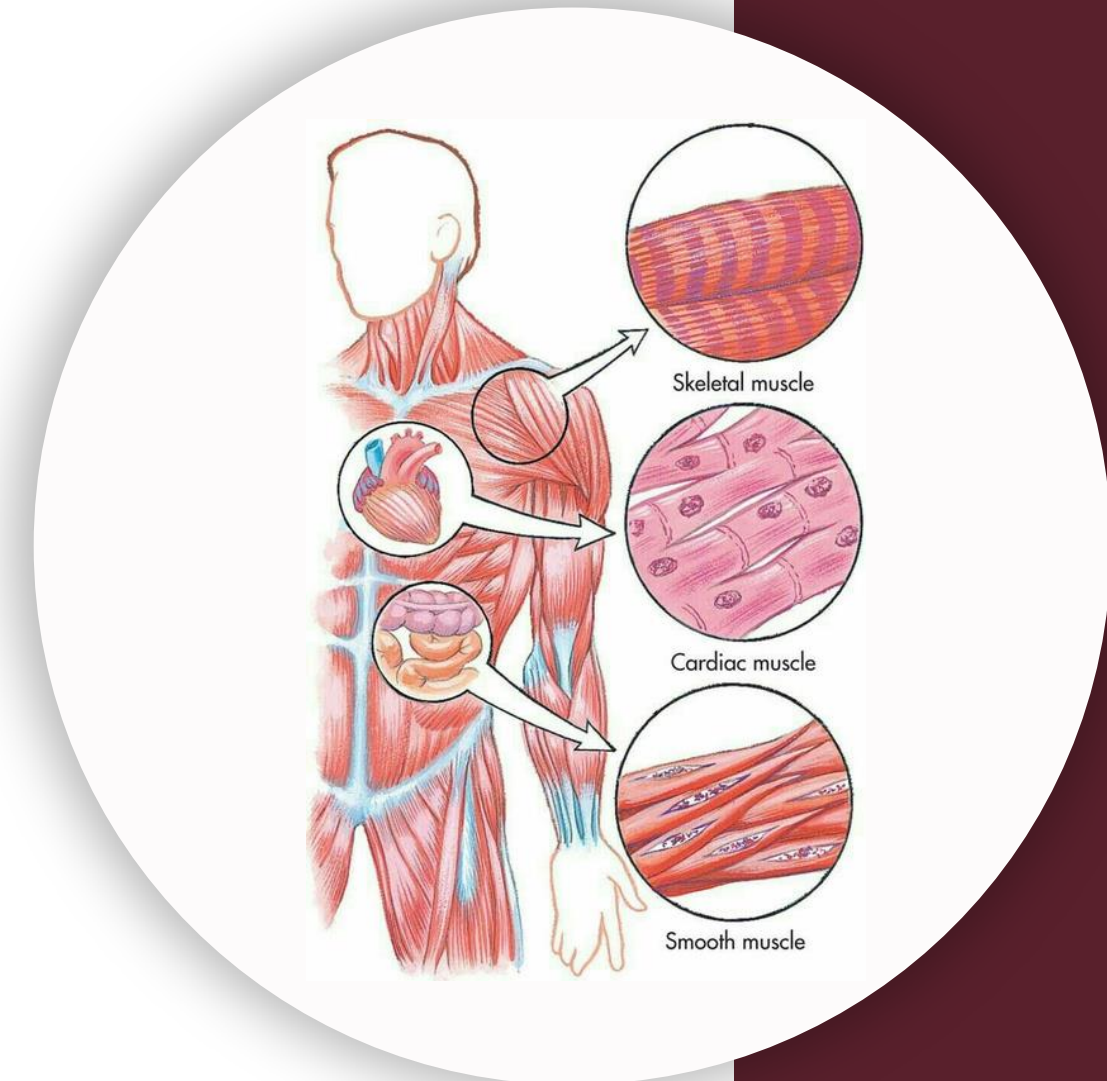


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



Histology - Lecture 3

Epithelium pt. 1



Written by : Taymaa Abdelkhaleq
Heba Salah

Reviewed by : Shorouq Matakah

EPITHELIUM

Epithelium tissue is one of the **4 basic tissues** in the body .
(**epithelium , connective , muscular , nervous**)

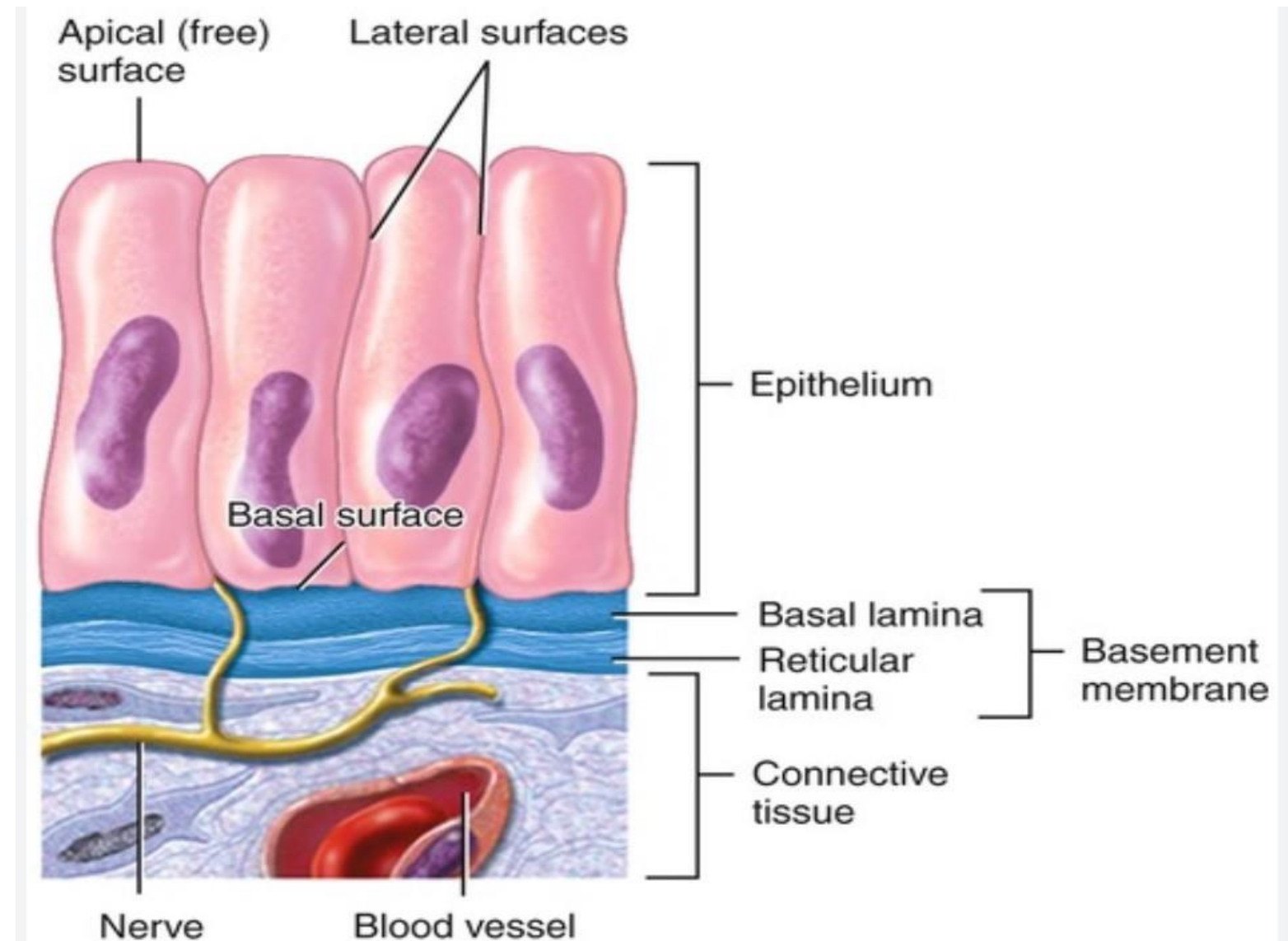
Classification of epithelium tissue includes :
1. Lining / covering 2. special types 3.glandular .

Epithelium

Epithelial cells are held by intercellular junctions (like tight junctions) Therefore the para-pathway is blocked to regulate and protect the body's internal environment .

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

With the help of Electron microscopy , we were able to observe the two layers of the basement membrane (the basal and reticular lamina)



The basal lamina is synthesized by *epithelium cells* Whereas the reticular lamina is synthesized by *connective tissue*

Characteristics of epithelium

- Supported by the underlying connective tissue. (their proximity to vascularized connective tissue is crucial for their survival and function)
- 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.** (good generation capacity = high renewal rate)
- **Epithelial cells are Avascular (they lack direct blood supply) but they're nourished by diffusion from underlying connective tissue which is rich in blood and lymphatic vessels .**
- **Blood in connective tissue → nutrients diffuse across the basement membrane → into epithelial cells.. Epithelial cells' waste products follow the reverse pathway , diffusing from epithelial cells back into connective tissue for removal .**

The Epidermis (superficial layer of skin) is made up of epithelial tissue.
The skin has a very high renewal rate , it can be renewed approximately every 30 days

Functions of epithelium

- Protection/covering—lining—epidermis.
- Secretion—glandular tissue
- Absorption—intestines.
- Detection of sensations.—inner ear, taste buds.
- Contraction---specialized cells---myoepithelial cells (glands)

Myoepithelial cells are epithelial cells with contraction capacity (they contain actin and myosin). They're not gland themselves but they assist glandular epithelial cells in moving fluids (they contract to push glandular secretions).

- Example on *detection* function:

The Olfactory epithelium which is located on the roof of the upper part of the nasal cavity .

It's responsible for detecting odor.

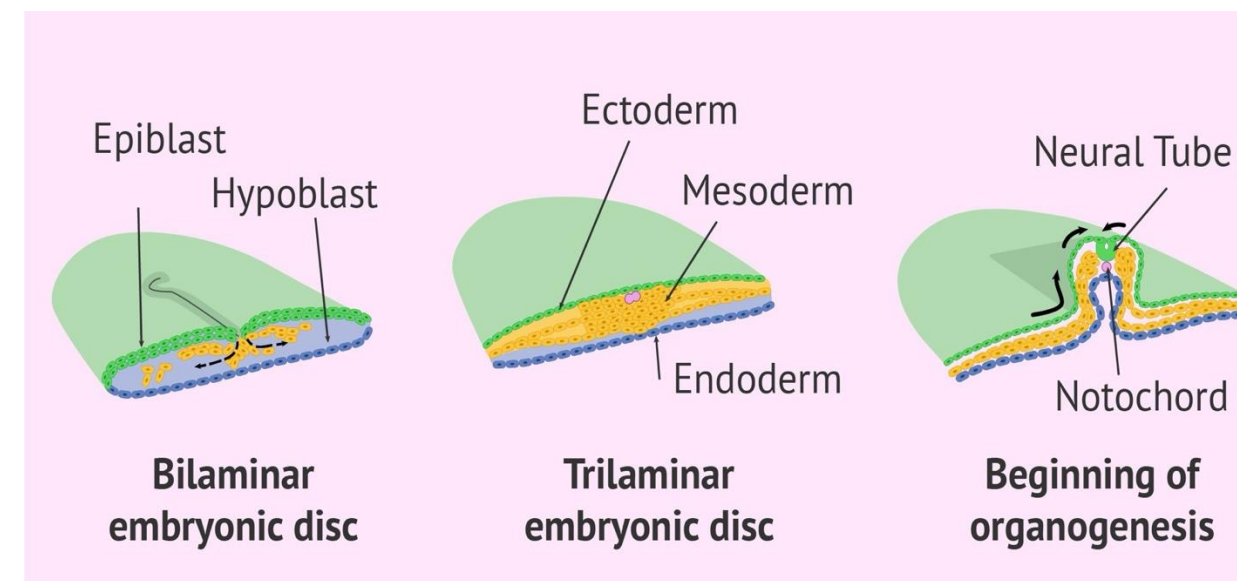
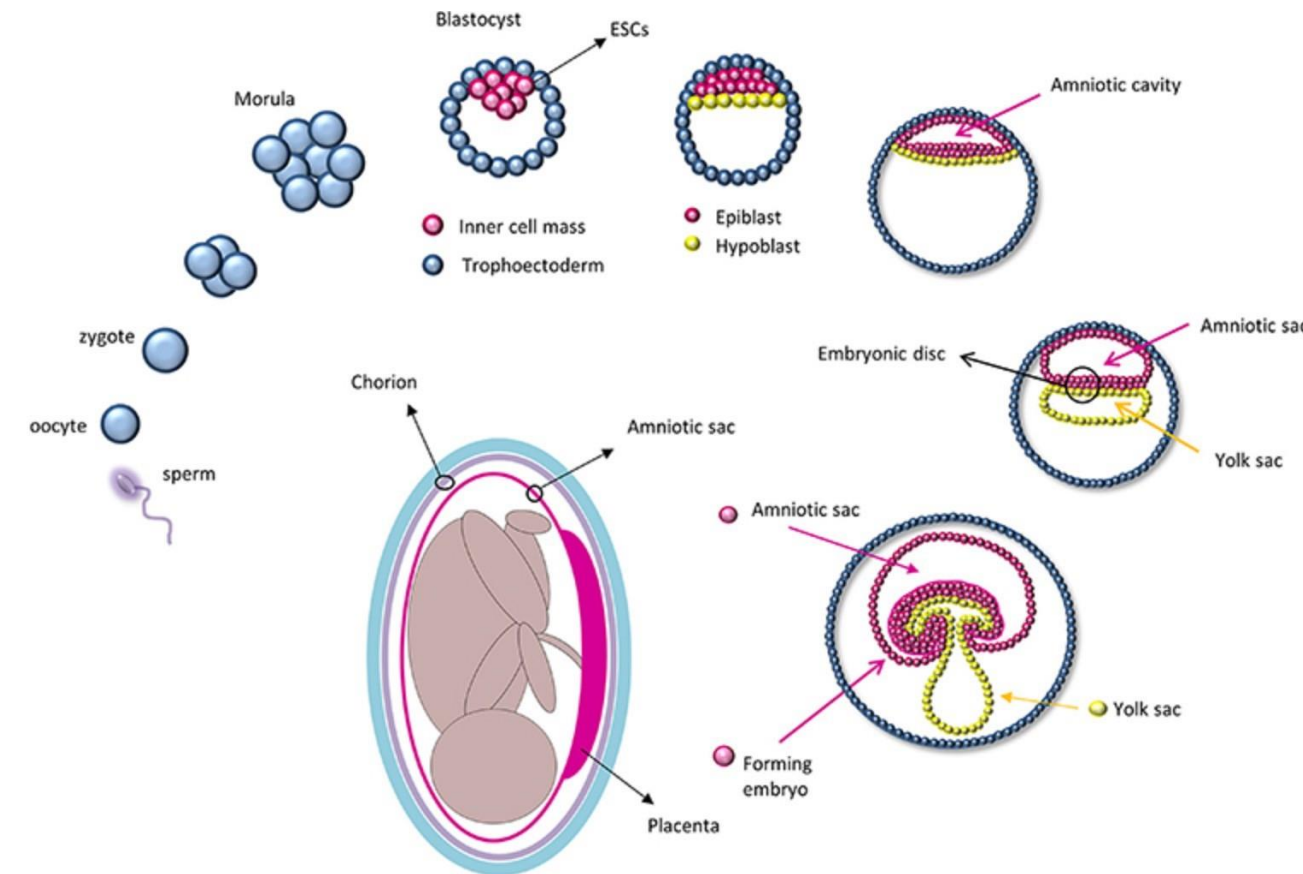
Embryogenesis of epithelium

How did we end up having 4 tissues ?

After fertilization, the zygote divides to form (the morula), and then forms a hollow structure called a **blastocyst**. The cells of the blastocyst differentiate into two main cell groups: the **epiblast** and the **hypoblast**. These groups contribute to the development of different tissues in the body.

Epithelium arises from all germinal layers
mesoderm, endoderm, ectoderm .

1. **Ectoderm:** epidermis –*superficial skin*–
(stratified squamous keratinized) and the nervous system.
2. **Mesoderm:** endothelium , muscle tissue ,
connective tissue .
3. **Endoderm:** GIT tract (*not all*), lungs.



–The mesoderm contributes the least to epithelial tissue formation compared to other germinal layers.

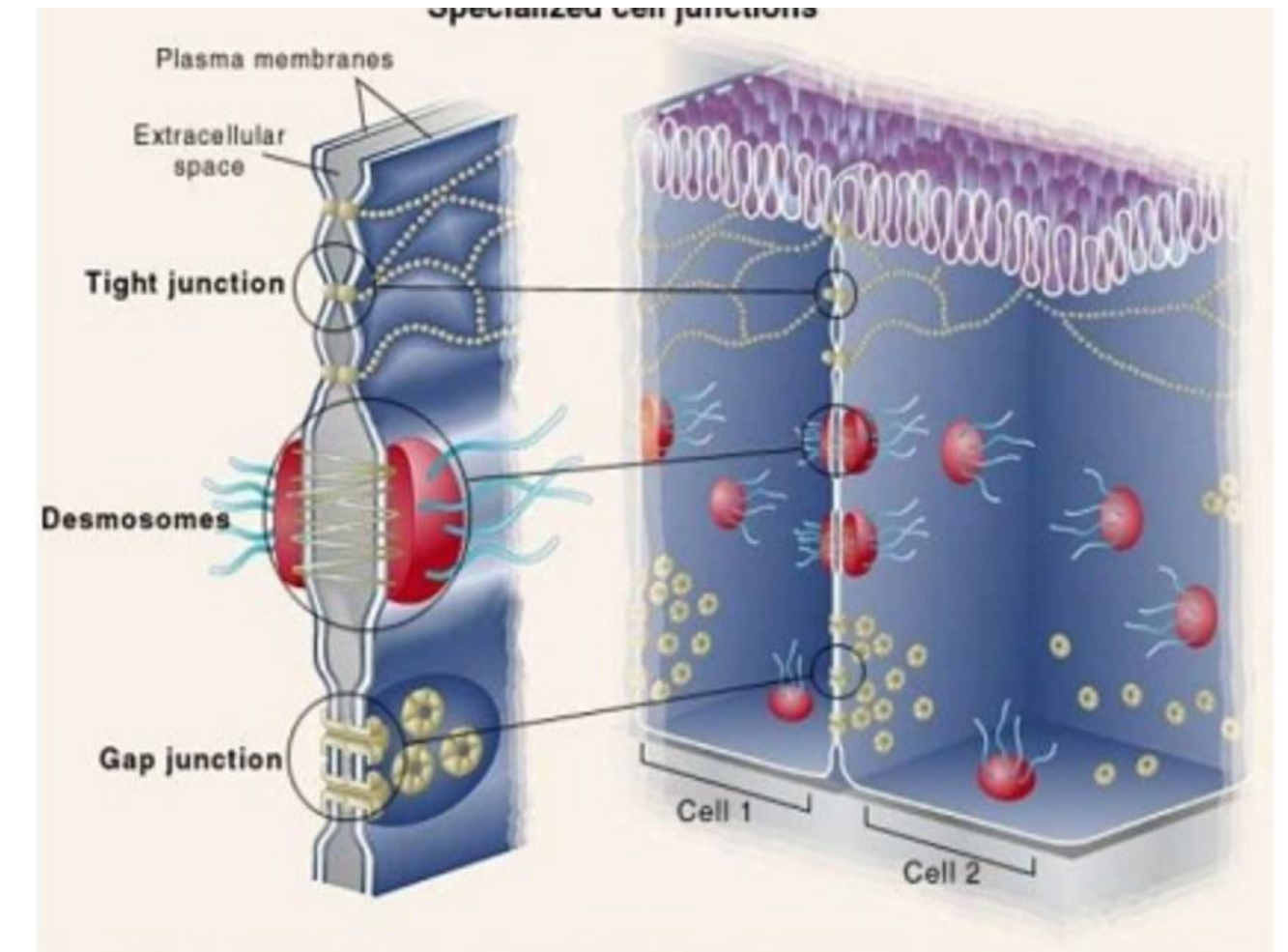
Features

We have already mentioned three features for epithelial cells such as they are **avascular, innervated and they can regenerate (variable)**. Also, epithelial cells are **highly polarized**.

When we say epithelial cells are polarized, we mean that **they have distinct structural and functional differences between their apical surface (top or head) and basal surface (bottom or feet) surfaces and lateral surface (arms). This polarity is essential for their specialized functions in absorption, secretion, and barrier formation.**

Epithelial cells are highly polarized:

- **Apical surface** - faces the lumen or the external environment) **In the skin, this surface is exposed to air. In the intestines, it faces the digestive tract(.**
 - **Microvilli, cilia, stereocilia).**these special structures that help apical surface in its function)
- **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



In a single-layer (simple) epithelium, the basal surface of each epithelial cell is located at the bottom, where it is attached to the basement membrane. This membrane separates the epithelium from the underlying connective tissue and provides structural support.

Hemidesmosomes: Similar to desmosomes but attach the cell to the basement membrane instead of other cells.

Features

Epithelial cells differ in their functions and locations , so they should have mechanisms to give these differences.

All the types of epithelial tissue play a protective role.

- 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 O₂--lamina propria (digestive, respiratory, urinary).

Classification of Epithelial :

1) Number of layers in the tissue

- Simple epithelial...single layer of cells or one row of nuclei
- Stratified epithelial...several layers of cells

2) Specific shape of each cell

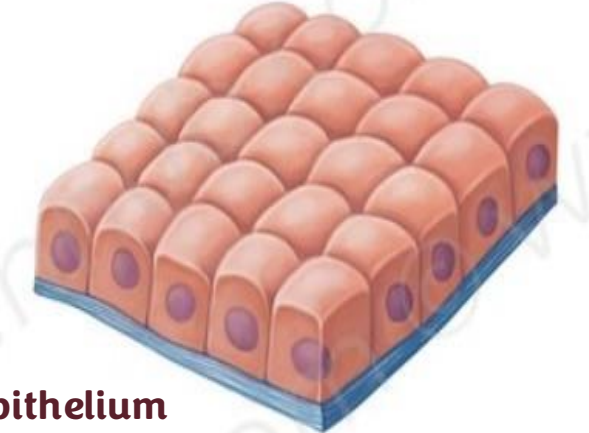
- Squamous cells (flat).
- Cuboidal cells(the nucleus is rounded).
- Columnar cells(the nucleus is oval in shape)

Nucleus takes the general shape of the cells

They have wide surface area and it's extremely thin,so they cover big surface area and play a vital role in the passage of gases through it .For example,lining of the blood vessels and alveoli



Simple squamous epithelium
(these are the shortest)



Simple cuboidal epithelium
(these are in between.Usually we see this type lining duct as small tubes in the kidney)



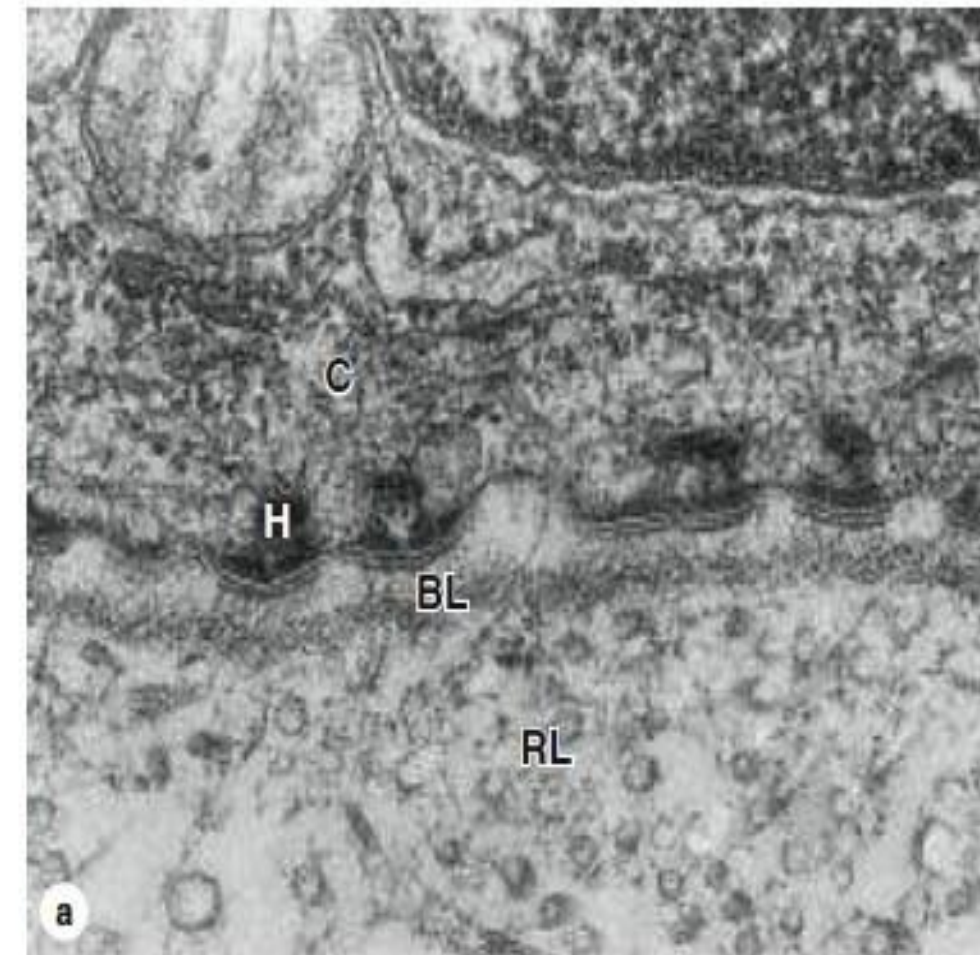
Simple columnar epithelium
(these are the tallest ,and they have huge amount of cytoplasm,so whenever you have secretion and absorption that's the type you will see in that tissue)

Basement membrane

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

Basement membrane that the structure we see with light microscope, but if we're referring to the electron microscope, what do we see? The basal lamina adjacent to the connective tissue

TEM (black, white and gray)



Epithelial cell

Basement membrane

Connective tissue

Basal Lamina (BL): thin layer
Reticular Lamina (RL): thick layer

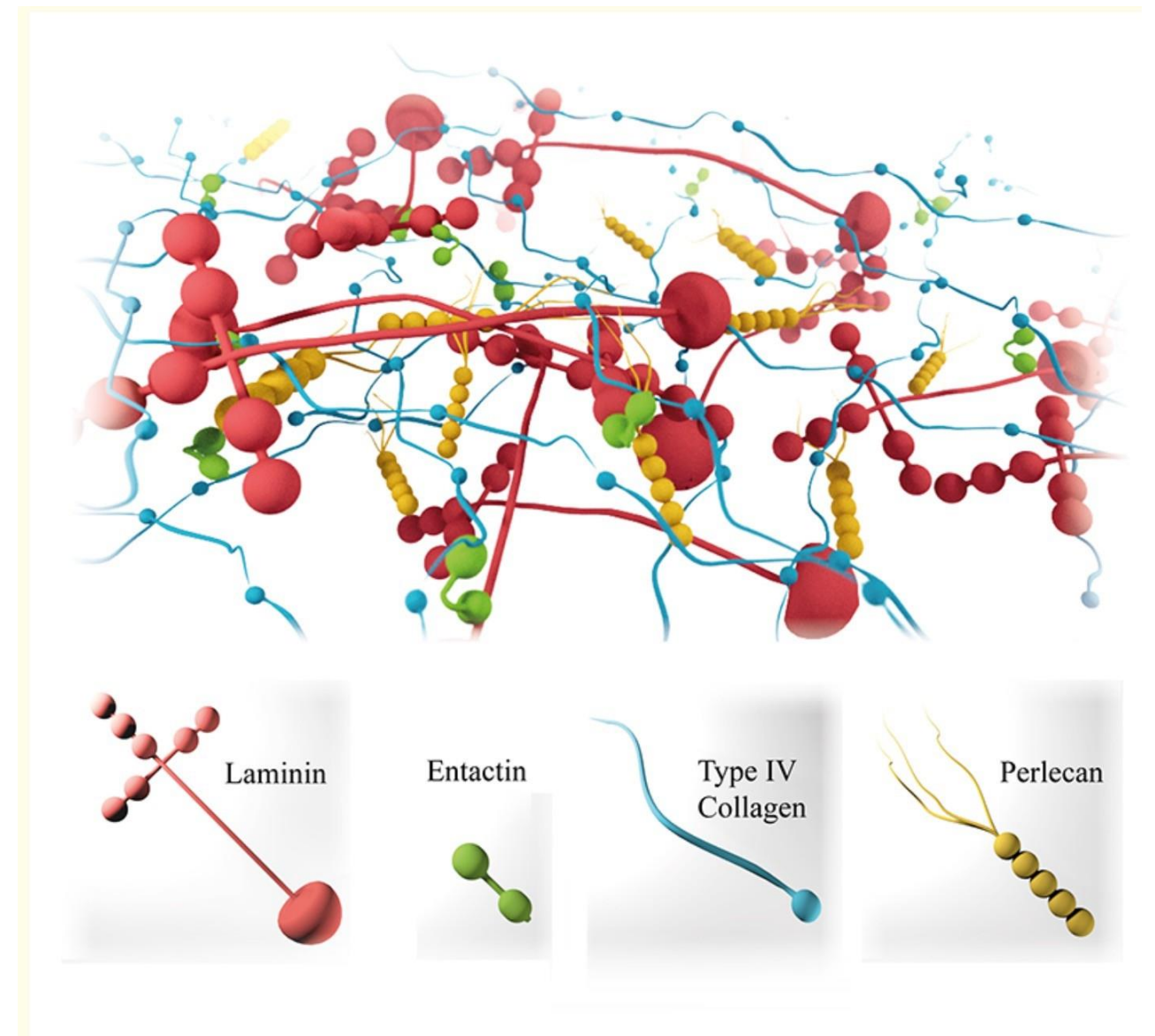
- **Basal Lamina** connects with the epithelium.
- **Reticular Lamina** connects with the connective tissue.

Basal Lamina

- **Molecules of basal lamina:**

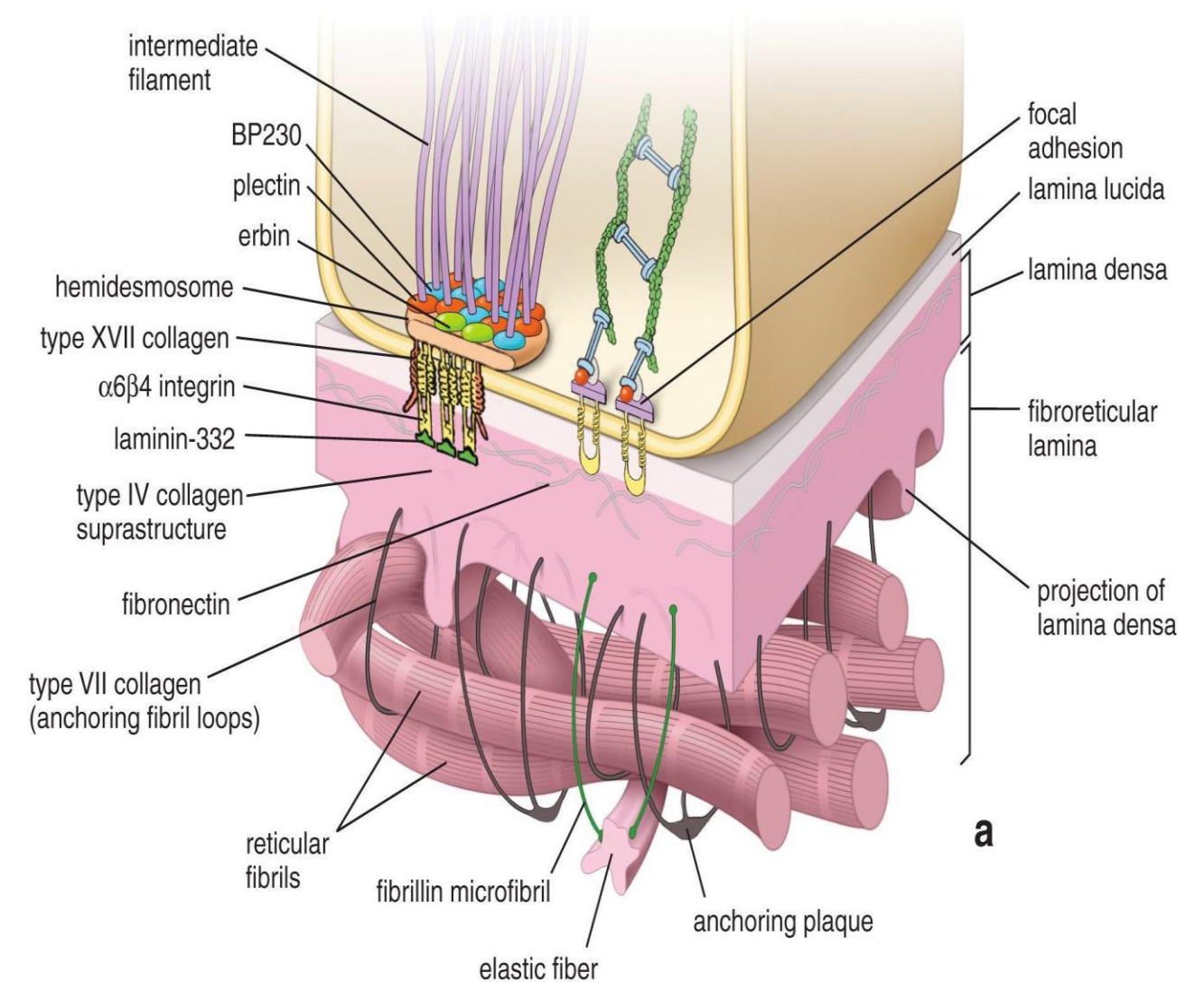
1. Type IV collagen: a two-dimensional network of evenly spaced subunits.
2. Laminin: large glycoproteins that attach to integrins, and project through the network of collagen IV.
3. Nidogen (entactin) and perlecan: **protein** (Nidogen) and a **proteoglycan** (Perlecan), cross-link laminin to the collagen 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 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.



Additional Resources:

رسالة من الفريق العلمي:

عن سهل بن سعد رضي الله عنه أن النبي صلى الله عليه وسلم قال: في الجنة ثمانية أبواب، فيها باب يسمى الريان، لا يدخله إلا الصائمون (رواه البخاري، وزاد النسائي): فإذا دخل آخرهم أغلق، من دخل فيه شرب، ومن شرب لم يظماً أبداً).



For any feedback, scan the code or click on it.



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	Slide number 9	Basement membrane that the structure we see with light microscope, but if we're referring to the electron microscope, what do we see? The basal lamina is adjacent to the connective tissue	Basement membrane that the structure we see with light microscope, but if we're referring to the electron microscope, what do we see? The basal lamina is adjacent to the epithelial tissue (basal surface), and the reticular lamina is adjacent to the connective tissue
V1 → V2	Slide 4	-	Some changes