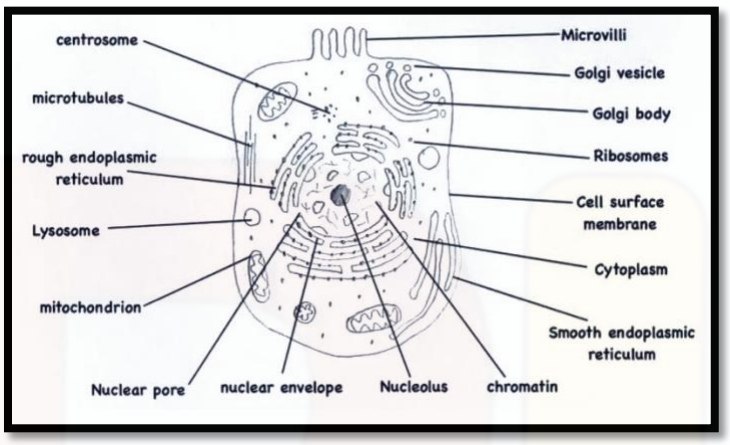
Pharma Unit

Human Anatomy & Physiology (HAP) Top 15 Questions with Answers According To PCI New Syllabus ER -2020

1. Discuss in detail about the structure of cell with its components and functions?

Ans. The cell is the basic structural and functional unit of life. All living things are made up of one or more cells.



- **Cell Membrane :-** The cell membrane is the outermost layer of the cell. It separates the inside of the cell from its environment. It is made up of a double layer of lipids and proteins. The lipids form a barrier that prevents certain molecules from entering or leaving the cell, while the proteins help the cell to communicate with its environment.
- Cytoplasm :- The cytoplasm is a jelly-like substance that fills the cell. It contains lots of tiny structures called organelles. The organelles are like tiny machines that help the cell to do its job.
- **Nucleus :-** The nucleus is like the control centre of the cell. It contains the cell's genetic material, which controls how the cell grows, develops, and functions. The genetic material is made up of DNA (deoxyribonucleic acid), which contains all the instructions for building and maintaining the cell.
- **Mitochondria :-** Mitochondria are organelles that produce energy for the cell. They are the powerhouse of the cell. They break down glucose (a type of sugar) to produce ATP (adenosine triphosphate), which is the main energy source for the cell.
- **Ribosomes :-** They are small organelles that make proteins. They read the genetic instructions in the DNA and use them to assemble proteins from amino acids.
- **Endoplasmic reticulum (ER) :-** Endoplasmic reticulum (ER) is a network of tubes and membranes that help to transport proteins and lipids within the cell. There are two types of ER: rough ER, which has ribosomes attached to its surface and helps to make proteins, and smooth ER, which does not have ribosomes and is involved in lipid synthesis.
- **Golgi apparatus :-** Golgi apparatus is an organelle that modifies and packages proteins for export out of the cell. It works closely with the ER to ensure that the proteins are properly folded and processed before they are sent out of the cell.
- **Lysosomes :-** Lysosomes are organelles that contain digestive enzymes. They help to break down and recycle cellular waste, such as damaged organelles or old proteins.

These are the main components of a cell and their functions. Each part of the cell works together to help the cell perform its many functions, such as growing, dividing, and carrying out specialized tasks within the body.

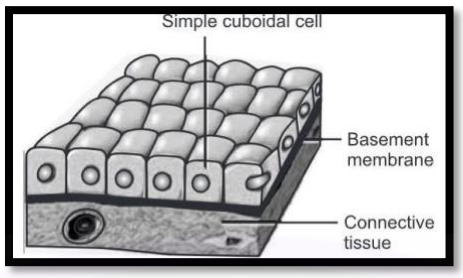
2. Discuss in detail about epithelial tissue and connective tissue?

Ans.

Epithelial tissue

It is a type of tissue that lines the surface of your body and covers your organs. It is made up of cells that are tightly packed together and serves as a barrier between the inside and outside of your body.

Epithelial cells are closely packed together and have very little extracellular matrix. They are arranged in one or more layers and can have different shapes, such as squamous, cuboidal, or columnar. The cells of the epithelial tissue rest on a basement membrane, which is a thin layer of extracellular matrix that separates the epithelium from the underlying connective tissue. Epithelial tissue can be arranged in different ways, such as simple (one layer of cells), stratified (multiple layers of cells), or pseudostratified (appears to have multiple layers, but all cells are in contact with the basement membrane).



Classification of Epithelial tissue

- **Squamous epithelial tissue:** It consists of thin, flattened cells that are arranged in a single layer. Squamous epithelial tissue can be found in the lining of blood vessels and lungs.
- **Cuboidal epithelial tissue:** It consists of cube-shaped cells that are arranged in a single layer. Cuboidal epithelial tissue can be found in the kidney tubules.
- **Columnar epithelial tissue:** It consists of tall, elongated cells that are arranged in a single layer. Columnar epithelial tissue can be found in the lining of the digestive tract.
- **Transitional epithelial tissue :** It is found in areas such as the bladder
- **Pseudostratified epithelial tissue :** It is found in the respiratory tract

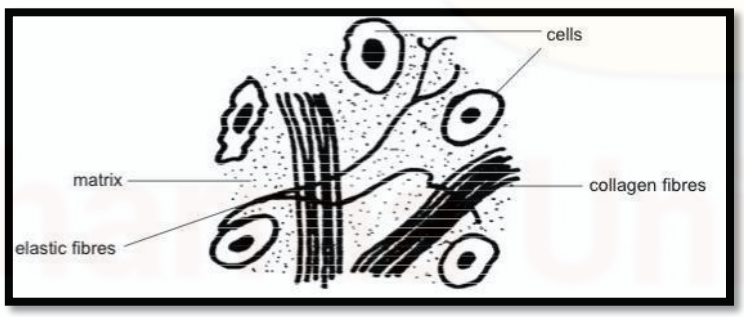
Function :-

- Protection: It protects the body from physical, chemical, and biological factors.
- Absorption: It absorbs nutrients and other substances.
- Secretion: It secretes hormones, enzymes, and other substances.
- Sensory reception: It contains sensory receptors that detect changes in the environment.
- Excretion: It helps to remove waste products from the body.

Connective tissue

Connective tissue is a type of tissue in our body that connects, supports, and protects other tissues and organs. It is made up of different types of cells and extracellular matrix.

Connective tissue consists of cells and extracellular matrix. The cells include fibroblasts, adipocytes, chondrocytes, osteoblasts, and many others. The extracellular matrix includes proteins, such as collagen and elastin, and ground substance, which is a gel-like material.



Classification of connective tissue

- **Loose Connective Tissue:** This type of connective tissue is found throughout the body and is made up of loosely arranged collagen fibers and other cells. It functions to provide support and elasticity to the surrounding tissues.
- **Dense Connective Tissue:** This type of tissue is made up of tightly packed collagen fibers and is found in tendons and ligaments, which connect muscles and bones to each other.
- **Cartilage:** Cartilage is a strong, flexible tissue that is found in joints and other parts of the body, such as the ears and nose. It provides cushioning and support to joints and helps to absorb shock.
- **Bone:** Bones are a type of connective tissue that provide support and protection to the body, as well as serving as a storage site for minerals like calcium.
- **Blood:** Blood is also a type of connective tissue and is responsible for transporting oxygen, nutrients, and waste products throughout the body.

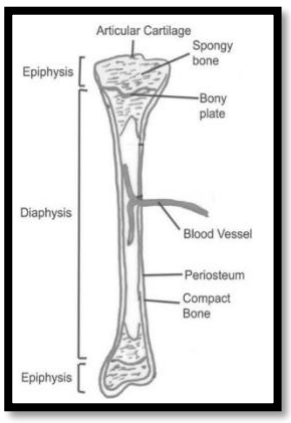
Function of connective tissue :-

- Providing structural support to other tissues and organs.
- Aiding in movement and flexibility of the body.
- Acting as a cushion and shock absorber.
- Providing insulation and storing energy in the form of adipose tissue.
- Participating in the body's defence against infection and foreign substances through immune cells in the tissue.

3. Define Bone Draw neat, labelled diagram of bone and write function of bone?

Ans.

Bone is a rigid body tissue that makes up our body skeleton. Bone is a connective tissue that is made up of different types of cells. Internally, it contains honeycomb-like matrix that gives rigidity to bones.



Function of Bone

- ➢ Support: Bones provide a framework for our body. They hold up our muscles, organs, and tissues.
- ➢ Protection: Bones protect our internal organs. For example, our skull protects our brain, our rib cage protects our heart and lungs, and our spine protects our spinal cord.
- ➢ Movement: Bones work with our muscles to help us move. Our muscles attach to our bones, and when our muscles contract, they pull on our bones to make us move.
- ➢ Blood cell production: Bones also produce red and white blood cells. These cells are important for carrying oxygen and fighting infections.
- ➢ Mineral storage: Bones store important minerals like calcium and phosphorus. These minerals are essential for healthy bones and teeth, and they can be released into the bloodstream when our body needs them.

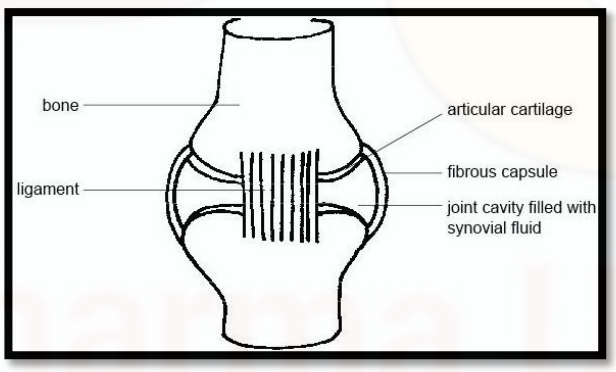
4. Discuss in detail about joints?

Ans.

A joint means a point where two or more bones are connected. Joints are important because they allow us to move our body in different ways.

Classification of Joints :-

- **Fibrous joints:** These are joints where the bones are held together by strong connective tissue, like in the skull. These joints do not allow for any movement.
- **Cartilaginous joints:** These joints are connected by cartilage, which is a firm, rubbery substance. For example, connection between the ribs and the sternum. These joints allow for some movement, but not as much as other types of joints.
- **Synovial joints:** These are the most common type of joint in our body. They are surrounded by a capsule of connective tissue and contain synovial fluid, which helps to lubricate the joint and reduce friction. There are six types of synovial joints: Hinge joint, Ball-and-socket joint, Pivot joint, Saddle joint, Condyloid joint, Gliding joint.



Function of Joints :-

- ➢ Facilitate movement: Joints connect bones together and allow them to move in different directions, which is important for a wide range of activities like walking, running, jumping, and playing sports. Without joints, we would be unable to move our body and perform these activities.
- ➢ Provide stability and support: Joints also provide stability and support to our body, which is important for maintaining posture and balance. Some joints, like the hip and shoulder, are designed to bear weight and provide support to the rest of the body.
- ➢ Absorb shock: Certain joints, like those in the knee and ankle, are designed to absorb shock and protect our body from injuries during high-impact activities like running and jumping.
- ➢ Allow for flexibility: Joints are also designed to allow for flexibility and range of motion. Some joints, like those in the neck and spine, are designed to allow for a wide range of movement, while others, like those in the fingers and toes, allow for more precise and delicate movements.
- ➢ Protect vital organs: Some joints, like those in the rib cage, protect vital organs like the heart and lungs from external injuries and trauma.

5. Write about composition and function of blood?

Ans.

Definition: Blood is a fluid connective tissue that circulates throughout the body via the circulatory system. It is composed of a fluid called plasma, along with various cellular and non-cellular components.

Composition:

The main components of blood are:

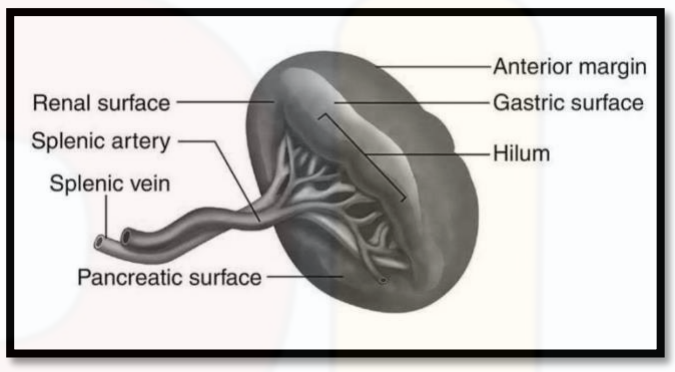
a. Plasma: This is the liquid portion of blood, which makes up around 55% of its total volume. It is mostly made up of water, along with various proteins, electrolytes, and other molecules.
b. Red blood cells (RBCs): These are the most numerous cells in the blood, and they are responsible for carrying oxygen from the lungs to the body's tissues. Makes up around 41% of its total volume rbcs contain a protein called haemoglobin, which binds to oxygen and helps transport it throughout the body.
c. White blood cells (WBCs): These are immune cells that help protect the body against infections and foreign invaders. Makes up around 4% of its total volume There are several different types of wbcs, each with its own unique function.
d. Platelets: These are small, disc-shaped cells that help with blood clotting. They are important for stopping bleeding and repairing damaged blood vessels.

Function:

a. Transport: Blood carries oxygen, nutrients, and other essential molecules throughout the body. It also helps remove waste products like carbon dioxide and urea.
b. Regulation: Blood helps regulate the body's ph balance, temperature, and fluid balance.
c. Protection: White blood cells and platelets help protect the body against infections and injuries.

6. Write structure and Function of spleen?

Ans.

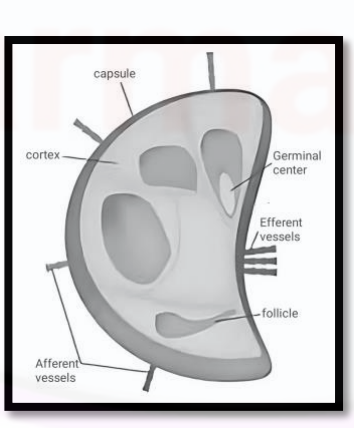


Function :-

- It acts as a filter for the blood, removing old or damaged red blood cells, platelets, and other debris.
- It stores a reserve of blood cells that can be released into circulation if the body needs them for example, in cases of bleeding or injury
- It plays a role in the immune response, producing white blood cells called lymphocytes that help fight infections.
- Spleen is also involved in the production of antibodies, which are proteins that help the body recognize and destroy foreign substances like viruses or bacteria

7. Write structure and function of Lymph node?

Ans.

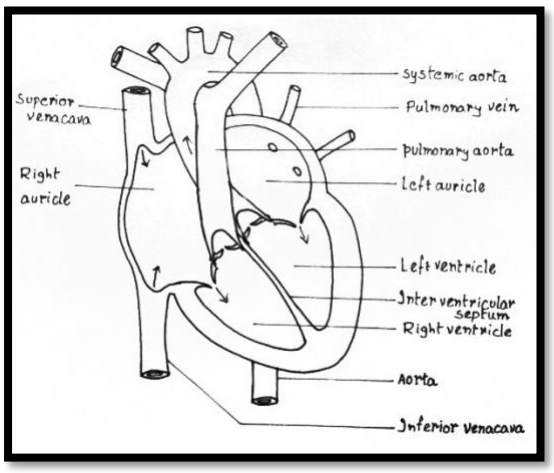


Function :-

- Lymph nodes act as filters for the lymphatic fluid that circulates throughout the body. They trap and remove foreign particles, such as bacteria and viruses, and other unwanted substances.
- Lymph nodes are also a site of immune cell activation. They contain immune cells, including lymphocytes and macrophages, which help identify and destroy pathogens.
- When a part of the body becomes infected or inflamed, the lymph nodes in that area may become swollen and tender. This is a sign that the immune system is responding to an infection or other stimulus.
- Lymph nodes are connected to each other by a network of lymphatic vessels, which allows immune cells and other substances to be transported between them.
- Some lymph nodes are located near important organs, such as the lungs and intestines, to help fight infections that may affect these organs.

8. Write anatomy of heart with diagram?

Ans.



The heart is a muscular organ that is responsible for pumping blood throughout the body.

It is divided into four chambers: the right atrium, the left atrium, the right ventricle, and the left ventricle.

The right atrium receives blood that is low in oxygen and high in carbon dioxide from the body through the veins. This blood is then pumped into the right ventricle, which then pumps it to the lungs where it picks up oxygen and releases carbon dioxide.

The left atrium receives oxygen-rich blood from the lungs through the pulmonary veins. This blood is then pumped into the left ventricle, which then pumps it out to the rest of the body through the arteries.

The heart has its own electrical system, which controls the timing and rhythm of its contractions. The sinoatrial (SA) node, located in the right atrium, acts as the heart's natural pacemaker. It sends out electrical signals that cause the heart muscles to contract and pump blood.

The atrioventricular (AV) node, located between the atria and ventricles, helps coordinate the timing of the contractions between the two. These electrical signals cause the heart to beat in a coordinated way, allowing it to efficiently pump blood throughout the body.

In addition, the heart has blood vessels called arteries and veins that help circulate the blood. Arteries carry oxygen-rich blood away from the heart, while veins bring oxygen-poor blood back to the heart.

9. Explain anatomy and Physiology of respiration and their functions?

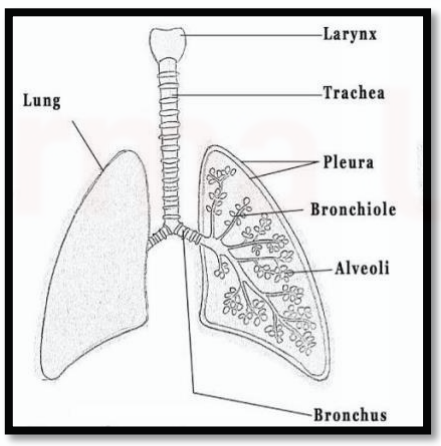
Ans.

Anatomy of Respiration:

Respiration is the process by which the body takes in oxygen and releases carbon dioxide. It involves two main parts: the respiratory system and the circulatory system.

The respiratory system consists of the nose, mouth, throat, trachea, bronchi, and lungs. Air is breathed in through the nose or mouth, and it travels down the throat and into the trachea, which branches into two tubes called the bronchi. The bronchi further divide into smaller tubes called bronchioles, which eventually end in tiny air sacs called alveoli.

The alveoli are surrounded by a network of tiny blood vessels called capillaries, which are part of the circulatory system. This is where the exchange of gases occurs: oxygen from the air in the alveoli diffuses into the capillaries and is carried to the rest of the body, while carbon dioxide from the body diffuses into the capillaries and is exhaled out of the body.



Physiology of Respiration:

The process of breathing involves two main phases: inhalation (breathing in) and exhalation (breathing out).

During inhalation, the diaphragm (a large muscle located at the bottom of the lungs) and the intercostal muscles (located between the ribs) contract, causing the chest cavity to expand. This creates a negative pressure within the lungs, and air is drawn into the lungs through the nose or mouth.

During exhalation, the diaphragm and intercostal muscles relax, causing the chest cavity to shrink. This creates a positive pressure within the lungs, and air is forced out of the lungs through the nose or mouth.

The exchange of gases between the alveoli and the capillaries occurs through a process called diffusion. Oxygen diffuses from the air in the alveoli into the capillaries, where it binds to haemoglobin (a protein in red blood cells) and is carried to the rest of the body. Carbon dioxide, which is a waste product produced by the body's cells, diffuses from the capillaries into the alveoli and is exhaled out of the body.

Overall, respiration is an essential process that allows the body to obtain the oxygen it needs to function properly and to get rid of carbon dioxide, which is a waste product that can be harmful in high concentrations.

10. Explain anatomy and Physiology of gastrointestinal tract(GIT)?

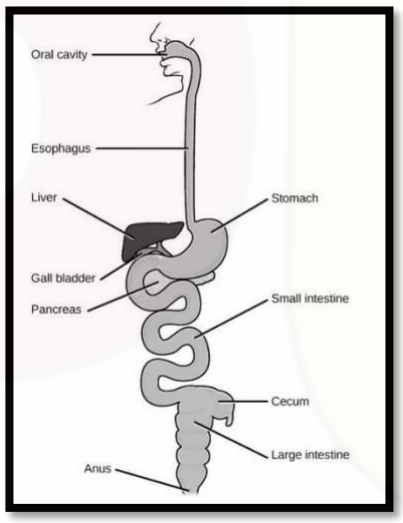
Ans.

The gastrointestinal tract, also known as the digestive system, is a long tube that runs from your mouth to anus. It's responsible for breaking down the food we eat into nutrients our body can use.

Anatomy of the GIT

The GIT is made up of several organs, including the mouth, oesophagus, stomach, small intestine, large intestine (also called the colon), rectum, and anus. Each of these organs has a specific work in the digestive process.

a) **Mouth :-** When we eat food, we chew it in mouth, which starts the digestive process. Our teeth break the food down into smaller pieces, and saliva starts to break down the carbohydrates in the food.
b) **Pharynx :-** The pharynx is enclosed in the neck and functions as part of both the digestive system and the respiratory system. It protects the food from entering the trachea and lungs.
c) **Oesophagus :-** The food then travels down to oesophagus, which is a muscular tube that connects mouth to stomach. In this the action of swallowing becomes involuntary and is controlled by the oesophagus.
d) **Stomach :-** The stomach is a J-shaped bag-like organ that stores the food temporarily. In stomach the food mixes with stomach acid and digestive enzymes. This helps break the food down even further. Stomach muscles then push the food into your small intestine.
e) **Small intestine :-** It is where most of the nutrients from the food are absorbed into the bloodstream. The walls of the small intestine are lined with tiny finger-like projections called villi, which increase the surface area of the small intestine and allow for more efficient absorption of nutrients. Food is mixed with enzymes from the liver and the pancreas in the small intestine
f) **Large intestine :-** After the small intestine, the food passes into the large intestine. The large intestine absorbs water and electrolytes from the leftover food waste and forms it into solid stool. This stool is then stored in the rectum until it's ready to be eliminated through the anus.



Physiology of the GIT :

- Digestion is a complex process that involves several different types of enzymes and hormones. Enzymes are proteins that help break down food molecules, while hormones are chemical messengers that help regulate various aspects of digestion.
- When we eat food, body releases several digestive enzymes and hormones to help break down the food and absorb the nutrients. For example, the hormone gastrin is released in response to food in the stomach, and it helps stimulate the production of stomach acid and digestive enzymes.
- Another important hormone is insulin, which is released by the pancreas in response to carbohydrates in the food. Insulin helps to regulate blood sugar levels by moving glucose from the bloodstream into cells.

11. Write in detail about muscle contraction?

Ans.

Muscle contraction is the process by which muscles generate force to produce movement. There are three types of muscles in the human body: skeletal, smooth muscle, and cardiac muscle.

Skeletal muscles are made up of many long and thin fibers. Each fiber contains many smaller structures called myofibrils, which are made up of even smaller structures called sarcomeres. Sarcomeres are like tiny units that work together to contract the muscle fiber.

Sarcomeres are made up of two types of proteins called actin and myosin. Actin is thin and flexible while myosin is thicker and has a bulbous head. When the muscle fiber is stimulated by a nerve impulse, calcium ions are released from storage within the cell.

The presence of calcium ions triggers a series of chemical reactions that lead to the myosin filaments binding to the actin filaments. This forms cross-bridges between the two filaments, allowing the myosin filaments to pull the actin filaments closer together. As the actin filaments slide past the myosin filaments, the sarcomeres shorten, causing the muscle fiber to contract.

This process is repeated throughout the muscle fiber, causing the entire muscle to contract and produce force. The force generated by the muscle can be controlled by the number of muscle fibers that are stimulated to contract, as well as the frequency of the nerve impulses that cause the muscle fibers to contract.

After the contraction is completed, the calcium ions are pumped back into storage and the myosin filaments release the actin filaments. The muscle fiber then relaxes and returns to its original length.

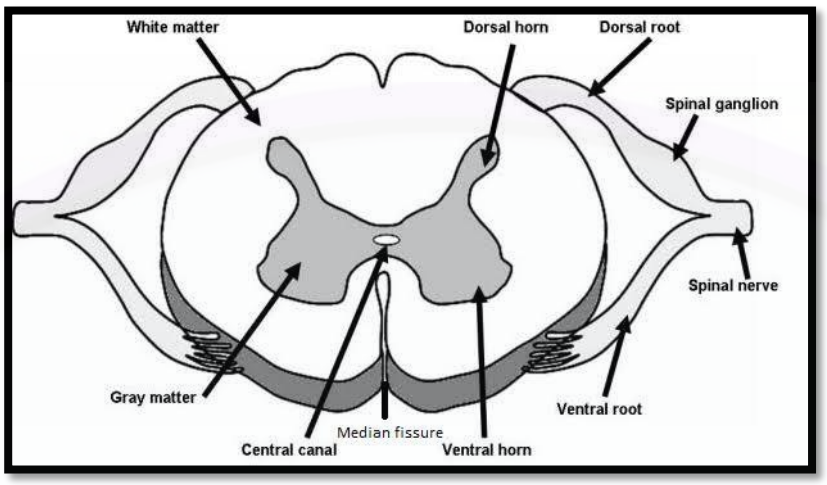
In conclusion, muscle contraction is a process that involves the interaction between actin and myosin filaments within the sarcomeres of muscle fibers. When these filaments slide past each other, the sarcomeres shorten and the muscle generates force, allowing us to produce movement.

12. Discuss in detail about structure of spinal cord and its function?

Ans.

The spinal cord is a long, thin tube of nerve tissue that runs from the base of the brain all the way down to lower back. It's part of the central nervous system, which is responsible for controlling all the functions in body.

The spinal cord is protected by a series of bones called vertebrae, which make up your spine. The spinal cord itself is made up of millions of nerve cells, called neurons, and their support cells, called glial cells. Cross-section of spinal cord have grey matter which is butterfly shape and it is surrounded by a white matter.



Grey matter consists of the central canal at the centre and is filled with CSF (Cerebrospinal fluid). It consists of horns (which have four projections) and forms the core and mainly containing neurons and cells of the CNS. These horns are divided into two dorsal and two ventral horns.

The white matter consists of a collection of axons which helps in communicating between different layers of CNS. A tract is a collection of axons and carries specialized information. Ascending tracts and descending tracts send and transmit signals from the brain respectively to various nerve cells across the body.

Spinal nerves act as mediators, communicating information to and from the rest of the body and the spinal cord. There are 31 pairs of spinal nerves.

Three layers of meninges surround the spinal cord and spinal nerve roots.

Dura mater - Dura mater consists of two layers- periosteal and meningeal. Epidural space is present between the two layers.

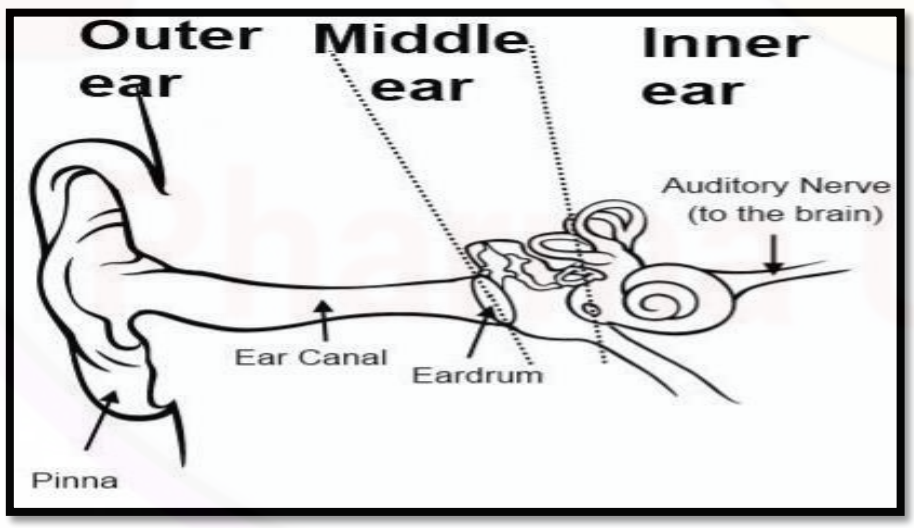
Arachnoid mater - Subarachnoid space lies between the arachnoid mater

Pia mater - It is filled with cerebrospinal fluid

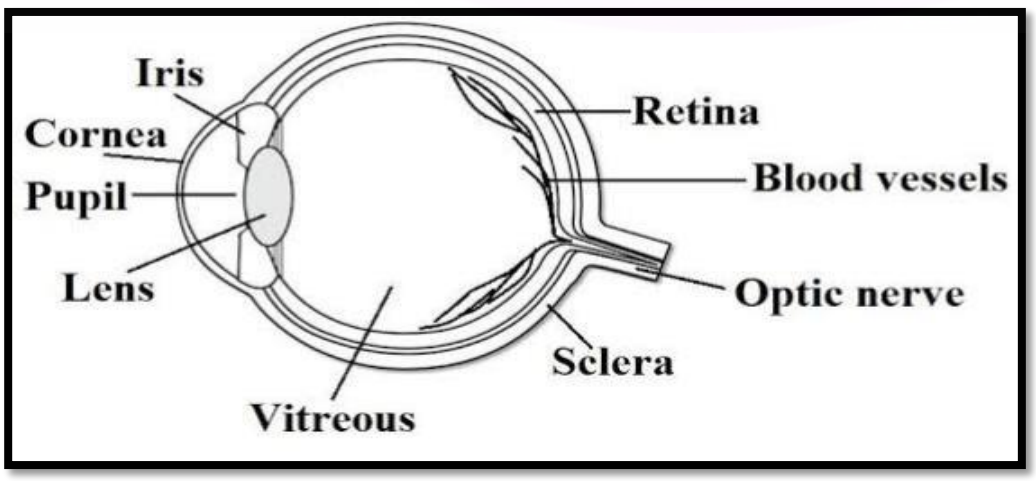
13. Draw the well labelled structure of ear, eye, skin and its layer?

Ans.

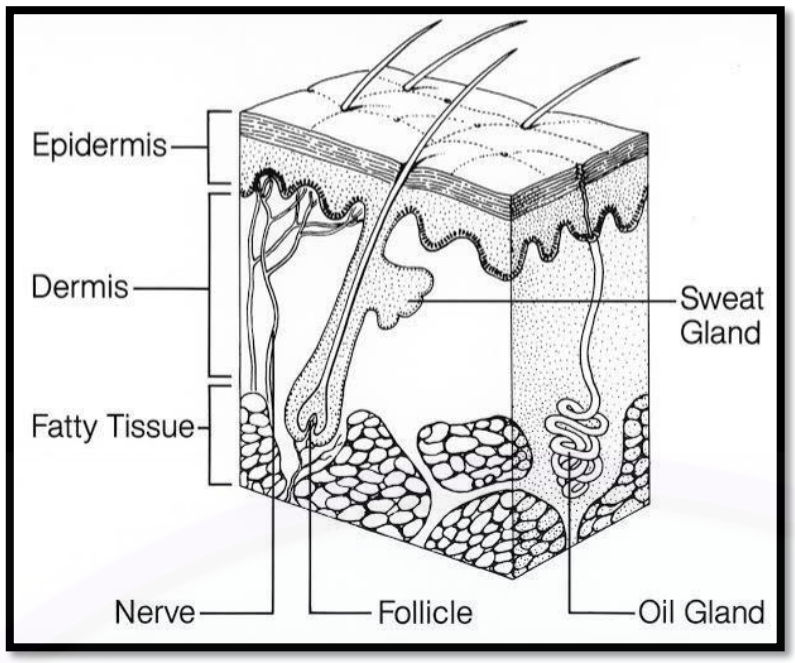
Structure of Ear



Structure of Eye



Structure of Skin



14. Write Physiology of urine formation?

Ans.

Urine formation is a complex process that involves several steps in the kidneys

a) **Filtration:** The first step in urine formation is filtration, which takes place in the glomerulus, a network of small blood vessels called capillaries located in the Bowman's capsule of the kidneys. As blood flows through the glomerulus, water and small solutes like electrolytes, glucose, and amino acids are filtered out of the blood and into the Bowman's capsule, forming a filtrate.
b) **Reabsorption:** After filtration, the filtrate moves into the renal tubules, where reabsorption takes place. Reabsorption is the process by which the kidneys reclaim useful substances like water, glucose, and electrolytes from the filtrate and return them to the bloodstream. The amount of water and electrolytes reabsorbed depends on the body's needs at the time.
c) **Secretion:** Secretion is the opposite of reabsorption, where substances that were not filtered out in the glomerulus are actively transported from the blood into the renal tubules. Examples of substances that are secreted include drugs, toxins, and hydrogen ions.
d) **Concentration:** The final step in urine formation is concentration, which occurs in the collecting ducts. Here, water is reabsorbed from the urine and returned to the bloodstream, while the concentration of electrolytes and waste products in the urine increases. The concentration of urine depends on the body's needs, with more water being reabsorbed when the body is dehydrated.

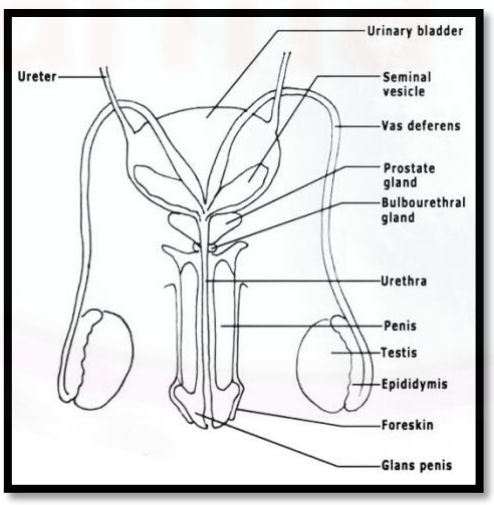
Once the urine is fully formed, it travels from the collecting ducts to the renal pelvis and then to the ureters, which are tubes that connect the kidneys to the bladder. From the bladder, urine is expelled from the body through the urethra during urination.

15. Write anatomy of male and female reproductive system with diagram?

Ans.

Male Reproductive system:

The male reproductive system is responsible for producing and delivering sperm, which are necessary for fertilizing a female egg and initiating pregnancy.

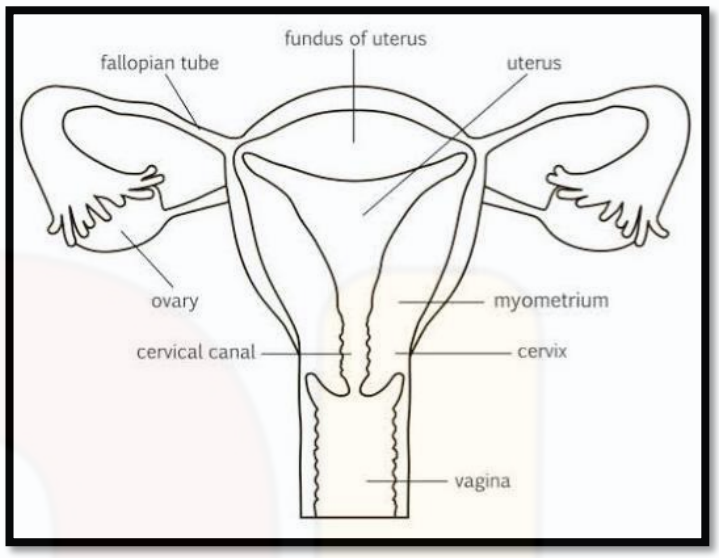


a) Testes: The testes, also known as testicles, are the two oval-shaped glands that produce sperm and the hormone testosterone. The testes are located in the scrotum, a sac of skin that hangs outside the body to keep the testes cooler than the body temperature, which is necessary for sperm production.
b) Scrotum : The scrotum is the loose sac-like skin bag which hangs below the penis. This part of the male reproductive system holds the testes or testicles, along with many blood vessels and nerves.
c) Urethra : It is a tube which carries urine starting from the bladder to travel outside the body. Considering males, the additional purpose of ejaculating semen at the time of orgasm is managed by urethra

d) Epididymis: The epididymis is a tightly coiled tube located behind each testis. Sperm produced in the testes move into the epididymis, where they mature and gain the ability to swim.
e) Vas deferens: The vas deferens is a long, muscular tube that carries sperm from the epididymis to the urethra, the tube that carries semen and urine out of the body.
f) Seminal vesicles, prostate gland, and bulbourethral gland: These three glands secrete fluids that make up semen, which helps nourish and protect sperm. The seminal vesicles and prostate gland are located near the base of the bladder, while the bulbourethral gland is located at the base of the penis.
g) Penis: The penis is the male organ used for sexual intercourse and urination. It contains three cylinders of spongy tissue, which fill with blood during sexual arousal, causing the penis to become erect.

Female Reproductive system:

The female reproductive system is responsible for producing and delivering eggs, as well as providing a suitable environment for fertilization and pregnancy.



a) Ovaries: The ovaries are two almond-shaped glands located on either side of the uterus. They produce and release eggs, as well as the hormones estrogen and progesterone.
b) Fallopian tubes: Also known as oviducts, the fallopian tubes are two narrow tubes that extend from the ovaries to the uterus. They serve as a pathway for the egg to travel from the ovary to the uterus. Fertilization typically occurs in the fallopian tubes.
c) Uterus: The uterus is a pear-shaped organ located in the lower abdomen. It provides a suitable environment for a fertilized egg to develop into a fetus. The inner lining of the uterus, called the endometrium, thickens each month in preparation for pregnancy. If pregnancy does not occur, the endometrium is shed during menstruation.
d) Cervix: The cervix is the lower part of the uterus that connects to the vagina. It produces mucus that helps protect the uterus from infection, and it also dilates during childbirth to allow the baby to pass through.
e) Vagina: This is tube like region which gets open in the outer region of the female body through vulva. This is the region through which the sperms move towards the egg for fertilisation. This is also called as the birth canal through which the child comes out.

Very Imp Note :-

- **Please Read All the chapters very carefully before Human Anatomy & Physiology Exam**
- **These questions are only for the reference purpose**