Mon / Wed / Fri = AT

T / Th / Sat = Blood & Circulation

Animal Tissues - I

Course on Structural Organization in Animals (Animal Tissues)

Dr Amit Gupta • Lesson 1 • Sept 6, 2021

ANIMAL TISSUES

origin

Structure / function

Tissue : A group of cells in which cells are similar in structure, function and origin is called tissue.

Group of similar cells along with intercellular substance perform a specific function such organisation is called tissue. But sometimes in a tissue, cells may be dissimilar in structure and function but they are always similar in origin.

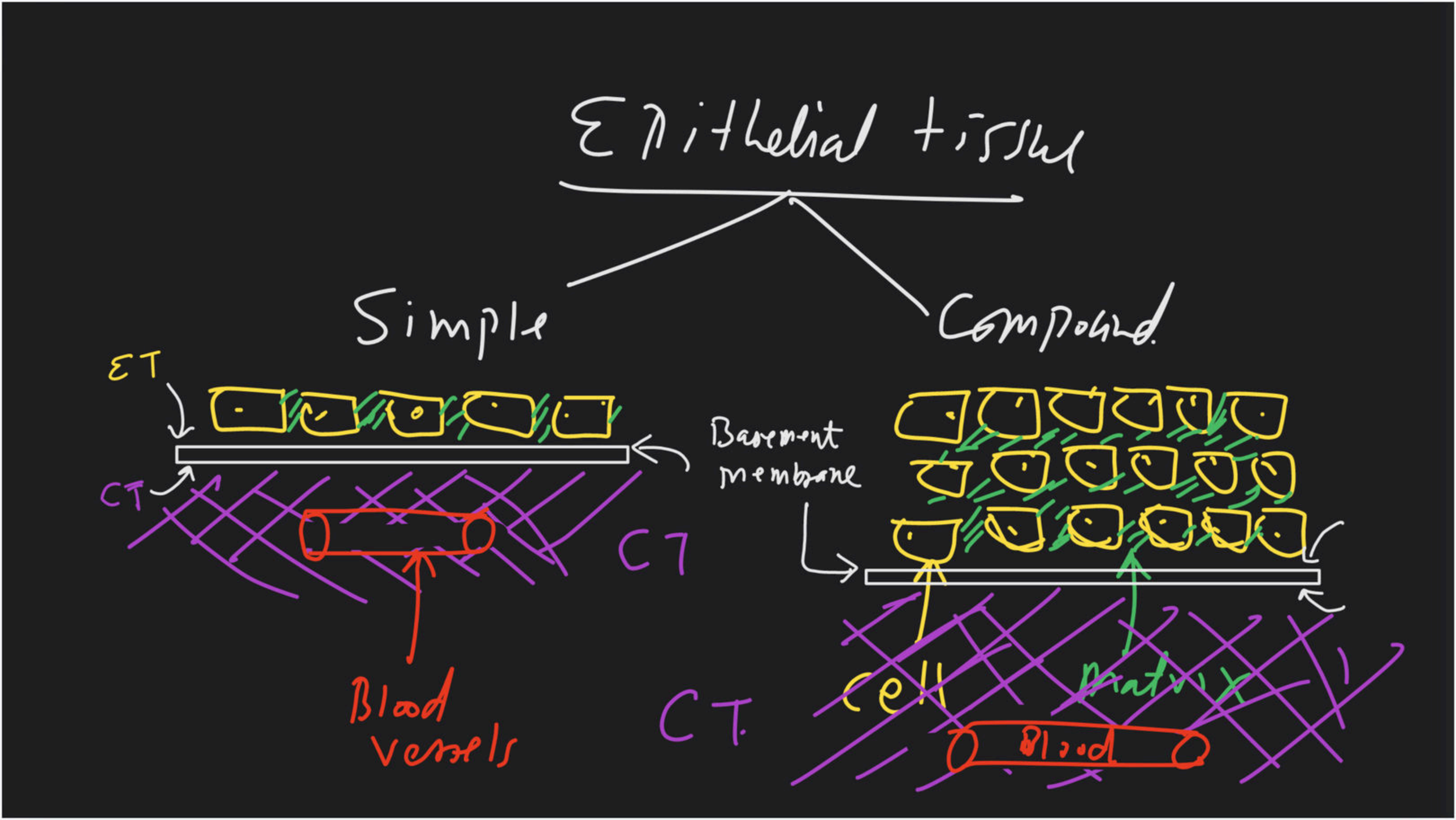
Organ: Tissues are organised in specific proportion and pattern to form organ.

Organ system : When two or more organ perform common function by their physical &/or chemical interaction, they together form organ system.

Division of labour : Cell tissue, organs and organ systems splits up the work in a way that they exhibit division of labour.

On the basis of functions & structure tissues are of four types :

1. **Epithelium/Epithelial Tissue :** Covering & protective tissue.
2. **Connective Tissue –** To connect structures, provide support to the body and transport substances in the body.
3. **Muscular Tissue –** Helps in contraction & locomotion.
4. **Nervous tissue –** To generate and conduct nerve impulses in body.

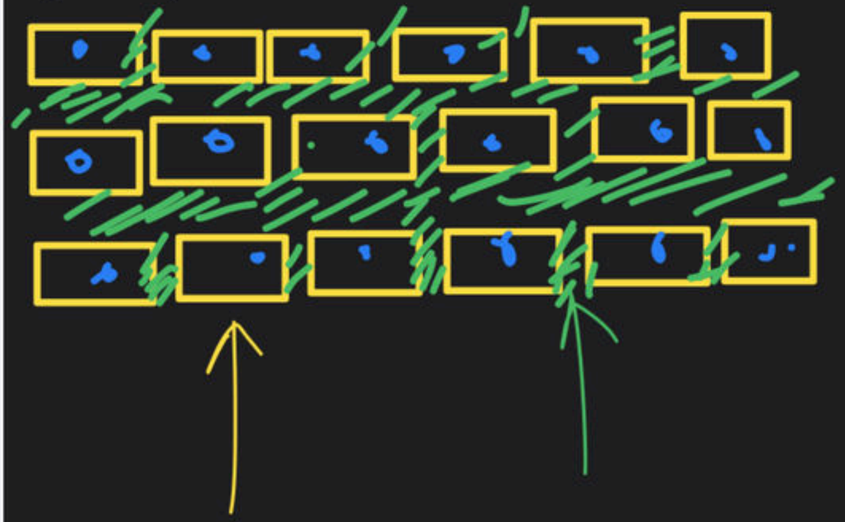

Epithelial tissue
Simple
Compound
ET
CT
Basement membrane
CT
Blood vessels
CT
cell
Blood

Animal tissues

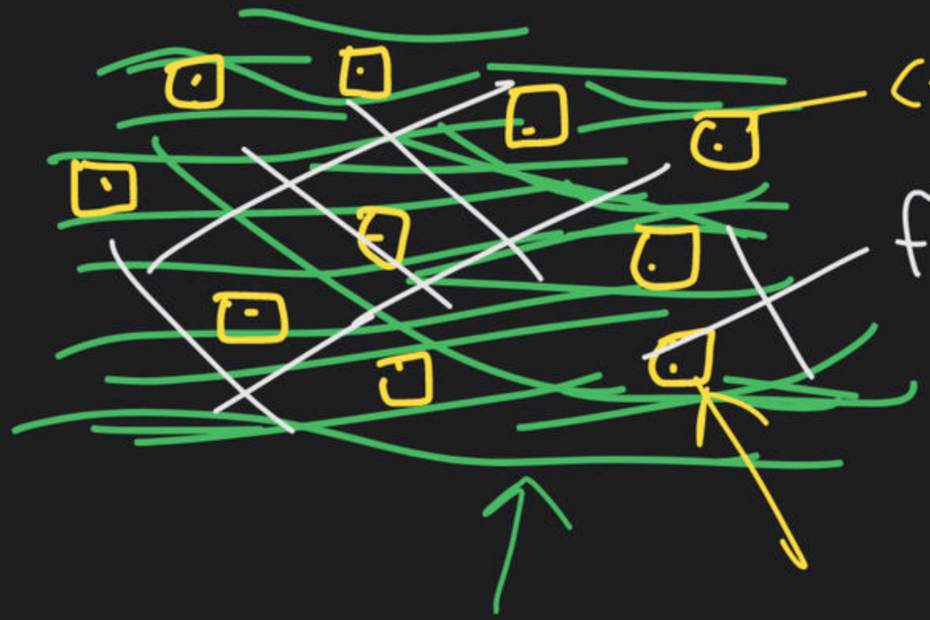
Ecto / Meso / Endo

Mesodermal

- Epithelial tissue
  - Simple
  - Compound.
- Connective Tissue
- Muscular Tissue — Mesodermal
- Nervous Tissue. — Ectodermal



cells > Matrix



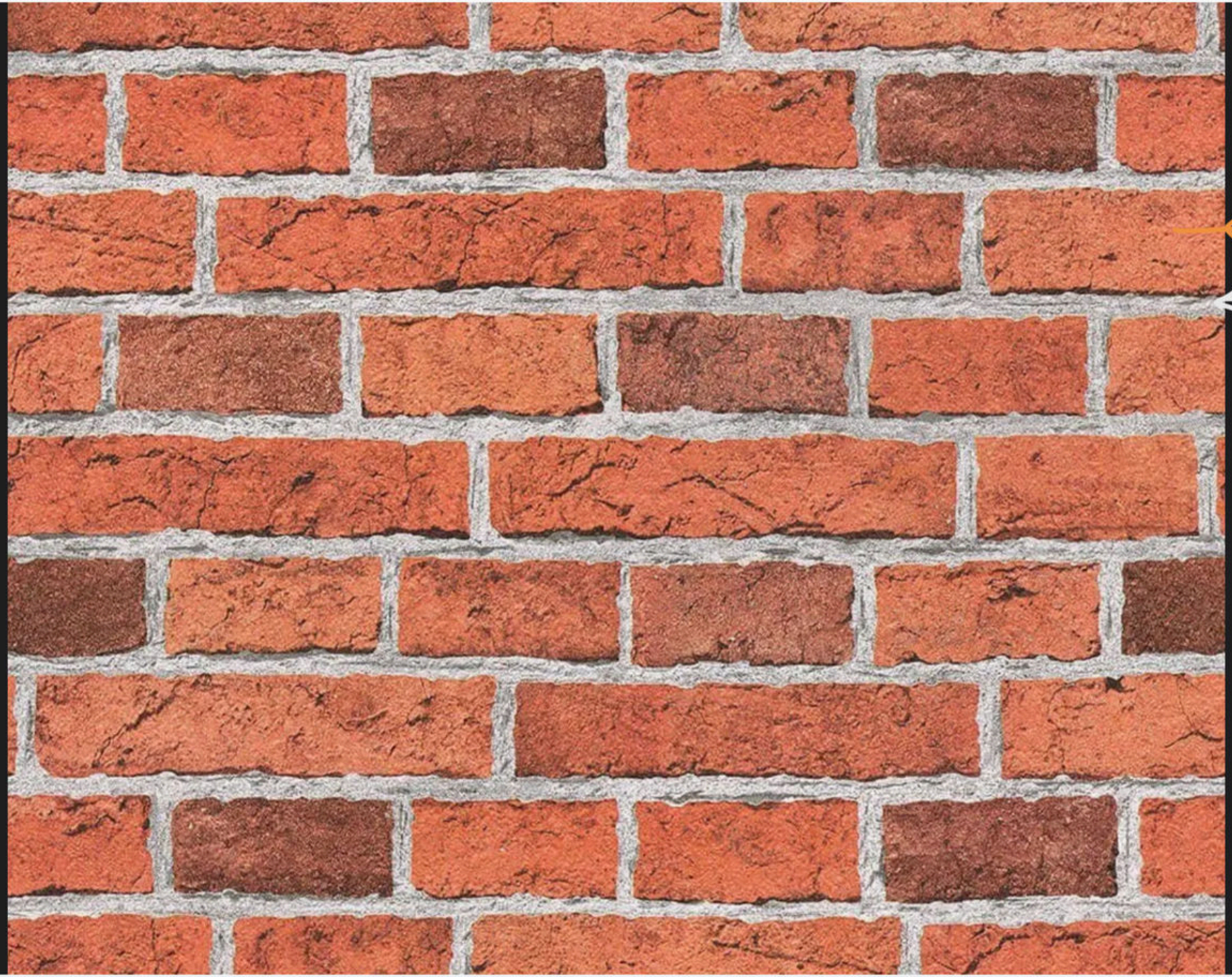
matrix > cell

in a connective Tissue

The cells Secrete

- Matrix
- fibers

Cell > Matrix



(Bricks)
cell
matrix
[cement]
Hyaluronic Acid


matrix
cell
fiber

EPITHELIUM TISSUE

During embryonic development epithelium orginates first.

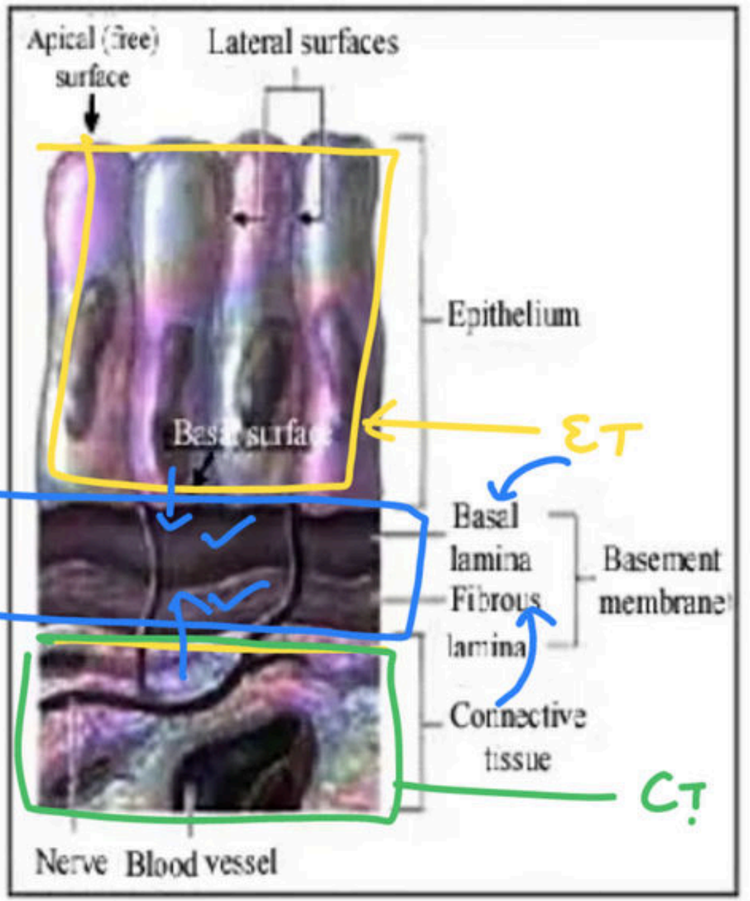
Power of regeneration is present in this tissue while power of regeneration is absent or least power is found in nervous tissue.

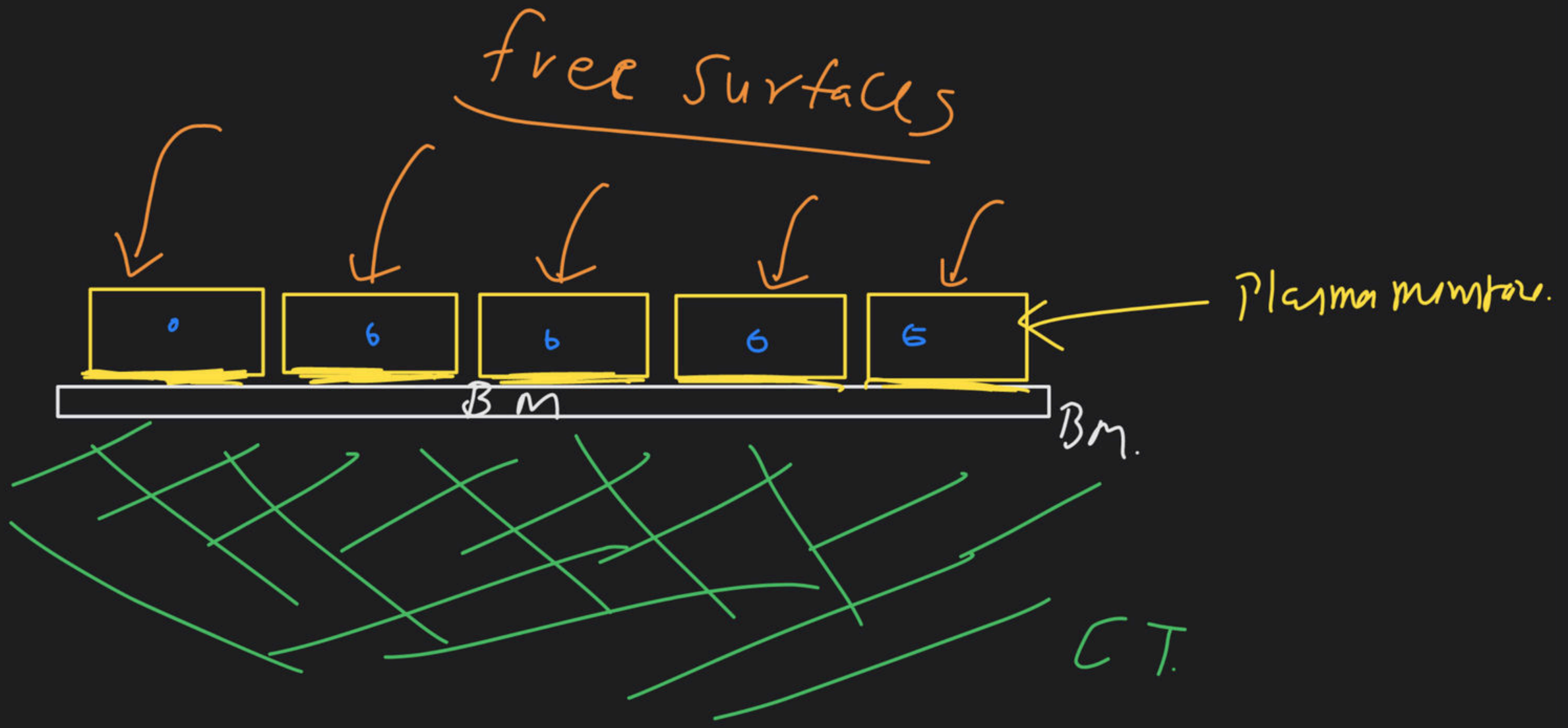
This tissue faces either a body fluid or outside environment and thus provide a covering or a lining.

Word epithelium is composed of two words.

Epi – Upon **Thelia – growth**

A tissue which grows upon another tissue is called Epithelium.




free surfaces
o
6
6
6
6
Plasma monitor.
BM
BM.
CT.

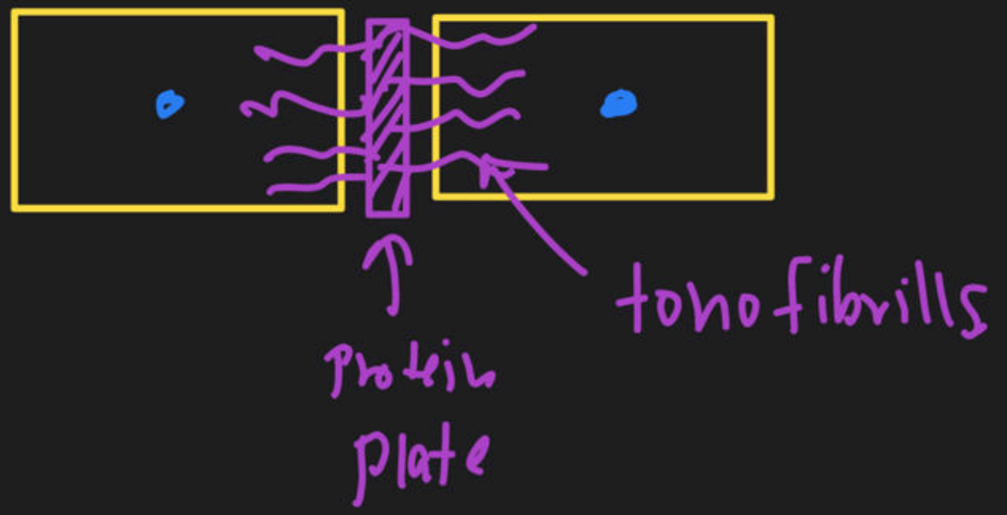
CLASSIFICATION OF EPITHELIAL TISSUE

Table : Classification of Epithelia

- **EPITHELIAL TISSUES**
  - **Simple (one cell thick)**
    - Squamous
    - Cuboidal
    - Columnar
    - Ciliated
      - Columnar
      - Cuboidal
    - Pseudostratified
      - Columnar
      - Ciliated
  - **Compound (more than one-cell thick)**
    - Stratified
      - Squamous
        - Keratinized
        - Non-Keratinized
      - Cuboidal
      - Columnar
      - Columnar ciliated
    - Transitional

1) Interdigitation

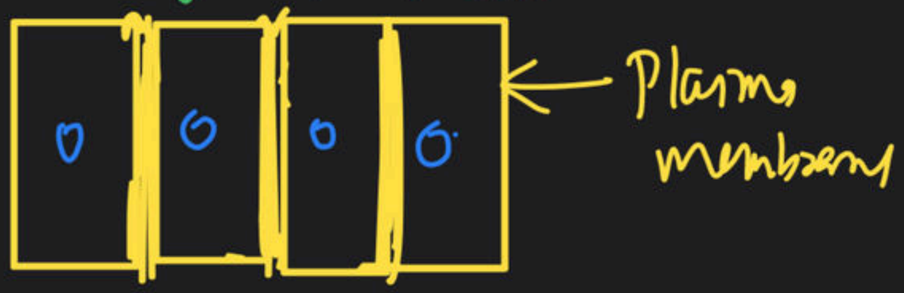
2) Desmosomes / Adhering Junction



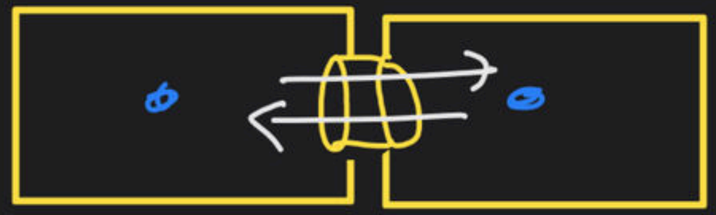
3) Tight Junction

Leak proof

Cavity with fluid

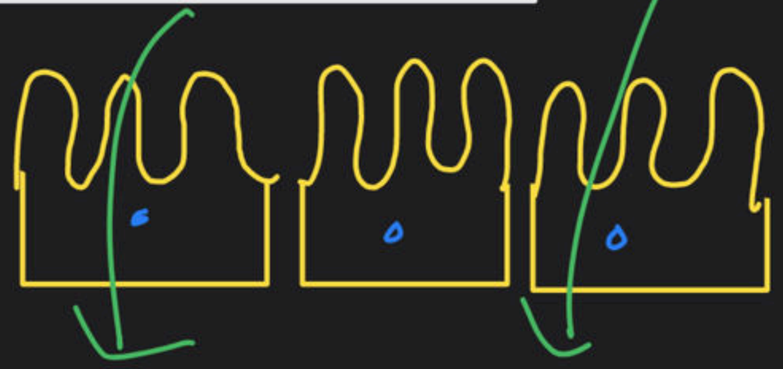


4) Gap Junctions



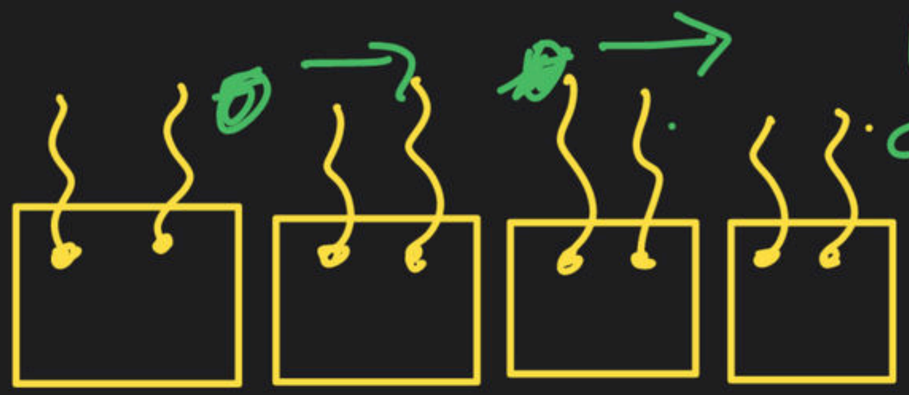
Functional Modification of free end of PM

1) Microvilli



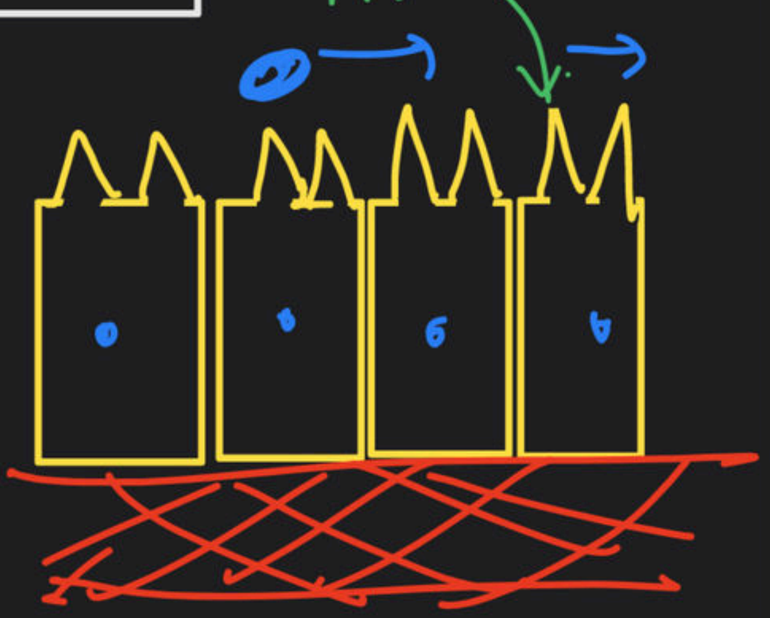
To ↑ Surface Area for absorption

2) Cilia



(movable cilia) To propel the particles forward.

3) Stereocilia



It always rest upon underlaying connective tissue. Epithelium is the only tissue in which cells are always arranged in uniform layer. Epithelium cells are compactly packed with little intercellular matrix.

Due to absence of intercellular spaces blood vessels, lymph vessels & capillaries are unable to pierce this tissue so blood circulation is absent in epithelium. Hence cells depend for their nutrients on underlying connective tissue.

Basement membrane : Between epithelium and connective tissue, a thin non living acellular basement membrane is present which is highly permeable. Basement membrane consist of 2 layers.

(a) **Basal lamina** : Towards epithelium and it is made up of glycoprotein, which is secreted by epithelium cells.

(b) **Fibrous lamina** : Towards connective tissue, in which collagen and reticular fibres are suspended in mucopolysaccharide which is matrix of connective tissue. Mucopolysaccharide is present in the form of Hyaluronic acid.

So basement membrane is secreted by both epithelium and connective tissue.

Intercellular junction : To provide both structural and functional link between its individual cell epithelial cells modify to form following structures (Intercellular Junctions) :

(i) **Interdigitation** – Finger like processes of plasma membrane which enter into cytoplasm of adjacent cell. These structures are mainly found in **transitional epithelium**.

(ii) **Adhering/*Desmosomes*** – This type of (Macula Adherens) Junction consists of disc - like protein plate with intermediate fibre known as tonofibrils composed of keratin like protein. These filaments are deeply situated in the cytoplasm of respective cell. These structures provide mechanical support to **stratified epithelium** or performing cementing to keep neighbouring cell together. e.g. Stratified epithelium

(iii) **Tight Junction** – At some places Plasma membrane of adjacent cells become fused to form tight junction to stop substance from leaking across a tissue. These structures are mostly found in **columnar epithelium**.

(iv) **Gap Junction** – Faciliate the cells to communicate with each other by connecting cytoplasm of adjoining cells for rapid transfer of ions, small molecules and sometimes big molecules.

Functional modification of plasma membrane of free end :

(i) **Microvilli**

1. These are minute process which are non motile, non contractile. They increase surface area by more than 20 times.
2. They help in absorption, secretion and excretion.
   These are present in the **wall of Intestine, Gall bladder, Proximal convoluted tubule etc.**

(ii) Cilia or Kinocilia

1. Long cylindrical process, those are motile and contractile.
2. These helps in movement of particles or mucus in a specific direction. Mainly present in the inner surface of hollow organs.
3. These are found in

e.g. **– Fallopian tube. Uterus (Cilia in only present in patches).**
– Trachea and Bronchioles
– Ependymal epithelium : (Inner lining of ventricles of brain and central canal of spinal cord. Function of cilia is to conduct substances in CSF.)

(iii) Steriocilia

(i) Long process those are non motile and non contractile.
(ii) Its plasma membrane is thick and rigid.
(iii) They increase surface area and found in

eg. **– Epididymis** **– Vasadeferens**

Origin of Epithelium Tissue

It is the only tissue which originated from all the three primordial germinal layers.

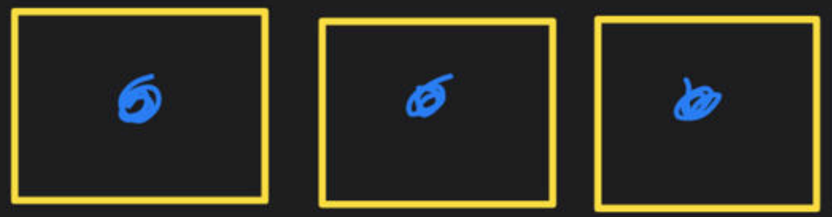
eg. (i) **Ectodermal** – Epidermis (stratified squamous Epithelium)

(ii) **Mesodermal** – Mesothelium (simple squamous Epithelium)

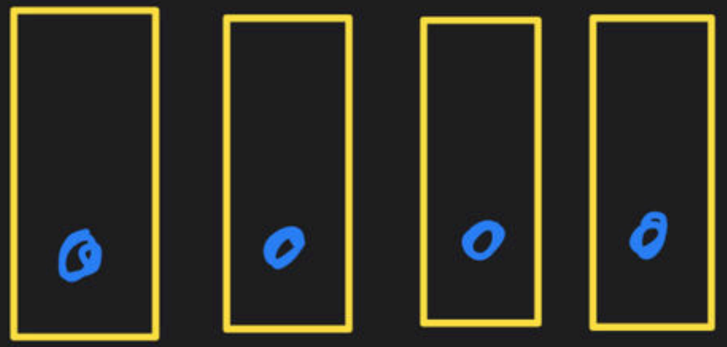
(iii) **Endodermal** – Inner living of gut (simple columnar Epithelium)

Type of cells

Flat / Squamous cells



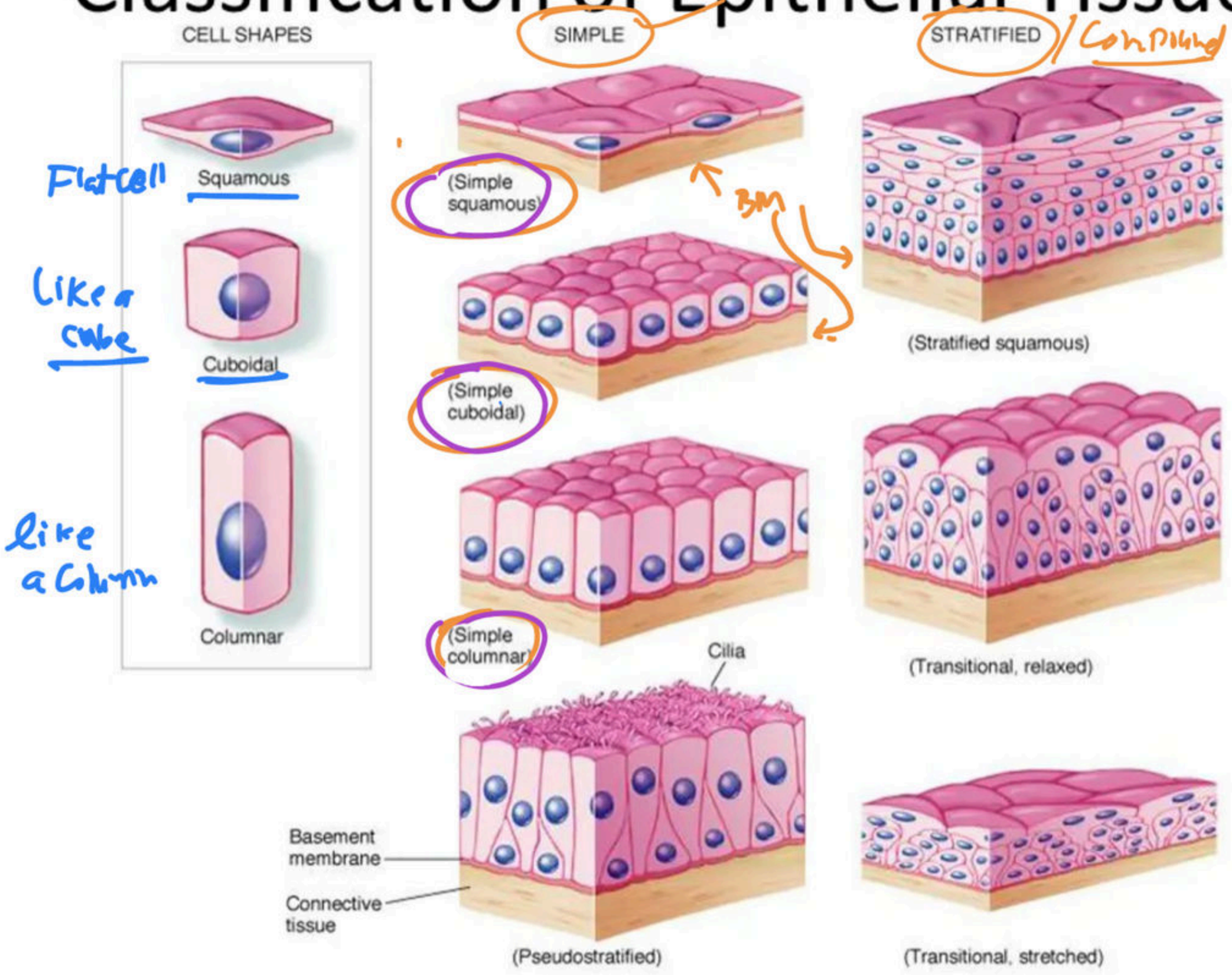
Cuboidal cells



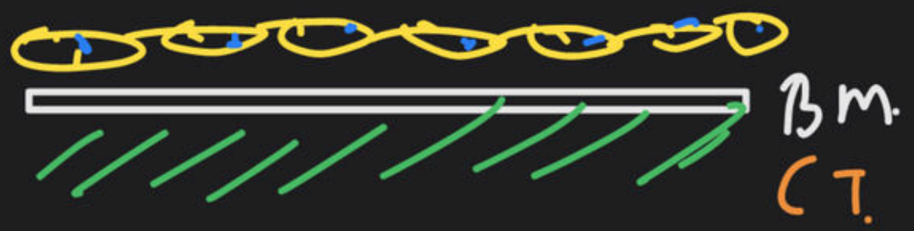
Columnar cells

Ciliated columnar cell

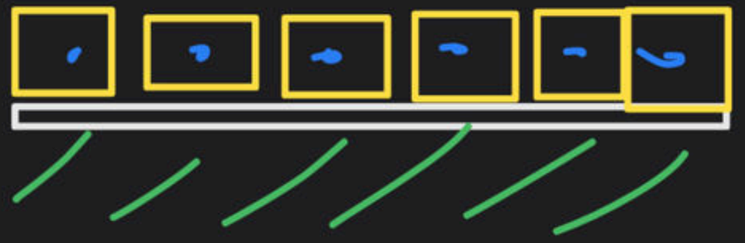
Classification of Epithelial Tissues



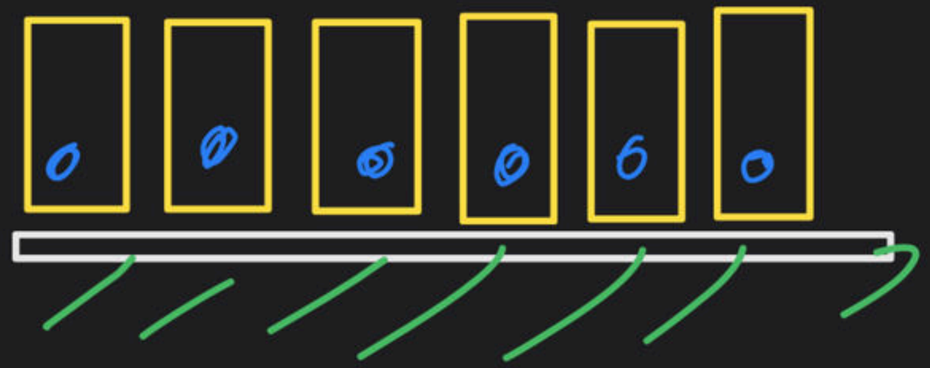
Simple Squamous



Simple Cuboidal



Simple Columnar.



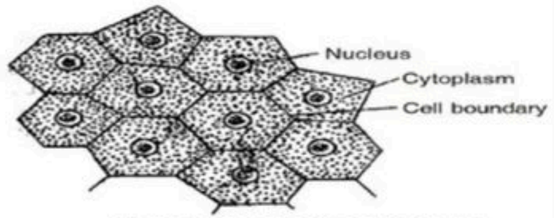
SIMPLE EPITHELIUM TISSUE

1. Simple Squamous epithelium

(i) Single layer of flat, scale like cell with irregular boundaries.

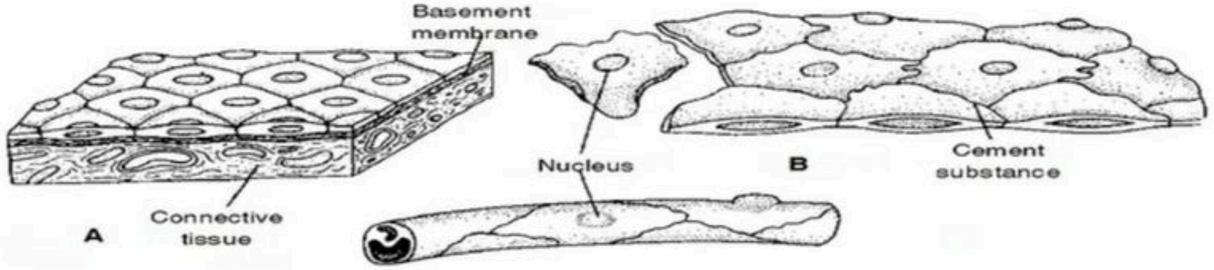
(ii) It is also called **pavement epithelium** due to its tile like appearance.

(iii) It is also called **Tesselated epithelium** due to its wavy appearance.



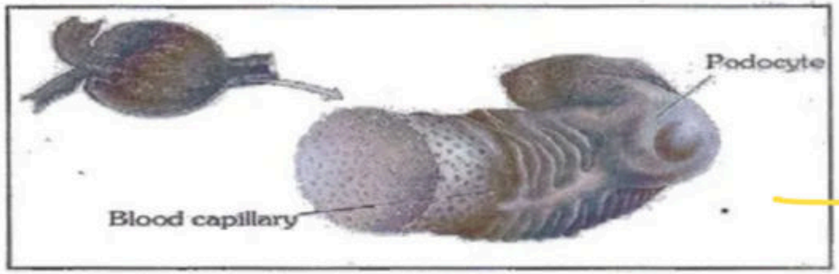
(Simple squamous epithelium)

Functions : forming a diffusion boundary

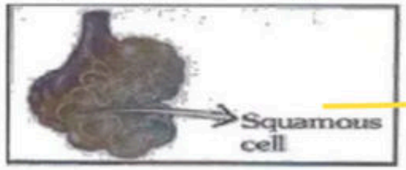


eg. It is found in the lining of :

(i) – Bowman's capsule (Podocyte)



(ii) – Alveoli of lungs (Pneumocytes) (air sac)



(iii) – Mesothelium – Covering of coelom is called as mesothelium. (Tesselated). (Visceral & Parietal peritonium, Visceral and parietal pleura, Visceral and Parietal pericardium).

(iv) – Endothelium – Inner lining of blood vessels and lymph vessels. (Tesselated) Inner lining of heart wall (Tesselated).