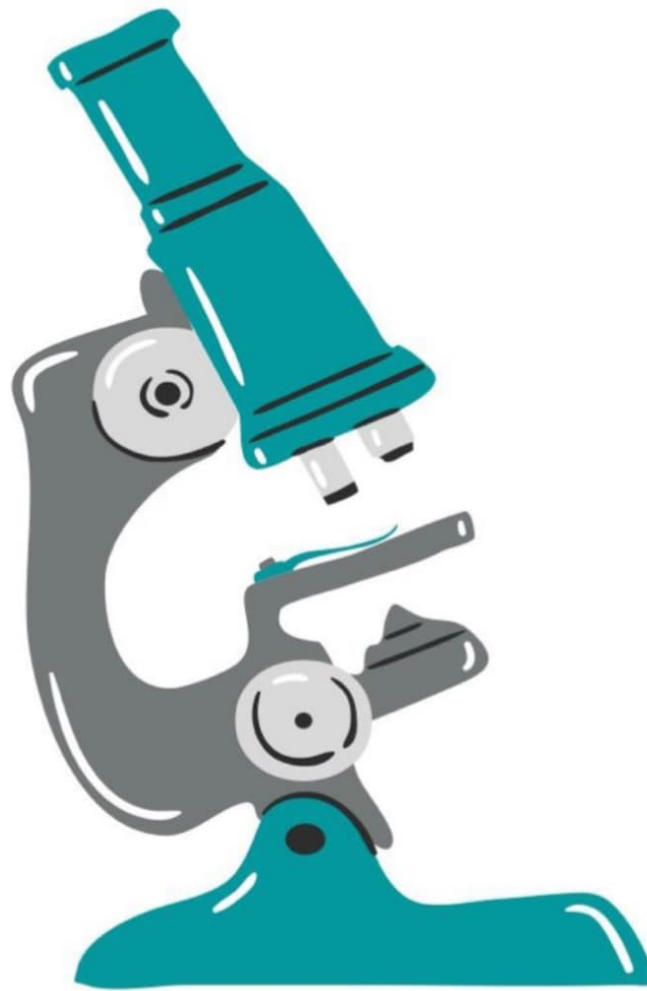


Sheet no. 4



Histology



Writer: Rawan Aqaileh

Corrector: Rama Harb

Doctor: Ghada Abu El-Ghanam

These are some questions that the doctor asked at the beginning of the lecture as a revision to the previous lecture:

1. True or false:

- a) The epithelial tissue is none innervated. (False)
- b) Epithelial tissue is vascular. (False, it is avascular)
- c) Connective tissue it's not necessarily presented under the epithelial tissue. (False)
- d) the epithelial tissue has secretory functions. (True, it forms glands)

2. The basement membrane is the term that we use when we use EM or LM?

(When we use the LM, because it's visible with the light microscope). But when we look using the EM we see two laminae: basal lamina adjacent to the epithelial tissue and reticular lamina adjacent to the connective tissue.

Laminae is the plural of lamina.

3. Transitional epithelium: according to its name it transit from one form to the other depending on the physiological state of the organ that this tissue is presented in.

4. Is pseudostratified epithelium simple or stratified?

(It is simple, it's called pseudo because it appears stratified and that because the nuclei of its cells aren't at the same level).

Types Of Epithelium

TABLE 4-3 Common types of covering epithelia.

Major Feature	Cell Form	Examples of Distribution	Main Function
Simple (one layer of cells)	Squamous	Lining of vessels (endothelium); Serous lining of cavities: pericardium, pleura, peritoneum (mesothelium)	Facilitates the movement of the viscera (mesothelium), active transport by pinocytosis (mesothelium and endothelium), secretion of biologically active molecules (mesothelium)
	Cuboidal	Covering the ovary, thyroid	Covering, secretion
	Columnar	Lining of intestine, gallbladder	Protection, lubrication, absorption, secretion
Stratified (two or more layers of cells)	Squamous keratinized (dry)	Epidermis	Protection; prevents water loss
	Squamous nonkeratinized (moist)	Mouth, esophagus, larynx, vagina, anal canal	Protection, secretion; prevents water loss
	Cuboidal	Sweat glands, developing ovarian follicles	Protection, secretion
	Transitional	Bladder, ureters, renal calyces	Protection, distensibility
	Columnar	Conjunctiva	Protection
Pseudostratified (layers of cells with nuclei at different levels; not all cells reach surface but all adhere to basal lamina)		Lining of trachea, bronchi, nasal cavity	Protection, secretion; cilia-mediated transport of particles trapped in mucus out of the air passages

1. Simple squamous epithelium:

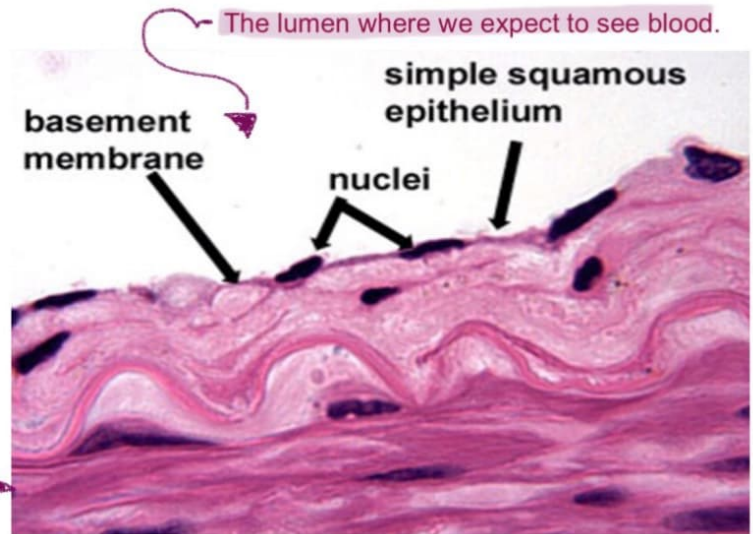
A. The endothelium.

* The simple squamous epithelium that lining the vessels is called endothelium.

*All types of blood vessels are lined with endothelium from the inside.

When we look at the vessel we expect to see one line of cells, we see flattened cells.

This section has been taken from a blood vessel, we expect to find blood and going deep inside in the tissue we're facing the connective tissue.



This has been taken by LM (bright field), and it's stained using H&E.

The characteristics of the simple squamous epithelium that it consists of one line of cells (flattened cells) and the cells have a small amount of cytoplasm, but have a big surface area. The maximum dimension of the cell is transversally, so the simple squamous type has the biggest surface comparatively with the other types, but the least amount of cytoplasm.

The nuclei follow the same shape and appear compressed or flattened or spindle shaped. However, sometimes you'll find some cells a-rounded more than the other, there is no 100% shape that you're going to see, but definitely you'll see a-rounded nucleus inside it. So shapes are flattened, how much flattened? It depends, if it was a bit stretched it'll look like align but if it's a bit relaxed, the cells will be somehow rounded. And sometimes it depends on the section that has taken from the tissue.

هون للتوضيح الذكورة ذكرت مثال على البيضة، إذا أخذنا مقطع من طرف البيضة رح تكون مساحته الي مبينة النا صغيرة، إذا أخذنا مقطع من نص البيضة رح تكون مساحة هالمقطع الي مبينة النا كبيرة، ونفس المبدأ بالنسبة للنويات الي بالخلايا.

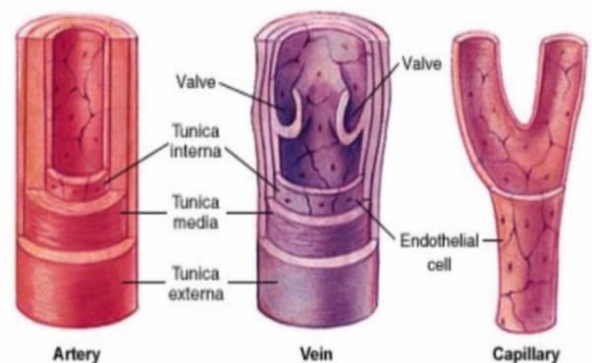
*Nucleus usually centrally located.

Usually blood vessels have three layers:

1. Tunica interna.
2. Tunica media.
3. Tunica externa.

The endothelium is a part of the tunica interna layer.

Blood Vessels



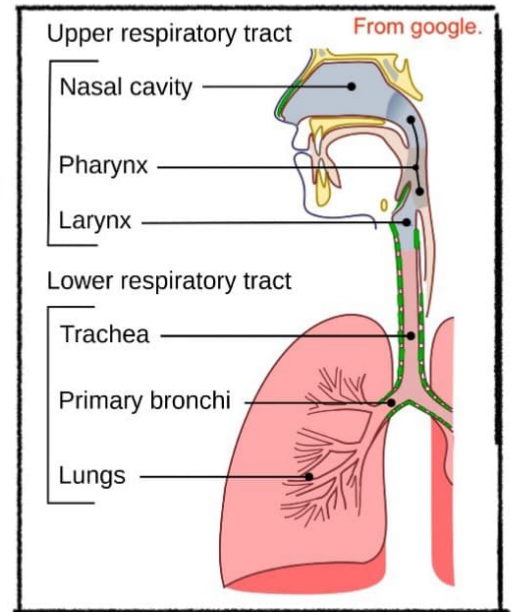
B. The simple squamous epithelium in lung alveoli:

The lungs start from the upper respiratory tract where the air passes, then the air enters the trachea. The trachea is separated to bronchi, in which each bronchus reach a lung and they are called primary bronchi, then inside the lungs the bronchi branch and get smaller and smaller until eventually the respiratory tract ends with what we call it the alveoli (alveoli are sacs like).

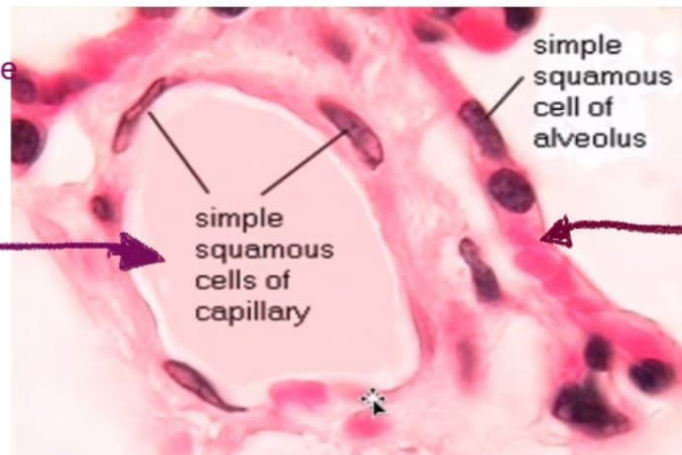
(Alveoli is the plural of alveolus) (Bronchi is the plural of bronchus.)

The alveoli at the site of gaseous exchange, for gaseous exchange we need the simple squamous epithelium for two reasons:

1. To minimize the distance that the gases travel for more efficient respiration.
2. The big surface area that the simple squamous epithelium has. (It's the biggest).



The lumen of alveolus where the air will be.



In trachea no gas exchange is done, it just moves it from top to the bottom.

The gas exchange is done in the inner of the lungs.

C. Mesothelium:

It's simply a simple squamous epithelium covering the cavities (thoracic and abdominal cavities) at the inner line of them, and covers the organs inside them.

How can we distinguish between the mesothelium that covers the whole cavity and that one that covers the organs?

➡ We call the mesothelium that covers the cavity: **parietal** (جداري), and the one that covers the organs: **visceral** (viscera means organ).

Mesothelium

Pleura

The Mesothelial tissue that covers the thoracic cavity and its organs (the lungs).

Pericardium.

The mesothelial tissue that covers the heart.

Peritoneum

The mesothelial tissue that covers the abdominal cavity and its organs.

Mediastinum.

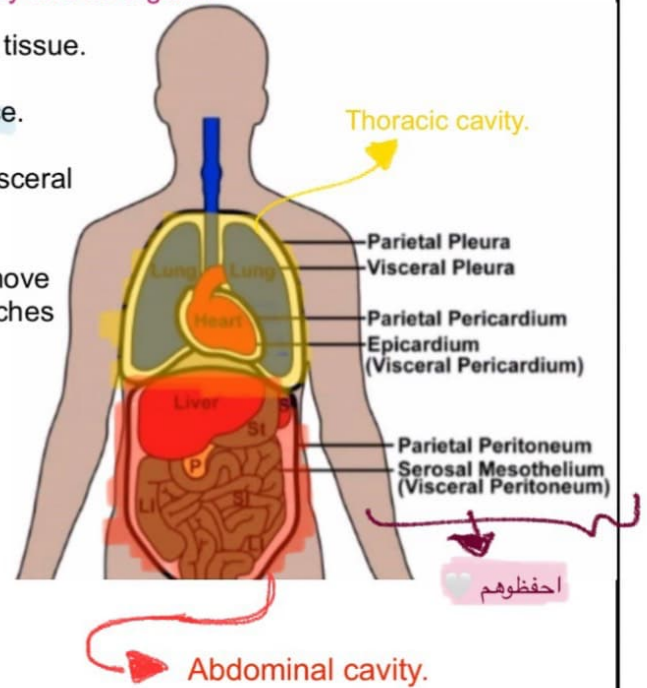
The area that separates the lungs.

There is a tiny space between the parietal tissue and the visceral tissue.

*Between the parietal pleura and the visceral pleura: pleural space.

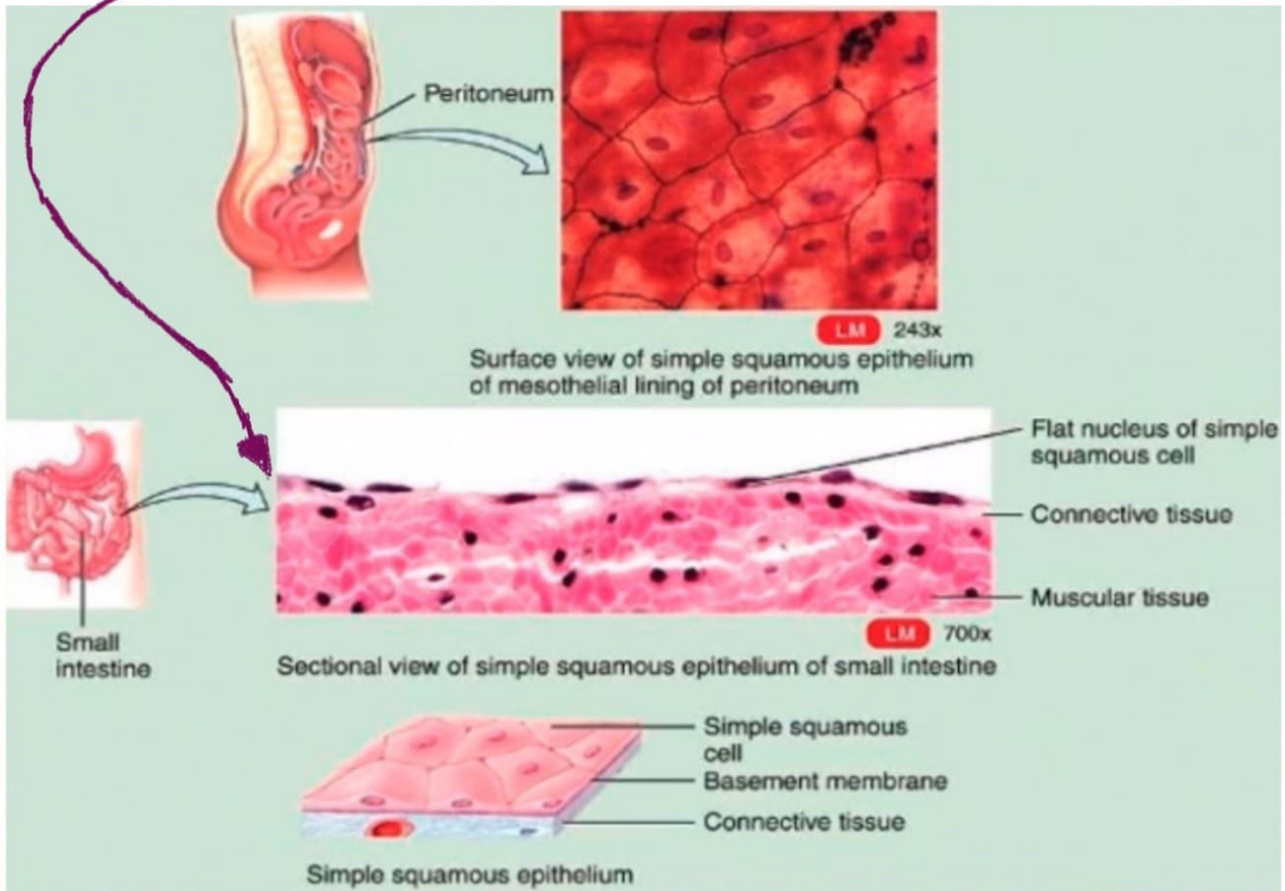
*Between the parietal peritoneum and the visceral peritoneum (visceral peritoneum): peritoneal space.

The peritoneal space has a small amount of fluid so the organs move easily, e.g; when the stomach fills in food it stretches so this stretches somehow will be facilitated.



This is visceral peritoneum because the section had been taken from small intestine.

We have beneath it connective tissue.



2. Simple cuboidal epithelium:

The nuclei of the cells are rounded, this tissue is located in:

- Small collecting ducts of kidney.
- Glands and ducts (pancreas and salivary).
- Kidney tubules.
- covering the ovaries.

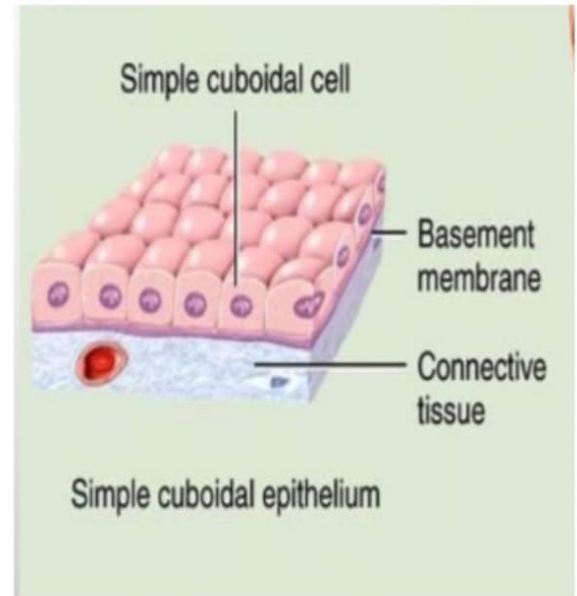
Pancreas is a gland that has an endocrine and exocrine secretion.

From the book, but was mentioned in the lecture.

Exocrine glands remain connected with the surface epithelium, the connection forming the tubular ducts lined with epithelium that deliver the secreted material where it is used. **Endocrine glands** lose the connection to their original epithelium and therefore lack ducts.

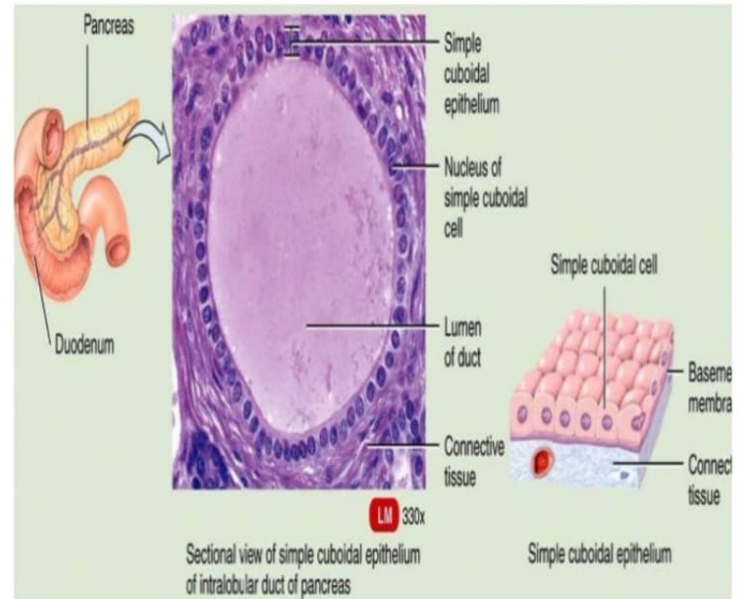
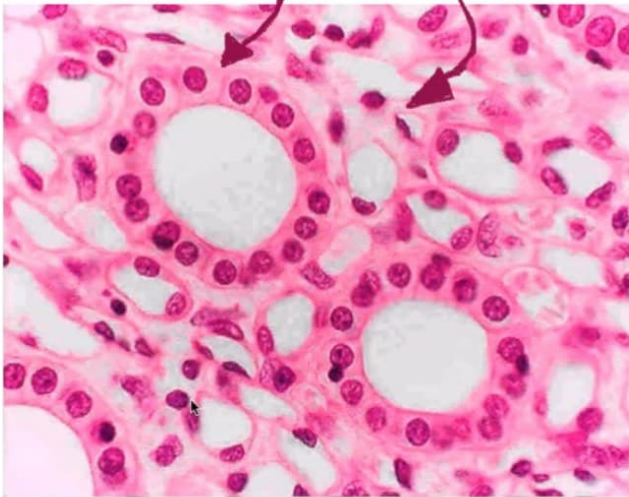
Endocrine secretion goes directly with the blood to the target cells.

Exocrine has ducts take the secretion to specific locations, e.g; salivary glands' secretion will be taken to the oral cavity; lacrymal glands' secretion will be taken to the eyes.



Simple cuboidal epithelium.

Simple squamous epithelium.



How to distinguish between the simple squamous epithelium and the simple cuboidal epithelium?

The simple squamous epithelium: its nuclei are distanced and the amount of the cytoplasm is less than the cuboidal.

The simple cuboidal epithelium: its nuclei are close to each other and the amount of the cytoplasm is more than the squamous.

3. Simple columnar epithelium:

Its cells are long, they have the highest volume (so the most cytoplasm), nuclei usually are basally located, nuclei are oval and elongated, and the amount of the cytoplasm above the nuclei is more than beneath it.

This type has an apical surface usually associated with specialized structures (it has apical modifications) such as:

1. Cilia.
2. Microvilli.
3. Stereocilia.

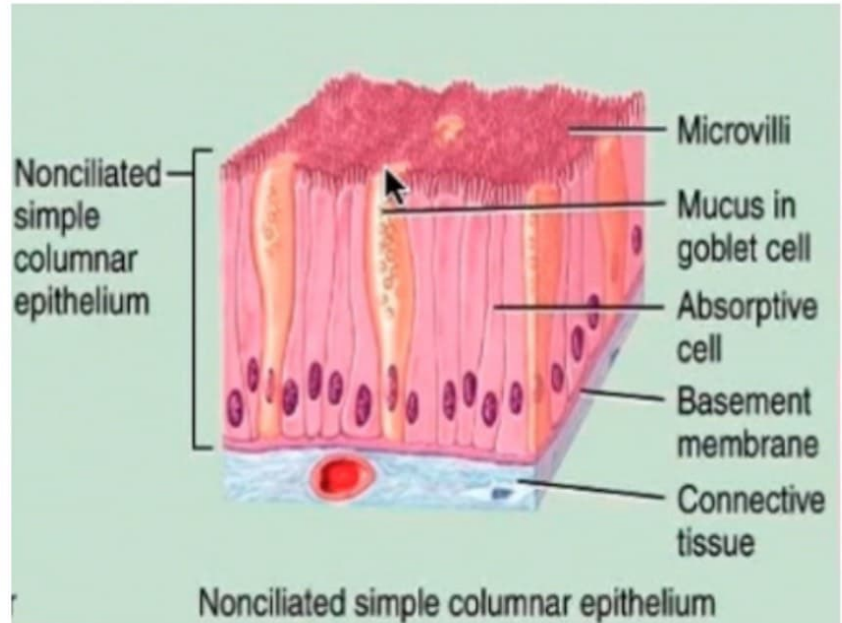
But the most important in this type of the epithelium is the Microvilli.

*Location:

1. Small intestine.
2. Stomach.
3. Gallbladder.

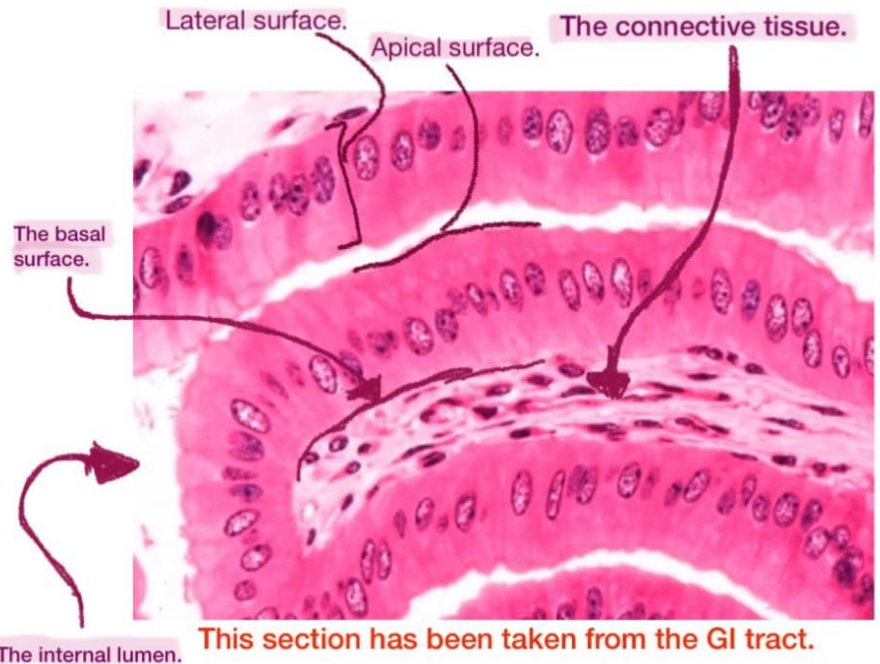
We can find goblet cells in the columnar and pseudostratified epithelium.

Goblet cells are unicellular glands, and they're specialized in mucus secretion, mucus is a highly hydrated protein (it binds to too much water molecules).



In glands we start with tiny ducts then they become bigger until we reach the major ducts. The tiny ones are small cuboidal, the bigger forward are high cuboidal, later on they become stratified cuboidal. In the major ducts we can see stratified cuboidal and simple columnar epithelium lining in ducts.

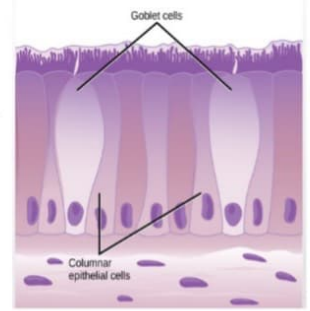
We find the simple columnar epithelium in the GI tract in general and it is involved in secretion and absorption. Any way it is not in all the GI tract, it starts to appear from the stomach to the upper part of the large intestine. (The lower part of the GI tract becomes more stratified).



From google.

What is the meaning of GI tract?

(GAS-troh-in-TES-tih-nul trakt) **The organs that food and liquids travel through when they are swallowed, digested, absorbed, and leave the body as feces.** These organs include the mouth, pharynx (throat), esophagus, stomach, small intestine, large intestine, rectum, and anus.

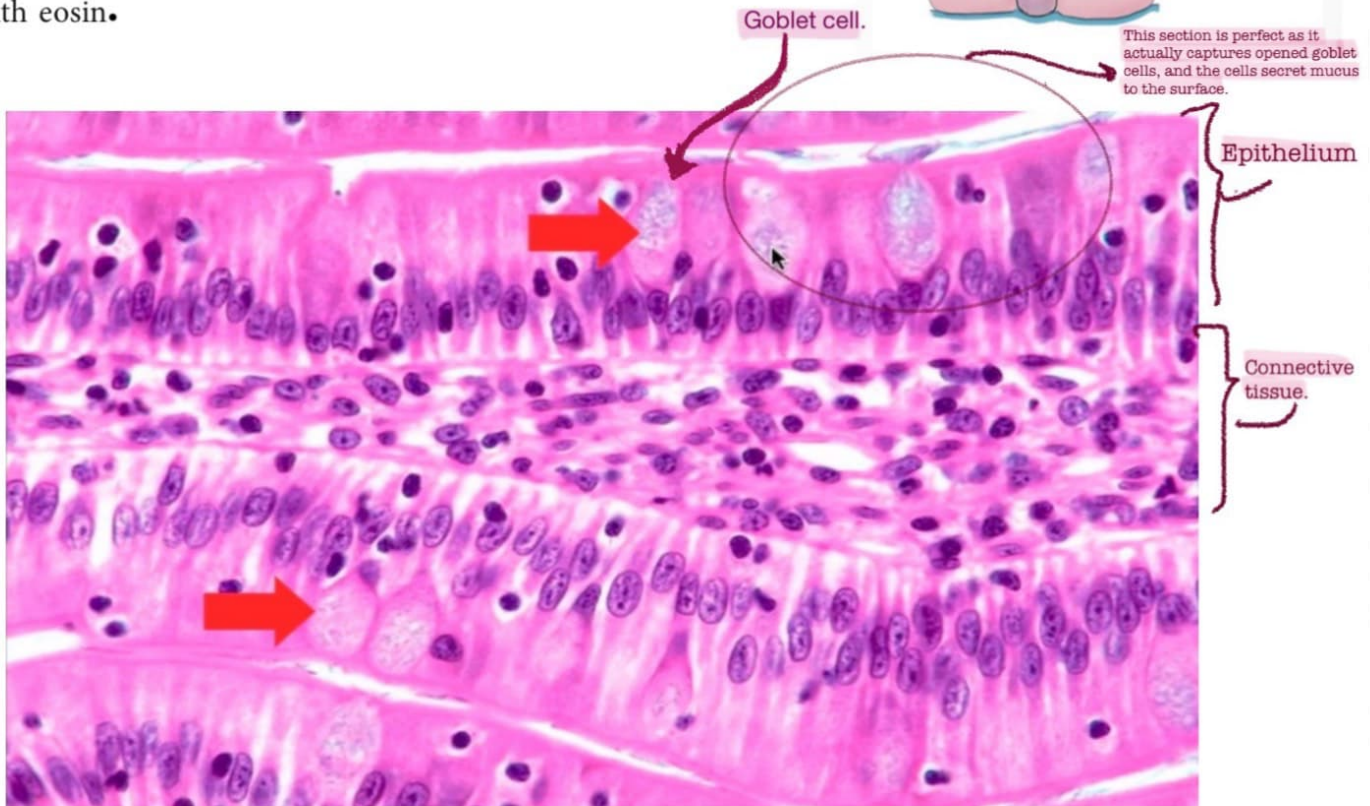
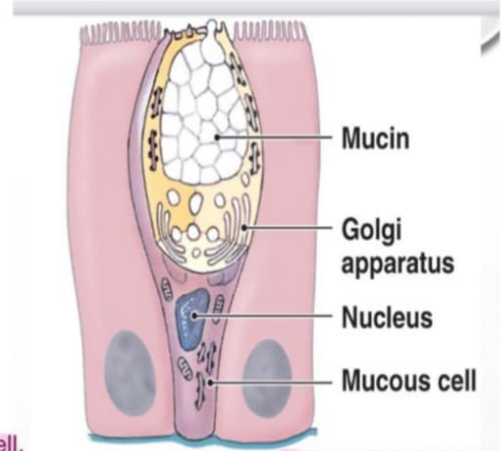


The connective tissue that underlies the epithelia lining the organs of the digestive (like the GI tract), respiratory, urinary systems is called the **Lamina propria.**

Why are goblet cells stained with light color?

The paragraph is from the book, but was mentioned in the lecture.

Mucous cells, such as goblet cells, also have RER and Golgi complexes and are filled apically with secretory granules, but these contain heavily glycosylated proteins called **mucins**. When mucins are released from the cell, they become hydrated and form a layer of **mucus**. The hydrophilic mucins are usually washed from cells during routine histological preparations, causing the secretory granules to stain poorly with eosin.



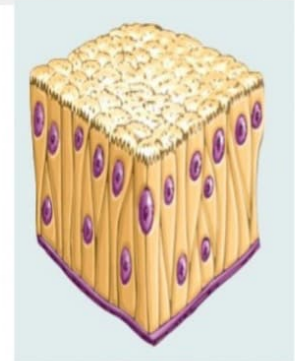
FUNCTION OF SIMPLE COLUMNAR EPITHELIUM

- ENGAGED IN THE PROTECTION OF WET SURFACES, ABSORPTION AND SECRETION.
- FORMS MAJOR DUCTS OF EXOCRINE GLANDS.
- WHEN CILIATED (FALLOPIAN TUBE, UTERUS), IT HELPS IN MOVEMENT OF FLUID IN THE FEMALE GENITAL TRACT.

4. Pseudostratified columnar epithelium:

What is special about this type?

1. All the cells touch the basement membrane, there's no true stratification.
2. We can also see within it goblet cells.
3. We can also see within it an apical modification which is cilia.



The main location of the pseudostratified columnar epithelium is the respiratory tract (trachea and bronchi) and male genital tract.

It entraps foreign particles in the respiratory tract.

What is the importance of having goblet cells and cilia in the respiratory tract?

1. Goblet cells: Secret mucus (highly hydrated protein), the function of the mucus is humidifying the air, so it will not injure the inner structures of the respiratory tract. In addition, if there is any impurities within the air, it can easily be attracted by the mucus.

2. The cilia: It is important particularly in the lower regions of the respiratory tract because the mucus eventually will get more exhausted, so we must get rid of it by cilia movement (motion) so it can clear up all the exhausted used mucus. When you have cold or flue, you'll have excessive secretion of mucus. But too much of mucus may go deep inside the smaller respiratory airways, so this excess is cleaned up through the upward movements of the cilia.
Cilia sweeps mucus.

How can we distinguish between the pseudostratified epithelium and the simple columnar epithelium?

1. by the color and the tall of the apical modifications:

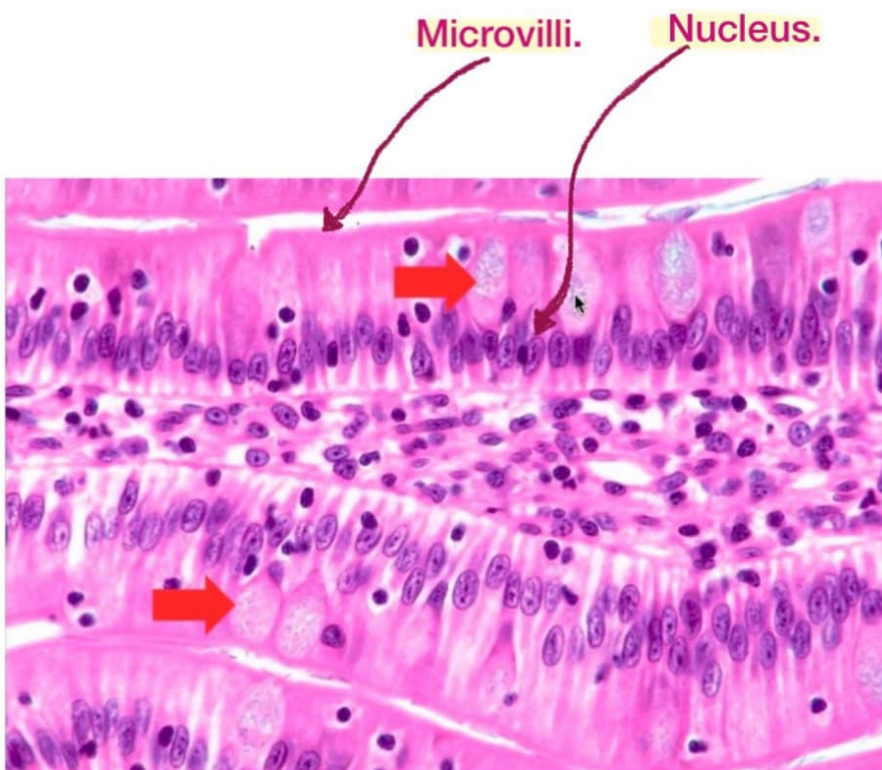
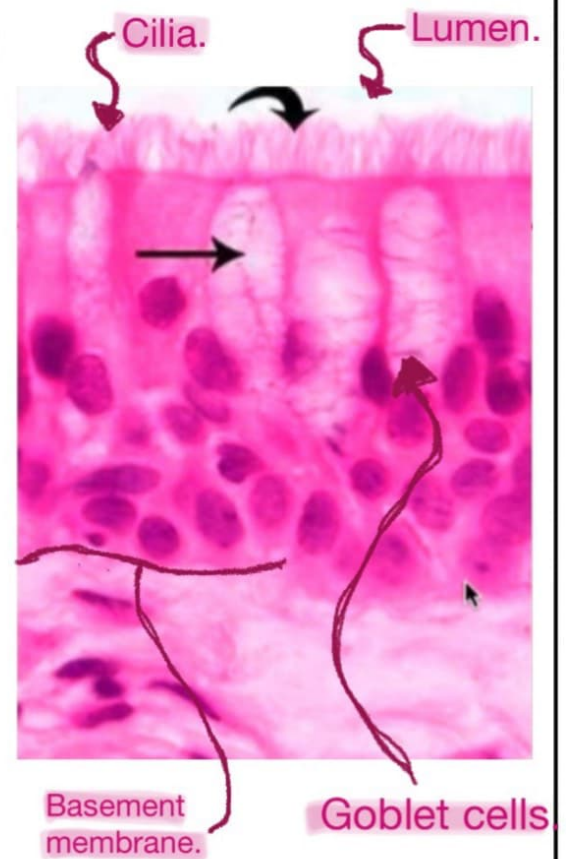
Simple columnar has microvilli, the microvilli is shorter and more pinkish.

Pseudostratified has cilia, the cilia is taller and less pinkish.

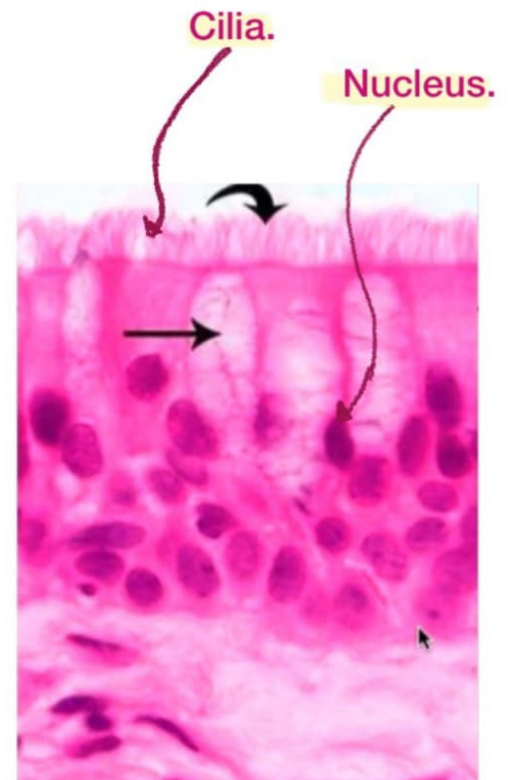
2. by the nuclei:

Simple columnar's nuclei are at the same level, they have some uniformity.

Pseudostratified's nuclei aren't at the same level.



Simple columnar epithelium.



Pseudostratified epithelium.

5. Stratified squamous epithelium.

We call the stratified squamous epithelium in the epidermis of the skin: keratinized.

Where else we find stratified squamous epithelium it will be: non-keratinized.

A. Stratified squamous non-keratinized epithelium:

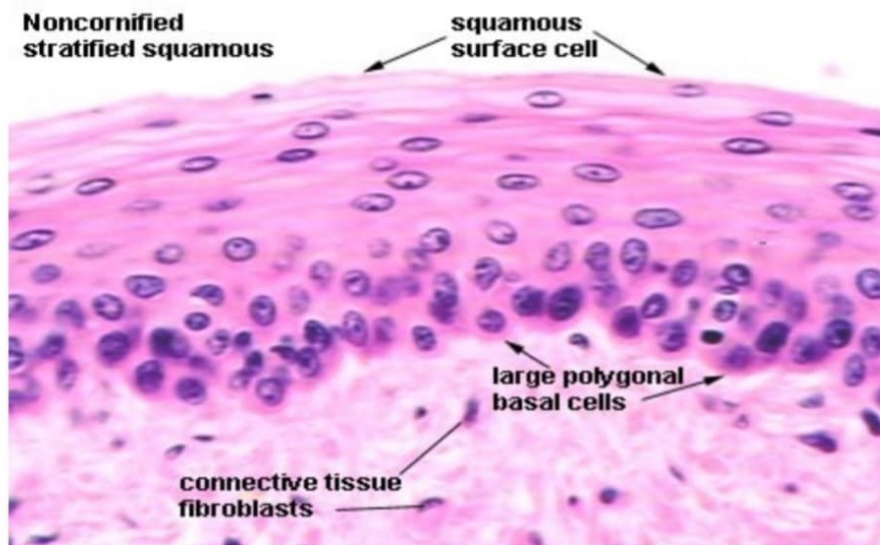
Locations:

- ~ oral cavity.
- ~ pharynx.
- ~ esophagus.
- ~ anal canal.
- ~ uterine cervix.
- ~ vagina.

(Oral cavity, pharynx, esophagus, anal canal) these regions will be subjected to the food when it is still in its hard texture, so we need in this regions this type of epithelium to protect them from excessive pressure and friction applied on them.

The thickness of the stratified squamous epithelium depends on how much stresses it is subjected to.

The basal layer of this tissue is where usually most of the regenerations come from, so its cells have the ability to divide. When a cell from the basal layer divides, one of the daughter cells stays in the basal membrane and the other one travels to the surface (the superficial layers). Surface's cells are threatened with loss, so when we lose cells from the surface, the basal layer membrane regenerates cells.



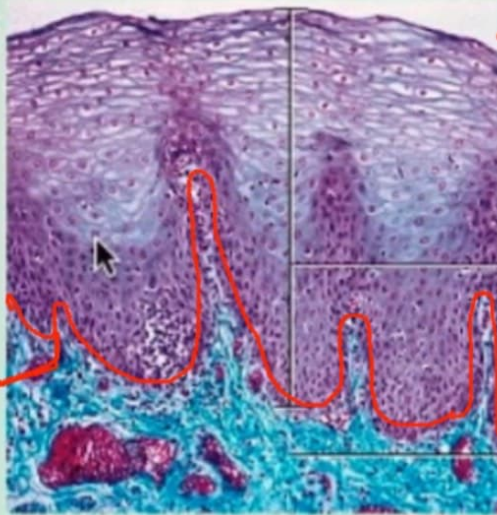
Here we have used a special stain, not H&E.
For the connective tissue we have used a collagen dye.

The superficial layers.

The intermediate layers.

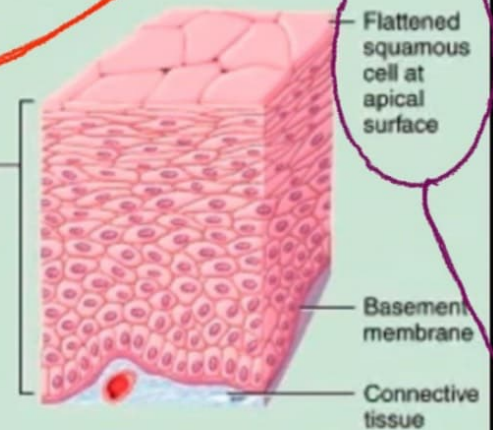


Vagina



LM 200x

Sectional view of stratified squamous epithelium of vagina



Stratified squamous epithelium

The basal layer, it is the only layer of the epithelium that rest on the basement membrane.

We identify the type of the tissue basing on the most superficial layers, for example:

In this section of the tissue the shape of the cells in the superficial layers is flattened, so it's squamous epithelium, stratified squamous epithelium.

Important!

Notice that there's a difference between the "basal layer" term and the "basement membrane" term...

The basal layer is a layer of cells from the epithelial tissue itself, it is a part of it.

The basement membrane is a membrane separates between the connective tissue and the epithelial tissue.

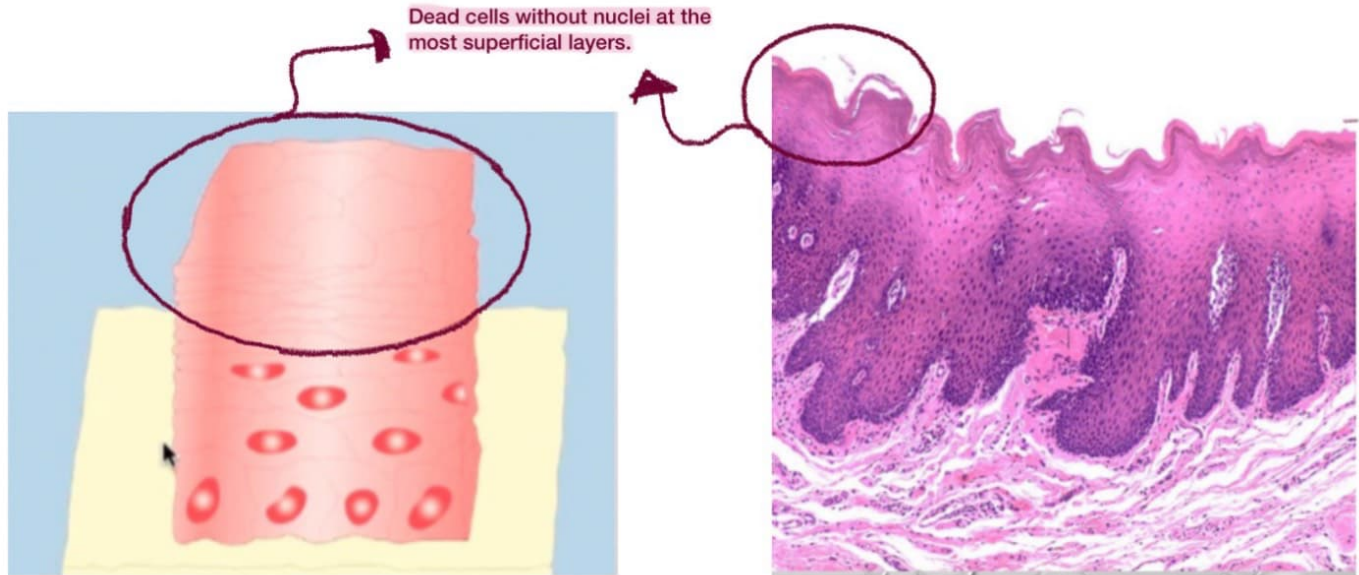
B. Stratified squamous keratinized epithelium:

We find this type only in the most superficial layers of the skin that are called the epidermis.

It's a layer of dead cells over the other cells.

The prefix Epi means upon, on, over.

Our skin has two principal layers : epidermis and dermis. The epidermis is composed of epithelial tissue, and the dermis is connective tissue.



From the book, but was mentioned in the lecture.

The very thin surface cells of stratified squamous epithelia can be “keratinized” (packed with keratin filaments) or “nonkeratinized” (with relatively sparse keratin). **Stratified squamous keratinized epithelium** is found mainly in the epidermis of skin, where it helps prevent dehydration from the tissue (Figure 4–15a). Its cells form many layers, with the less differentiated cuboidal cells near the basement membrane. These cells have many desmosomes and become more irregular in shape and then flatten as they accumulate keratin in the process of **keratinization** and are moved progressively toward the skin surface, where they become thin, metabolically inactive packets (squames) of keratin lacking nuclei.

Prevent dehydration: keep the moisture of the living cells beneath it.

Keratin is a protein.

لا لشهاداتٍ وآرابٍ أُخْر

واطلبِ العلمَ لذاتِ العلمِ

وَقَفْنَا لِلَّهِ وَإِيَّاكُمْ