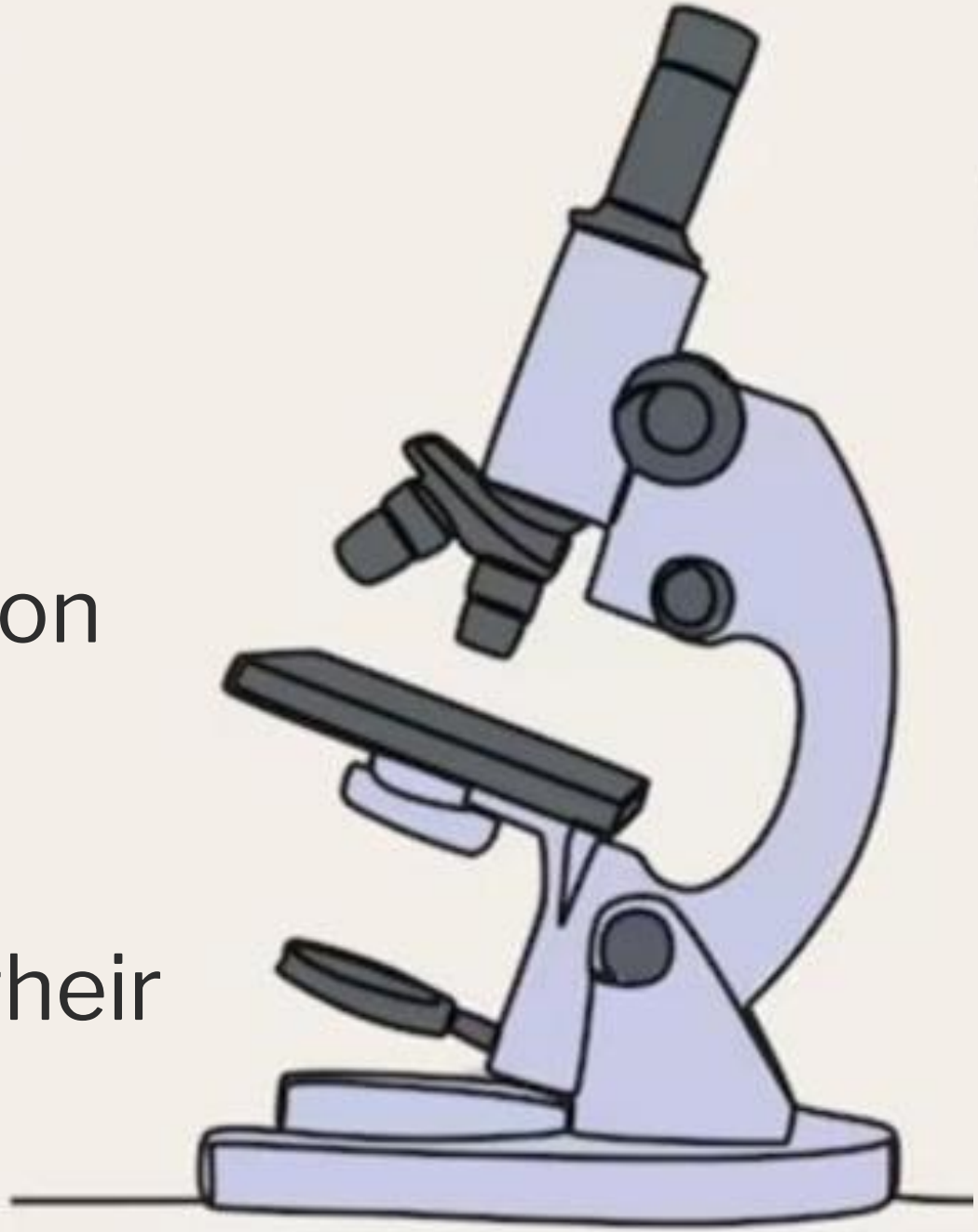
Histology

Modified n. 3

Writer: Raya AbuLimoon

Corrector: Nour Elzogheir



EPITHELIUM

Epithelium

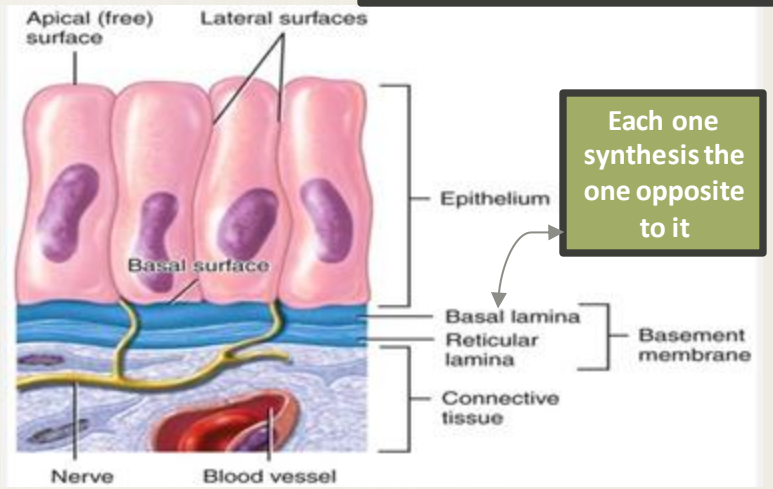
ECM is the structure that surrounds the cells, and it's closer to the basal surface of epithelium

The apical(free), lateral (cell to cell), basal (near ECM) surfaces makes the epithelium

- Continuous sheets of cells adhering strongly to one another and to the underlying ECM. They line internal surfaces and cover the external surfaces

- It is a selective barrier that cover, lines , and protects tissues and is often involved in absorption or secretion (best seen in the GI tract)

- Separated from the adjacent connective tissue by a **basement membrane**



Each one synthesis the one opposite to it

epithelium
،(طلاء)تعني النسيج الطلائي من
In every single cavity, tube, blood vessel's lining you always gonna see epithelium
Arteries, veins and capillaries are all connected to the heart so the heart (which is the pump) is also lined(مبطّن) with epithelium
Examples : the ureter , the major cavity within the scalp, the trunk's cavities
* The type of epithelium depends on its function, for example the tissues that do absorption have a type of epithelium that differs from other tissues that do digestion

Characteristics of epithelium

- Supported by the underlying connective tissue.
- Innervated (has nerves).
- Avascular (no blood vessels) ; blood supply is in supporting connective tissue.
- Has a **good regeneration capacity but varies**
- **widely; GIT every week—or quite slow**
- **as in large glands.**

The cells of the epithelium are attached to each other, adhering strongly one to another and often do not allow the passage of materials through them, but there are some exceptions where the function of the lined tissue requires the entry and exit of materials.

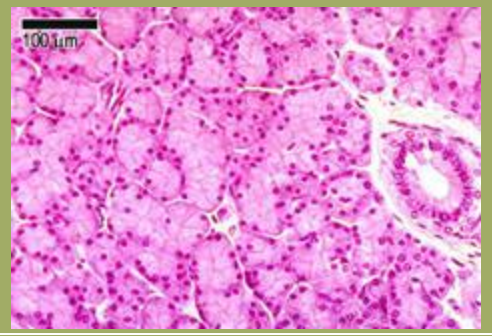
Some functions of the underlying connective tissue include:

- it connects the epithelium with other tissues
- it protects and supports the overlying epithelium
- it supplies the overlying epithelium with blood by diffusion because Epithelium doesn't contain blood vessels inside it and the process is called vascularization

The connective tissue usually divided into two types : 1-loose 2- dense , loose means it's not thick nor hard and that's the type we usually have under the epithelium, it has more cells and less fibers in some locations this loose connective tissue is called lamina propria

Functions of epithelium

- Protection main function/covering—lining—epidermis.
- Secretion—glandular tissue
- Either glands or regular epithelial cells do the secretion



Glandular tissue , exists in breast, stomach and skin. It plays a role in secreting substances such as sweet, breast milk, digestive enzymes and hormones

- The glands are mainly made from the epithelium

Secretion in epithelium:- Epithelium includes some special cells that are designed for secretion for example the lining of the stomach is a type of epithelium and it secretes mucus, HCl, and enzymes

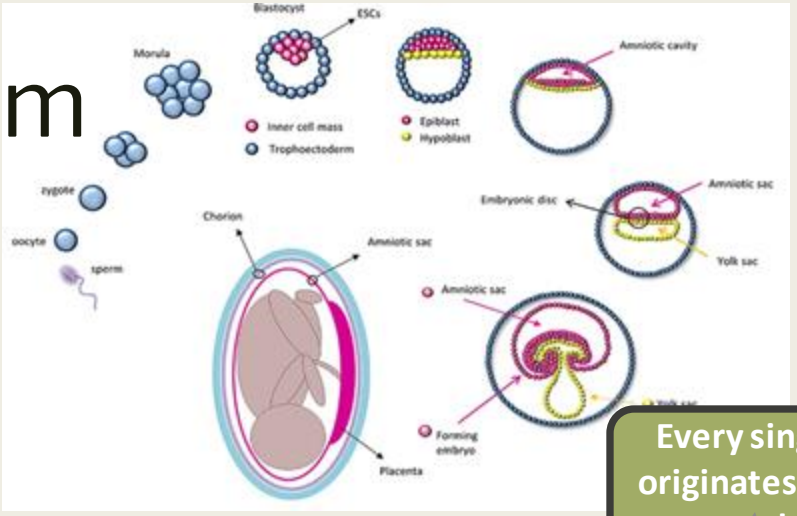
How glands are developed? During the development of the embryos, there are signaling pathways that alert some cells to go inside in the connective tissue's direction leaving the surface and then proliferating (multiplying) inside with changes creating glands

Functions of epithelium

- Absorption—intestines.
- Detection of sensations.—inner ear, taste buds.special cells designed with built-in mechanism so they can detect sensation and balance
- Contraction (means shortening)--- specialized cells or fibers ---myoepithelial cells (glands) cells that have the fibers that are used for contractions and are usually in glands

There's a liquid that moves on the surface of the cells, then the cells detect this motion and translate into hearing , that's how we hear actually

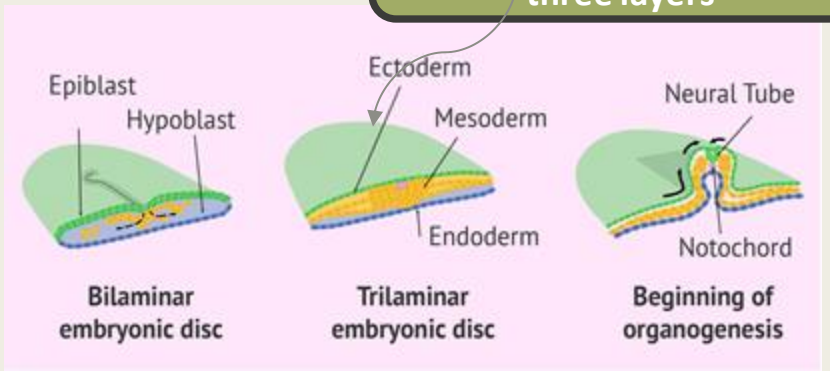
Embryogenesis of epithelium



Epithelium arises from all germinal layers: mesoderm, endoderm, and ectoderm, **depending on the location and function of the epithelium. For example, if the epithelium will function in the lungs, it will arise from endoderm**

1. **Ectoderm**: epidermis(stratified squamous keratinized).
2. **Mesoderm**: endothelium.
3. **Endoderm**: GIT tract (not all), lungs.

Every single type of tissue originates from one of these three layers



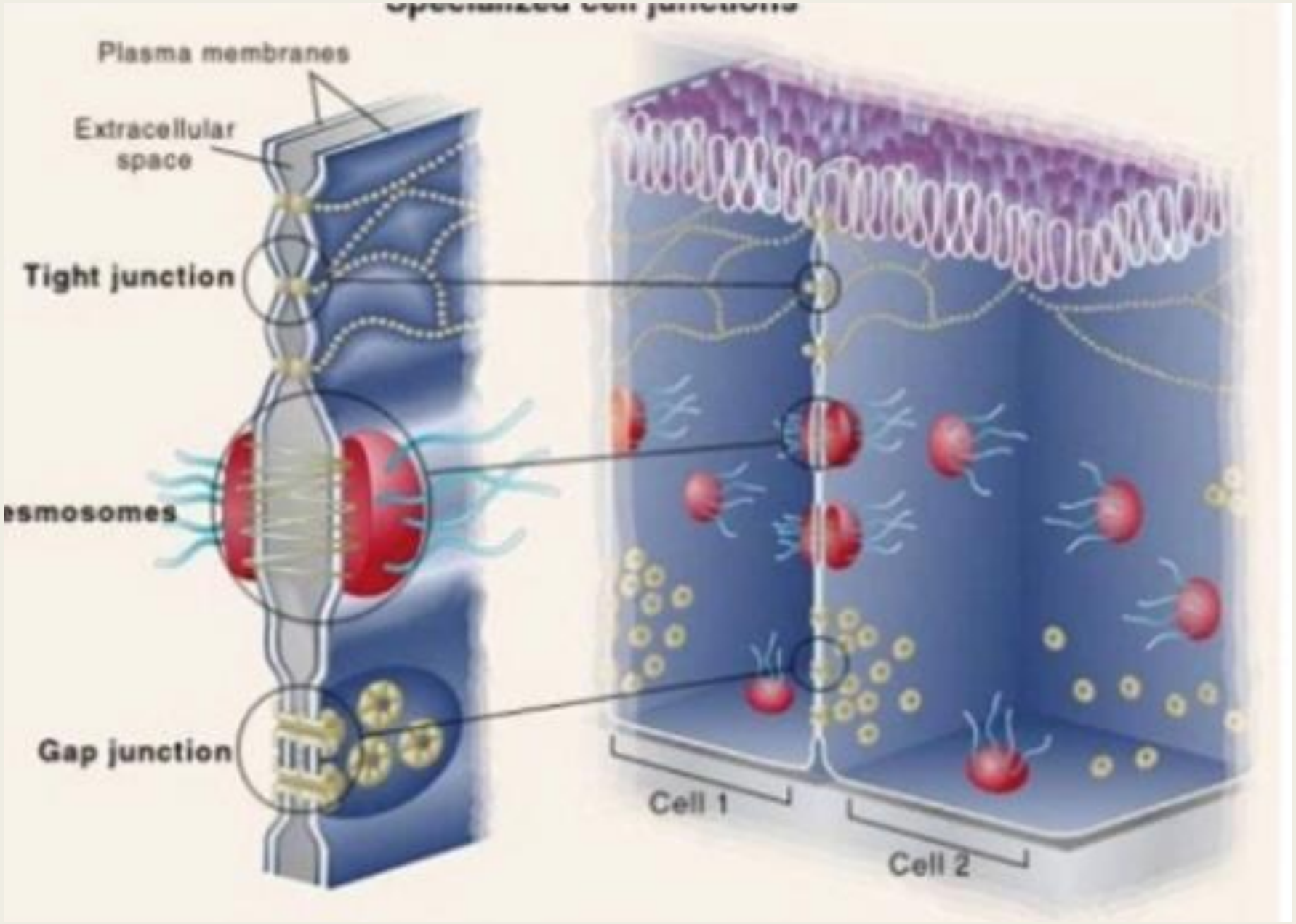
Endothelium:
A thin layer of cells that lines the insides of the heart and blood vessels it releases substances that control vascular relaxation and contraction as well as enzymes that control blood clotting

Features >>> what distinguishes the epithelium from other tissues

Epithelial cells are highly polarized:

- **Apical surface -** faces the lumen or the external environment
  - Microvilli, cilia, stereocilia usually seen in columnar epithelium
- **Lateral surface -** faces the sides of adjacent cells
  - Tight junctions, desmosomes, gap junctions (intercellular junction)
- **Basal surface -** attaches to the basement membrane
  - Basement membrane, hemidesmosomes

The apical surface usually has what we call apical modifications or **extensions** like cilia and they're connected to the cytoplasm of the cell , we can only see them using the electronic microscope
The microvilli is shortest, and their main function is absorption & increasing the surface area
The cilia is significantly longer, its main function is mobility because of its inner structure which consists of motor proteins
Stereocilia can be found in the inner ear and function in hearing and equilibrium
It can also be found in the genital tract in males and function in absorption (similar to microvilli)


Plasma membranes
Extracellular space
Tight junction
esmosomes
Gap junction
Cell 1
Cell 2

Features

simple epithelium :- one layer of cells
Stratified epithelium:- more than one layer of cells

- Cells' shape: columnar cuboidal and squamous---function.
- Nucleus shape: elliptic (oval), spherical, or flattened---cell---shape.
- Most epithelia are adjacent to connective tissue-----receive nutrients and O_2--lamina propria (digestive, respiratory, urinary).

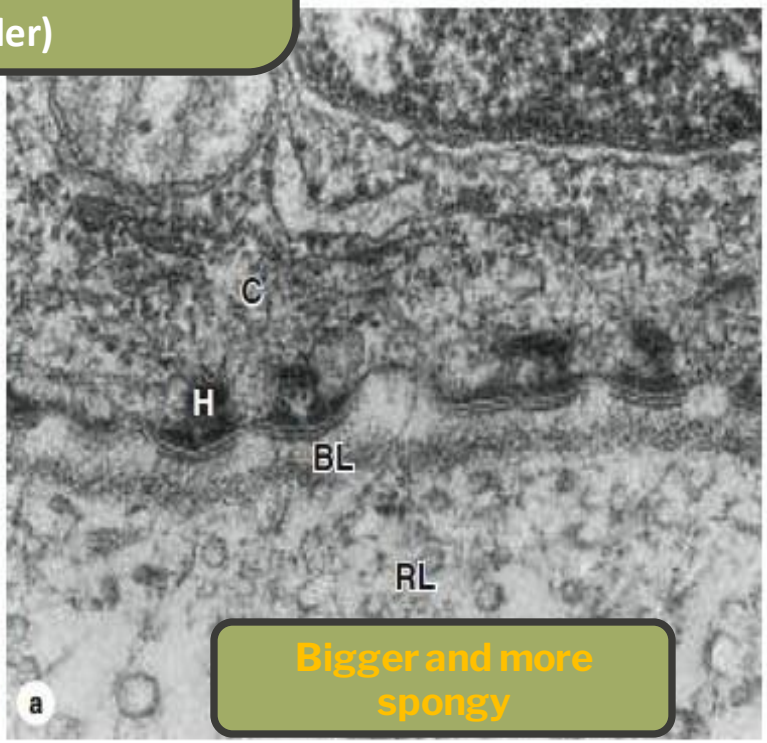
The nuclei is elongated

Basement membrane

Anything that needs to move from the epithelium to connective tissues and vice versa will go through the basement membrane(it also works as a check border)

- Thin extracellular, felt-like sheet of macromolecules.
- A <u>semipermeable filter for substances</u> reaching epithelial cells from below
- Electron microscope: basal lamina (epithelium), reticular lamina(CT).

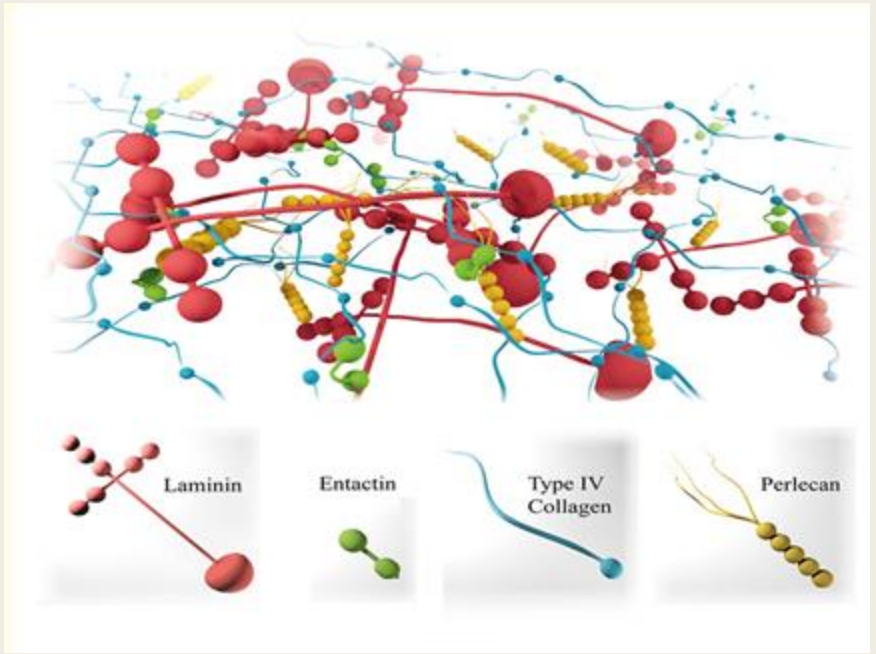
Connective tissue



By Electron microscope (TEM)

BL: basal lamina
RL: reticular lamina

Basal Lamina



So much important

- Molecules of basal lamina:

1-Type IV collagen: a two-dimensional network of evenly spaced subunits.

(Collagen is a protein and it has many type with two designated types which are network and Filamentous)

2- Laminin: large glycoproteins that attach to integrins, and project through the network of collagen IV.

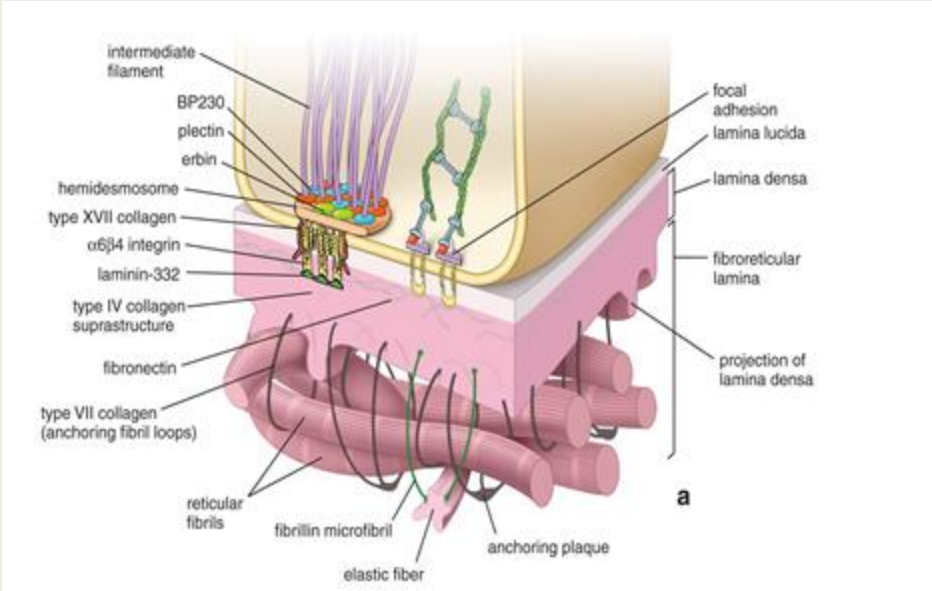
3- Nidogen (entactin) and perlecan: protein and a proteoglycan, cross-link laminin to the collagen network and help determine the porosity of the basal lamina and the size of molecules able to filter through it.

Reticular lamina: contains collagen type III which is bound to basal lamina by collagen type VII.

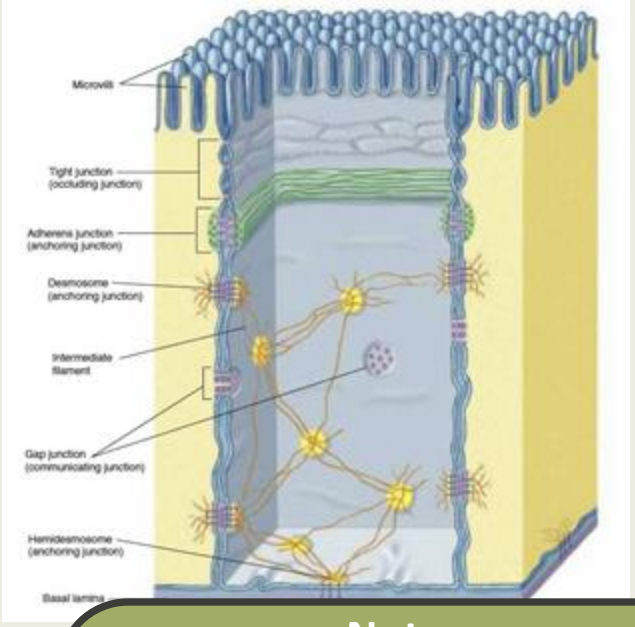
Reticular fibers

Reticular lamina

- Contain reticular fibers (collagen type III)
- Anchoring fibrils of type VII collagen link the basal lamina with the reticular fibers of the reticular lamina
- Product of the connective tissue.



Junctional Complexes



- Membrane-associated structures provide <u>adhesion and communication between cells</u>
- Epithelial cells adhere strongly to neighboring cells and basal laminae
- Tight or occluding junctions form a seal between adjacent cells.(it's immediately under the apical surface most apical)
- <u>Adherent or anchoring junctions are sites of strong cell adhesion.</u>
- Gap junctions are channels for communication between adjacent cells.
- Desmosomes or macula adherens are disc-shaped structures at the surface of one cell that are matched with identical structures at an adjacent cell surface.

Note:
in the GI tract, the nutrients can't pass between the cells(paracellular).Instead, it passes through the epithelial tissues by entering their cells (transcellular)

The adhering , glowing character came from junctional complexes

Junction also appear in the basal surface:-
<u>Hemidesosomes</u> are specialized junction complexes that contribute to the attachment of epithelial cells to the basement membrane (which is why the skin is hard to peel)