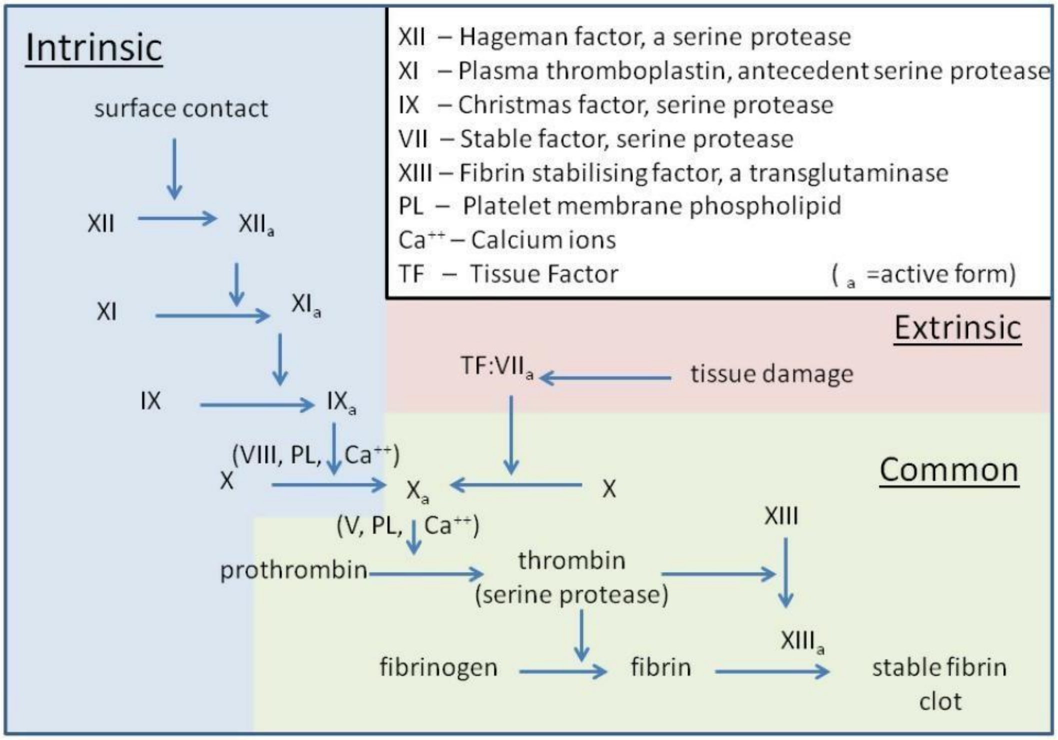
2. Conversion of prothrombin to thrombin

Prothrombin or factor II is a plasma protein and inactive form of the enzyme thrombin. Vitamin K is required for the synthesis of prothrombin in the liver. The prothrombin activator formed above converts prothrombin to thrombin. Thrombin is a proteolytic enzyme. It also stimulates its own formation, i.e., the conversion of prothrombin to thrombin. It promotes the formation of a prothrombin activator by activating factors VIII, V, and XIII.

3. Conversion of fibrinogen into fibrin

Fibrinogen or factor I is converted to fibrin by thrombin. Thrombin forms fibrin monomers that polymerize to form long fibrin threads. These are stabilized by the factor XIII or fibrin stabilizing factor. The fibrin stabilizing factor is activated by thrombin to form factor XIIIa. The activated fibrin stabilizing factor (XIIIa) forms cross-linking between fibrin threads in the presence of Ca2+ and stabilizes the fibrin meshwork. The fibrin mesh traps the formed elements to form a solid mass called a clot.

The three pathways that makeup the classical blood coagulation pathway



12. Blood grouping system

Blood Group System

Karl Landsteiner, an Austrian scientist discovered the ABO blood group system in the year 1900. In his experiments, he mixed different blood types and noted that the plasma from certain blood types produced agglutinates or formed clusters, which were caused by the absence of molecules on red blood cells and resulted in antibodies to defeat that molecule. He then noted the agglutination and divided the blood types into 4 different groups. For the discovery of the ABO blood group, he was awarded the Nobel Prize.

The blood grouping system is pivotal in blood transfusion. Our immune system recognizes another blood type as foreign and attacks it if introduced into the body, causing a ***transfusion reaction***. Any inappropriate match with the Rh and ABO blood types causes the most serious and life-threatening transfusion reactions. Therefore, before a blood transfusion, it is suggested to have a blood group checked.

ABO and Rh blood groups

The two most important group systems examined during the blood transfusion are the ***ABO system*** and the ***Rhesus system***.

The ABO blood group system consists of 4 types of blood groups – A, B, AB, and O and is mainly based on the antigens and antibodies on red blood cells and in the plasma. Both antigens and antibodies are protein molecules in which antigens are present on the surface of Red Blood Cells, and antibodies are present in the plasma, which is involved in defending mechanisms.

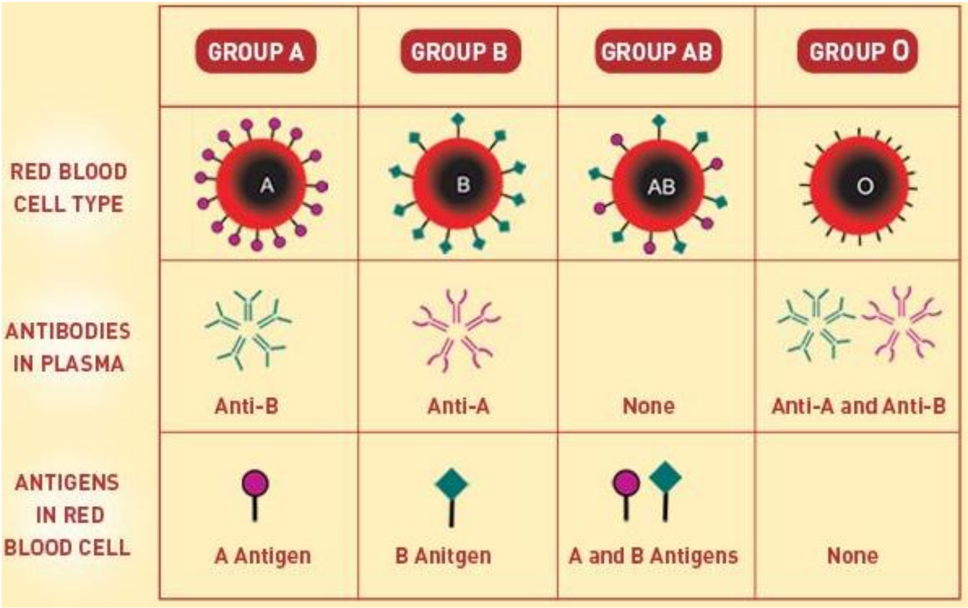
On the other hand, the Rh blood group system consists of 50 defined blood group antigens. In the Rh system, the most important antigens are D, C, c, E, and e. The ABO and Rh blood systems are discussed in detail below.

1. ABO blood Group system

The basis of ABO grouping is of two antigens- Antigen A and Antigen B. The ABO grouping system is classified into four types based on the presence or absence of antigens on the red blood cell surface and plasma antibodies.

- **Group A** – contains antigen A and antibody B.
- **Group B** –contains antigen B and antibody A.
- **Group AB** –contains both A and B antigens and no antibodies (neither A nor B).
- **Group O** – contains neither A nor B antigen nor antibodies A and B.

The ABO group system is important during blood donation or blood transfusion as mismatching of blood groups can lead to clumping of red blood cells with various disorders. The blood cells need to match while transfusing, i.e., donor-recipient compatibility is necessary. For example, a person of blood group A can receive blood from group A or O as there are no antibodies for A and O in blood group A.



As shown in the above table, individuals of blood group O are called as ***universal donors***, whereas individuals of blood group AB are ***universal recipients***.

2. Rh Blood Group System

In addition to the ABO blood grouping system, the other prominent one is the Rh blood group system. About two-thirds of the population contains the third antigen on the surface of their red blood cells, known as ***Rh factor*** or ***Rh antigen***; this decides whether the blood group is positive or negative. If the Rh factor is present, an individual is ***rhesus positive*** (Rh+ve); if an Rh factor is absent, the individual is ***rhesus negative*** (Rh-ve) as they produce Rh antibodies. Therefore, compatibility between donor and individual is also crucial in this case.

Unit-4

13. Origin and function of spinal and cranial nerves

Spinal nerves are formed by the motor and sensory nerve fibers that emerge from the spinal cord. 31 pairs of spinal nerves exit the spinal cord and travel to various body parts, including the muscles, skin, and internal organs. Each spinal nerve is associated with a specific region of the body, called a dermatome, and is responsible for transmitting sensory information and motor commands to and from that region.

Cranial nerves, on the other hand, are nerves that emerge directly from the brain and are responsible for transmitting sensory and motor information to and from the head and neck region. There are 12 pairs of cranial nerves, each with a different function. The olfactory nerve, for example, is responsible for transmitting information related to smell, while the optic nerve is responsible for transmitting information related to vision. Other cranial nerves are responsible for controlling the movement of the eyes and facial muscles, as well as transmitting sensory information from the tongue, throat, and other structures in the head and neck.

Origin and functions of 31 pairs of spinal nerves

The 31 pairs of spinal nerves are part of the peripheral nervous system and are classified into five different categories based on their location in the spinal cord:

1. 8 pairs of cervical nerves – These originate from the cervical region of the spinal cord, which is located in the neck. They control the muscles and sensory input of the neck, shoulders, arms, and hands.
2. 12 pairs of thoracic nerves – These originate from the thoracic region of the spinal cord, which is located in the chest. They control the muscles and sensory input of the chest and abdominal muscles.
3. 5 pairs of lumbar nerves – These originate from the lumbar region of the spinal cord, which is located in the lower back. They control the muscles and sensory input of the lower back, hips, and legs.
4. 5 pairs of sacral nerves – These originate from the sacral region of the spinal cord, which is located in the pelvis. They control the muscles and sensory input of the buttocks, legs, and feet.
5. 1 pair of coccygeal nerves – These originate from the spinal cord's coccygeal region, located at the bottom of the spine. They control the muscles and sensory input of the anus and surrounding areas.

Functions: The spinal nerves are responsible for controlling the motor and sensory functions of the body. They transmit sensory information from the skin, muscles, and organs to the spinal cord and brain and motor signals from the brain and spinal cord to the muscles and glands of the body. This allows the body to respond to external stimuli and control its movements, balance, and coordination. Dysfunctions of the spinal nerves can lead to a range of neurological disorders, including chronicpain, sensory deficits, and paralysis.

Origin and functions of 12 pairs of cranial nerves

The 12 pairs of cranial nerves emerge from the brainstem and control various functions related to the head, neck, and organs in the thoracic and abdominal cavities. They are numbered based on their position, starting with the most anterior nerve at the front of the brainstem and moving posteriorly.

Here is a brief overview of the functions of each of the 12 pairs of cranial nerves:

1. Olfactory nerve (I) – This nerve controls the sense of smell.
2. Optic nerve (II) – This nerve controls vision.
3. Oculomotor nerve (III) – This nerve controls eye movement, pupil dilation, and eyelid movement.
4. Trochlear nerve (IV) – This nerve controls eye movement.
5. Trigeminal nerve (V) – This nerve has three branches that control sensation in the face, as well as chewing and biting movements.
6. Abducens nerve (VI) – This nerve controls eye movement.
7. Facial nerve (VII) – This nerve controls facial expression, taste, and saliva production.
8. Vestibulocochlear nerve (VIII) – This nerve controls hearing and balance.
9. Glossopharyngeal nerve (IX) – This nerve controls taste and swallowing, as well as saliva production.
10. Vagus nerve (X) – This nerve controls the heart, lungs, and digestive system.
11. Accessory nerve (XI) – This nerve controls movement of the head and shoulders.
12. Hypoglossal nerve (XII) – This nerve controls tongue movement and speech.

The cranial nerves are responsible for transmitting sensory information from the head, neck, and organs in the thoracic and abdominal cavities to the brain, as well as controlling motor functions such as eye movements, facial expression, chewing, swallowing, and speech. Dysfunction of the cranial nerves can lead to neurological disorders, including vision and hearing loss, facial paralysis, and difficulty with speech and swallowing.

Unit-5

14. Electrical conduction of the heart

The cardiac conduction system contains specialized cells and nodes that control heartbeat -

- Sinoatrial node.
- Atrioventricular node.
- Bundle of His (atrioventricular bundle).
- Purkinje fibres.

The sinoatrial node is sometimes called the heart's natural pacemaker. It sends the electrical impulses that start the heartbeat. The SA node is in the upper part of your heart's right atrium. The sympathetic nervous system (fight or flight response) makes your SA node work faster, which increases your heart rate. The parasympathetic nervous system (rest and digest response) makes your SA node work slower, which decreases your heart rate.

The atrioventricular node delays the SA node's electrical signal. It delays the signal by a consistent amount of time (a fraction of a second) each time. The AV node is in an area known as the triangle of Koch (located between the septal leaflet of the tricuspid valve, the coronary sinus, and the membranous portion of the interatrial septum). This is near the central area of the heart. Bundle of His, also called the atrioventricular bundle. It is a branch of fibers (nerve cells) that extends from your AV node. This fiber bundle receives the electrical signal from the AV node and carries it to the Purkinje fibers.

The bundle of His runs down the length of the interventricular septum, which separates your right and left ventricles. The bundle of His has two branches: The left bundle branch sends electrical signals through the Purkinje fibers to your left ventricle. The right bundle branch sends electrical signals through the Purkinje fibers to your right ventricle.

Purkinje fibers are branches of specialized nerve cells. They send electrical signals very quickly to your right and left heart ventricles. Purkinje fibers are in the subendocardial surface of your ventricle walls. When the Purkinje fibers deliver electrical signals to your ventricles, the ventricles contract. As they contract, blood flows from your right ventricle to your pulmonary arteries and your left ventricle to your aorta. The aorta is the body's largest artery. It sends blood from your heart to the rest of your body.

15. Short note on cardiac arrest

Cardiac arrest occurs when the heart suddenly and unexpectedly stops pumping. If this happens, blood stops flowing to the brain and other vital organs.

Cardiac arrests are caused by certain types of arrhythmias that prevent the heart from pumping blood. The lack of blood flow to the brain and other organs can cause a person to lose consciousness, become disabled, or die if not treated immediately.

Emergency treatment for sudden cardiac arrest includes cardiopulmonary resuscitation (CPR) and shocks to the heart with a device called an automated external defibrillator (AED). Survival is possible with fast, appropriate medical care.

Symptoms of sudden cardiac arrest are immediate and severe and include

- Collapse.
- No pulse.
- No breathing.
- Loss of consciousness.

16. What causes cardiac arrest?

Cardiac arrest can be caused by a heart condition, or it can occur unexpectedly. However, there are three main causes of cardiac arrest:

- Arrhythmia and ventricular fibrillation. Arrhythmia occurs when electrical signals in the heart are the problem, leading to an abnormal heartbeat. Ventricular fibrillation is a type of arrhythmia and is the most common cause of cardiac arrest. Ventricular fibrillation is a rapid heartbeat in the heart's ventricle, which causes the heart to tremble instead of normally pumping blood.

- Enlarged heart (cardiomyopathy): The heart muscle dilates or thickens, leading to abnormal heart contractions.

- Coronary artery disease: This type of heart disease occurs when the coronary arteries are narrowed and thickened by plaque blockages, restricting blood flow to the heart. If left untreated, coronary artery disease can lead to heart failure or arrhythmias, which both can lead to cardiac arrest

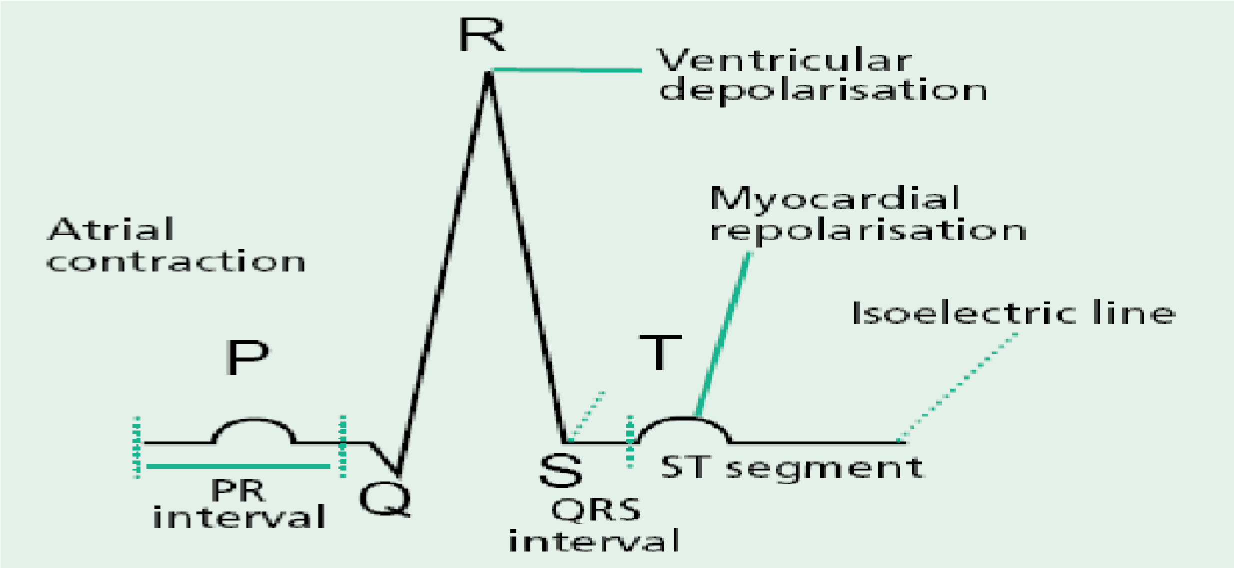
17. Write a short note on ECG.

An electrocardiogram (ECG) is the permanent graphical record on a thermo-sensitive paper during the depolarisation and repolarisation in the myocardium. Electrodes (small, plastic patches sticking to the skin) are placed at certain chest, arms, and leg spots. The electrodes are connected to an ECG machine by lead wires. The heart's electrical activity causes the cardiac muscles to contract, which results in the heart pumping. The ECG is in the form of spikes and dips, known as waves. The wave pattern helps in assessing the rate and rhythm of our heartbeat. P to T in the graph represents a specific activity of the heart.

- The P wave is the electrical excitation of the atria, or depolarization, initiating atrial contraction.

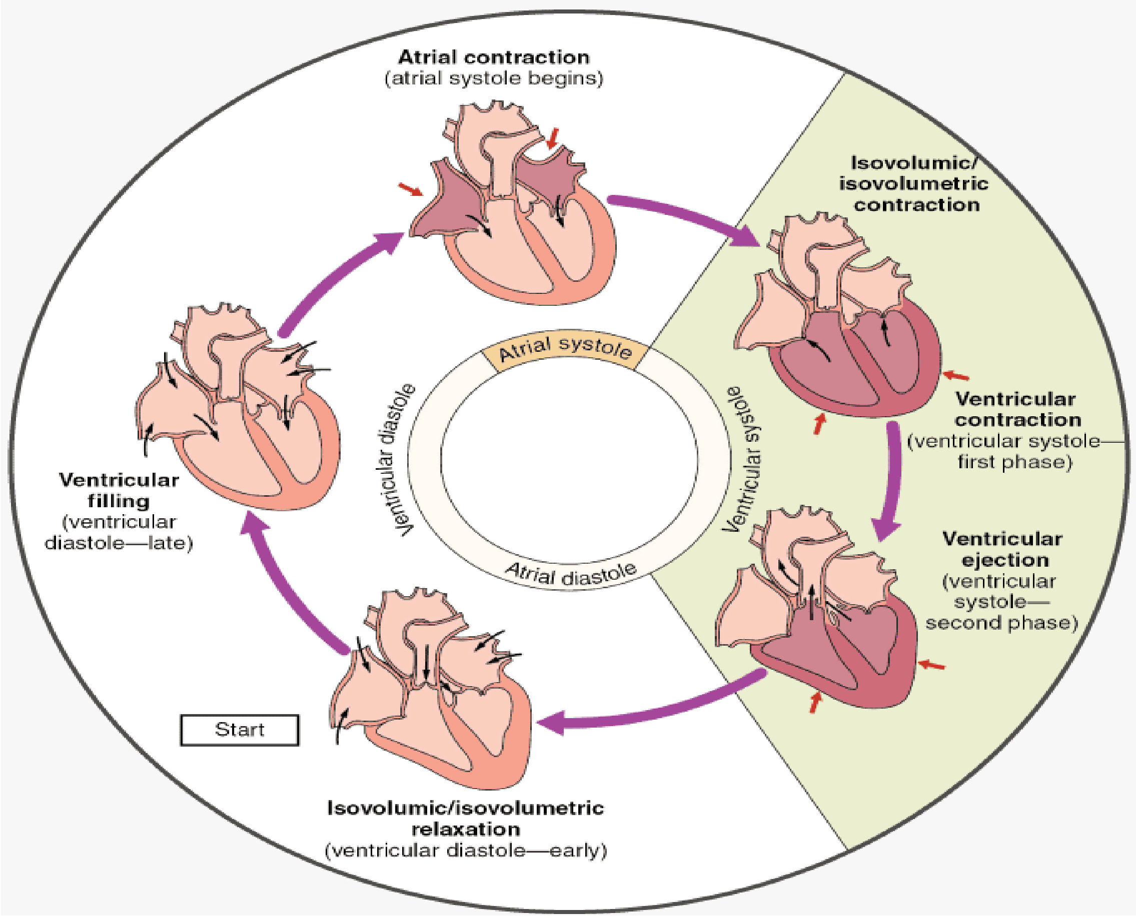
- The QRS complex is the depolarization of ventricles, initiating ventricular contraction. Marking the beginning of the systole.

- T wave means the return of ventricles to the normal state (repolarization). Marking the end of the systole



18. Write a short note on the cardiac cycle.

The cardiac cycle is attributed to a comprehensive heartbeat from its production to the commencement of the next beat. It comprises diastole, the systole, and the intervening pause. The occurrence of a cardiac cycle is illustrated by a heart rate, which is naturally indicated as beats per minute. A healthy human heart beats 72 times per minute, meaning there are 72 cardiac cycles per minute. The cardiac cycle involves a complete contraction and relaxation of both the atria and ventricles, and the cycle lasts approximately 0.8 seconds.



Cardiac Cycle Physiology

The humanheart consists of four chambers, comprising left and right halves. Two upper chambers include left and right atria; lower two chambers include right and left ventricles. The key function of the right ventricle is to pump deoxygenated blood through the pulmonary arteries and pulmonary trunk to the lungs. The left ventricle pumps newly oxygenated blood to the body through the aorta.

Cardiac Cycle Phases

Atrial Diastole: In this stage, chambers of the heart are calmed. That is when the aortic valve and pulmonary artery closes and atrioventricular valves open, thus causing chambers of the heart to relax.

Atrial Systole: At this phase, bloodcells flow from atrium to ventricle and at this period, atrium contracts.

Isovolumic Contraction: At this stage, ventricles begin to contract. The atrioventricular valves, valve, and pulmonary artery valves close, but there won't be any transformation in volume.

Ventricular Ejection: Here ventricles contract and emptying. The pulmonary artery and aortic valve close.

Isovolumic Relaxation: In this phase, no blood enters the ventricles, and consequently, pressure decreases, and ventricles stop contracting, and begin to relax. Now, due to the pressure in the aorta – the pulmonary artery and aortic valve close.

Ventricular Filling Stage: In this stage, blood flows from the atria into the ventricles. It is altogether known as one stage (first and second stage). After that, there are three phases that involve blood flow to the pulmonary artery from the ventricles.

Duration of Cardiac Cycle

In a normal person, a heartbeat is 72 beats/minute. So, the duration of one cardiac cycle can be calculated as:

1/72 beats/minute=.0139 minutes/beat

At a heartbeat of 72 beats/minute, the duration of each cardiac cycle will be 0.8 seconds.

The duration of different stages of the cardiac cycle is given below:

- **Atrial systole:** continues for about 0.1 seconds
- **Ventricular systole:** continues for about 0.3 seconds
- **Atrial diastole:** continues for about 0.7 seconds
- **Ventricular diastole:** continues for about 0.5 seconds

19. Renin-angiotensin-aldosterone system (RAAS)

The **renin-angiotensin-aldosterone system** (RAAS) is an essential component of blood pressure regulation that acts to increase blood volume and increase systemic vascular resistance.[1] This system is dependent on hormonal changes that induce transcription of genes to produce vasoactive proteins, making it a **slower means of controlling blood pressure** than the baroreceptor reflex.[3]

The RAAS system starts with **renin**, a hormone released from **granular cells** in the **juxtaglomerular apparatus**, a specialized structure involving parts of the distal convoluted tubule (DCT) and the adjacent afferent arteriole of the glomerulus.

Renin is released in response to increased concentration of salt in the blood, reduction in renal blood flow, or stimulation from the sympathetic nervous system acting on beta-1 receptors.

Renin converts **angiotensinogen**, a protein synthesized by the liver, into angiotensinogen I, which is subsequently converted by an **angiotensinogen-converting enzyme** (ACE) into **angiotensin II**. Angiotensin II causes **vasoconstriction** in the systemic circulation and the renal microvasculature, preferentially constricting the efferent arteriole.

ACE, found primarily in the lungs, also rids the body of a vasodilator called **bradykinin**, causing further vasoconstriction.

Importantly, angiotensin II **increases salt reabsorption** at the level of the kidney and does so indirectly through the activation of **aldosterone** released from the zona glomerulosa of the adrenal cortex. Increased salt retention subsequently increases plasma volume and blood pressure.

Angiotensin II is also capable of **increasing plasma volume** through the stimulation of thirst and antidiuretic hormone (ADH), another regulator of blood pressure, which will be discussed shortly.

Aldosterone acts on the principal cells found in the DCT and collects the duct of the nephron, **increasing Na^+ reabsorption** while increasing K^+ secretion into the tubules.

Aldosterone-mediated salt resorption is also linked to **H^+** secretion.[1] Given the ability of aldosterone to increase the volume of the extra-cellular fluid compartment and thus BP, several common anti-hypertensive medications aim to decrease blood pressure through inhibition of aldosterone formation.

Very Short Answer Type Questions (2 Marks)

Unit-1

1. Define anatomy and physiology.

Ans: Anatomy and physiology are two of the most basic terms and areas of study in the life sciences. Anatomy refers to the internal and external structures of the body and their physical relationships, whereas physiology refers to the study of the functions of those structures.

2. Differentiate anterior and posterior?

Ans: Anterior indicates the front surface of the body and is used interchangeably with ventral. Posterior indicates the back surface of the body or nearer to the back.

3. Contact-dependent cell signaling

Ans: cells can interact in a 'classic' signaling manner, through cell surface molecules, in a so-called **contact-dependent** way. Here, the signaling molecule is not secreted but is bound to the plasma membrane of the signaling cell (or may even form part of the extracellular matrix) and interacts directly with the receptor exposed on the surface of the target cell. This type of signaling is particularly important between immune cells, where it forms the basis of antigen presentation and the initiation of the immune response, and also during development, when tissues are forming and communication between cells and their neighbors is paramount in deciding between cell fates such as proliferation, migration, death or differentiation.

Unit-2

4. What is Tendon and its function?

Ans: Tendons are the tough, thick band of fibrous tissues that connects muscle to bone. Tendons have the following primary functions:

- They create muscle tension, making it contract and move.
- They provide additional support to a joint by reducing stress on the ligaments and muscles around it.

5. What is the Integumentary System?

Ans: our integumentary system is an organ that consists of a few main structures: skin, nails, hair, and glands, along with the nerves and blood vessels that support them. Function:

- Protects you from the sun's ultraviolet (UV) rays and sunburn.
- Excretes sebum, sweat, and other waste from your body.
- Regulates your body temperature and allows you to stay cool.

6. What is a joint?

Ans: It is the point where two bones intersect. Joint means an articulation or in other words, a strong connection that joins the bones, teeth, and cartilage together. It is necessary for all types of movement in the body involving bones.

7. What is the osseous system?

Ans: The skeletal or osseous systems are your body's central framework. It comprises bones and connective tissue, including cartilage, tendons, and ligaments. It's also called the musculoskeletal system.

8. Add a note on gout.

Ans: Gout is a type of arthritis that causes sudden, severe attacks of pain, swelling, and redness in the joints. It's caused by a build-up of uric acid in the blood. When the body has too much uric acid, sharp crystals can form in the joints, usually the big toe. These crystals can cause the joint to become inflamed and painful.

9. What is Osteoporosis?

Ans: Osteoporosis is a bone disease that develops when bone mineral density and bone mass decrease or when the structure and strength of bone change. This can lead to a decrease in bone strength, which can increase the risk of fractures.

10. Write a note on Arthritis.

Ans: Arthritis is the swelling and tenderness of one or more joints. The main symptoms of arthritis are joint pain and stiffness, which typically worsen with age. The most common types of arthritis are osteoarthritis and rheumatoid arthritis.

11. What is a Suture?

Ans: Sutures are immobile joints between adjacent bones of the skull. The narrow gap between the bones is filled with dense, fibrous connective tissue that unites the bones. The main sutures of the skull are the coronal, sagittal, lambdoid and squamosal sutures.

12. What is syndesmosis?

Ans: A syndesmosis is a type of fibrous joint that connects two parallel bones using a strong membrane or ligaments. The gap between the bones may be wide and filled with a fibrous interosseous membrane. In the forearm, the wide gaps between the shaft portions of the radius and ulna bones are strongly united by an interosseous membrane. In the leg, the shafts of the tibia and fibula are also united by an interosseous membrane.

13. What is a neuromuscular junction?

A neuromuscular junction is a chemical synapse between a motor neuron and a muscle fiber. It allows the motor neuron to signal to the muscle fiber, causing muscle contraction.

Muscles require innervation to function—and even maintain muscle tone, avoiding atrophy. In the neuromuscular system, nerves from the central nervous system and the peripheral nervous system are linked and work together with muscles.

Unit-3

14. What is hemopoiesis?

Hamia-Blood, Poiesis- To make something

Hemopoiesis is blood cell production. Your body continually makes new blood cells to replace old ones. Hematopoiesis ensures you have a healthy supply of blood cells to supply oxygen to your tissue (red blood cells), fight infection (white blood cells), and clot your blood when you're injured (platelets). Most blood cells are made in your bone marrow.

15. What is anemia?

Ans: Anaemia is a problem of insufficient healthy red blood cells or haemoglobin to carry oxygen to the body's tissues. It is a condition that develops when your blood produces a lower-than-normal amount of healthy red blood cells. Having anemia can cause tiredness, weakness and shortness of breath.

16. What is sickle cell anemia?

Ans: - Sickle cell anemia is a group of inherited red blood cell disorders. Red blood cells contain hemoglobin, a protein that carries oxygen. In someone with Sickle Cell Disease, the hemoglobin is abnormal, which causes the red blood cells to become hard and sticky and look like a C-shaped farm tool called a "sickle." The sickle cells die early, which causes a constant shortage of red blood cells. Also, when they travel through small blood vessels, they get stuck and clog the blood flow. This can cause pain and other serious complications (health problems) such as infection, acute chest syndrome, and stroke.

17. What is reticuloendothelial system?

The reticuloendothelial system (RES) is a heterogeneous population of phagocytic cells in systemically fixed tissues that play an important role in the clearance of particles and soluble substances in the circulation and tissues and form part of the immune system. Substances that are cleared include immune complexes, bacteria, toxins, and exogenous antigens.

The RES: Consists of the phagocytic cells located in reticular connective tissue, primarily monocytes and macrophages. Since phagocytosis is their primary role, the mononuclear phagocytic system has been suggested as an alternative name.

18. What is lymph?

Ans: Lymph, or lymphatic fluid, is a collection of the extra fluid that drains from cells and tissues and is not reabsorbed into your capillaries. Lymph contains many substances, including proteins, minerals, fats, damaged cells, cancer cells, and germs. Lymph is made of White blood cells, primarily lymphocytes - responsible for attacking blood bacteria.

19. What is the function of Spleen?

Ans: - The spleen's main function is to act as a filter for our blood. It recognizes and removes old, malformed, or damaged red blood cells. It controls the level of white blood cells, red blood cells, and platelets.

Unit-4

20. Define color blindness.

Ans: - The defect of the eye due to which a person is unable to distinguish between certain colors is known as color blindness. Cone-shaped retinal cells are responsible for making a person differentiate between colors. The color-blind persons do not possess cone cells that respond to certain colors.

21. Differentiate Myopia and Hyperopia?

Ans: - Hyperopia is a condition in which an image of a distant object becomes focused behind the retina, making objects up close appear out of focus. Myopia is a condition in which, opposite to hyperopia, an image of a distant object becomes focused in front of the retina, making distant objects appear out of focus

22. What is otosclerosis?

Otosclerosis. This is a common cause of progressive conductive hearing loss in young adults that may affect one ear but is more commonly bilateral. It is usually hereditary, more common in females than males, and often worsens during pregnancy. Abnormal bone develops around the footplate of the stapes, fusing it to the oval window and reducing the ability to transmit sound waves across the tympanic cavity.

23. What is conjunctivitis?

Conjunctivitis Inflammation of the conjunctiva may be caused by irritants, such as smoke, dust, wind, cold or dry air, microbes, or antigens, and may be acute or chronic. Corneal ulceration is a rare complication.

24. What is Glaucoma?

This is a group of conditions in which intraocular pressure rises due to impaired drainage of aqueous fluid through the scleral venous sinus (canal of Schlemm) in the angle between the iris and cornea in the anterior chamber. Persistently raised intraocular pressure may damage the optic nerve by mechanical compression or compression of its blood supply, causing ischemia.

25. What is a cataract?

This is the opacity of the lens, which impairs vision, especially in poor light and darkness when weak light rays can no longer pass through the cloudy lens to the retina. Although most commonly age-related, this condition also be congenital or secondary to other conditions, e.g., ocular trauma, uveitis, and diabetes mellitus. The most common cause of visual impairment worldwide, cataracts can affect one or both eyes. The extent of visual impairment depends on the location and opacity.

Unit-5

26. Structure and function of artery?

Arteries are thick-walled, muscular, and valveless blood vessels. Anatomically, the artery's wall comprises three layers: the *tunica externa*, the *tunica media*, and the *tunica intima*.

It is responsible for carrying the blood away from the heart and distributing it to several other organs and tissues. Simply, the blood vessels that carry blood away from the heart are arteries.

27. Structure and function of veins?

Veins are the blood vessels that collect the deoxygenated blood from the various tissues and organs of the body and transport it back to the heart. The blood vessels that carry blood toward the heart are veins.

Veins are thin-walled valves containing blood vessels. Anatomically, veins have the same three layered walls as arteries that are the *tunica externa*, the *tunica media*, and the *tunica intima*

28. Structure and function of Capillaries?

Capillaries are the smallest blood vessels in the body, connecting the smallest arteries to the smallest veins. They deliver oxygen and nutrients to cells while removing carbon dioxide to be eliminated from the lungs.

Capillaries are extremely thin, measuring approximately 5 micrometers in diameter.

The walls of capillaries are composed of only two layers of cells surrounded by a layer of protein called the basement membrane.

29. Define CVS?

Ans: - The cardiovascular system is sometimes called the blood-vascular or circulatory system. It consists of the heart, a muscular pumping device, and a closed system of vessels called arteries, veins, and capillaries.

30. What is BP?

Blood pressure can be measured in several different ways, with the most common being **systolic** and **diastolic** blood pressure:

- **Systolic blood pressure** (SBP) represents the pressure in the blood vessels when the heart contracts (systole).
- **Diastolic blood pressure** (DBP) represents the pressure in the blood vessels between heartbeats (diastole).