

!!JAY AMBE!!

3. ELEMENTARY TISSUES OF THE BODY

PREPARED BY

**DR. NAITIK D. TRIVEDI,
M. PHARM, PH. D**

**LECTURER AT GOVERNMENT AIDED,
A. R. COLLEGE OF PHARMACY & G. H. PATEL INSTITUTE OF
PHARMACY, VALLABH VIDYANAGAR, ANAND.**

Mobile: +91 - 9924567864

E-mail: mastermindnaitik@gmail.com

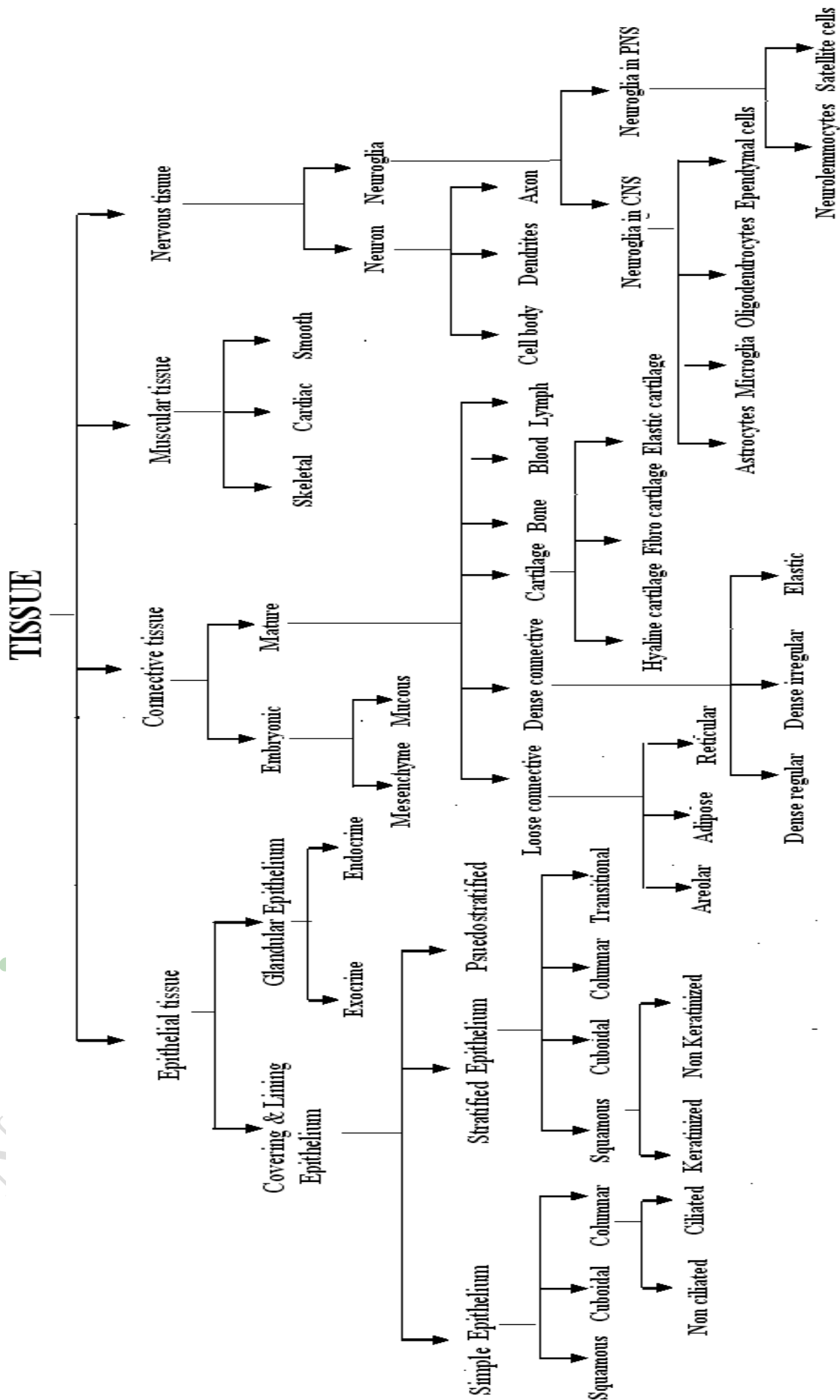
&

**DR. UPAMA N. TRIVEDI,
M. PHARM, PH. D**

**ASSOCIATE PROFESSOR & HoD (Pharm.D),
INDUBHAI PATEL COLLEGE OF PHARMACY AND RESEARCH
CENTRE, DHARMAJ.**

E-mail: ups.aasthu@gmail.com

3. ELEMENTRY TISSUE OF THE BODY



3. ELEMENTARY TISSUE OF THE BODY

!! JAY AMBE!!

ELEMENTARY TISSUES OF THE BODY

DEFINITION: “It is a group of cells that usually have common embryonic origin and function together for special activities.”

INTRODUCTION:

Body tissues can be classified in to four principal types according to their function and structure:

1) Epithelia tissue:

- It cover body surface, lines hollow organs, body cavity and ducts.
- It also forms glands.

2) Connective tissue:

- It provides the supports and protects the body and its organs.
- It binds organs together.
- It store energy as reserved fat.
- It provides immunity.

3) Muscle tissue:

- It is responsible for movements and generation of force.

4) Nervous tissue:

- It initiates and transmits action potential (Nerves Impulse) that helps coordinate body activities.

During the embryonic developments zygote produces three germ layers:

- a) Ectoderm
- b) Endoderm and
- c) Mesoderm.

These three are embryonic tissue from which all tissues and organs of the body develop.

- Epithelium tissue derived from all three layers.
- Connective tissue and most muscles tissue derived from mesoderm.
- Nervous tissue derived from ectoderm

Four types of tissue



Connective tissue



Epithelial tissue



Muscle tissue



Nervous tissue

3. ELEMENTARY TISSUE OF THE BODY

► EPITHELIAL TISSUE ◀

General feature of epithelial tissue:

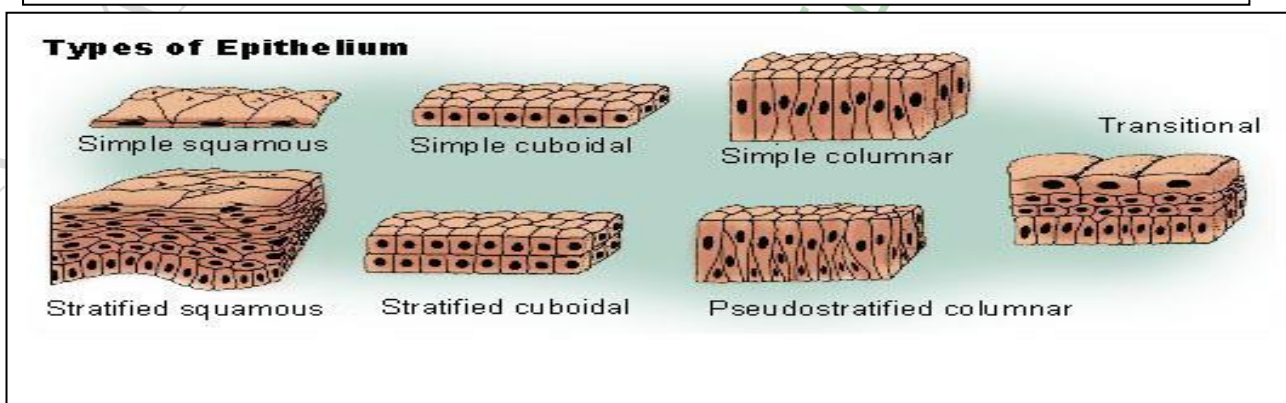
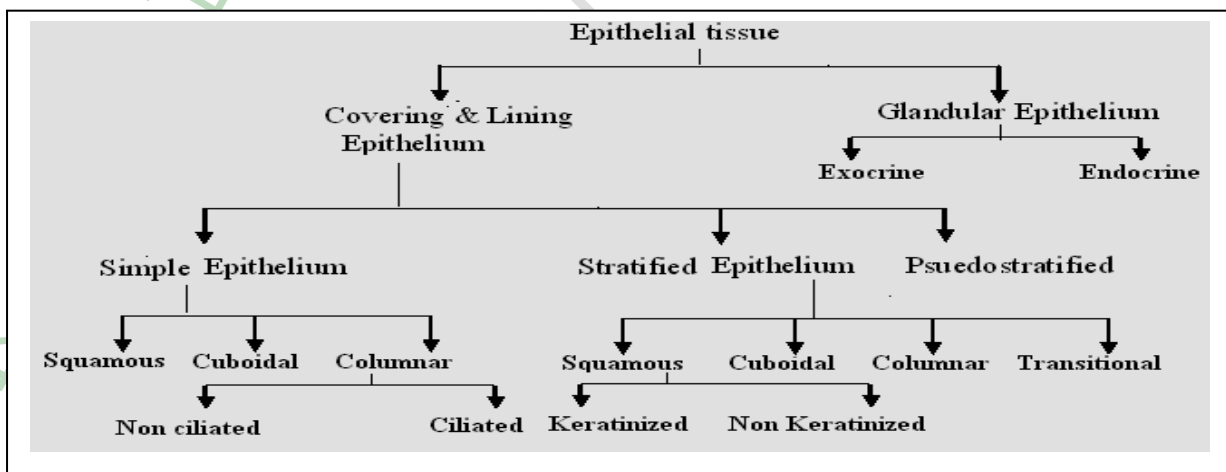
- It consists large and closely packed cells with little extracellular material between adjacent cells.
- Its arrangement produces continuous sheet which is either single layer or multi layers.
- Epithelial cells have an apical (free) surface, which produces the lining of internal organ so it is exposed to a body cavity.
- The basal surface of the epithelial cells is attached with the basement membrane.
- Epithelial cells are avascular so the blood vessels that supply to nutrients and move wastes are located in adjacent connective tissue.
- The material exchanges take place in epithelium by the diffusion process.
- Epithelial cells are adhered to connective tissue which holds the epithelium in their position.
- The junction between the epithelium and connective tissue is known as basement membrane which consists two layers.

1) **Basal lamina:** contains collagen, laminin and proteoglycan secreted by epithelium.

2) **Reticular lamina:** This contains reticular fibers, fibronectin and glycoproteins.

- The main function of epithelium is protection, filtration, lubrication, secretion, digestion, absorption, transportation, sensory reception and reproduction.

➤ CLASSIFICATION OF EPITHELIAL TISSUE:



3. ELEMENTARY TISSUE OF THE BODY

1) Covering and lining epithelium:

- It forms the superficial layer of the skin and some internal organ.
- It forms the inner lining of blood vessels, ducts, body cavities and the interior of the respiratory, digestive, urinary and reproductive systems.

➤ According to **arrangements of layer** it is classified in to three types:

I) Simple epithelium:

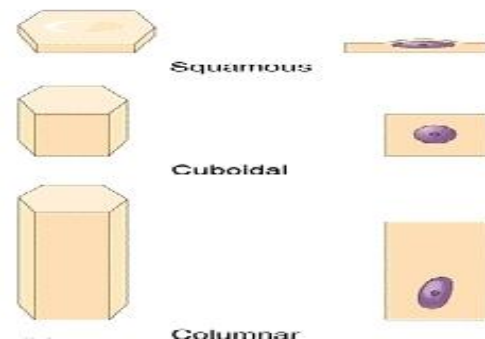
- It is a single layer of cells.
- It founds where activities such as diffusion, osmosis, filtration, secretion and absorption occurs.

✓ According to **shape of the cells** it is further divided in to:

Epithelium is named according to shape, structure, and arrangement of cells.

- squamous - thin and flat cells
- cuboidal - cube shaped cells
- columnar - column shaped cells
- simple - single layer of cells
- stratified - multilayered cells
- pseudostratified - false stratified
- transitional - stretchable
- ciliated - cells possess cilia

Epithelial Shapes



a) Simple squamous Epithelium:

- It is a flat in shape.
- This consists of a single layer of flat cells.
- Their surfaces look like as tiles floor.
- The nucleolus of each cell is oval or spherical shape.
- It follows the osmosis or diffusion process.
- It found in the body where the little wear and tear is found.
- It lines the hearts, blood vessels and lymphatic vessels and also forms the wall of capillary known as endothelium.
- The cells which form the epithelial layer of serous membrane are known as mesothelium.

b) Simple cuboidal epithelium:

- It is cuboidal in shape.
- The nucleus of the cell is round.
- The main function of this tissue is absorption and secretion.

c) Simple columnar epithelium:

- It is rectangular in shape.
- It consist oval nuclei.
- It mainly produces two forms:

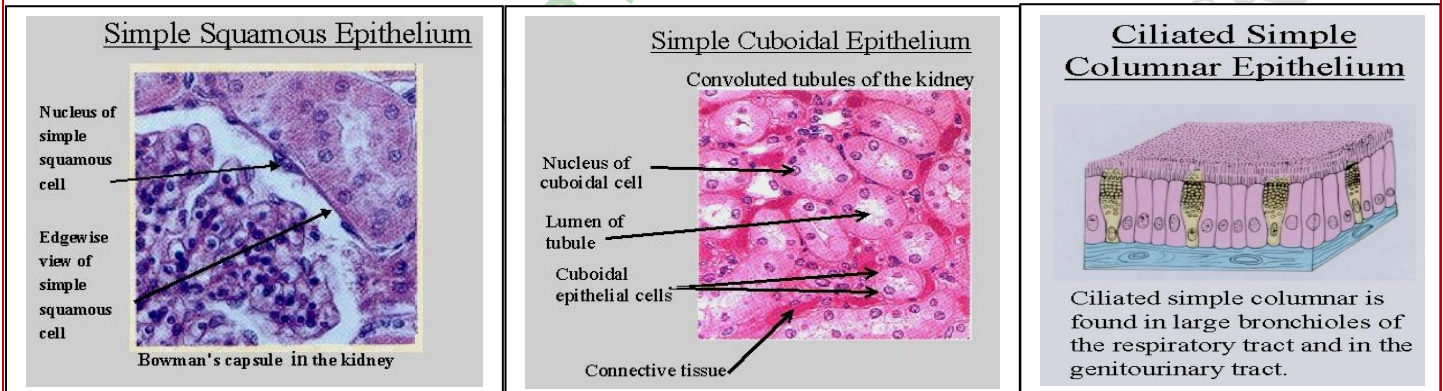
3. ELEMENTRY TISSUE OF THE BODY

i) Nonciliated simple columnar epithelium:

- It contains microvilli and goblet cells.
- Microvilli produce the microscopic fingerlike structure which increases the surface area of plasma membrane.
- Goblet cells secrete mucus which is slightly sticky fluid.

ii) Ciliated simple columnar cells:

- Cilia produces the hairlike processes means it's movement gives the motion.
- Eg.: Secondary oocyte moves toward fallopian tube for fertilization by or fertile ovum down the uterin tube to the uterus help of cilia.



II) Stratified Epithelium:

- It contains two or more layers.
- It protects the underline tissues from where there is considerable tear and wear.

➤ According to **shape it can** be further classified as under:

a) Stratified squemous epithelium:

- In the superficial layer this type of cells are flat whereas in the deep layers cells vary in shape from cuboidal to columnar.
- Here, the basal cells continuously replicate by cell division and produce new cells which shift upward toward the surface.
- So, they loss their blood supply from the connective tissue so they become dehydrated, shrunken and harder.
- These processes replace old cells by new cells.

✓ **Stratified squemous epithelium exists in two forms:**

i) Keratinized stratified squemous epithelium:

- It consist tough layer of keratin.
- It is a protein which is water proof and prevents us from several bacterial attacks.

ii) Non keratinized stratified squemous epithelium:

- It does not contain keratin and remains moist.

b) Stratified cuboidal epithelium:

- It consist two or more layer of cells in which superficial cells are cube-shaped.
- Duct of adult sweat glands and part of male urethra consist these cells.
- The main function is to give protection.

3. ELEMENTARY TISSUE OF THE BODY

c) Stratified columnar epithelium:

- It consists several layers of polyhedral cells.
- Only the superficial cells are columnar.
- Conjunctiva of eye, anal mucous membrane, urethra consist these cells.
- It gives protection and secretion.

c) Transitional epithelium:

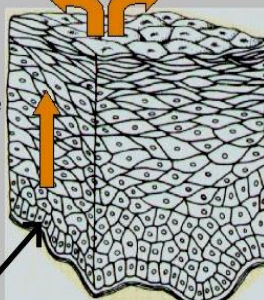
- Its appearance is variable mainly it depends either it is stretched or relaxed.
- It lines the urinary bladder and portion of ureters and urethra.

Stratified Squamous Epithelium

old cells exfoliate from surface

cells move up from below

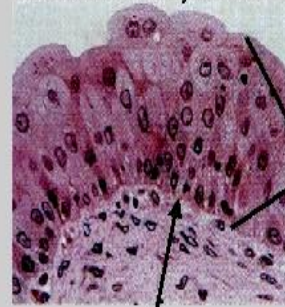
Basal layer undergoes mitosis



Stratified squamous epithelium forms the outer layer or **epidermis** of the skin. Skin is found as the organ of the integument and also as the lining of mucous membranes in the oral cavity, esophagus, anus and vagina. Internal skin is **non-keratinized**, while the external **keratinized** skin has layers of cells impregnated with keratin and other protective and waterproofing substances.

Transitional Epithelium in the Urinary Tract

Wall of the urinary bladder



basement membrane

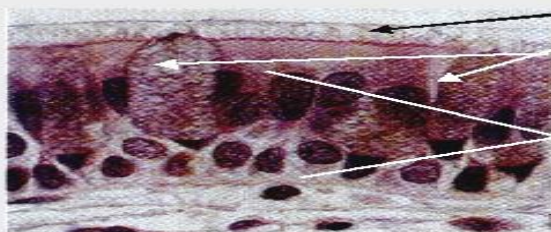
Non-distended transitional epithelium. Distension reduces the number of cell layers.

Transitional epithelium lines the renal calyces, the ureters, the urinary bladder, and a portion of the urethra.

III) Pseudostratified epithelium:

- It contains mixture of cells in one layer.
- It produces multilayered tissue like appearance because all cells nuclei not reach to the surface of cells. These type of cells either ciliated or secrete mucus.

Pseudostratified Ciliated Columnar Epithelium in the respiratory tract



Cilia

Goblet cells secrete mucus

Pseudostratified epithelial cells

Cilia beat in wave-like fashion to move mucus along the lining surface, carrying dust and particulates up and out of the respiratory tract

3. ELEMENTRY TISSUE OF THE BODY

2) Glandular epithelium:

- These types of cells are mainly present in gland the main function of these cells is secretion.

➤ **There are two types of secretory gland:**

a) exocrine:

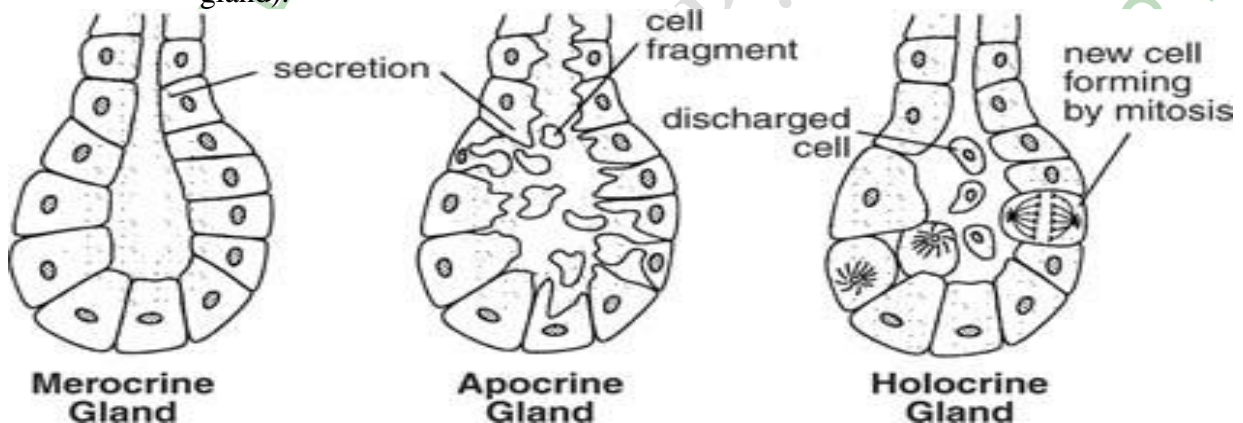
- It secrete their product in to duct.
- The secretion includes mucus, perspiration, skin oil, ear wax and digestive enzymes.
- Eg.: Sweat glands, Salivary glands.

✓ **According to structure it is divided into two classes:**

- unicellular
- multi cellular

✓ **According to function it is divided in to:**

- Merocrine glands:** it forms the secretory product and discharge it. (salivary glands)
- Apocrine glands:** accumulate their secretory product on their apical surface. (mammary glands).
- Holocrine glands:** accumulate secretory product in cytosol. (Sebaceous gland).



b) endocrine glands:

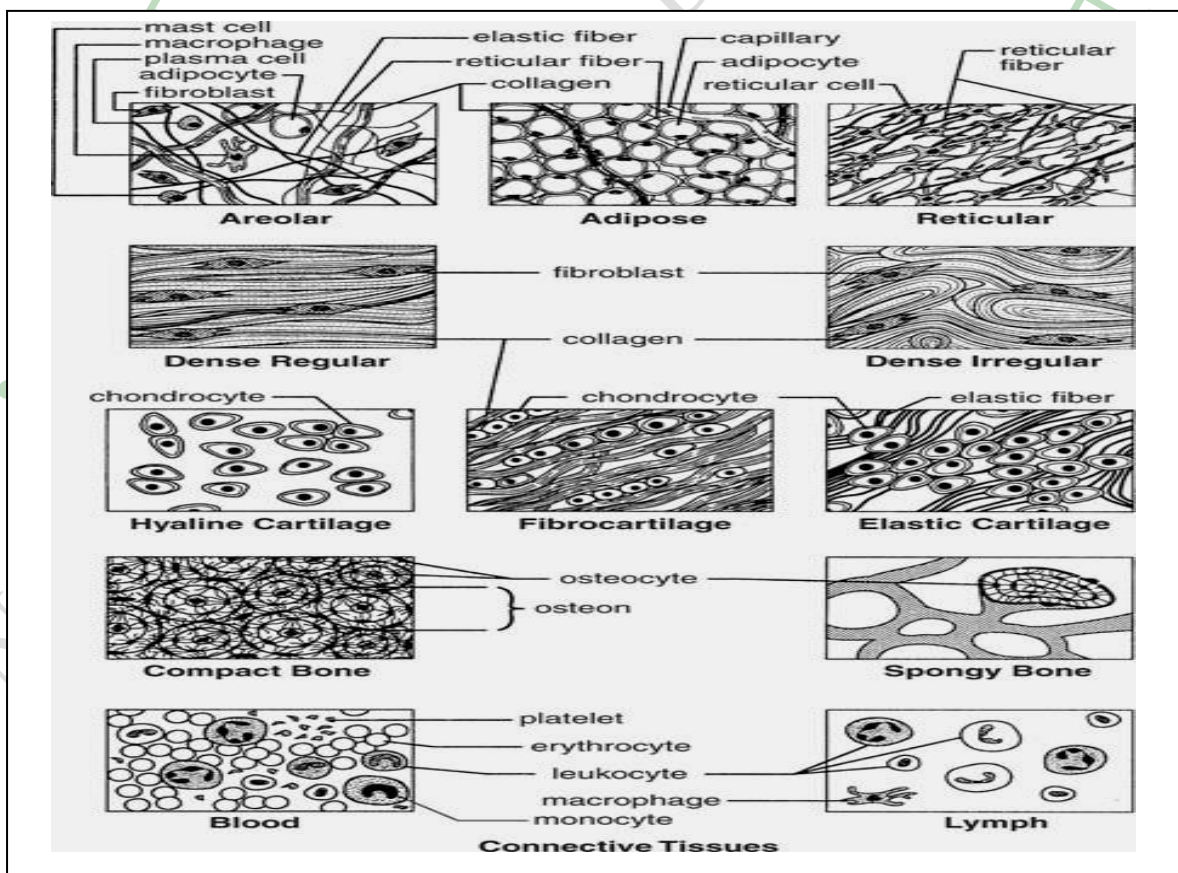
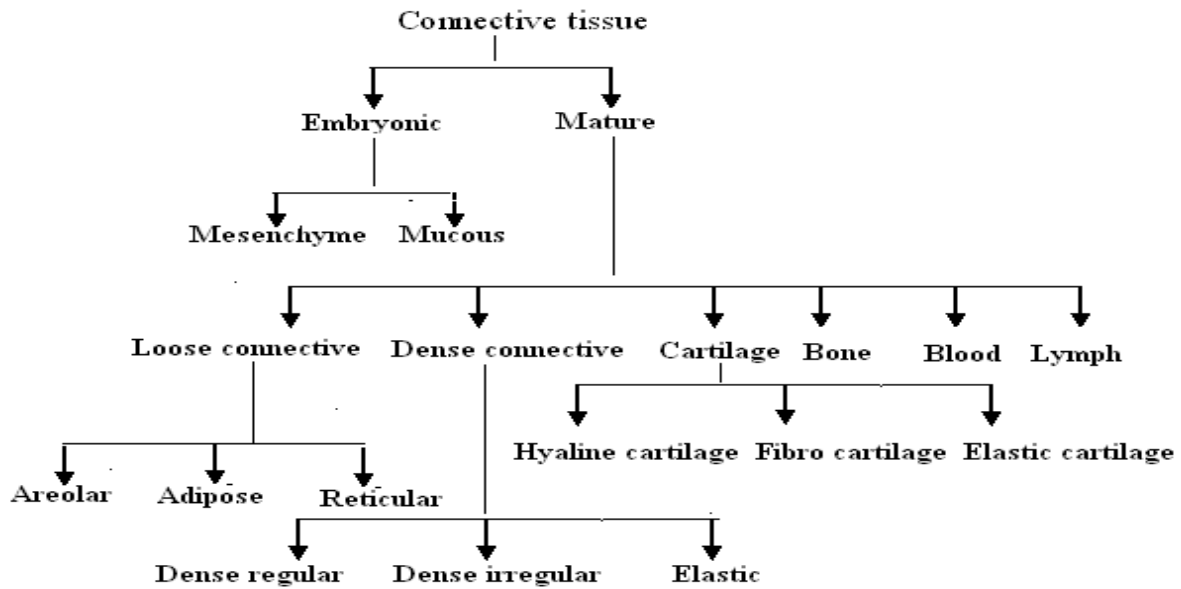
- Secret product in to blood.
- Eg.: endocrine glands, pituitary glands, thyroid gland.

3. ELEMENTARY TISSUE OF THE BODY

► CONNECTIVE TISSUE ◀

“It is the tissue which provide supports and strength of the other body tissues, protect and insulate internal organs also it binds the other cells or tissue together.

Classification of Connective tissue



3. ELEMENTARY TISSUE OF THE BODY

CONNECTIVE TISSUE			
Tissue Type	Cells Present	Fibers Present	Matrix Characteristics
Loose Connective Tissue:			
Areolar	Fibroblasts macrophages adipocytes mast cells plasma cells	Collagen elastic reticular	Loosely arranged fibers in gelatinous ground substance
Adipose	Adipocytes	Reticular collagen	Closely packed cells with a small amount of gelatinous ground substance; stores fat
Reticular	Reticular cells	Reticular	Loosely arranged fibers in gelatinous ground substance
Dense Connective Tissue:			
Dense regular	Fibroblasts	Collagen (some elastic)	Parallel-arranged bundles of fibers with few cells and little ground substance; great tensile strength
Dense irregular	Fibroblasts	Collagen (some elastic)	Irregularly arranged bundles of fibers with few cells and little ground substance; high tensile strength
Cartilage:			
Hyaline (gristle)	Chondrocytes	Collagen (some elastic)	Limited ground substance; dense, semisolid matrix
Fibrocartilage	Chondrocytes	Collagen (some elastic)	Limited ground intermediate between hyaline cartilage and dense connective tissue
Elastic	Chondrocytes	Elastic	Limited ground substance; flexible but firm matrix
Bone (osseous tissue):			
Compact (dense)	Osteoblasts osteocytes	Collagen	Rigid, calcified ground substance with (canal systems)
Spongy (cancellous)	Osteoblasts osteocytes	Collagen	Rigid, calcified ground substance (no osteons)
Blood & Lymph (vascular tissue):			
Blood	Erythrocytes leukocytes thrombocytes	"Fibers" are soluble proteins that form during clotting	"Matrix" is liquid blood plasma
Lymph	Leukocytes	"Fibers" are soluble liquid proteins that form during clotting	"Matrix" is blood plasma

3. ELEMENTRY TISSUE OF THE BODY

1) Embryonic Connective Tissue:

- It is primarily present in the embryo or fetus.
- The term embryo used for developing human from fertilization through the first two months of pregnancy.
- The term Fetus used for developing human from the third month of pregnancy to birth.
- **It is mainly divided in to two types:**
 - a) **Mesenchyme:**
 - It forms all kind of connective tissue.
 - It is composed by irregularly shaped mesenchymal cells, a semisolid ground substance and delicate reticular fibers.
 - b) **Mucous connective tissue:**
 - It is primarily found in umbilical cord of the fetus.
 - It also forms from the Mesenchyme.
 - It contains star shaped cells, a more viscous and jelly like ground substance and collagen fibers.

2) Mature connective tissue:

- It exists in new born baby.
- It, form from Mesenchyme and does not change after the birth.
- **It is sub divided in to:**

a) Loose connective tissue:

- Here the fibers are loosely woven.

It consists:

i) Areolar connective tissue:

- It is the most widely connective tissue.
- It consist several types of cells like as fibroblasts, macrophages, plasma cells, mast cells and a few white blood cells.
- All three type of fibers – collagens, elastic and reticular.
- The fluid, semi fluids or gelatinous ground substance contains hyluronic acid, chondroitin sulfate, dermatan sulfate and keratin sulfate.
- It located in subcutaneous layer of skin, papillary region of dermis of skin, mucous membrane, blood vessels, nerve and around body organ.
- It provides strength, elasticity and support.

ii) Adipose tissue:

- The cells of adipose tissue contain a fatty substance and they are large and round in shape.
- It consists adipocytes cells that are specialized to store triglyceride (Fat and oil). It is located in subcutaneous layer of skin, around heart, kidney, yellow bone marrow of long bone and behind the eye ball sockets.
- The main functions of these tissues are reduce heat loss through skin, serve as energy reserve, provides supports and protection.

iii) Reticular connective tissue:

- It consists fine interlacing reticular fibers and reticular fibers.
- It forms the framework of certain organs and helps to bind together certain cells.

3. ELEMENTARY TISSUE OF THE BODY

b) Dense Connective tissue:

- It consists more numerous, thicker and densely packed fibers.
- It further divided in to:

i) Dense regular connective tissue:

- Here, the bundle of collagen fibers regular and parallel arrangements which gives great strength.
- The tissue is silvery white and tough.

ii) Dense irregular connective tissue:

- It consists collagen fibers that are usually irregularly arranged.
- Heart valves, pericardium consists this type of tissue.

iii) Elastic connective tissue:

- It consist branched elastic fibers.
- It provides strength and can be stretched.

c) Cartilage:

- It is hard but elastic in nature.
- It consist elastic and collagen fibers.

✓ There are three types of cartilage:

i) Hyaline cartilage:

- It provides the supports and flexibility, reduce the friction and absorb the shock at joints.
- Cartilage cells are large, arranged in group of 2 and 4.
- It's mostly found in bones and ribs.

ii) Fibro cartilage:

- It consists large cells which are arranged in groups.
- The collagen fibers are more than hyaline cartilage.
- It is found in inner vertebral discs, in knee joints.

iii) Elastic Cartilage:

- It consist elastic fiber in matrix.
- Mostly found in laryngeal cartilages, epiglottis and in Eustachian tube.

d) Bone tissue:

- Together cartilage, joints and bone comprise the skeletal system.
- It is the hardest connective tissue.
- It consists two types of bone cells osteoclasts and osteoblasts.
- Bone tissue is mainly divided in to two types compact bone and spongy bone.
- Long bones are the examples of compact bones and spongy bones are flats at the end of long bones.
- The main function of bones are it provide support, protection, assists in movement, site of blood cell production, storage of energy.

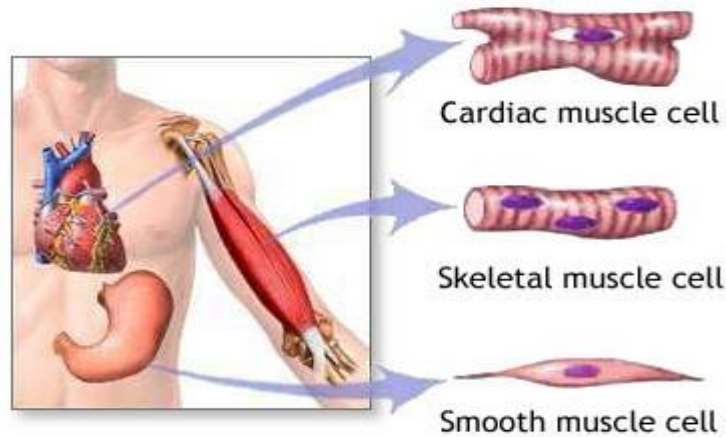
e) Blood (Vascular tissue):

- Blood is a liquid connective tissue.
- It consist mainly formed elements like platelets, leukocytes, erythrocytes and plasma consist protein, water and other solutes.
- The man function of blood tissue is transportation, regulation and protection.

3. ELEMENTRY TISSUE OF THE BODY

► MUSCLES TISSUE ◀

- Muscles cells consist fibers that are beautifully constructed and generate force for constriction.
- As a result of constriction power it provides motion, maintains posture and generates heat.



➤ Based on location, function and structure it is **divided in to three types:**

1) Skeletal muscles tissue:

- Its name shows its location means attached to bone.
- It is strait in nature, fiber contain light and dark band which is known as striation which are visible in microscope.
- A single skeletal muscles fiber is very long, roughly cylindrical in shape and has more than one nuclei which are periphery of the cells.
- Skeletal muscles are voluntary in nature because it can be contracted and relaxed below the conscious level.

2) Cardiac muscles tissue:

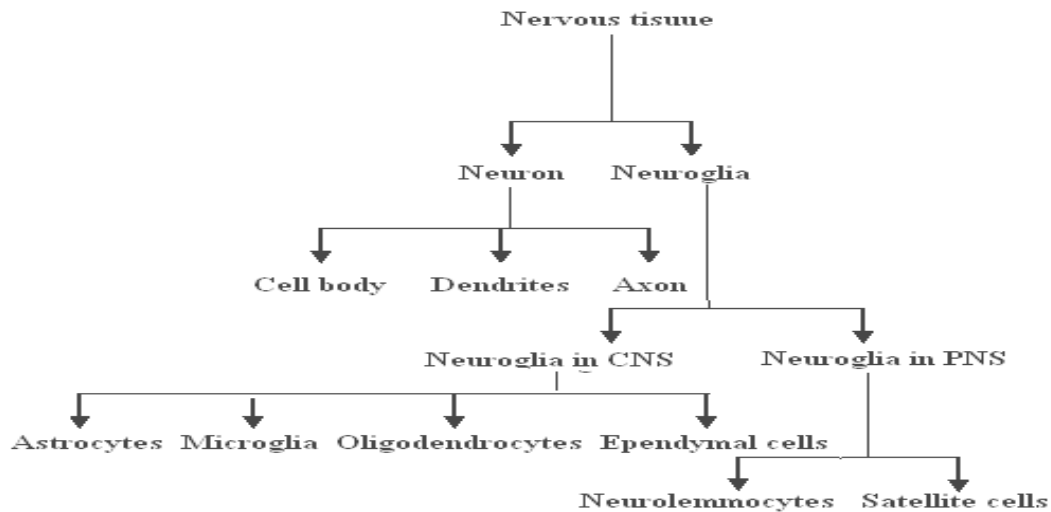
- They are in bulk form and produce wall of the heart.
- Like skeletal muscles it is striated but it is involuntary in nature means constriction in not under the control of conscious level.
- The fibers are branched and cross sections are squares in shape.
- Centrally it contain one nuclei and cardiac muscles fibers attached end to end by one another and the joint is known as intercalated disc which form welding like spot between cells.

3) smooth muscles tissue:

- It is located in the wall of hollow internal structures such as blood vessels, air ways to the lungs, intestines, gallbladders and urinary bladders.
- It provides help in break down of foods, elimination of wastage and move fluid and food through out body.
- It is involuntary in control.

3. ELEMENTARY TISSUE OF THE BODY

► NERVOUS TISSUE ◀



➤ It consist of the two principle kinds of cells

1) Neurons:

- ✓ The neurons consists of **three basic portion** :

a) Cell body:

- Cell body contains a nucleolus surrounded by cytoplasm that includes typical organelles such as lysosomes, mitochondria and Golgi complex.
- In the cytoplasm it also contains the **Chromatophilic substance (Nissl bodies)** which is ordinary arrangement of endoplasmic reticulum, the site of protein synthesis and it also contain **neurofibrils** which forms the cytoskeleton and provide the support and shape of the cells.

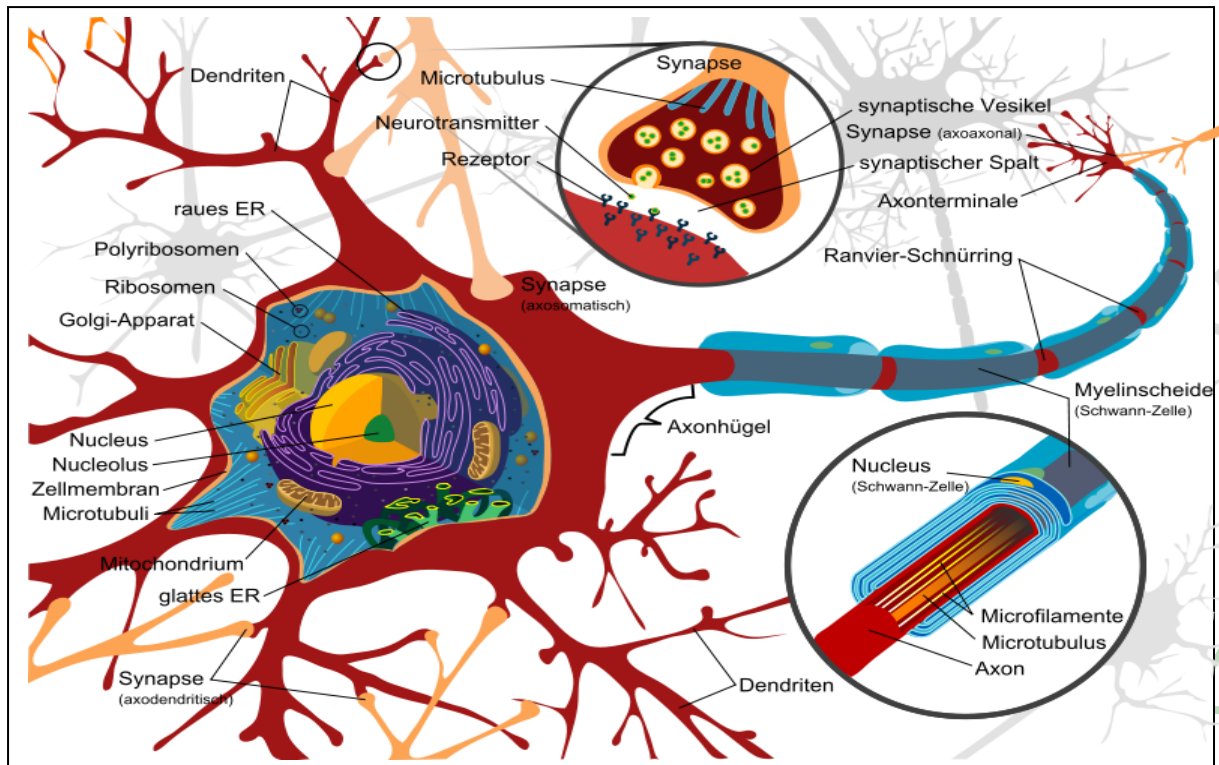
b) Dendrites:

- Dendrites are the receiving or input portion of the neurons.
- They are usually short, tapering and highly branched.
- Usually dendrites are not myelinated.
- Their cytoplasm contains chromatophilic substance, mitochondria and other organelles.

c) Axon:

- It is a long, thin and cylindrical in shape.
- It is joined with cell body by axon hillock.
- The first portion of axon is known as initial segment where the nerves impulse are arise.
- It also contains mitochondria, microtubules and neurofibrils but no rough endoplasmic reticulum so it does not synthesize protein.
- Its cytoplasm known as axoplasm which is surrounded by membrane known as axolema.
- The side branch of axon is known as axon collaterals.
- At the end of axon it divides branch like structure known as axon terminals.
- The tip of some axon terminals swell in to bulb shaped known as synaptic end bulbs.

3. ELEMENTARY TISSUE OF THE BODY



➤ Classification of neurons:

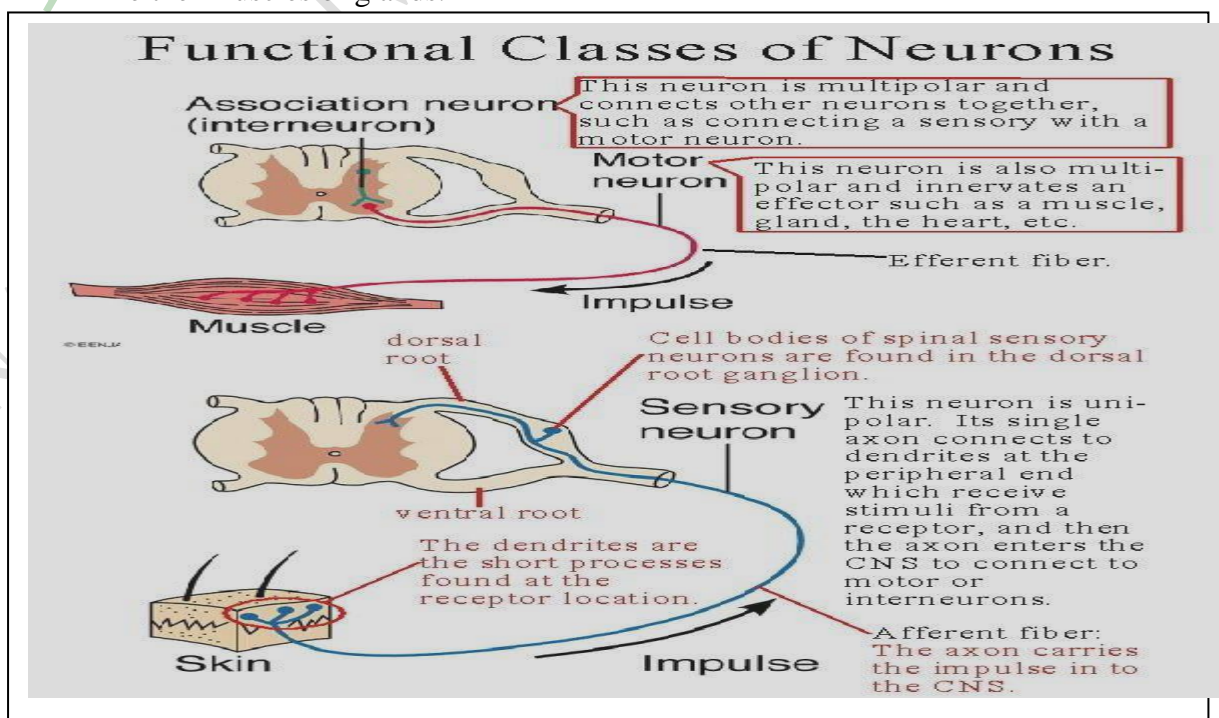
✓ According to functional classification it is divided in to:

i) Sensory neurons or afferent neurons:

- It transmits nerve impulse from receptors of skin, sense organ, muscles, and joints into the CNS.

ii) Motor or Efferent Neurons:

- It conveys motor nerve impulse from the CNS to the effectors which may be either muscles or glands.



3. ELEMENTARY TISSUE OF THE BODY

✓ According to structural it can be classified in to:

i) Multi polar neurons:

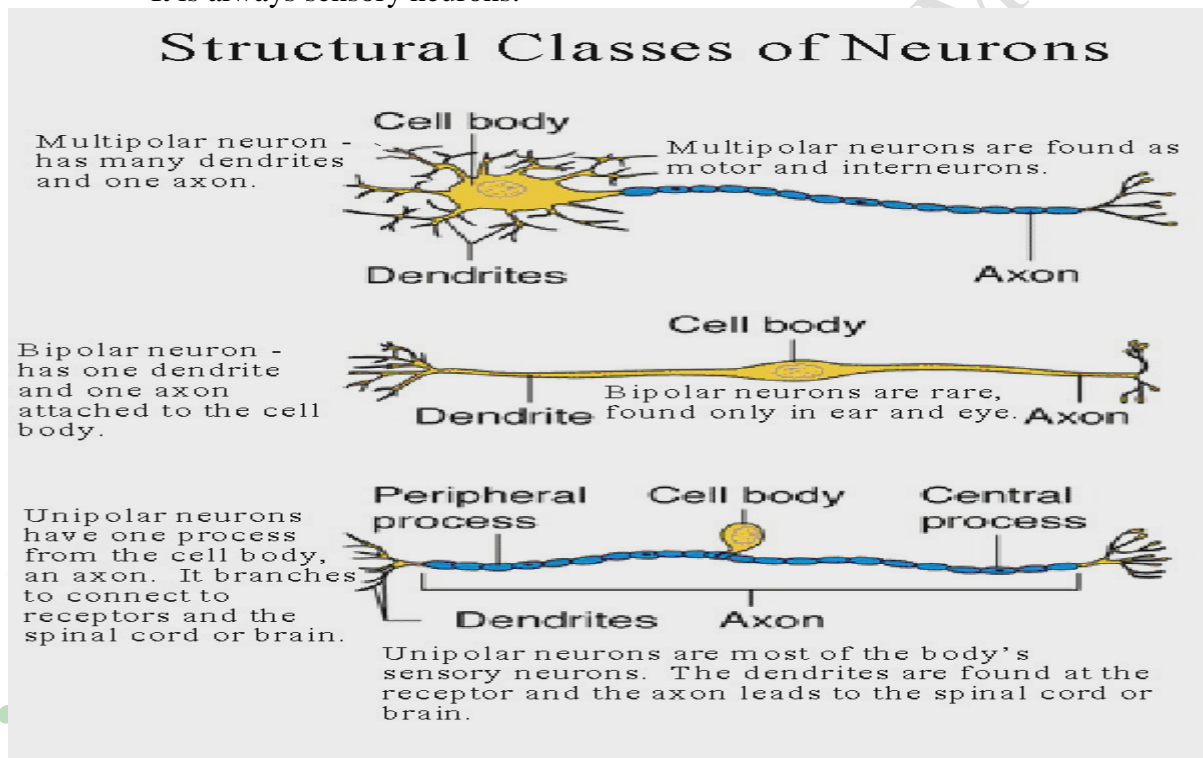
- It has several dendrites and one axon.
- Most neurons of brain and spinal cord are of this type.

ii) Bipolar neurons:

- It has one main dendrites and one axon.
- It is found in the eye, inner ear and olfactory areas of the brain.

iii) Unipolar neurons:

- It's originated as bipolar neurons in the embryo but during the development axon and body get fuse into a single process that divides in to two branch and consist one cell body.
- It is always sensory neurons.



2) Neuralgia:

- Neuroglia or glia fills about half of the CNS.
- Its have the glue like characteristics so it held nervous tissue together.
- Neuroglia are generally smaller than neurons.
- Neuroglia can multiply and divide in the mature nervous systems.

➤ Classification of Neuroglia:

- There are mainly six types of Neuroglia in which four astrocytes, oledodendrocytes, microglia and ependymal cells are **found in the CNS**.
- While neurolemmocytes (schwann cells) and satellite cells **found in peripheral nervous system**.

3. ELEMENTARY TISSUE OF THE BODY

a) Neuroglia found in CNS:

i) Astrocytes:

- They are star shaped.
- It produces the metabolism of neurotransmitters, maintain the proper balance of K^+ for generation of nerves impulse, and participate in brain development.
- It forms the blood brain barrier which regulates entry of substance in to the brain.

ii) Oligodendrocytes:

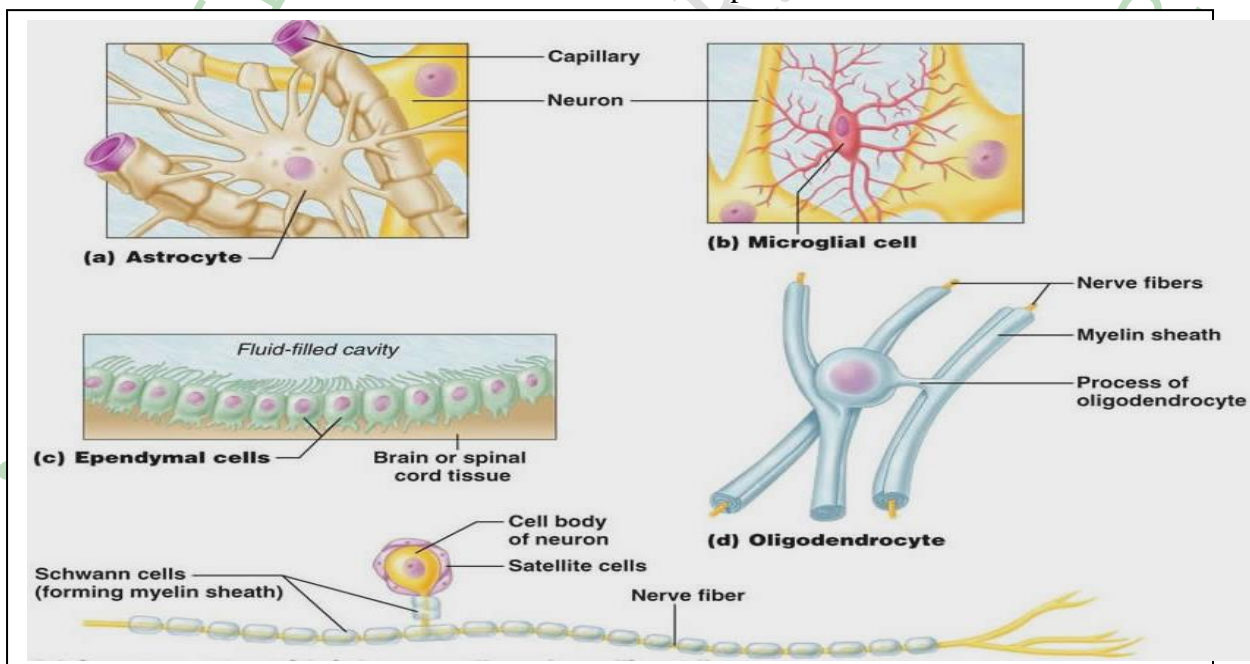
- It is the most common glial Cells in the CNS.
- It is smaller than astrocytes.
- They coil around neurons and produce supporting structure to the neurons.
- It produces protein and lipid covering known as myelin sheath.

iii) Microglia:

- It is the small and phagocytic Neuroglia derived from monocytes.
- They protect the CNS from the disease by engulfing invading microbes and clearing away debris from dead cells.

iv) Ependymal:

- It is the epithelial cells.
- The cells have different shaped from cuboidal to columnar and many are ciliated.
- Ependymal cells line the fluid filled ventricles, cavity within the brain and central canal means a narrow passage from spinal cord.
- It forms the fluid which is known as cerebrospinal fluids.



b) Neuroglia found in peripheral nervous system:

i) Neurolemmocytes (schwann cells):

- Each cell produces myelin sheath around PNS Neurons.

ii) Satellite cells:

- Which supports neurons in ganglia in PNS.

3. ELEMENTARY TISSUE OF THE BODY

Myelination:

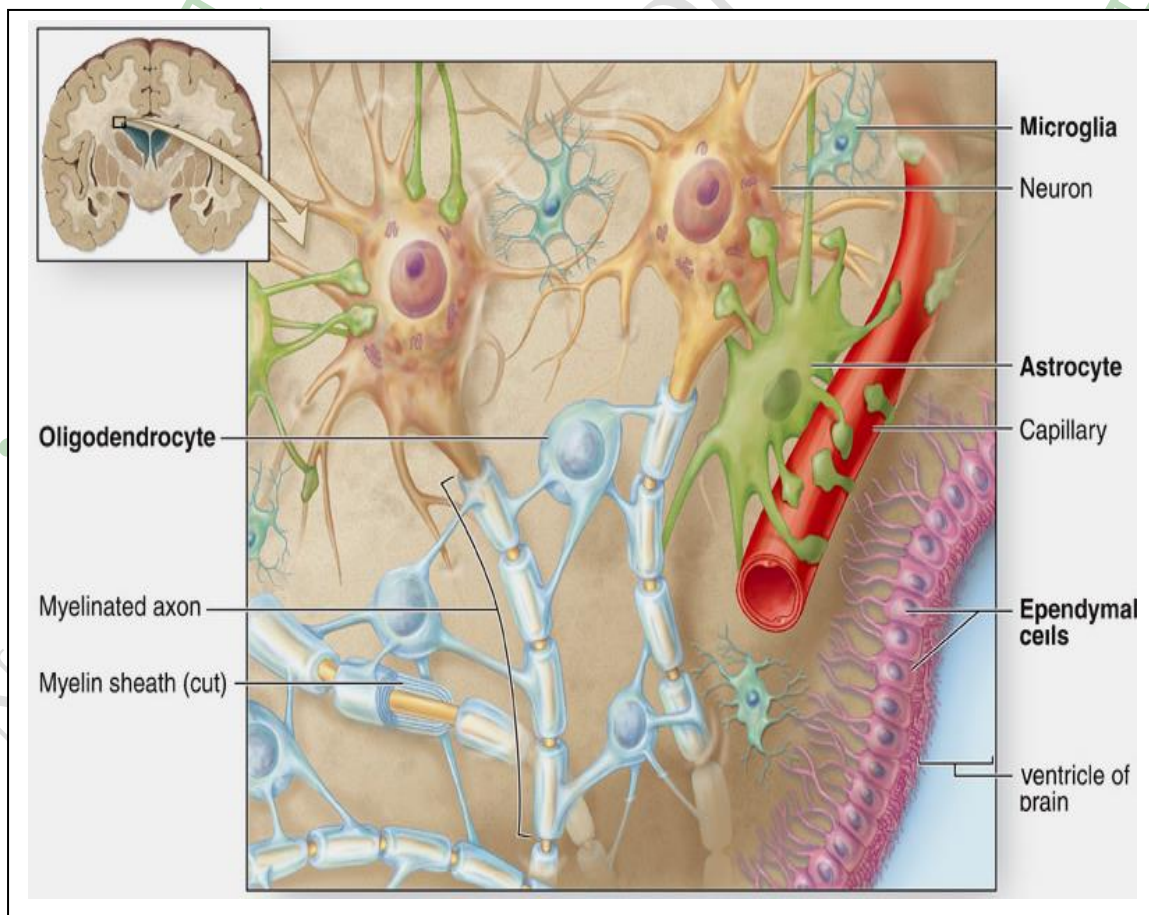
- The axons of most mammalian neurons are surrounded by a multilayered lipids and proteins of Neuroglia and this covering is known as myelin sheath and the axon with such a covering are said to be a myelinated.
- Whereas those without covering are known as unmyelinated axon.
- The sheath electrically insulates the axon of neurons and increases the speed of nerve impulse conduction.

Two types of Neuroglia produce myelin sheath:

a) Neurolemmocytes in PNS.

b) Oligodendrocytes in CNS.

- Myelination and unmyelination produce Grey matter and white matter in brain and spinal cord.
- White matter refers to aggregations of myelinated process from many neurons. The whites colour of myelin gives white matter.
- The grey matters of nervous system contain either neuron cell bodies, dendrites and axon terminals or bundles of unmyelinated axons and Neuroglia.
- In spinal cord the white matter surrounds inner core of gray matter shaped like a butterfly or the letter H.
- In the brain grey matter surrounds the outer region while white matter surround inner region of brain exactly opposite to spinal cord.



3. ELEMENTRY TISSUE OF THE BODY

➤ **Function of Nervous tissue:**

a) Sensory function:

- It sense certain changes both within body (the internal environment) such as stretching of your stomach or increase the acidity and out side the body (the external environment) such as rain drop landing on your arm or the aroma of rose.

b) Integrative Function:

- It analyzes the sensory information, store some aspect and make some decision regarding appropriate behavior.

c) Motor function:

- It may respond to stimuli by initiating muscular contraction or glandular secretion.

IMPORTANT QUESTION:

1. Write a short note on epithelial tissue.
2. Write a short note on Muscular tissue.
3. Explain the function of muscular tissue.
4. What is tissue? Classify it and Write a note on Nervous tissue.
5. Classify the connective tissue and explain the dense connective tissue.
6. Draw the neat labeled diagram of neurons and explain it.

“EVERYONE THINKS OF CHANGING THE WORLD, BUT NO ONE
THINKS OF CHANGING HIMSELF”

► **GOOD LUCK** ◄