

NAME OF TEACHER – POOJA MALKANI

MOB. NO – 9690847170

EMAIL ID – poojamalkani022@gmail.com

DESIGNATION – ASSISTANT PROFESSOR

UNIVERSITY NAME – MONAD UNIVERSITY

COLLEGE NAME – SCHOOL OF PHARMACY

STREAM NAME – PHARMACY

FACULTY NAME – POOJA MALKANI

DEPARTMENT NAME – SCHOOL OF PHARMACY

SUBJECT NAME – HUMAN ANATOMY AND PHYSIOLOGY

COURSE - D.PHARM

COURSE DURATION – 2 YEARS

**SUBTOPIC NAME – SCOPE OF ANATOMY AND PHYSIOLOGY, CELL
STRUCTURE, THE TISSUES**

CONTENT TYPE – TEXT

SEARCH KEYWORD – NUCLEUS, SUPERIOR, EPITHELIAL, MITOCHONDRIA

HUMAN ANATOMY AND PHYSIOLOGY (DPH - 115)

UNIT – 1

SCOPE OF ANATOMY AND PHYSIOLOGY

Anatomy: - Anatomy is a science that deals with the study of structure of the body and the relationship of various parts to each other. From ancient Greek word anatomy is taken from “Anatemnein” which means:

Ana- separate, apart from

Temnein – to cut up, cut open.

Physiology: - Physiology is a science that deals with the study of functions of the body. It includes the study of function of various organ systems like –

- ❖ Central nervous system
- ❖ Autonomic nervous system
- ❖ Cardiovascular system
- ❖ Respiratory system
- ❖ Excretory system
- ❖ Digestive system
- ❖ Endocrine system
- ❖ Reproductive system

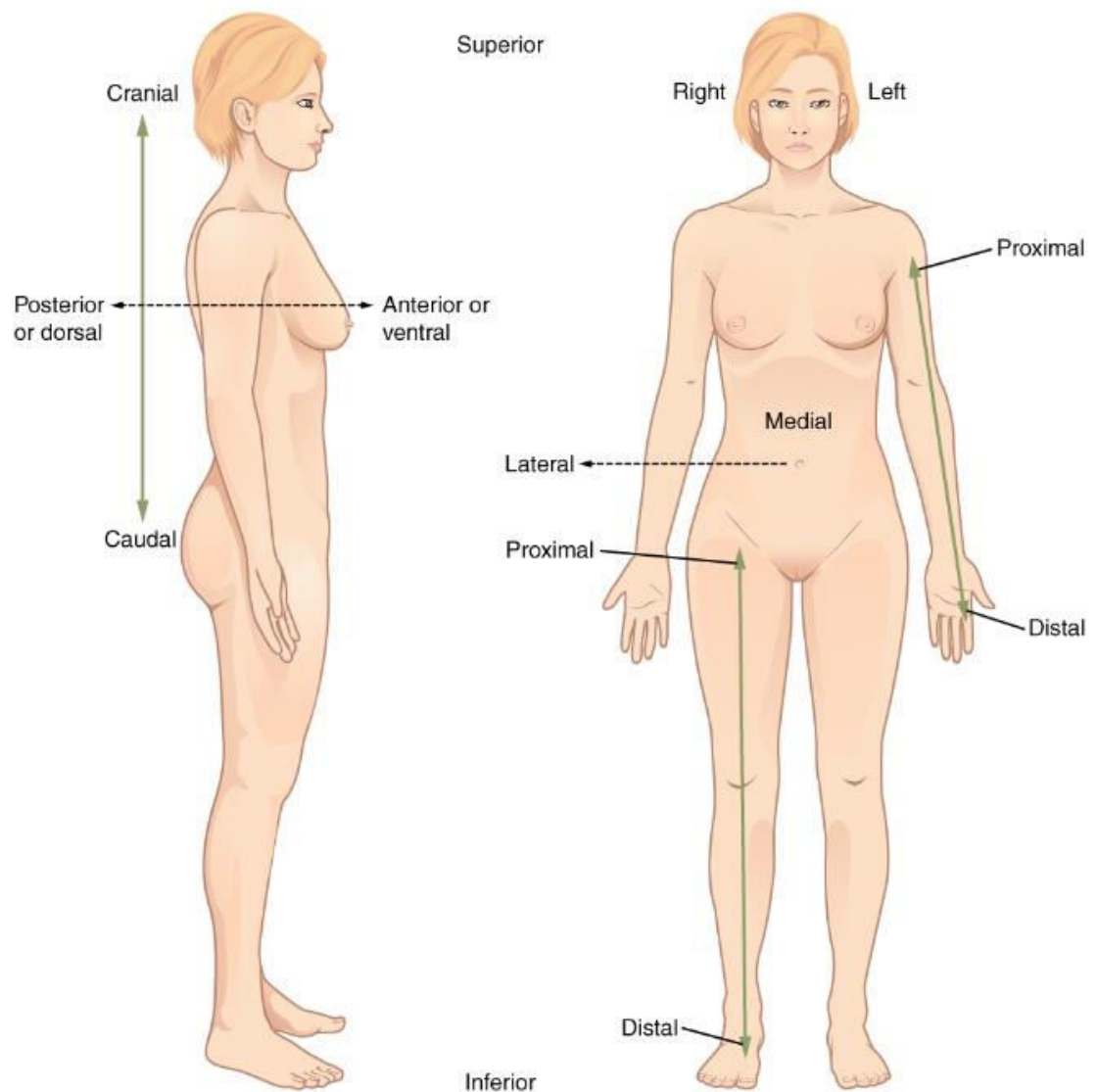
Both anatomy and physiology form the basics of medical sciences. A thorough knowledge of the structure of the body (Anatomy) is very essential to understand their functions (Physiology).

Various terms used in anatomy and physiology:

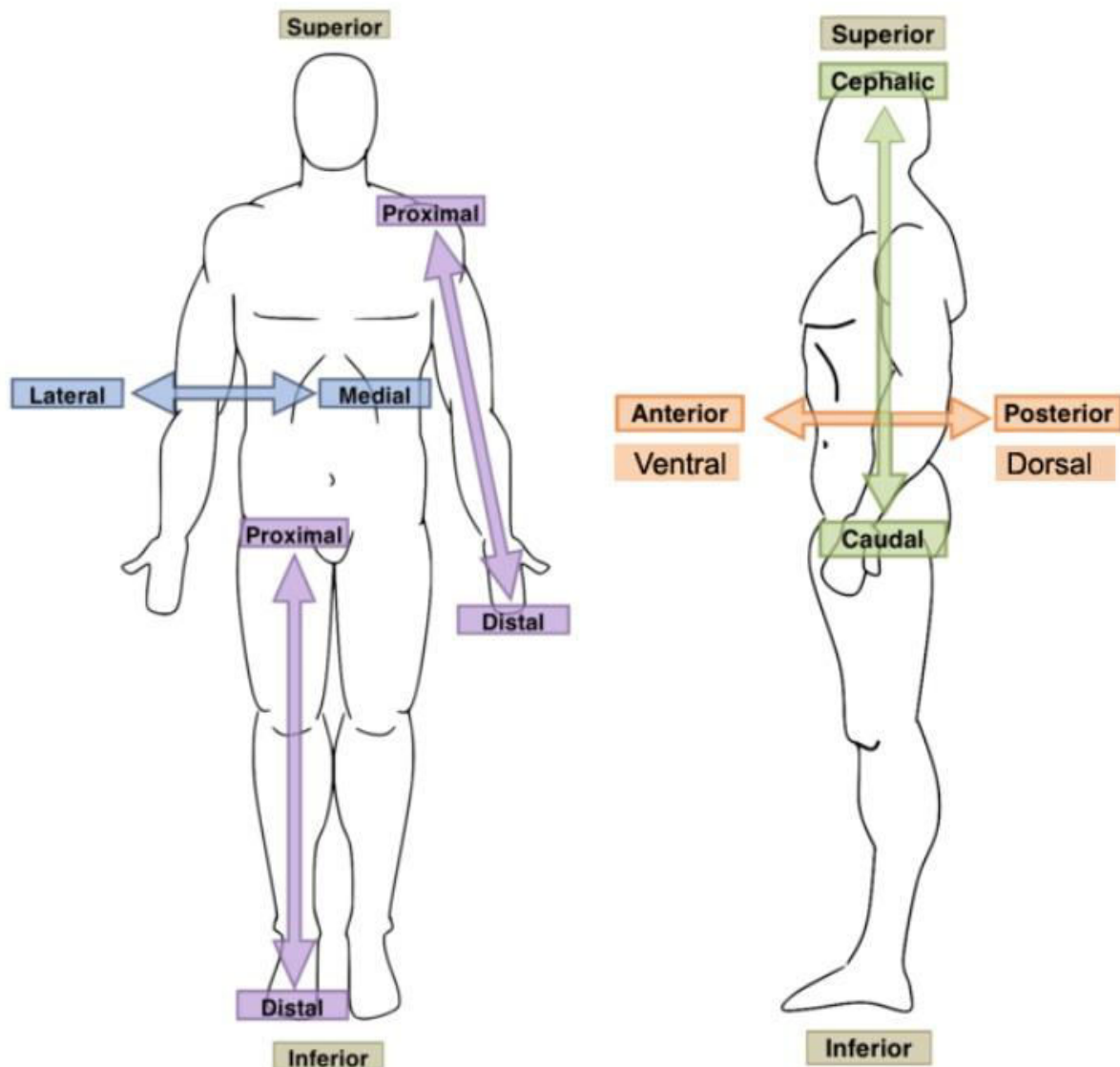
1. Cytology :- study of structure and functions of the cell
2. Histology:- study of tissues
3. Pathology:- study of nature, causes and processes of diseases
4. Gross or Macroscopic anatomy: - study of certain structures of the body by the naked eye. E.g. arrangement of muscles, nerves, veins and important organs like stomach, heart, lungs, brain etc.
5. Microscopic anatomy or histology: - study of organisation of the individual tissue and the cell.
6. Systemic anatomy: - study of divisions of the body into various organ systems, according to the functions they perform.
 - a) Osteology – study of bones
 - b) Arthrology- study of joints
 - c) Myology – study of muscles

- d) Splanchnology – study of organs
- e) Neurology – study of nervous system
- f) Cardiology – study of heart
- g) Ophthalmology – study of eyes and related structures
- h) Endocrinology – study of endocrine glands
- i) Otology – study of the ear
- j) Odontology – study of teeth
- k) Pulmonology – study of lungs and respiratory system
- l) Haematology – study of composition, functions and disorders of blood
- m) Nephrology – study of structure, function and diseases of the body
- n) Embryology – study of development of embryo

The following are the few important terms used to describe the human body:



1. Median line (Mid sagittal plane):- the central plane or the midline of the body which divides into two halves, i.e. right and left.
2. Transverse section: - type of section which divides body horizontally.
3. Longitudinal section: - type of section which divides body vertically.
4. Medial: - towards the midline of the body.
5. Lateral: - away from the midline of the body or sides of the body.
6. Superior: - above or nearer to the head.
7. Inferior:- below or nearer to the feet.
8. Anterior: - ventral or nearer to the front surface of the body.
9. Posterior:- dorsal or nearer to the back surface of the body.
10. Proximal:- nearer to the origin or the starting point of a structure.
11. Distal: - away from the origin of a structure.
12. Superficial: - nearer to the surface of the skin.
13. Cranial: - towards the head end.
14. Sagittal: - along the median plane of the body.
15. Coronal: - along the transverse plane of the body.
16. Septum:- this is a partition separating two cavities.
17. Border:- this is a ridge of bone which separates two surfaces.
18. Symmetric:- right and left limbs are similar. Other symmetrically arranged organs are eyes, ears, lungs, kidneys etc.
19. Asymmetric:- spleen and liver lie almost entirely on the right and left side of the body.



STRUCTURE OF CELL

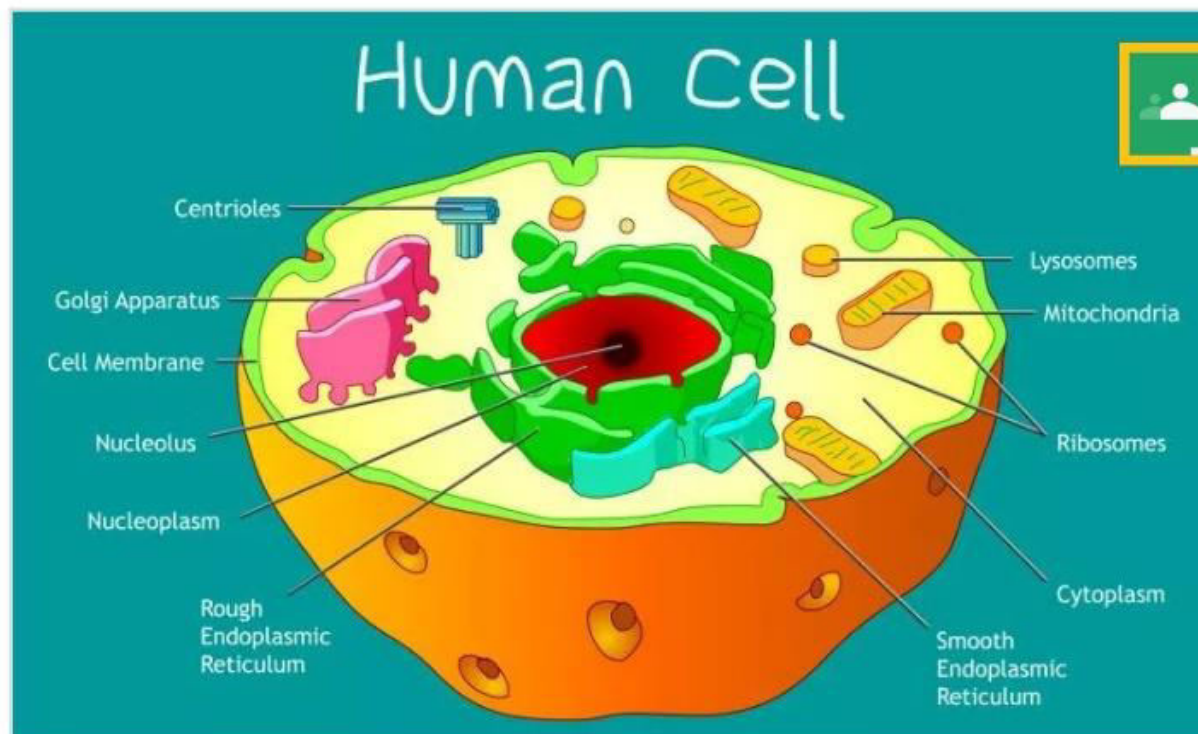
Cell is the smallest and functional unit of body. Many cells group together to form tissues, many tissues group together to form organs, and many organ systems group together and co-ordinate to form a living body.

Cells → Tissues → Organs → Organ systems → Living organism

Cell was first introduced by Robert Hooke. Cells of different tissue perform different functions. A cell is a microscopic jelly like mass of “Protoplasm” containing a “Nucleus” held together by a “Cell membrane”. The cell is made up of two major parts -

- 1) Plasma Membrane: - it is the outer surface of the cell. It is a covering of cell which is 0.1 micron in thickness. It is formed of 40% lipids and 60% proteins.
- 2) Protoplasm (Cytoplasm):- It is present within the cell membrane. This contains the cell organelles like Nucleus, Mitochondria, and Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Centrosomes, Microsomes and Ribosomes.

Cell Structure

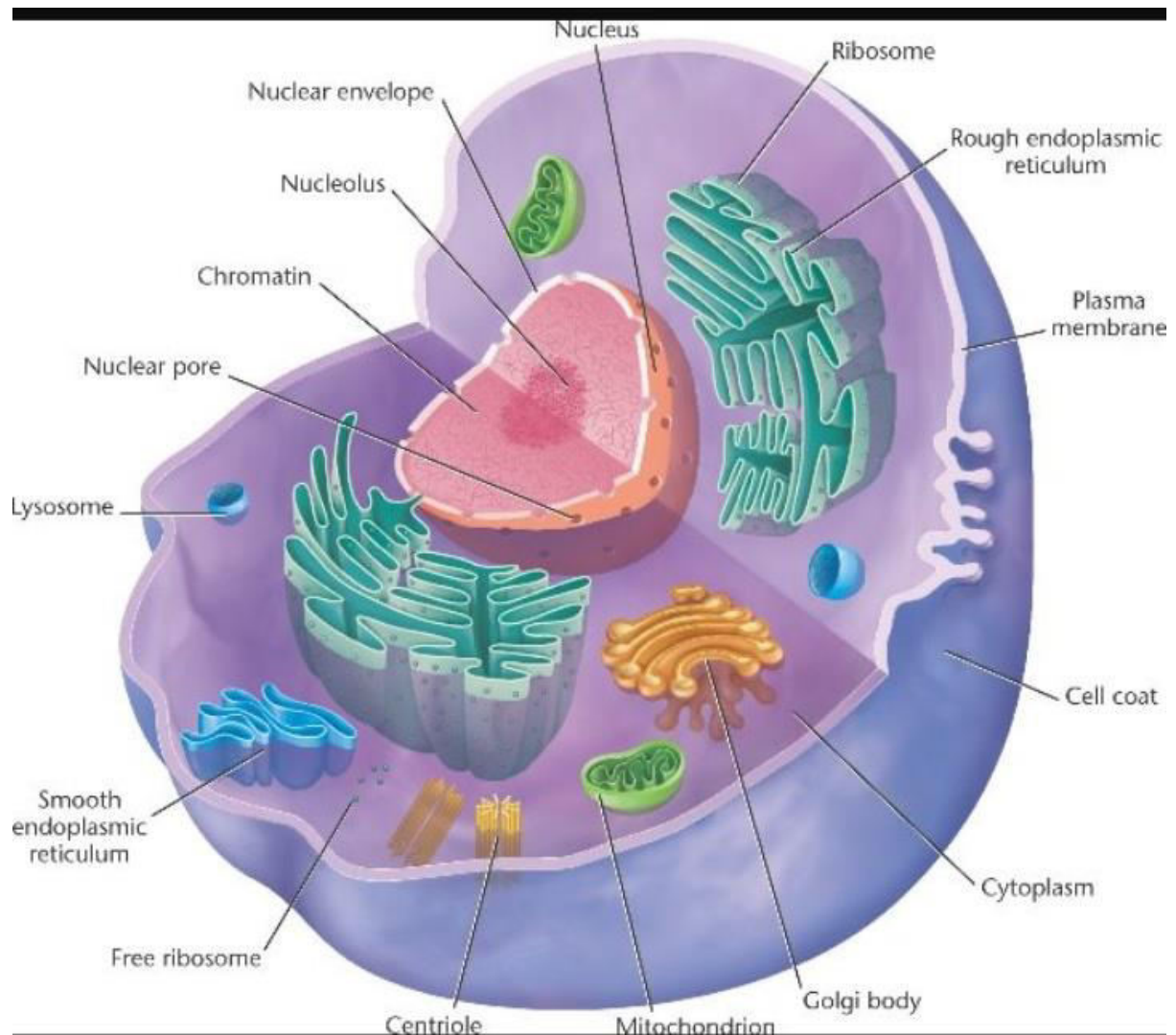


Functions of cell

1. Ingestion & Assimilation:- Cells ingest substance like amino acid from interstitial fluid. These substances are used to build up complicated substances like protein.
2. Growth & repair: - Ingested and assimilated materials are used to synthesize new protoplasm which increase in size and growth of cell.
3. Metabolism: - Chemical changes which takes place in the body necessary for fulfilment of vital functions.
4. Respiration: - It involves transport of oxygen from lungs and removal of waste products like carbon dioxide.
5. Excretion:- Cell eliminates waste material obtained from catabolism into the interstitial fluid which are carried by blood for elimination through lungs and kidneys.

6. Reproduction: - After growing to an optimum size, cell divides either by mitosis and meiosis.
7. Contractility: - Cells responds to any stimulus by contraction.

In multicellular organism, various cells perform various functions but there are certain structural characteristic features which are common to them all. Non-living organelles or material present in cytoplasm are called as cell inclusions (granules of phosphate, sulphate and glycogen).



Organelles are small internal organs of cells which hold important functions in cell metabolism. Following organelles are present in the cells –

- a) Nucleus: - It is the largest structure present almost at the centre of a cell. It is more or less spherical in shape. It is bounded by nuclear membrane. The nucleus contains Nucleolus and Chromatin.

- b) Endoplasmic reticulum: - It is a double layered structure and is made up of tubules and cisternae (vesicles). Also called as ergastoplasm. There are two types of Endoplasmic Reticulum-
1. Granular or rough surfaced endoplasmic reticulum: - They have rough surface as they contain ribosomes. Ribosomes are sites of protein synthesis.
 2. Agranular or Smooth surfaced endoplasmic reticulum: - They do not contain ribosome and are concerned with fatty acid and steroid synthesis.

Functions

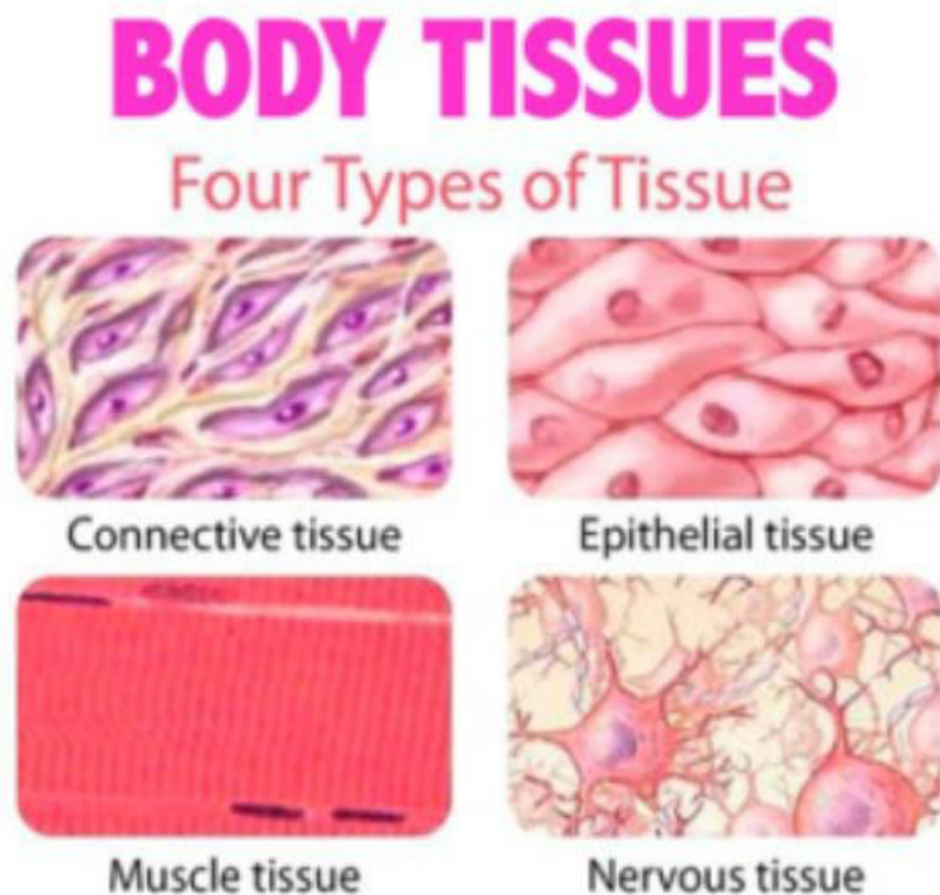
- Support to cytoplasmic matrix.
 - Synthesis of lipids and proteins.
 - Helps in muscle contraction by release and uptake of calcium ion.
- c) Golgi apparatus: - Structure of Golgi complex looks like a network fine threads or irregular granular material. It is a membranous organelle and has three main structures – Flattened vesicles, secretory vesicles and microvesicles.
- Functions: - It helps in movement of ER secretion. Secretion is sent to their proper location by means of vesicles that bud off from Golgi body.
- d) Mitochondria: - It is composed of two layers of membrane and cylindrical in shape. The outer layer is smooth and inner layer folded into sheets of tubules called “cristae”. Both these layers enclose a central cavity called matrix. Mitochondria occur in cytoplasm at variable numbers (1-1000). It is the powerhouse of cell and it is main site of ATP production.
- e) Lysosomes: - They are small, spherical or oval bodies surrounded by a single membrane. They vary in number and contain a variety of hydrolytic enzymes. The lysosomes breakdown bacteria engulfed by cell therefore, these are called as “suicide bag of the cell”.
- f) Centrosome: - It consists of specialized part of clear cytoplasm, centrosphere which contains two or more deeply stained particles – the centrioles lying close to the nucleus in resting cell. It works in polarization of spindle fibres and plays some part in their formation.
- g) Ribosomes: - These are ribonucleoprotein in nature and are found scattered in the cytoplasm either singly or in groups (polysomes). Ribosomes comprises of two subunits – larger and smaller. These act as protein factory as they are involved in protein synthesis.

THE TISSUES

A group of cells having the same origin, similar shape and specific (or) common generalised function is known as a tissue.

Classification: - The tissues are classified into major types namely:

1. Epithelial tissue
2. Connective tissue
3. Muscular tissue
4. Nervous tissue



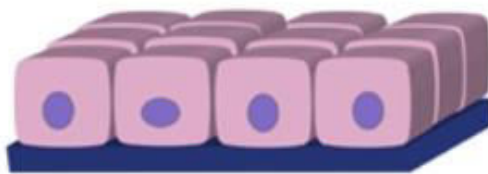
EPITHELIAL TISSUE

It forms the covering or lining to the free surfaces of the body. They are found on the outer surfaces of the body, inner lining of the alimentary canal, respiratory system and urinogenital system. They perform vital functions like protection, excretion, glandular secretion and absorption. The inter-cellular material is very less in these tissues. But they are arranged on an inert connective tissue called the "Basement membrane". Epithelial tissue is classified into:

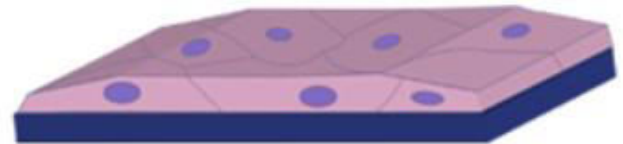
- A) Simple epithelium: - it consists of a single layer of cells. It is further classified into:

- a. Squamous epithelium- the cells in this type of tissue are flat and arranged like the tiles on the floor. This type of epithelium are found in mouth, pharynx, pericardium, alveoli of lungs etc.
 - b. Cuboidal epithelium- the cells, here, are cubical. They are arranged over a basement membrane. It is found in the distal convoluted tubules of the kidney.
 - c. Columnar epithelium- it consists of tall, pillar like cells arranged on a basement membrane. It is found in lungs and ducts of glands.
 - d. Ciliated epithelium- the cells may be cuboidal or columnar. But they contain fine, hair like structures called “cilia” present in the free border. It is found in the cells lining the trachea, uterine tubes etc.
-

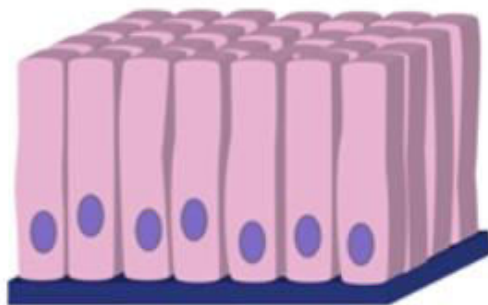
Epithelial Tissue



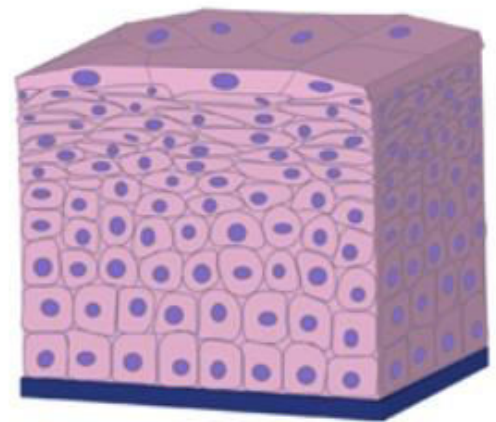
Simple Cuboidal



Simple Squamous

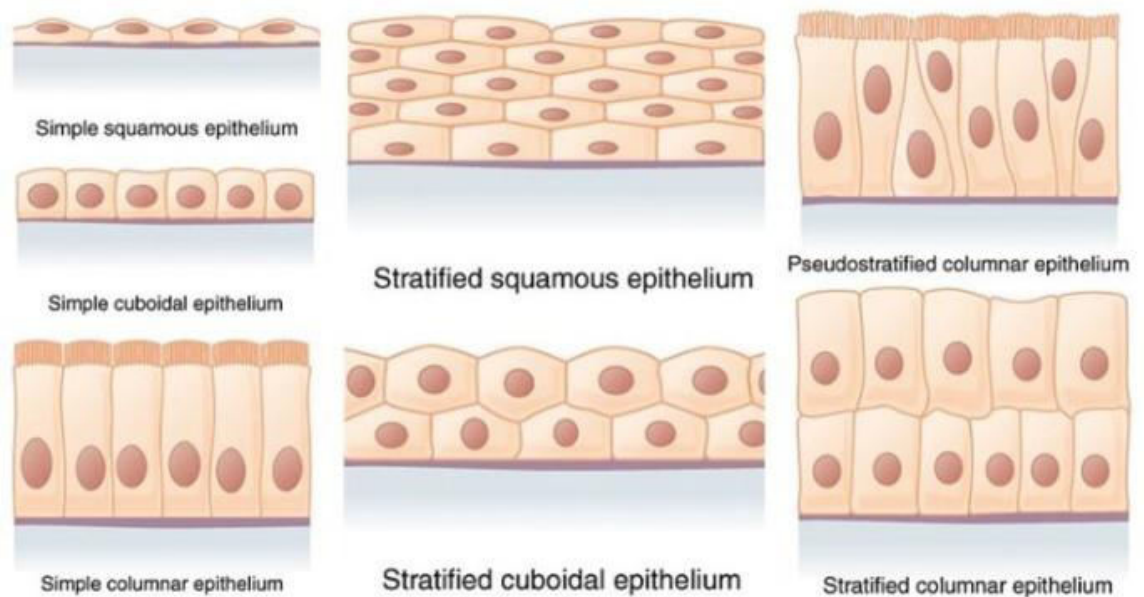


Simple Columnar



Stratified Squamous

-
- e. Glandular epithelium- it consists of columnar or cuboidal cells. The cytoplasm has granules. The glands may be of two types, namely unicellular and multicellular glands. Unicellular glands possess goblet cells which secrete mucin are present in stomach, colon and trachea. Multicellular gland are of two types, namely “Exocrine glands” possessing ducts which secrete enzymes and “Endocrine glands” or ductless glands, which secrete hormones.



- B) Stratified epithelium/compound epithelium:- it consists of several layers of cells and do not contain basement membrane. It is present in surfaces where there is considerable wear and tear. Depending on the types of cell present, it is further classified into:
- Stratified squamous epithelium
 - Stratified cuboidal epithelium
 - Stratified columnar epithelium

Sometimes, the superficial cells of stratified epithelium become dry and hard. They develop a protein called keratin. Then the epithelium is called “Keratinised stratified epithelium”.

- C) Transitional epithelium:- this is composed of several layers of pear shaped cells. They are found in the lining of the urinary bladder. It allows the urinary bladder to stretch when it fills up with urine.

Functions of epithelial tissue-

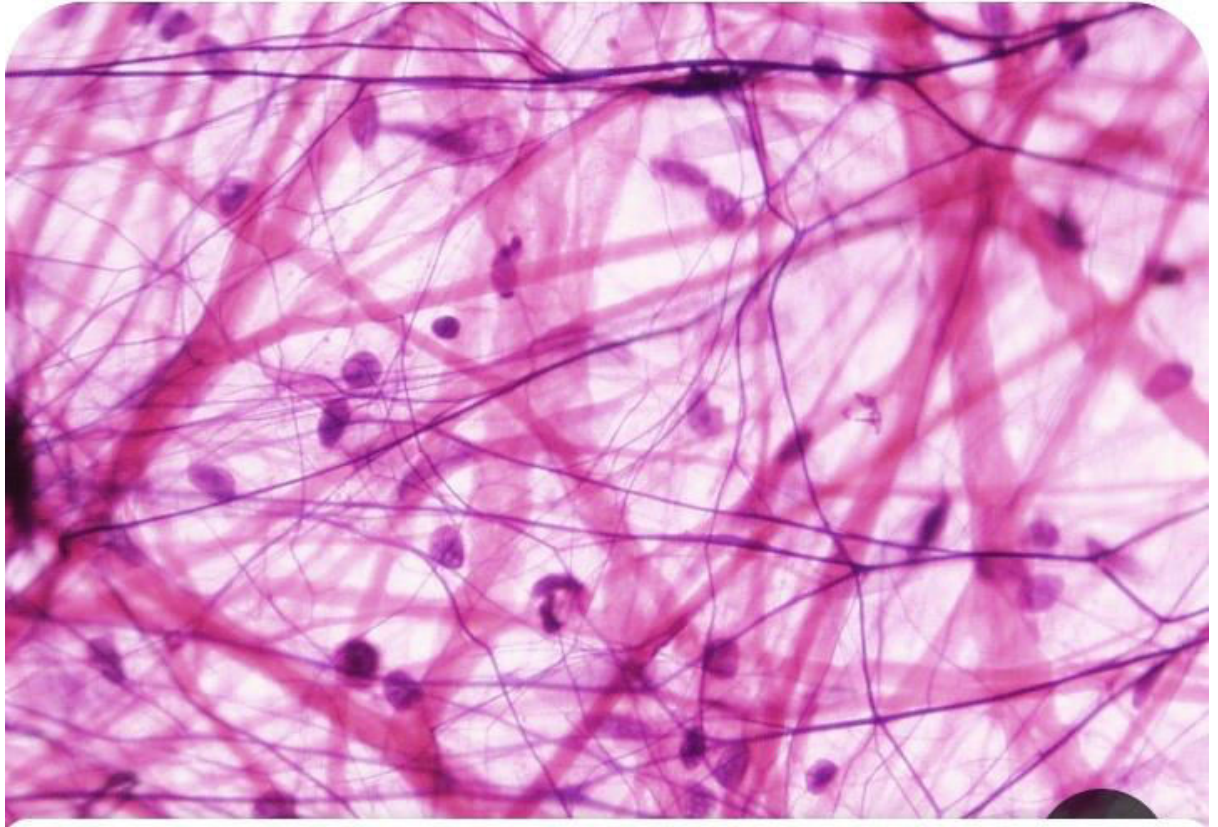
- It protect from injuries (squamous epithelium)
- It secretes enzymes and hormones (glandular epithelium)
- It helps in excretion (cuboidal epithelium)
- It helps in secretion and absorption (columnar epithelium)

CONNECTIVE TISSUE

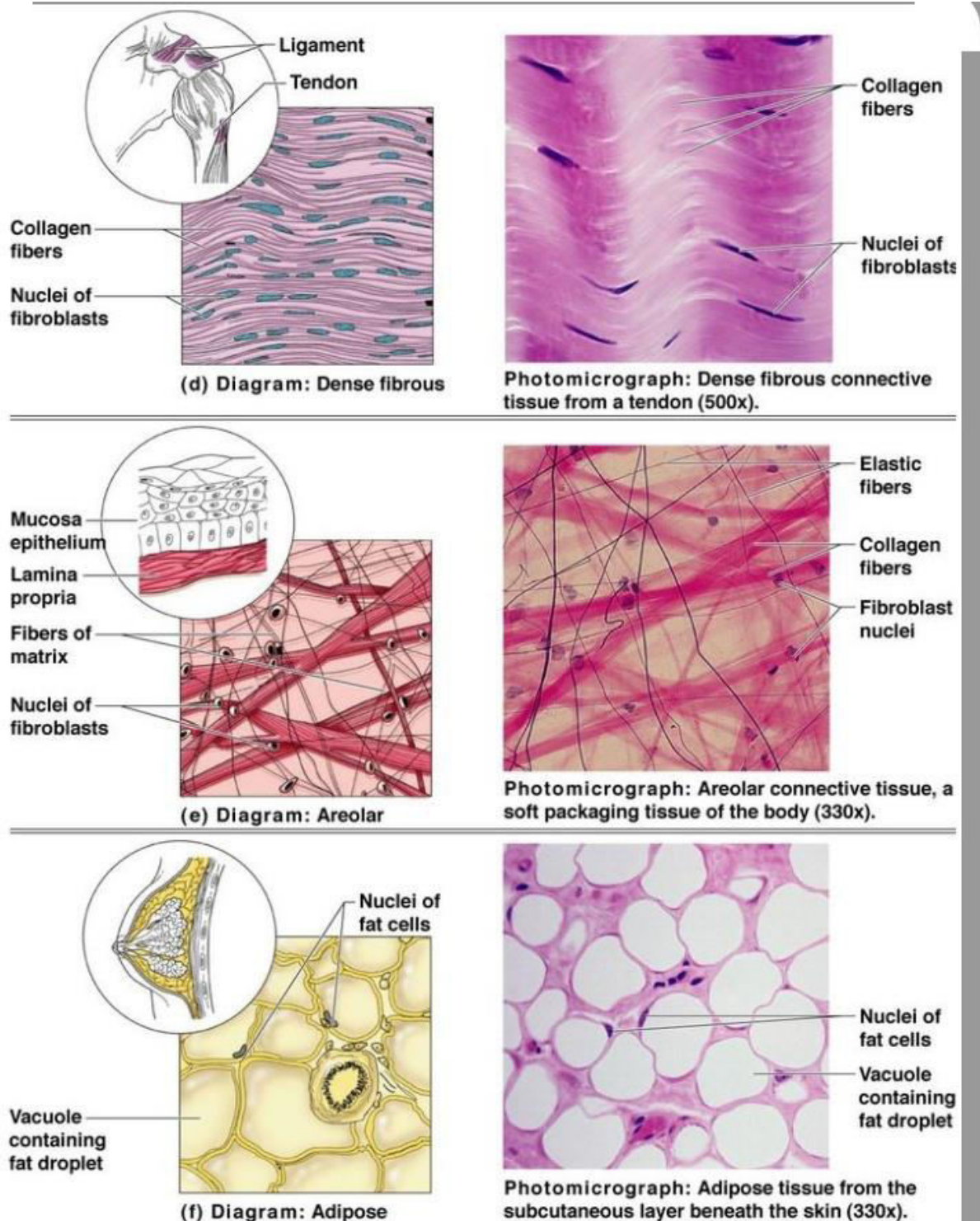
Connective tissues connects or binds together different organs or different parts of an organ. They contain an inter-cellular substance called “Matrix”. It helps in binding and

supporting the cells. Blood is also a connective tissue. Other than blood, the connective tissues are classified into six types, namely,

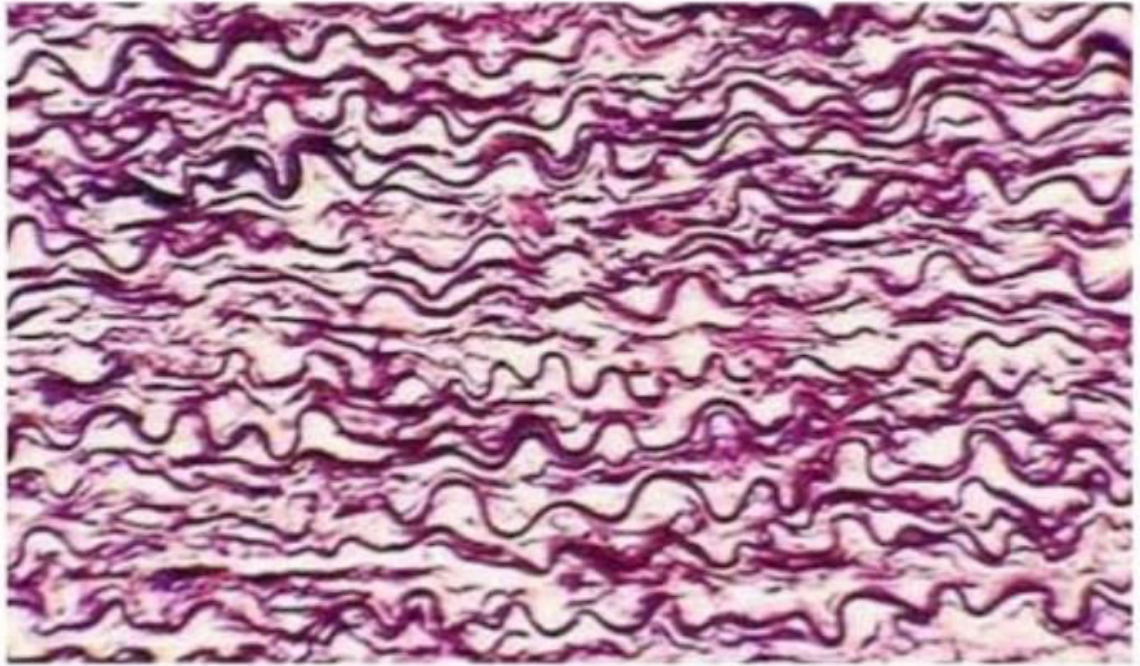
1. Areolar tissue
2. Fibrous tissue
3. Elastic tissue
4. Adipose tissue
5. Cartilage
6. Bone



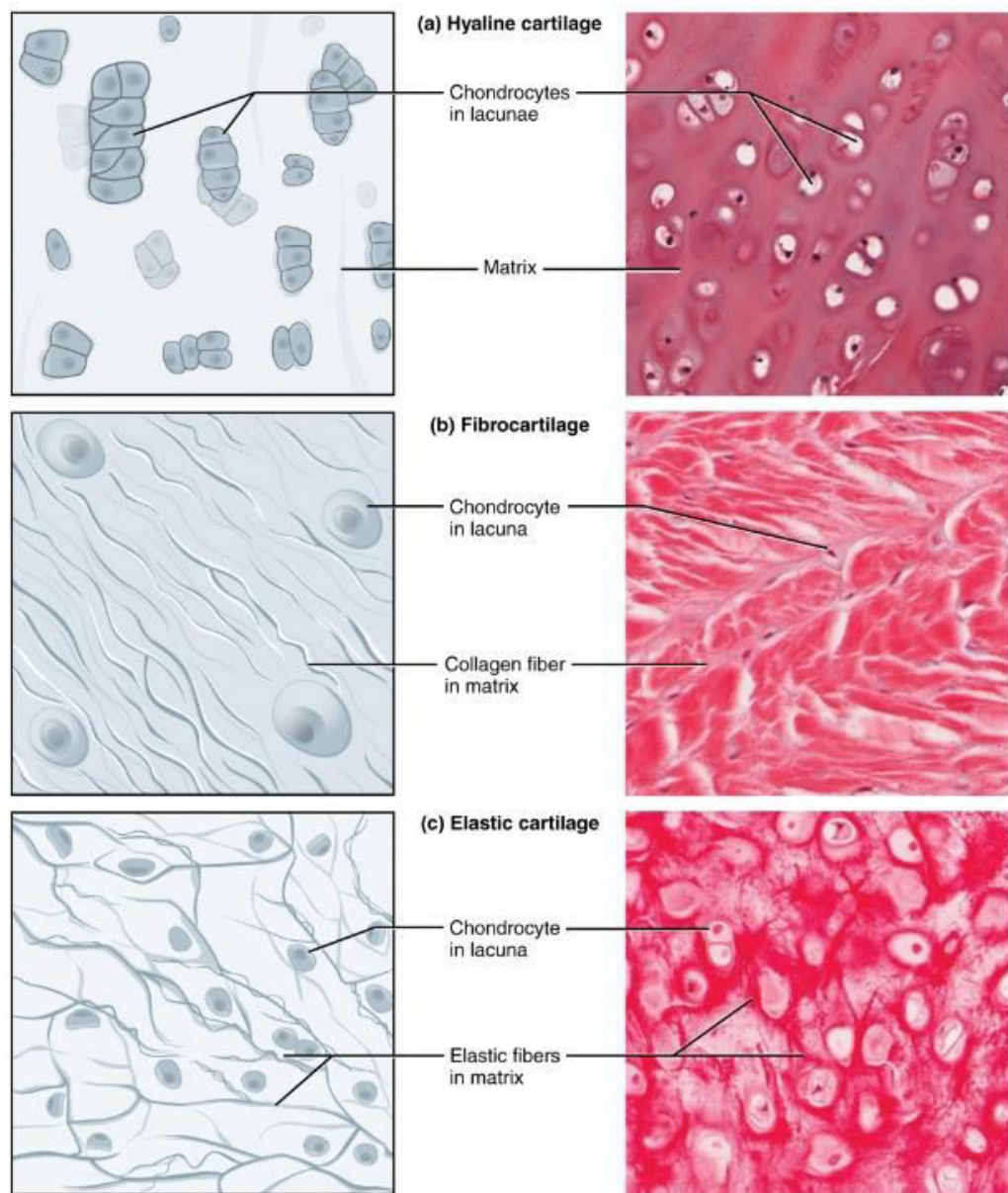
1. Areolar tissue: - It is a loose irregular and most widely distributed connective tissue in the body. It connects the skin to the underlying structures. It also fills unoccupied spaces between organs. It has a jelly like matrix. Within this matrix, white and yellow fibres are seen. Areolar tissue is found between muscles, blood vessels and nerves. Fibroblasts are present in between the fibres.



2. **Fibrous tissue:-** The tissue has compactly arranged collagen fibres which are dense and the interspace is greatly reduced. Fibres are arranged in bundles. Few cells, called as Fibrocytes are arranged in between the fibres. This type of tissue is found in tendons, ligaments, dermis of the skin etc.
3. **Elastic tissue:-** It is yellow in colour and contains more number of elastic fibres. The fibres are elastic in nature and branch at the ends. It is found in tissues where strength is required with elasticity. They are found in larynx, trachea, bronchi, aorta, arteries etc.



4. Adipose tissue:- It contains large, rounded cells and the cytoplasm is loaded with fat. The nucleus of the cells is pushed towards the periphery (at one end). They are found in subcutaneous tissue of skin, kidneys etc.
5. Cartilage:- It is a modified connective tissue. It is strong and tough. It has a tough, gelatinous and elastic matrix formed of "chondrin". The cells are more or less round and lie in groups of four embedded in the matrix. There are 3 types of cartilages namely:
Hyaline cartilage- In this cartilage, the matrix is solid, smooth and transparent. Fibres are absent. The tissue is bluish white in colour. It is found in trachea, larynx, tip of nose etc.



Elastic cartilage- The matrix is solid, filled with elastic fibres and lacunae of cells. It contains a network of branching and elastic fibres, which gives yellow colour to matrix. The tissue is present in epiglottis, ear pinna and blood vessel walls etc.

Fibro cartilage- This consists of dense masses of white collagen fibres in a matrix similar to hyaline cartilage. It is a tough, slightly flexible tissue found in inter-vertebral discs, on the rim of bony sockets of hip and shoulder joint.

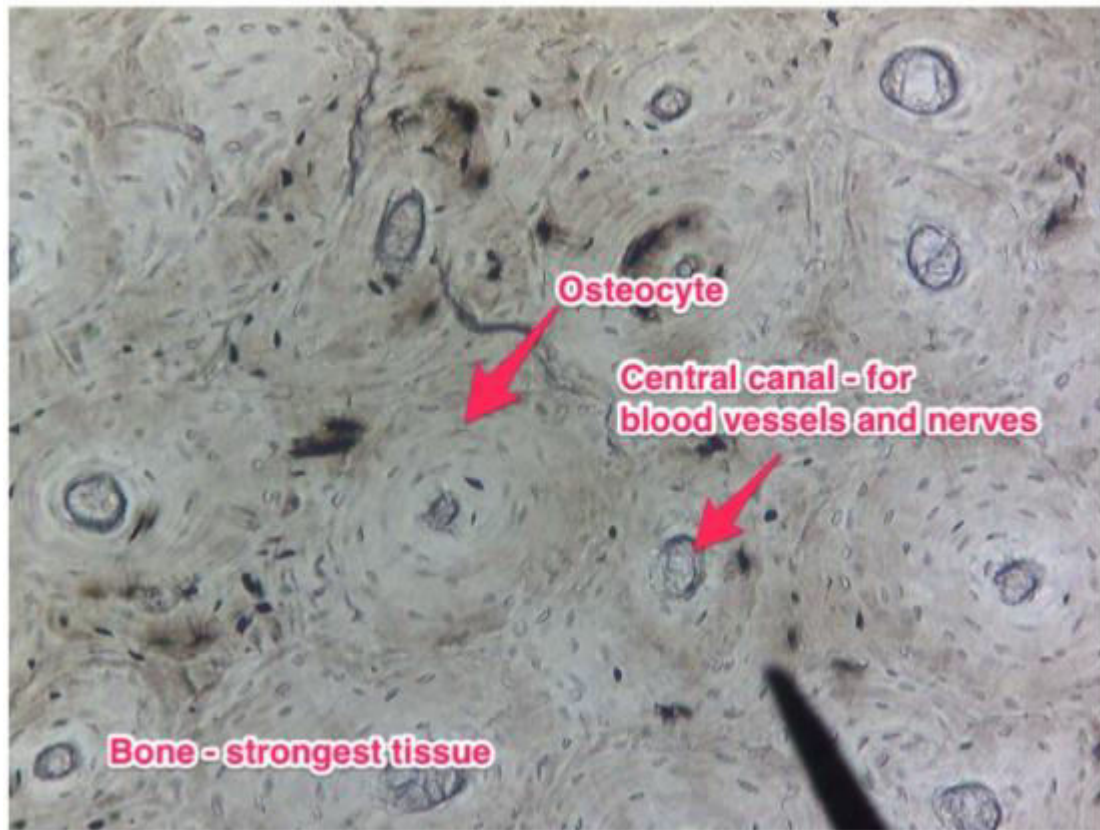
6. **Bone:-** bone is the hardest connective tissue. It contains a high concentration of salts like calcium phosphate and calcium carbonate. A bone generally consists of:

Periosteum is a membrane of fibrous tissue covering the surface of the bone.

Compact bone is a hard, dense substance found below the periosteum.

Cancellous or spongy bone is a porous tissue. It forms the interior of mature bone.

Bone marrow is a soft material which fills the hollow interior of a mature bone. It is of two types- Yellow bone marrow which is a fatty tissue and Red bone marrow from which the cells of body are developed.



Microscopic structure of bone:- The cross-section of a compact bone under the microscope shows the following structures:

- a) A central “Haversian Canal” which contains nerves, blood vessels and lymphatics.
- b) “Lamellae” which are layers of bone deposited in concentric circles around the haversian canal.
- c) “Lacunae” which are the spaces between the lamellae.
- d) “Canaliculi” which are minute canals. They join the lamellae and also communicate with the central haversian canal.

Functions of connective tissues:

- 1. Areolar tissue connects different kinds of tissues.
- 2. Fibrous tissue found in tendons, connects muscles and bones.
- 3. Elastic tissue permits enlargement due to elasticity.
- 4. Adipose tissue prevents loss of body heat and they maintain proper position of the organs.

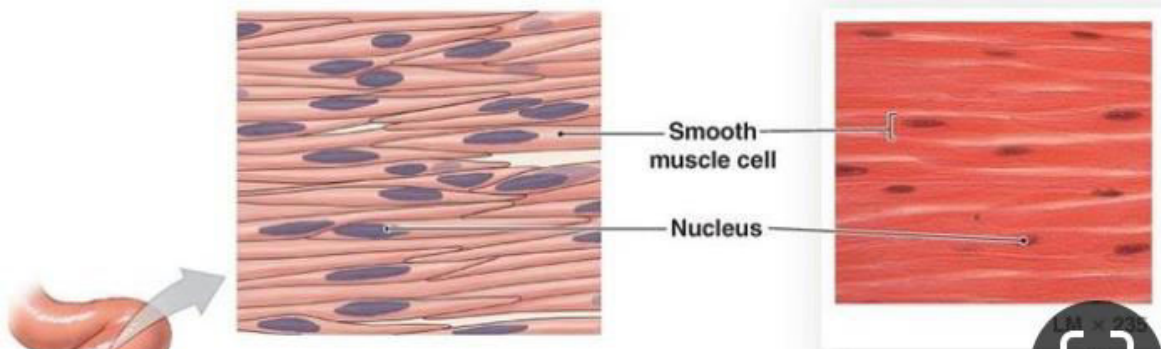
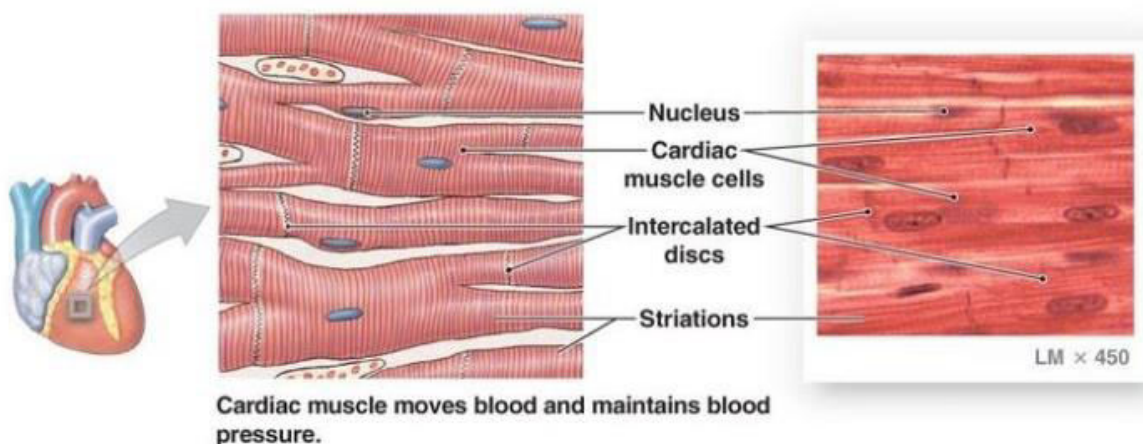
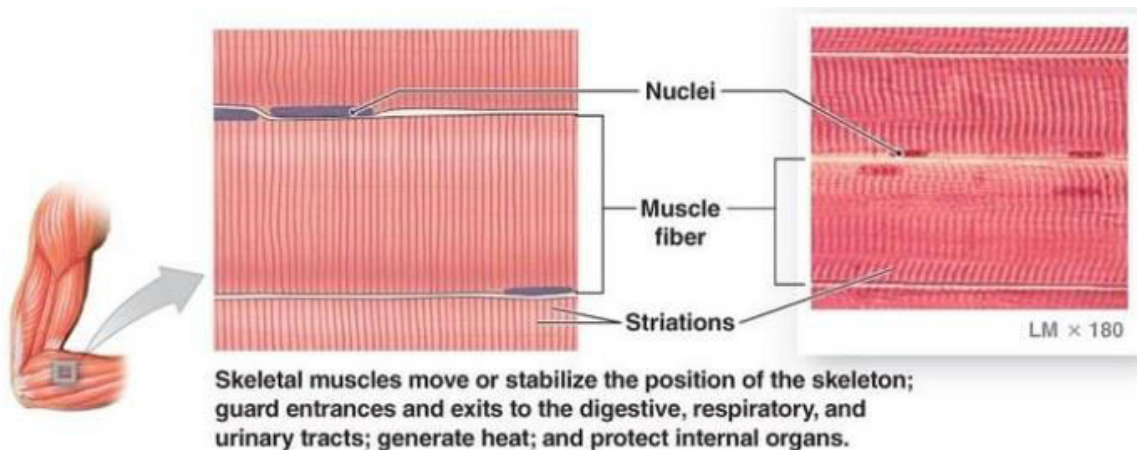
5. Bone gives shape to the body and protects the vital organs like brain, heart etc.

MUSCULAR TISSUE

Muscle is a tissue where its cells are long and thread like. Muscles have power of contraction. Contraction of muscles produce movements. Muscle cells are known as "Muscle fibres". All muscles contain bundle of fibres which run in the same direction.

Muscles are classified into 3 types. They are:

1. Voluntary/striated/skeletal muscle
 2. Involuntary/non-striated/smooth muscle
 3. Cardiac muscle
-
1. Striated muscle: - They are under the control of our will. They are long and cylindrical muscle fibres. The muscle contains unbranched fibres called "Myofibrils". These fibres contain distinct striations (stripes) and no. of nuclei in the peripheries. Each fibre is surrounded by a thin membrane called "Sarcolemma". They are found in the flesh of limbs and trunk. E.g. Deltoid, biceps and triceps muscles.
 2. Smooth muscle: - they are not controlled by our will. They are long and spindle shaped muscle fibres with a central nucleus. The fibres are non-striated and not covered by any membrane or sarcolemma. But they are joined together by a loose connective tissue. These muscles are controlled by ANS. They are present in the internal organs like stomach, intestine, uterus, blood vessels etc.
 3. Cardiac muscle: - they are found only in the heart. The muscle fibres are short, cylindrical and branched. They are not under the control of one's will. The striations seen in the cardiac muscle are vague. The nucleus is centrally placed. The cardiac muscle contracts automatically in a rhythmic manner. The ends of each cardiac cell and their branches are in very loose contact with the cells and branches of nearby cells. These joints are called "Intercalated discs".



DIFFERENCES BETWEEN VOLUNTARY AND INVOLUNTARY MUSCLES

S.No.	Voluntary muscle	Involuntary muscle
1.	The cells are long and cylindrical in shape.	Spindle shaped cells are present.
2.	They are under the control of our will.	They are not under the control of our will.
3.	Striations are present.	Striations are absent
4.	They have many nuclei, present peripherally.	They have a single, centrally located nucleus.
5.	They are present in the muscles of limbs and trunk.	They are present in the walls of visceral organs.

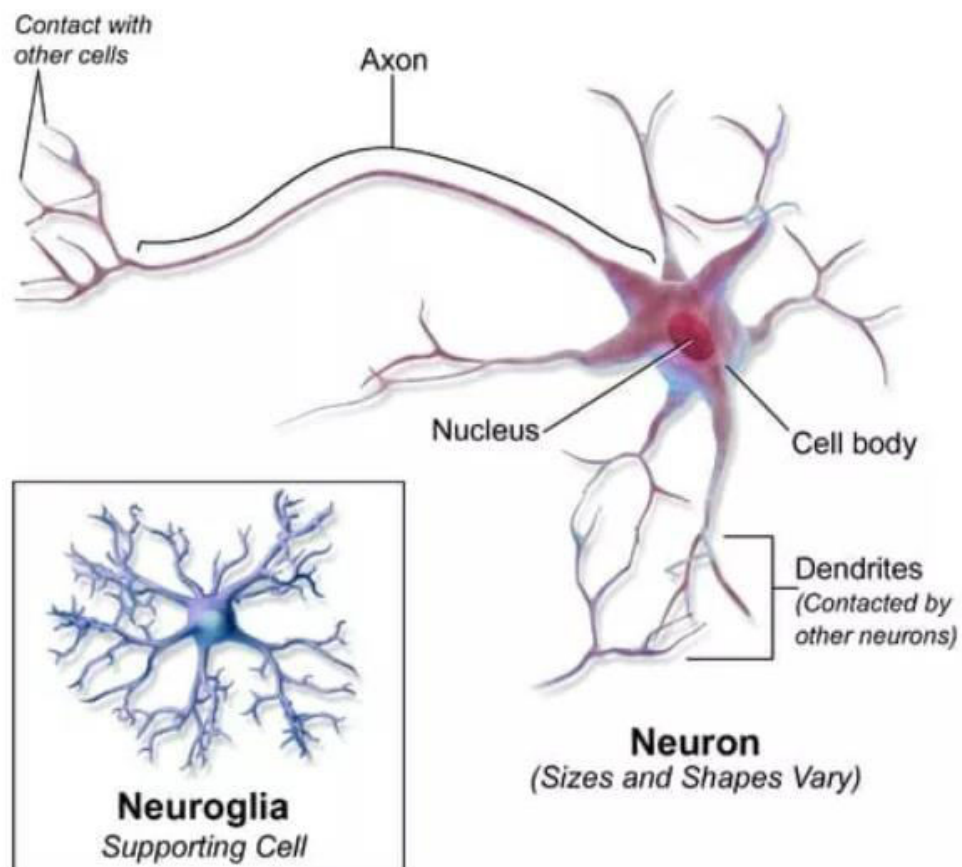
Functions of muscular tissue:

- Voluntary muscle provides voluntary movements of the body. They produce heat during contraction and keep the body warm.
- Involuntary muscle brings about the movement of food in the alimentary canal, movement of blood, urine etc.
- Cardiac muscle brings about the contractions of the heart.

NERVOUS TISSUE

Nervous tissue is composed of three kinds of matter.

1. “Gray matter” which forms the nerve cells or Neurons.
2. “White matter” which forms the nerve fibres.
3. “Neuroglia” is a supporting nervous connective tissue. It holds together and supports nerve cells and fibres.



Neural Tissue

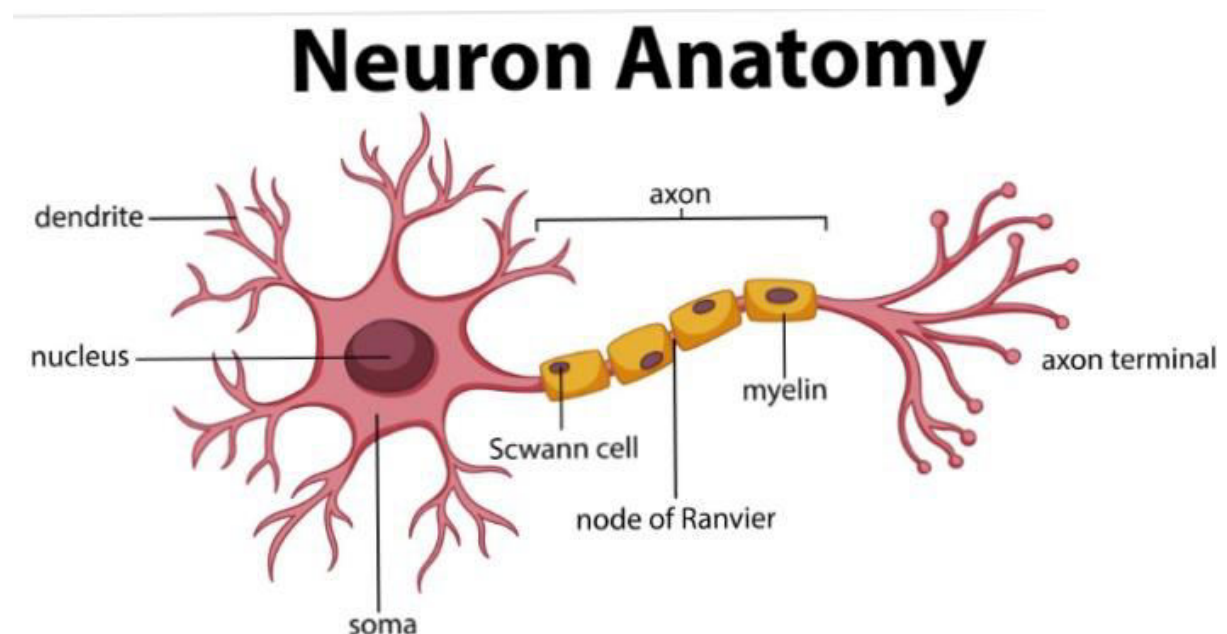
A nerve fibre possesses the power of conductivity and excitability. It is capable of receiving and responding to stimuli from some outside agent. A 'stimulus' may be mechanical, electrical, chemical or physical. This gives rise to an impulse which is conducted along the nerve fibres.

NERVE FIBRES: - Also called as “Neurons”. A neuron is the fundamental unit of nervous system. It consists of: Nerve cell body, Axon and Dendrites.

Nerve cell body- Each nerve cell body is irregular in shape, has a nucleus and a highly specialised protoplasm. The axon and dendrites arise from the nerve cell body.

Axon- It is the longest structure of the neuron. It is the main fibre which arises from the nerve cell body. It may or may not be covered by a Myelin Sheath. This sheath is covered by the neurilemma. The impulses pass through the axon in one direction only.

Dendrites- these are short fibres and many in number arising from the body of nerve cell. They conduct impulses towards the cell body. Synapse is the junction between axon of one neuron and dendrite of another neuron.



Nerve cells are present in the gray matter of cerebrum, spinal cord, ganglia etc. the nerves containing the medullary sheath are called as “Medullated nerves”. They contain nuclei. The nerves which do not contain this sheath are called as Non-medullated nerves.

Functions of Nervous tissue or nerve cells:

1. Sensory neurons conduct impulses from sense organs to the brain and spinal cord.
2. Motor neurons conduct impulses from the brain and spinal cord to the muscles, glands, organs etc.

REFERENCES:-

1. Maheshwari B. Uma, Sampath K; "A testbook of Human Anatomy & Physiology", published by Birla Publications Pvt. Ltd., tenth edition, page no. 1 to 19.
2. [En.m.wikipedia.org](https://en.m.wikipedia.org)