



SNS COLLEGE OF TECHNOLOGY (AN AUTONOMOUS INSTITUTION)

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Department of Biomedical Engineering

Course Name: 23BMT201 Human Anatomy & Physiology

I Year : II Semester

Topic : UNIT 1- Tissues

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TISSUES

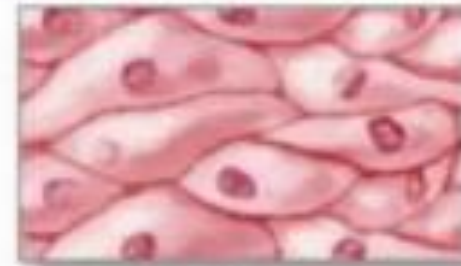
Human body is made up of four basic tissues: epithelial tissue, connective tissue, muscular tissue and nervous tissue.



Four types of tissue



Connective tissue



Epithelial tissue



Muscle tissue



Nervous tissue

TISSUES

Epithelial tissue

A. Simple epithelium

- i. Squamous
- ii. Cuboidal
- iii. Columnar
- iv. Pseudostratified

B. Stratified epithelium

- i. Transitional
- ii. Stratified squamous non-keratinized
- iii. Stratified squamous keratinized

Connective tissue

Cells

- a. i. Fibroblasts
- ii. Fibrocytes
- b. Adipose /fat cells
- c. Plasma cells
- d. Mast cells
- e. Macrophages
- f. Leucocytes
- g. Pigment cells
- h. Mesenchymal cells

Fibres

- i. Collagen fibres
- ii. Elastic fibres
- iii. Reticular fibres

Muscular tissue

- i. Skeletal muscles
- ii. Smooth muscles
- iii. Cardiac muscles

Nervous tissue

- i. Central nervous system
- ii. Peripheral nervous system
- iii. Autonomic nervous system

EPITHELIAL TISSUE

Epithelial tissue lines the external & internal surfaces of our body. It can be ectodermal, mesodermal and endodermal in origin.

Function:

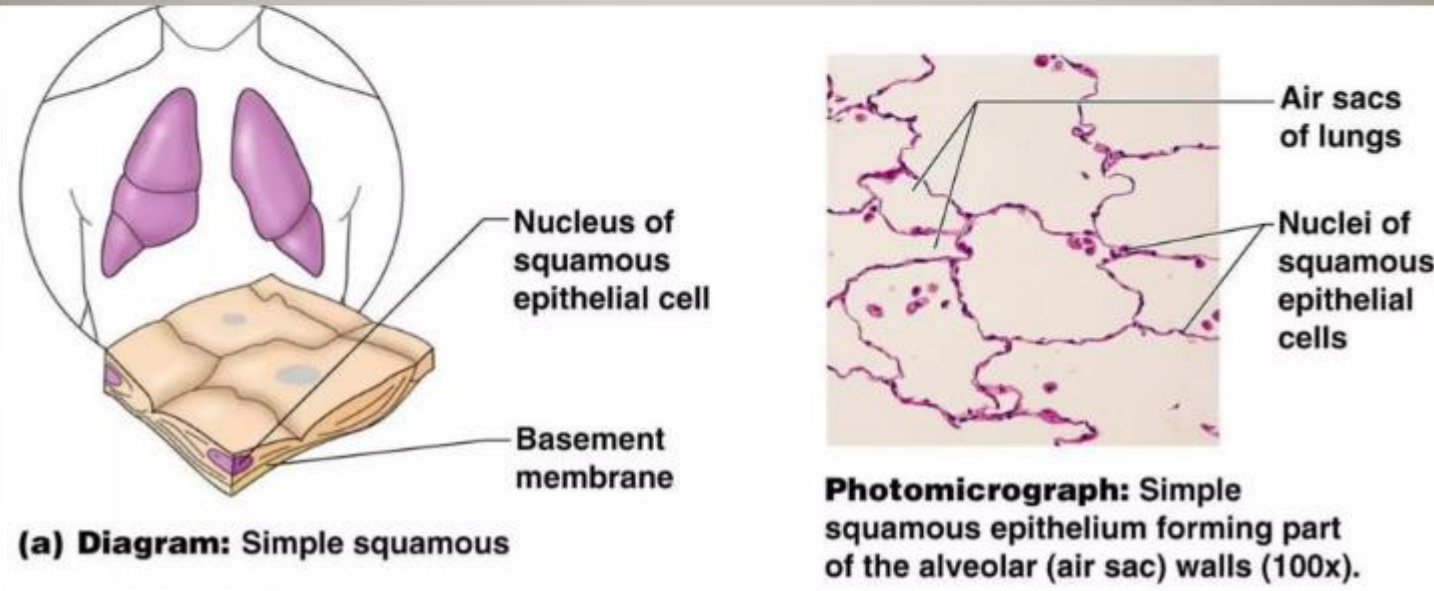
- i. Protection
- ii. Secretion
- iii. Absorption
- iv. Forms glands & ducts

Epithelium can be simple or stratified.

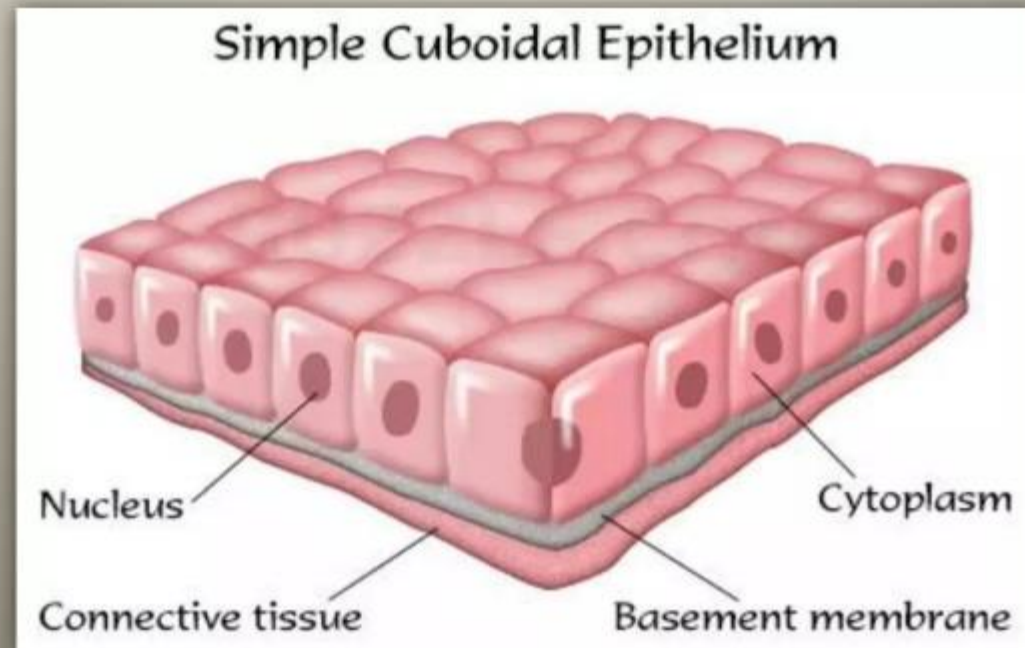
A. Simple Epithelium

An epithelium is called as simple when all the cells rest on the basement membrane. It can be :

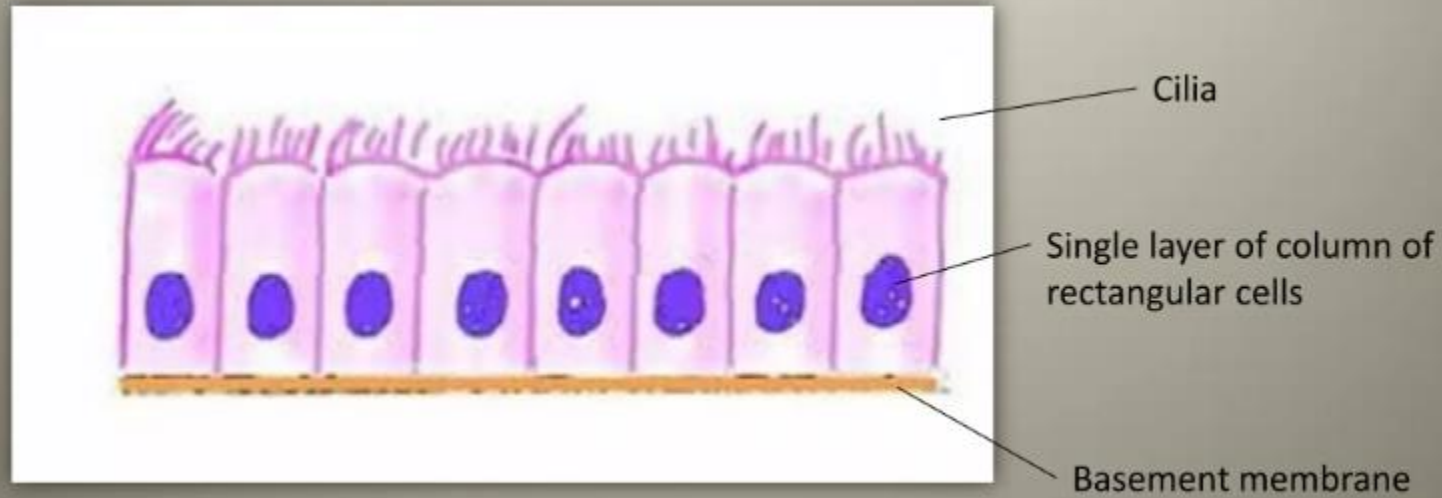
i. **Squamous epithelium-** is one in which cells are flattened with nuclei raising a bulge in the cell. It allows rapid exchange of substances through it. e.g. epithelial lining of alveoli .



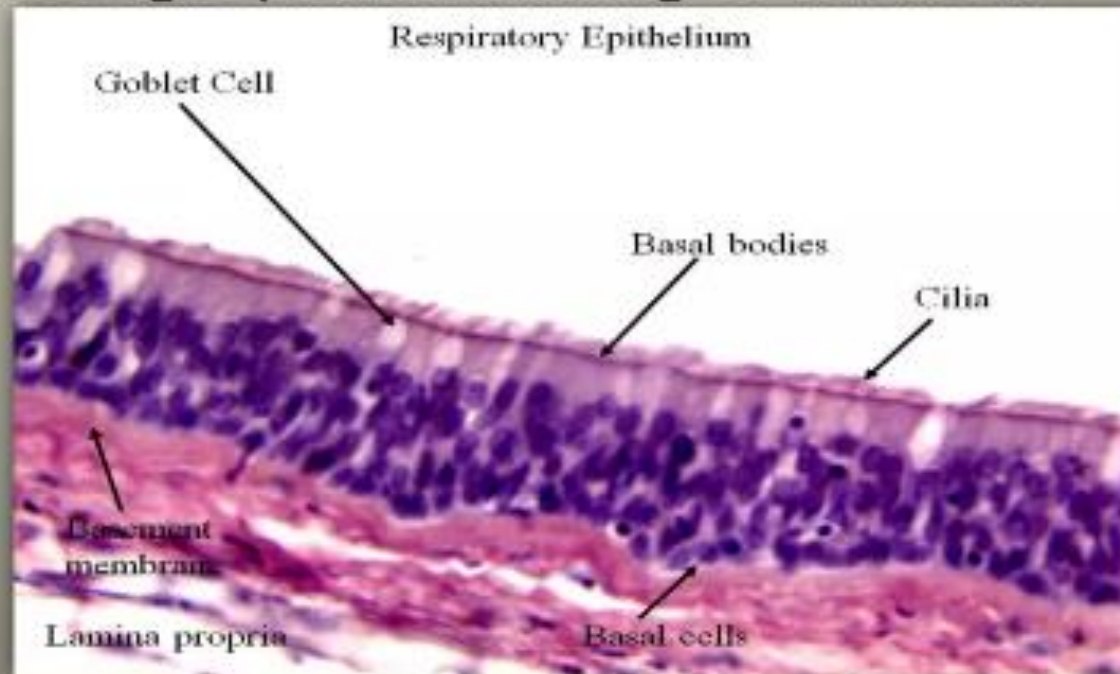
ii. **Cuboidal epithelium-** is one in which cells are like a square where height of the cell is equal to the width of the cell. The nucleus is central and round. Its main function is absorption and secretion e.g. epithelial lining of follicles of thyroid gland.






iii. **Columnar epithelium-** is the one wherein the height of the cells is greater than the width of the cells. The nuclei is basal and vertically elongated. Functions of a columnar cell are protection, secretion and absorption. e.g. epithelial lining of fallopian tubes.



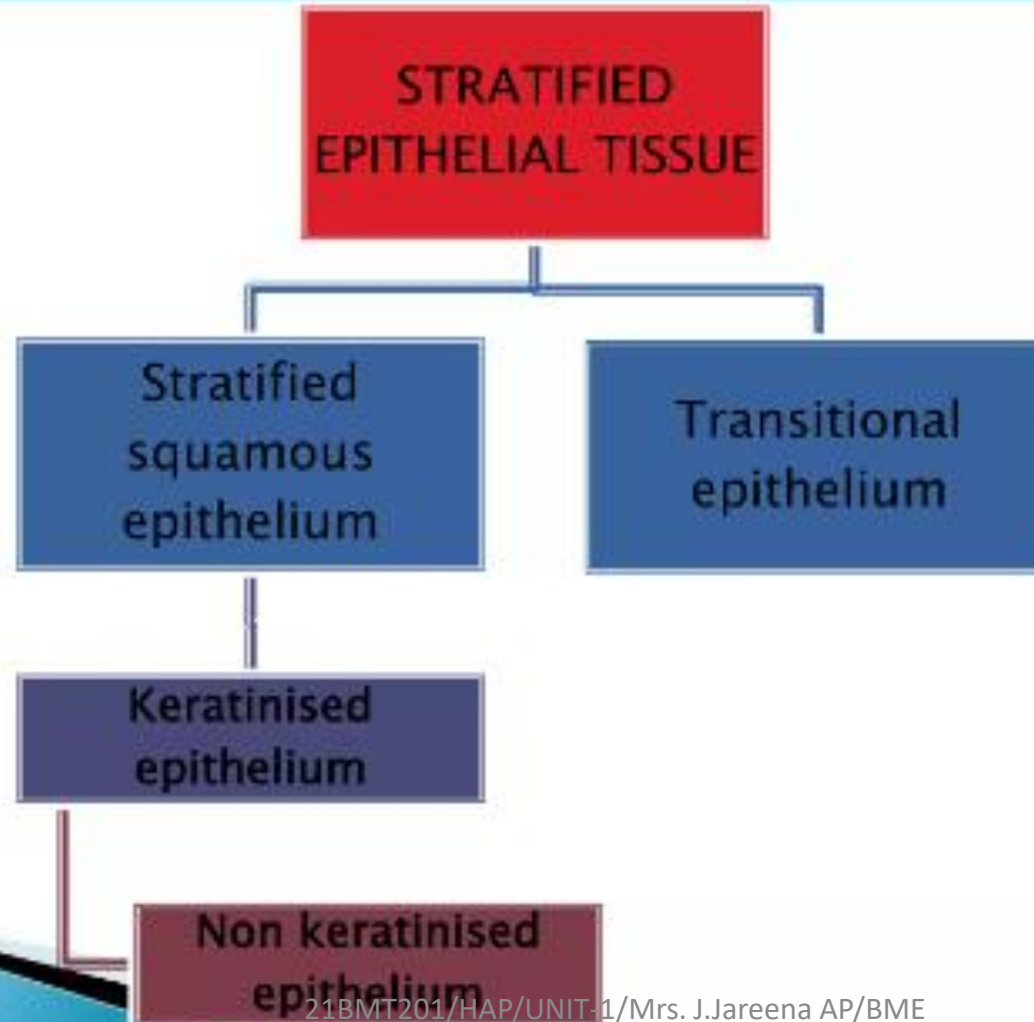
iv. **Pseudostratified epithelium-** Pseudo= false, stratified= multilayered. As the name suggest there is false appearance that the epithelium is multilayered. In fact some cells are short while the others are tall but all the cells rest on basement membrane e.g. epithelial lining of trachea.



DIFFERENT TYPES OF SIMPLE EPITHELIUM TISSUE

Type of Epithelium	Structure	Location in the body	Function
<p>Squamous epithelium</p> 	<p>Cells are thin, flat, irregular cells which fit like floor tiles to form delicate lining called PAVEMENT EPITHELIUM</p> <p>Nuclei in centre</p>	<p>Oesophagus, lining of mouth, alveoli of the lungs, blood vessels</p>	<p>Protects the underlying tissue from injury, grems</p> <p>Exchange of gases in lungs and materials between cells and blood</p>
<p>Cuboidal epithelium</p> 	<p>Cells are cuboidal with round nucleus in centre</p> <p>Nuclei in centre</p>	<p>Kidney tubules, duct of salivary glands</p>	<p>Gives mechanical support</p> <p>At times the epithelial tissue folds, forms a gland that secretes substances. Such epithilium is called GLANDULAR EPITHELIUM</p>
<p>Columnar epithelium</p> 	<p>Cells are more tall and less wide (PILLAR LIKE), placed side by side. Nucleus is situated near the base. (Rectangular shape)</p> <p>Nuclei near bass</p>	<p>Inner lining of intestine, In respiratory tract, cells have cilia (hair like) that move and push the mucous to clear it. Such epithilium is called CILIATED COLUMNAR EPITHELIUM</p>	<p>Helps in absorption excretion and secretion</p>

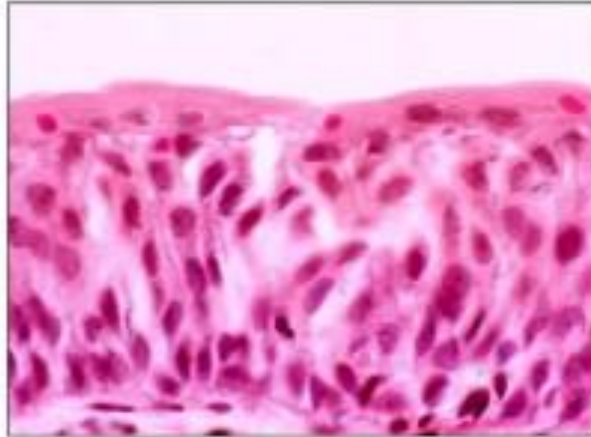
TYPES OF STRATIFIED EPITHELIAL TISSUES



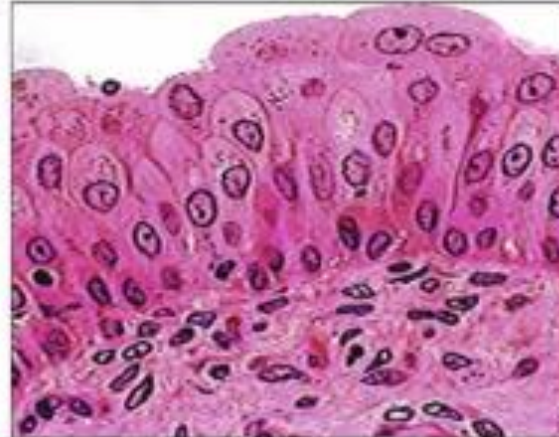
B. STRATIFIED EPITHELIUM

Multilayered epithelium is known as stratified epithelium.

i. **Transitional epithelium-** this kind of epithelium lines an organ which is distensible e.g. urinary bladder.



Distended bladder

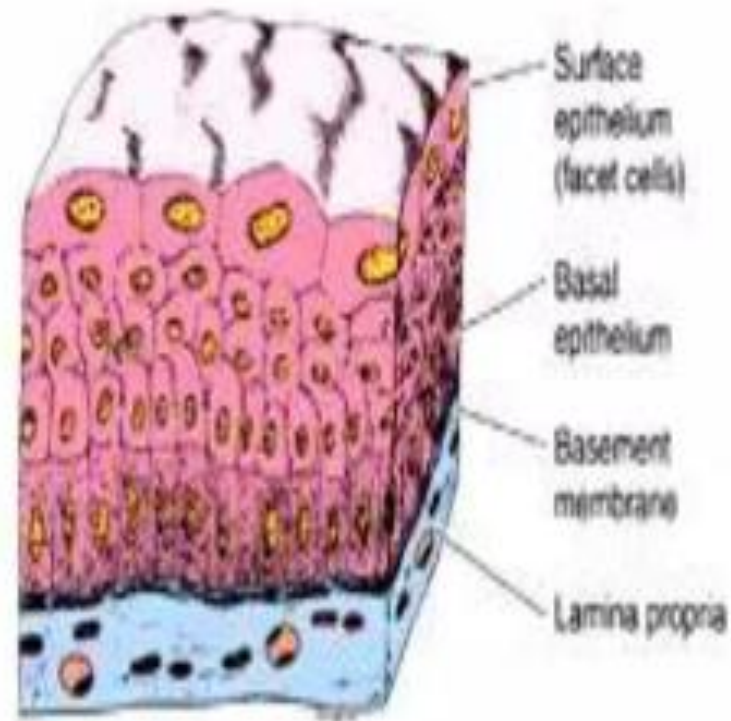


Empty bladder

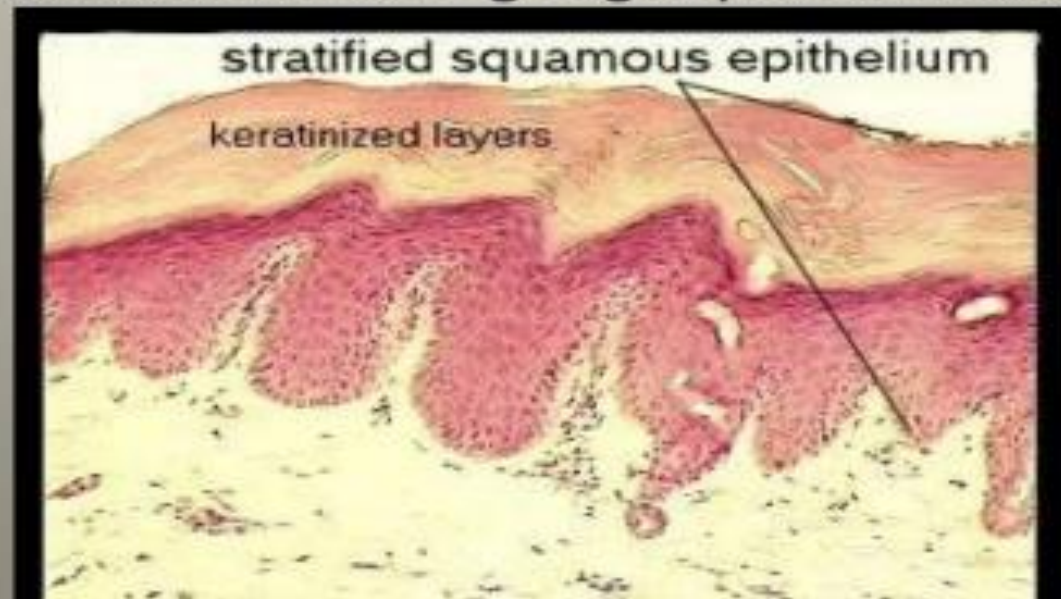
TRANSITIONAL EPITHELIUM

- ▶ Composed of several layers of pear shaped cells which are very elastic and have the capacity of dividing themselves.
- ▶ Sites
- ▶ Lines several parts of the urinary tract including the bladder.

B Transitional epithelium

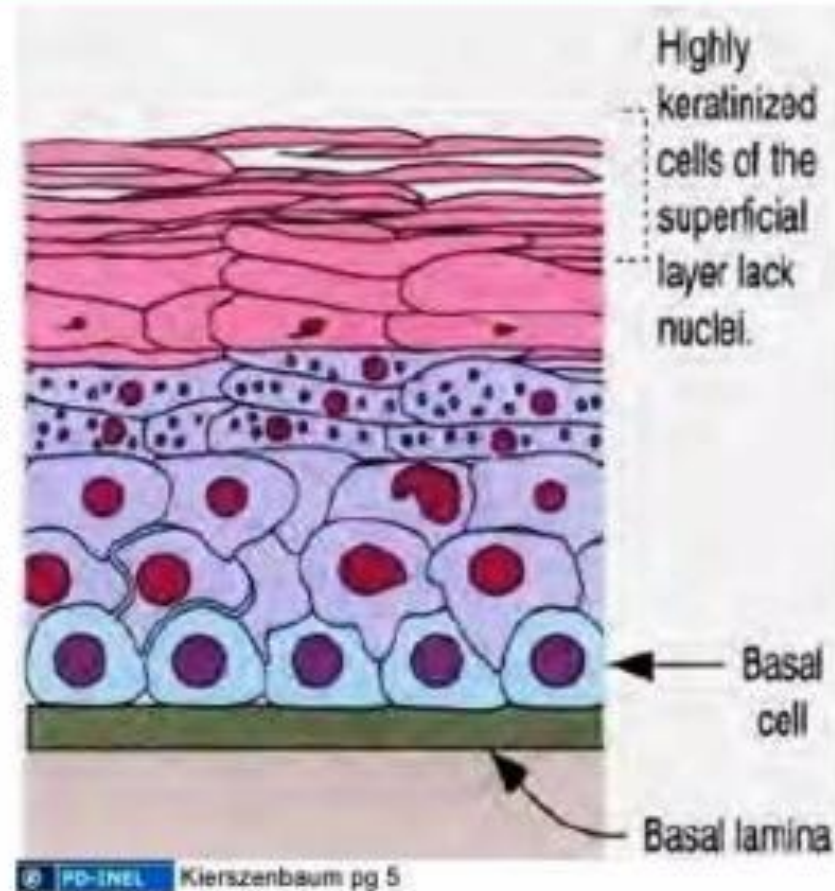


iii. **Stratified squamous keratinized epithelium** – It is a multilayered epithelium just like Stratified squamous non-keratinized epithelium but here the top most layer is that of keratin through which water can neither be evaporated from the body as in standing in sun nor can it be absorbed into the body as while swimming e.g. epidermis of skin.

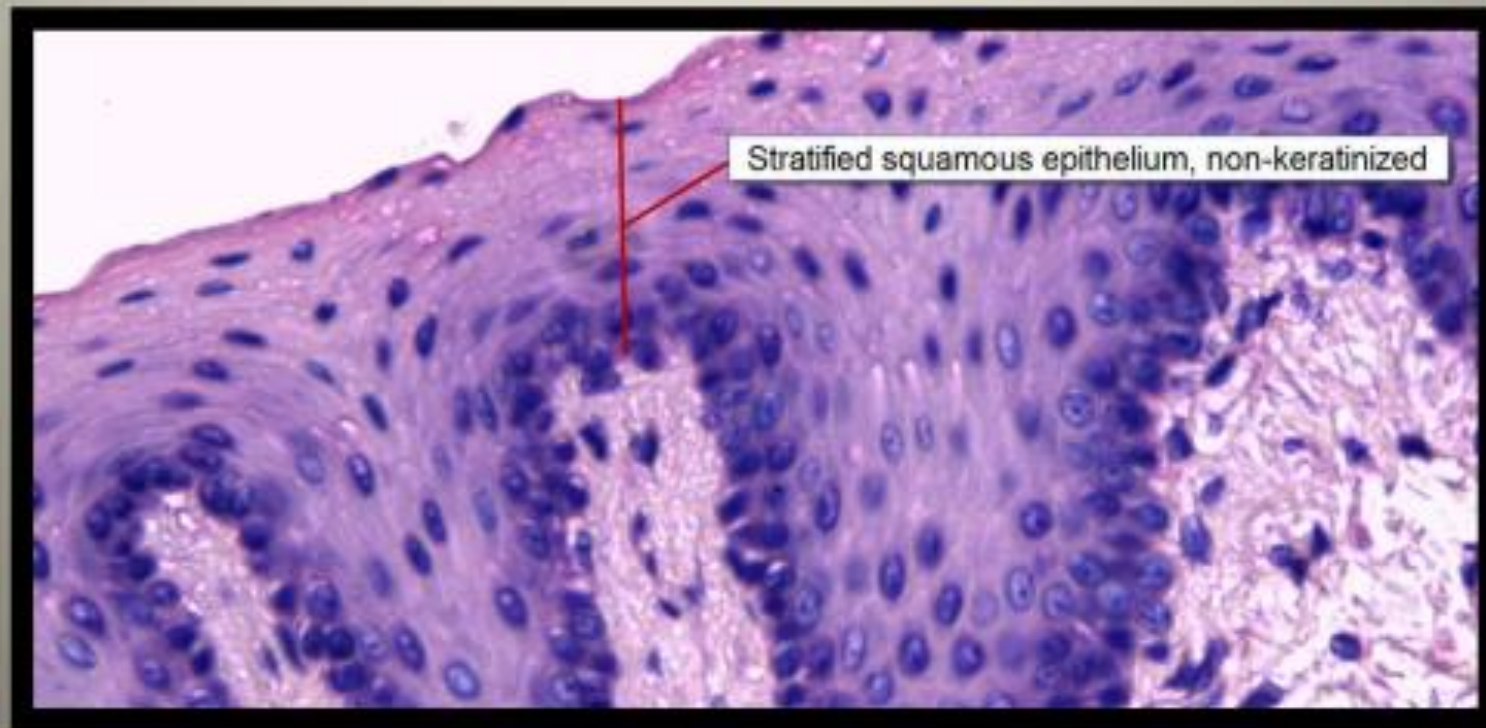


KERITINISED SQUAMOUS EPITHELIUM

- ▶ Found on dry surfaces subjected to wear and tear.
- ▶ Consists of dead epithelial cells that have lost their nuclei and contain the protein keratin.
- ▶ Sites
- ▶ Skin, hairs and nails

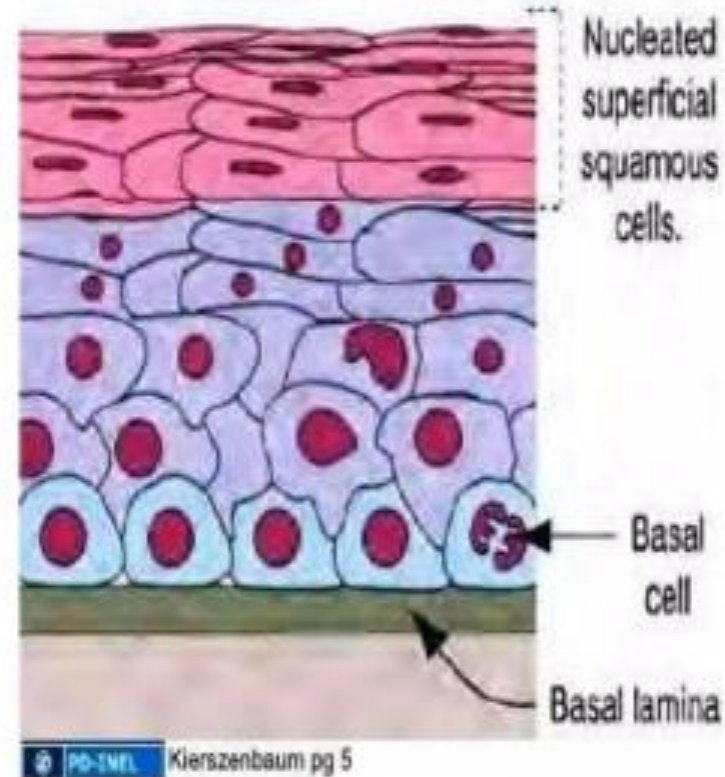


ii. **Stratified squamous non-keratinized epithelium**– it is a multilayered epithelium in which basal cells are columnar. E.g. epithelial lining of esophagus.



NON-KERATINISED EPITHELIUM

- ▶ Protects moist surfaces subjected to wear and tear and prevents them from drying out.
- ▶ **Sites**
- ▶ Conjunctiva of the eyes, the lining of the mouth, the vagina.



CONNECTIVE TISSUES

- ▶ It is most abundant tissue in the body
- ▶ Connective tissues cells are more widely separated from each other than in epithelial tissues and intercellular substance (matrix) is present in larger amount
- ▶ Made up of cells like **fibroblast, fat cells, macrophages, leukocytes and mast cells.**

FUNCTIONS OF CONNECTIVE TISSUES

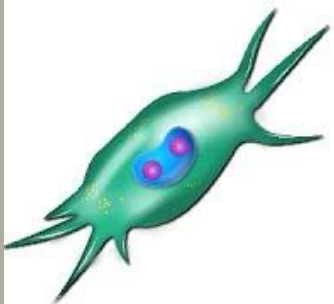
- ▶ Provide support
- ▶ Transport materials from one part of the body to another
- ▶ Store energy.
- ▶ Protection
- ▶ Insulation

Connective Tissue

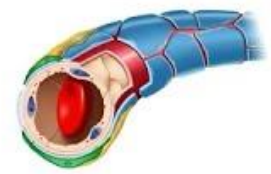
Many types with different functions

Originate locally & remain in the connective tissue - **Fixed cells**

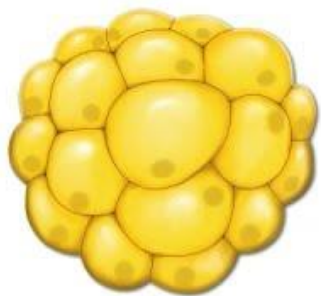
Originate elsewhere & remain only temporarily in connective tissue - **Transient cells**



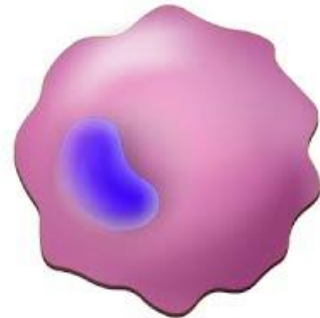
Fibroblasts



Pericytes



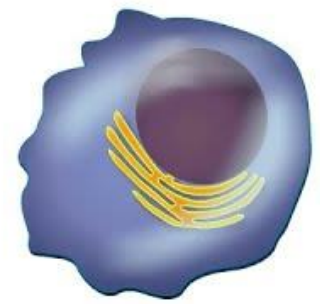
Adipose cells



Macrophages



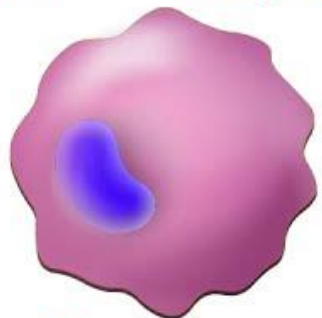
Lymphocytes



Plasma cells



Mast cells



Macrophages



Neutrophils



Eosinophils



Basophils

▶ Cells in connective tissues



Fibroblast



Fat globule

Adipose cell



Plasma cell



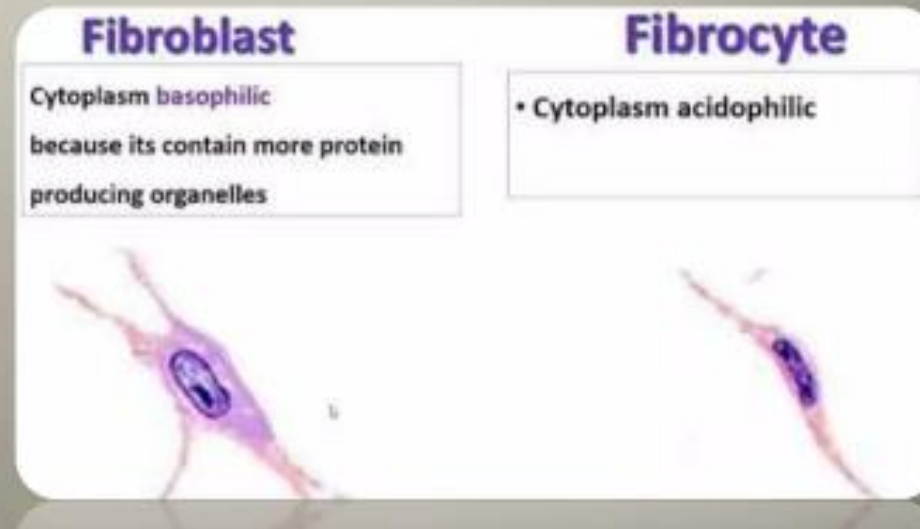
Mast cell



**Macrophage or
histocyte**

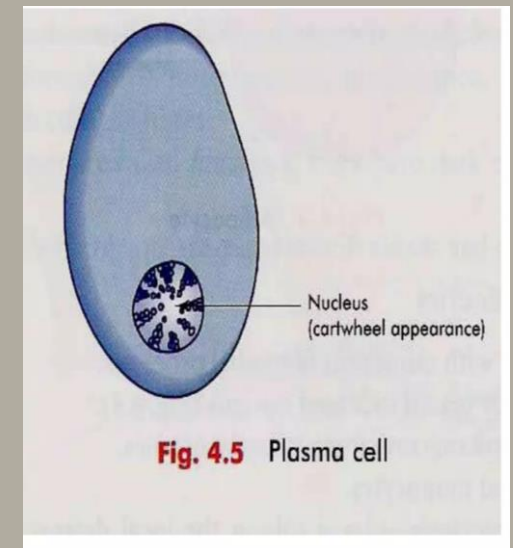
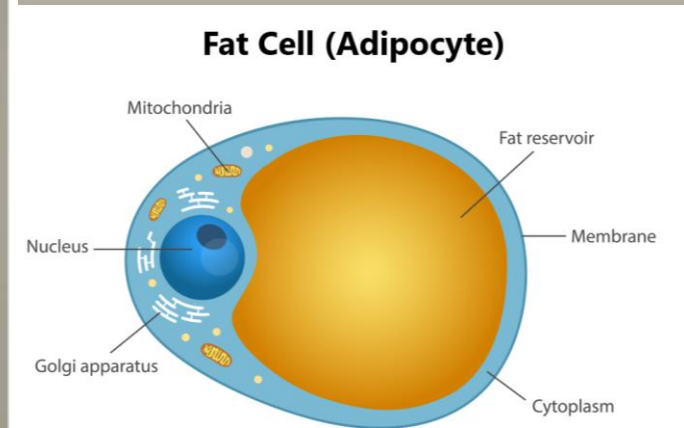
CELLS

- a. i. **Fibroblasts**- the cells which synthesize collagen fibres, elastic fibres and lays down matrix are know as fibroblasts.
- ii. **Fibrocytes**- when the fibroblasts mature they are known as fibrocytes.

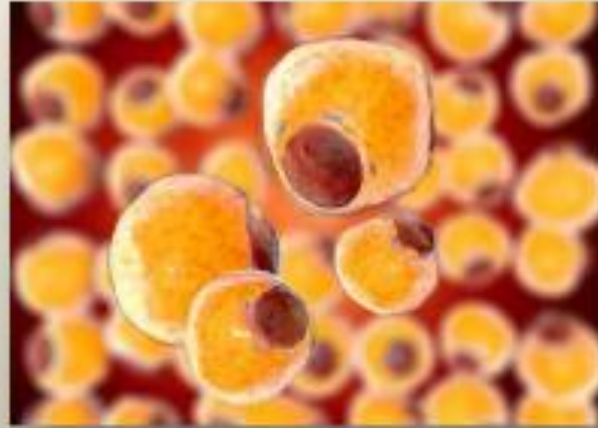


b. **Adipose / fat cells-** they are rounded cells but they are usually present in group, they get mutually compressed so may have variable shape. They have fat globule in their cytoplasm which pushes the nucleus to periphery giving the cell signet ring appearance. Their function is to store fat in their cytoplasm.

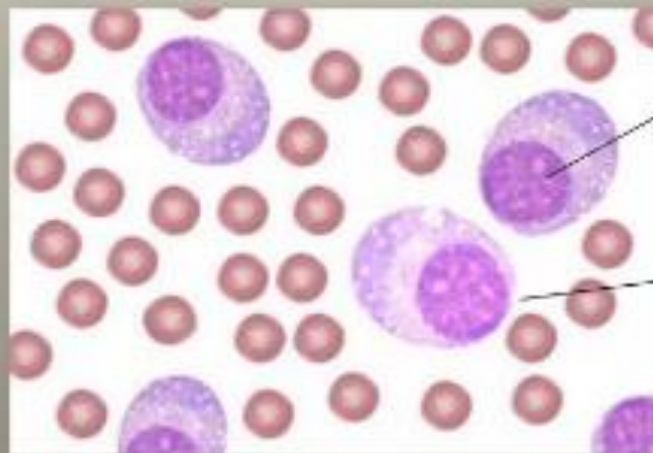
c. **Plasma cells-** rounded to ovoid basophilic cells with cart wheel nucleus. They are rich in rER. Their function is to synthesize immunoglobulins.



FAT CELLS



PLASMA CELLS



CART WHEEL
NUCLEUS

PLASMA
CELLS

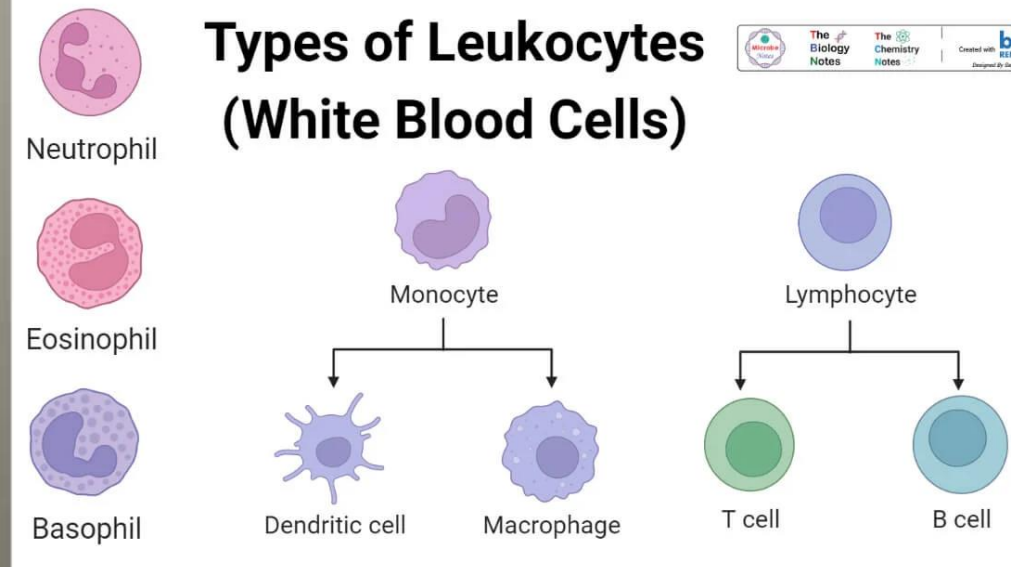
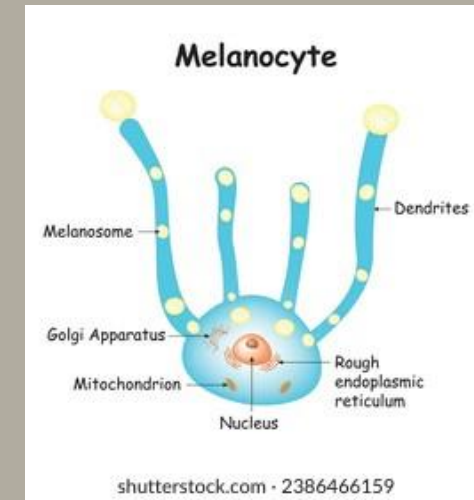
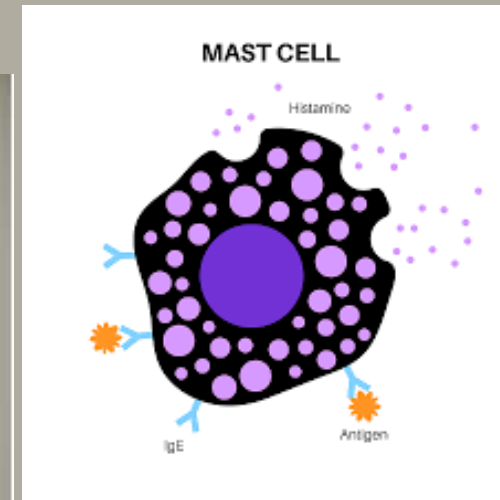
d. **Mast cells**- they are involved in inflammatory reactions.

e. **Macrophages**- their function is to engulf various foreign particles.

f. **Leucocytes**- White Blood Cells are known as leucocytes. They are neutrophils, lymphocytes, eosinophils, basophils and monocytes. They have defensive action.

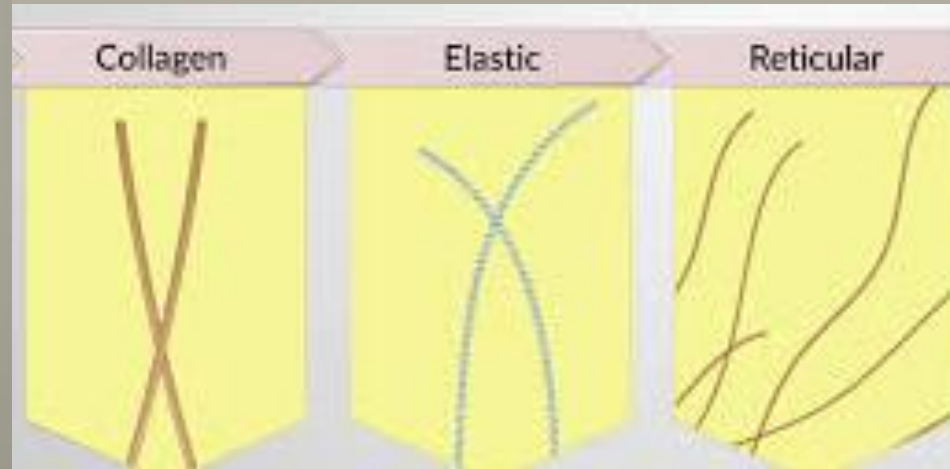
g. **Pigment cells**- impart brown color to the skin when they are present in epidermis. Their presence offers protection against ultraviolet rays of the sunlight.

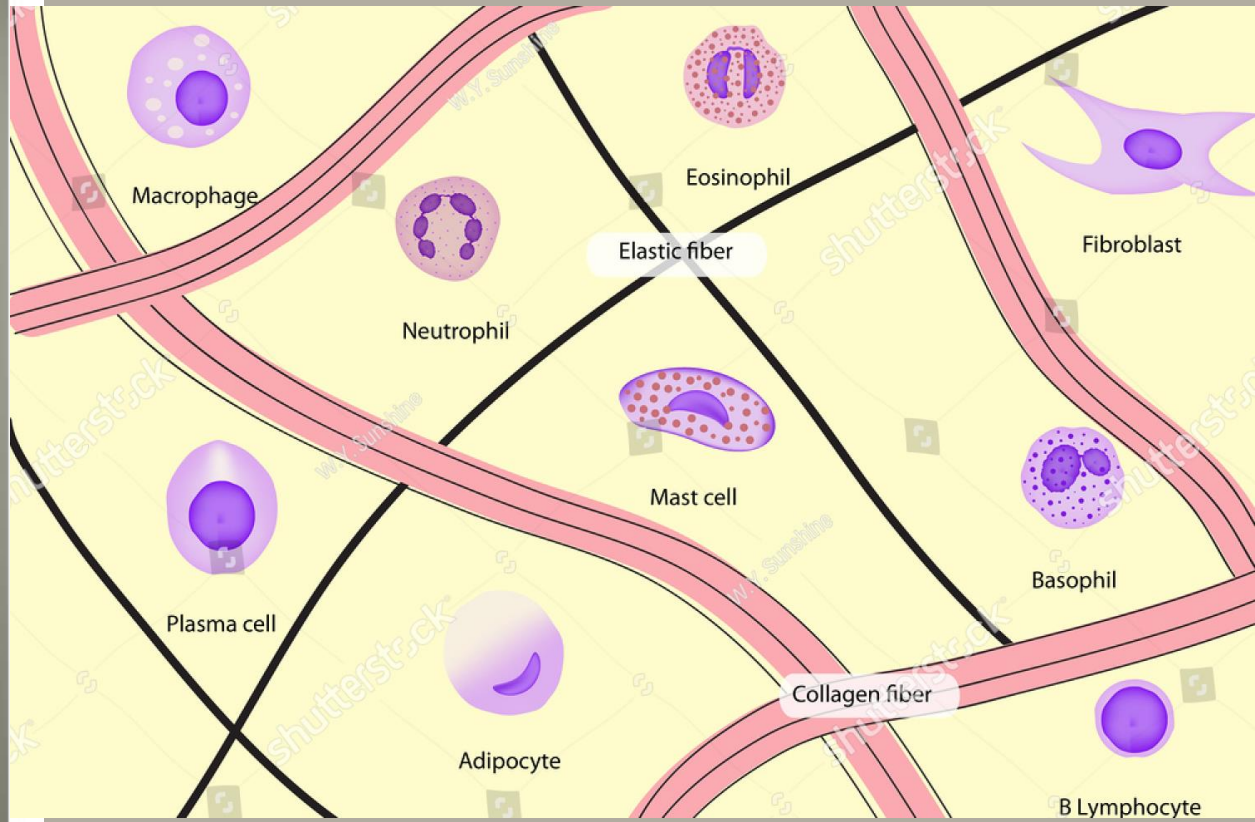
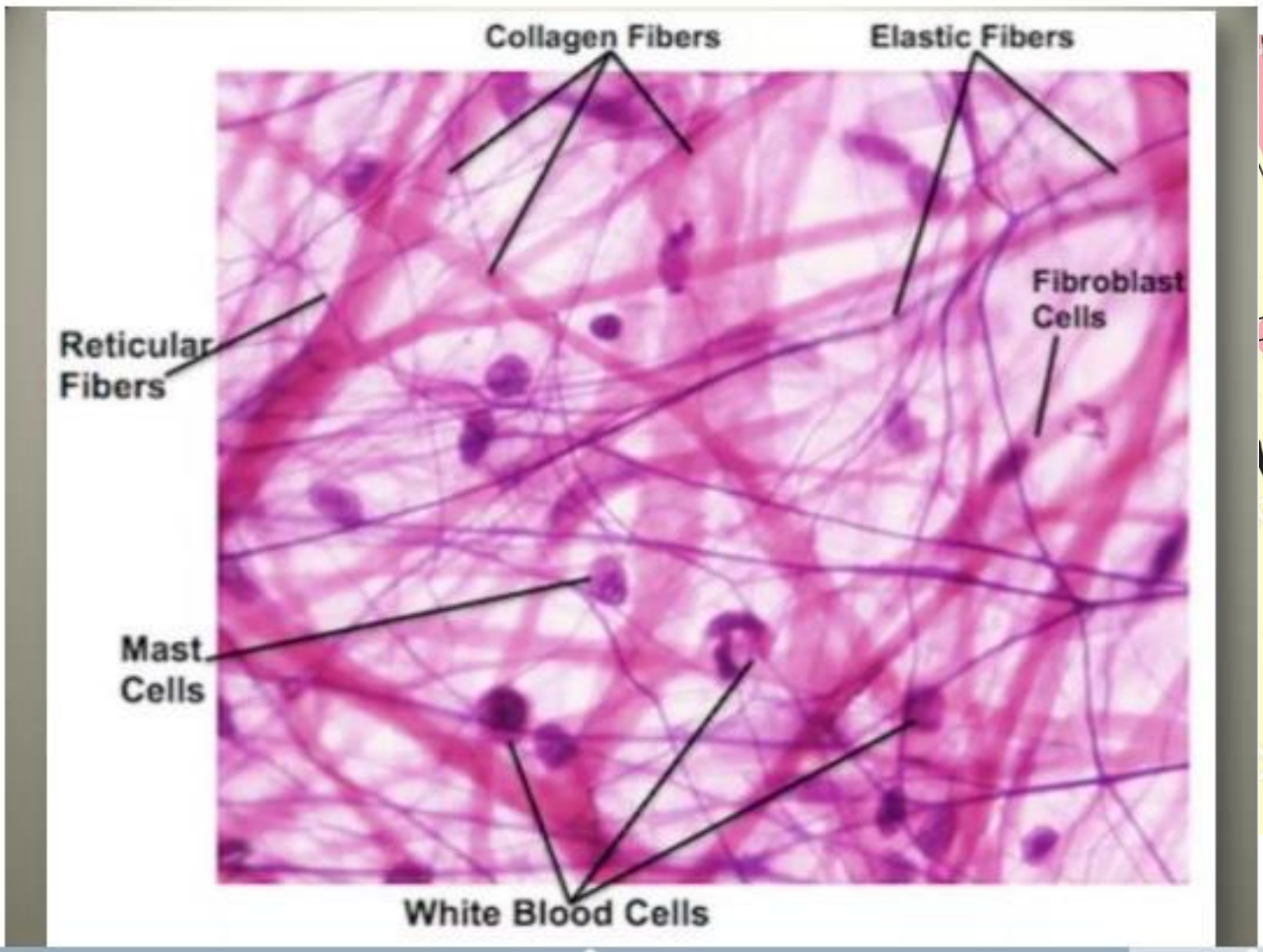
h. **Mesenchymal cells**- are undifferentiated cells. They can differentiate into a variety of cell types.



FIBRES

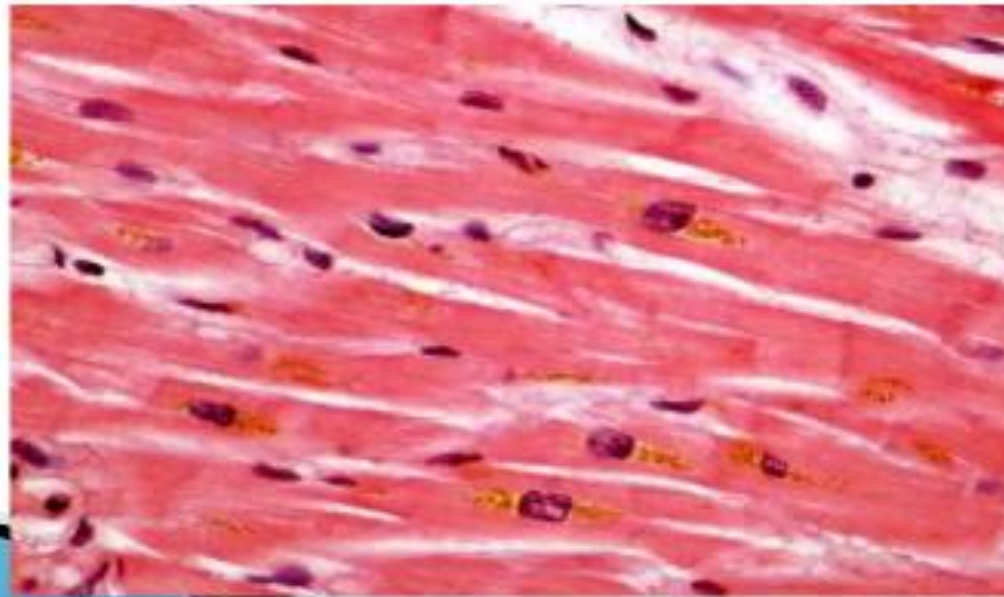
- a. **Collagen fibres-** they are flexible but offer great tensile strength. They found in tendons, ligaments and all kinds connective tissues.
- b. **Elastic fibres-** they can stretch and then come back to their normal size when stretching force is relieved. They are found in ligamentum nuchae, ligamentum flava and in the wall of large arteries.
- c. **Reticular fibres-** they are special type of collagen fibres and can be seen only by special stain. They are seen in the connective tissue framework of spleen, liver lymph nodes.





MUSCULAR TISSUES

- ▶ It is made up of muscle cells(muscle fibers) which unite to form muscle.
- ▶ It contracts and relaxes rhythmically.



MUSCULAR TISSUE

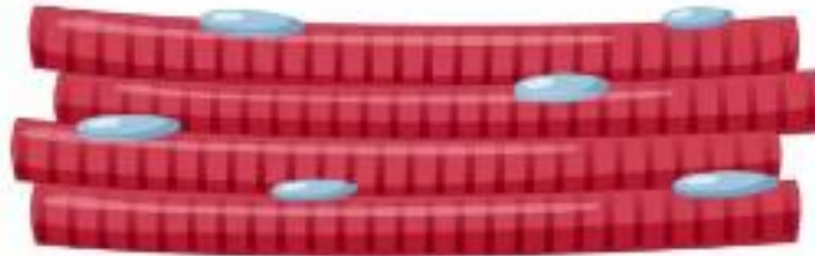
There are three types of muscles namely-

- a. **Skeletal muscle**- they help in locomotion e.g. biceps femoris.
- b. **Smooth muscles**- they are present in the viscera of our body e.g. muscle in the wall of stomach.
- c. **Cardiac muscle**- it is seen only in the heart. Contraction of this muscle helps in pumping of blood throughout our body.

Types of Muscle Tissue



smooth muscle cells






striated muscle cells



cardiac muscle cells

COMPARISON OF MUSCULAR TISSUES

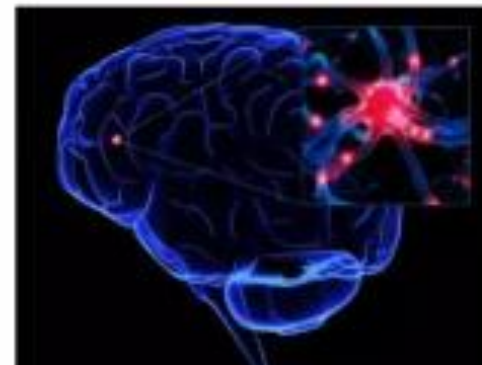
	SMOOTH	CARDIAC	SKELETAL
Location	Wall of hollow organs, vessels, respiratory passageways	Wall of heart	Attached to bones
Cell characteristics	Tapered at each end, branching networks, nonstriated	Branching networks; special membranes (intercalated disks) between cells; single nucleus; lightly striated	Long and cylindrical; multinucleated; heavily striated
			
Control Action	Involuntary Produces peristalsis; contracts and relaxes slowly; may sustain contraction	Involuntary Pumps blood out of heart; self-excitatory but influenced by nervous system and hormones	Voluntary Produces movement at joints; stimulated by nervous system; contracts and relaxes rapidly

Compare muscle tissue

Skeletal	Cardiac	Smooth
Striation: striated	somewhat striated	non-striated
Cells: straight cylindrical parallel, non-branching	tapered cylinders parallel & branched	spindle shape
Nucleus: multi-nuclei, peripheral	mostly uni-nucleus most peripheral	uni-nucleus central
Discs: none	intercalated	none
Location: attach bones	cardiac wall	hollow organs
Control: voluntary	involuntary	involuntary
Function: body movement	heart contraction	visceral & circulatory
Speed of contraction: fastest	intermediate	slowest

NERVOUS TISSUE

- ▶ These types of tissues are found in nervous system.
- ▶ Types
- ▶ Excitable cells–neurones
- ▶ Non excitable cells– Neuroglia



NERVOUS TISSUE CONTD...

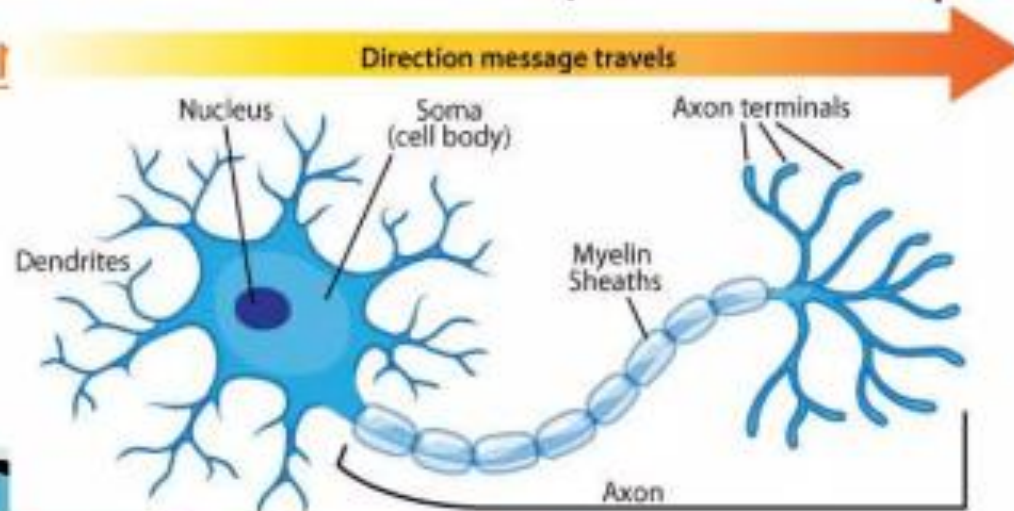
- ▶ **Functions**
- ▶ Irritability – the capacity to react to various physical and chemical agents.
- ▶ Conductivity– the ability to transmit the resulting reaction from one point to another.



▶ Neuron

- ▶ also known as a **neurone** or **nerve cell**) is an electrically excitable cell that receives, processes, and transmits information through electrical and chemical signals.
- ▶ It is the working unit of nervous system
- ▶ Consists of cell body with cytoplasmic extensions–dendrites, axon and pole

▶ Scier



- ▶ **Neuroglia**
- ▶ Neuroglia form the support structure of nervous tissues, insulating and protecting neurons.
- ▶ They are astrocytes, oligodendrocytes, microglia and ependymal cells.