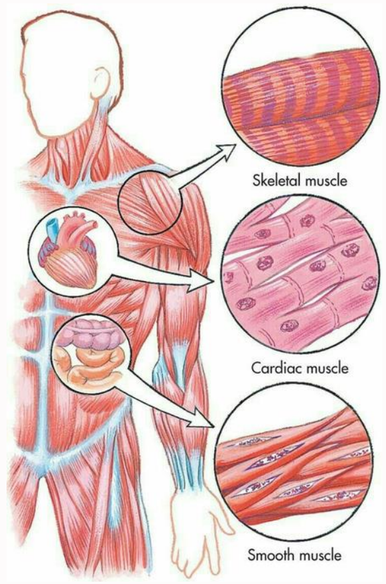
بسم الله الرحمن الرحيم

Histology - Lecture 5

Epithelium pt.3



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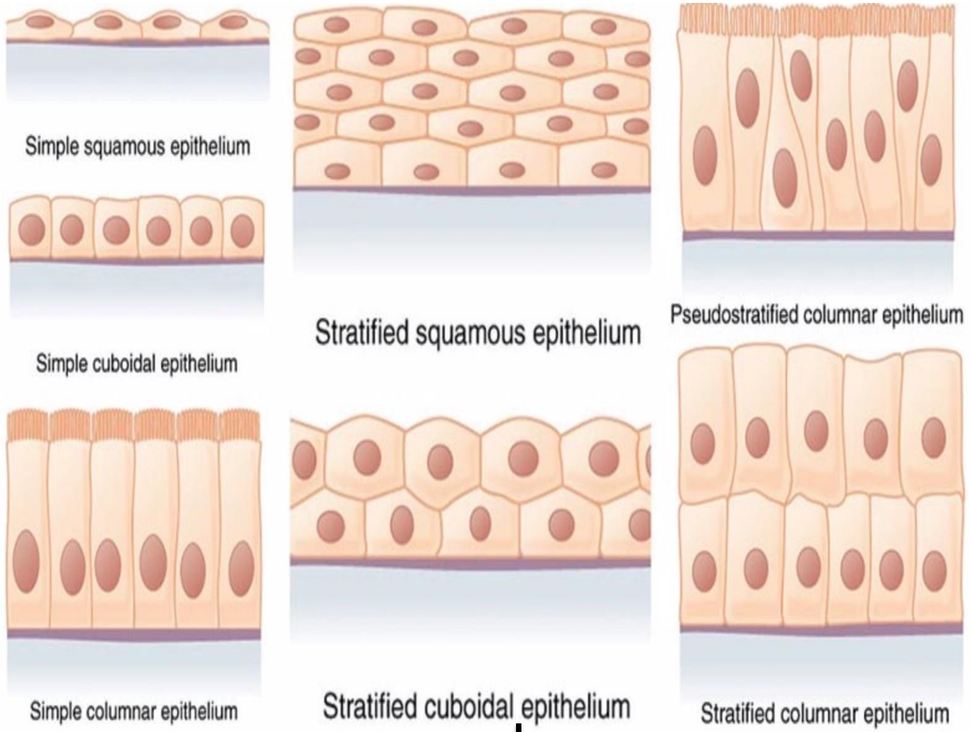
Types of epithelium

- In epithelial tissue, we can classify cells into three shapes: columnar, cuboidal, and squamous. When combined with two types of epithelium (simple and stratified), we get six possible combinations. However, in reality, there are eight types of epithelial tissues. This is because there are two additional types, one belonging to stratified epithelium called transitional epithelium and the other to simple epithelium called pseudostratified epithelium .

Types of epithelium

- Divide into covering/lining or glandular
- Epithelium.
- Covering/ lining: simple (one cell layer) or
- Stratified (two or more cell layers):



- ***Types of simple epithelium:***
- Simple squamous epithelium
- Simple cuboidal epithelium
- Simple columnar epithelium
- Pseudostratified columnar epithelium

What distinguishes the various types of simple epithelium is that all cells rest on the basement membrane.

- ***Types of stratified epithelium:***
- Stratified squamous epithelium
- Stratified cuboidal epithelium
- Stratified columnar epithelium
- Transitional epithelium

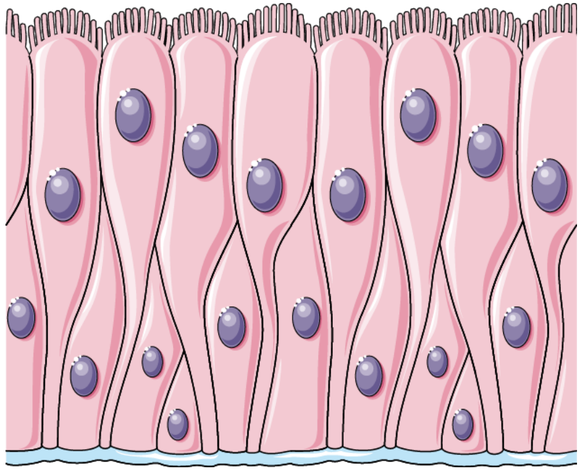
-In stratified epithelium, only the basal layer is attached to the basement membrane. It is important to note that the basal layer is different from the basal surface. Additionally, the second and upper layers of cells do not contact the basement membrane or the basal lamina; instead, they are in contact with the plasma membrane of the underlying cells.

-The basal layer is a layer of multiple cells and is only found in stratified epithelium , while the basal surface is just the bottom part of a single epithelial cell

To determine the name of stratified epithelium (whether it is stratified columnar, stratified cuboidal, or stratified squamous), we look at the shape of the cells in the uppermost layer (the surface layer).

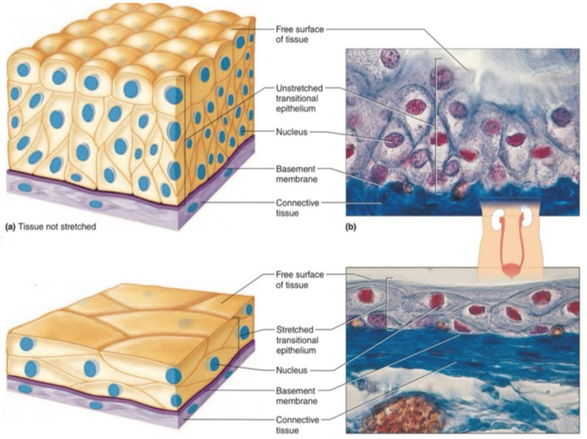
<u>*stratified cuboidal epithelium*</u> is sometimes referred to as "polyhedral" (or polyhedral-shaped) because its cells often have multiple surfaces that are interconnected with each other.

-We find that all types of simple epithelium and stratified epithelium are composed of cells that contain nuclei arranged in parallel rows. However, when we look at one type of simple epithelium, pseudostratified epithelium, we notice that the nuclei are not aligned in the same row. The reason we initially perceive it as multiple layers is due to the irregular arrangement of the nuclei within a single row. However, what classifies it as a type of simple epithelium is that all of its cells are in contact with the basement membrane.



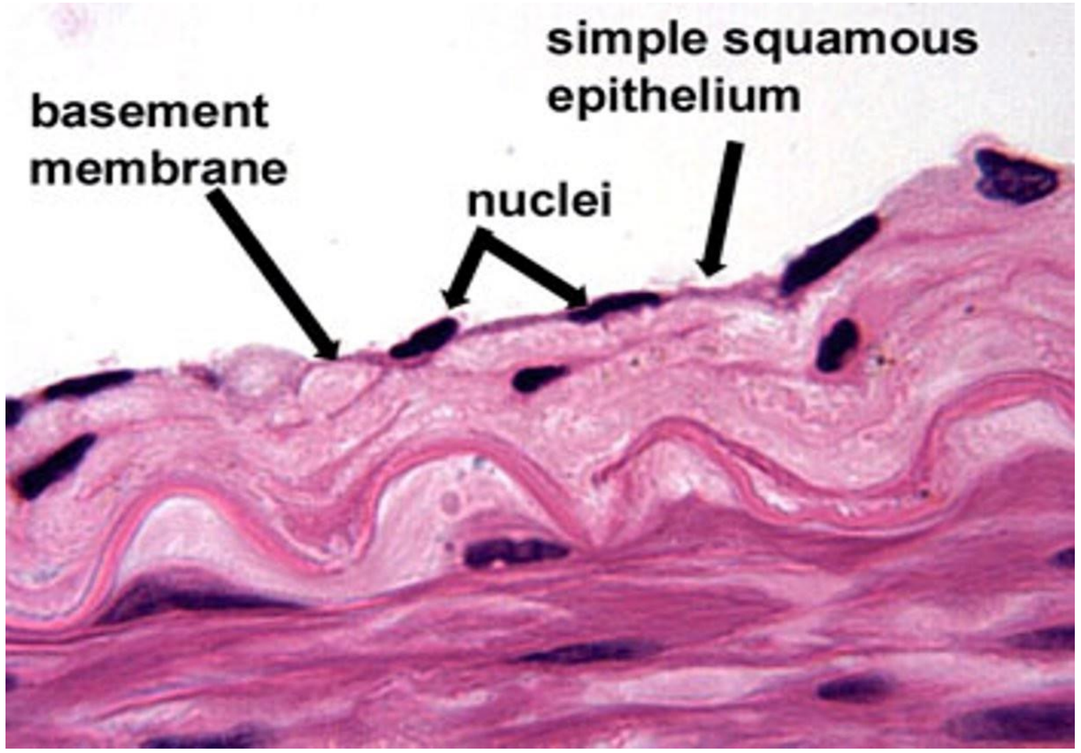
-**Pseudostratified epithelium** is found only in the respiratory tract and the male reproductive tract. It is not found elsewhere in the body.

Transitional epithelium is a type of stratified epithelium, typically found in organs like the bladder, where the tissue stretches and changes shape. The urinary bladder functions to store urine, acting as a small pouch with thick walls that are lined with transitional epithelium.
When we take a sample from the bladder, and it is full, the lining of the bladder appears as stratified squamous epithelium. This is because the cells are stretched out due to the bladder being filled with urine.
However, when the bladder is empty, the lining appears as stratified cuboidal epithelium. This change in appearance occurs because the transitional epithelium is designed to stretch and accommodate varying amounts of urine.



Simple squamous epithelium:

1.Endothelium : **Is the simple squamous epithelium that lines blood vessels**



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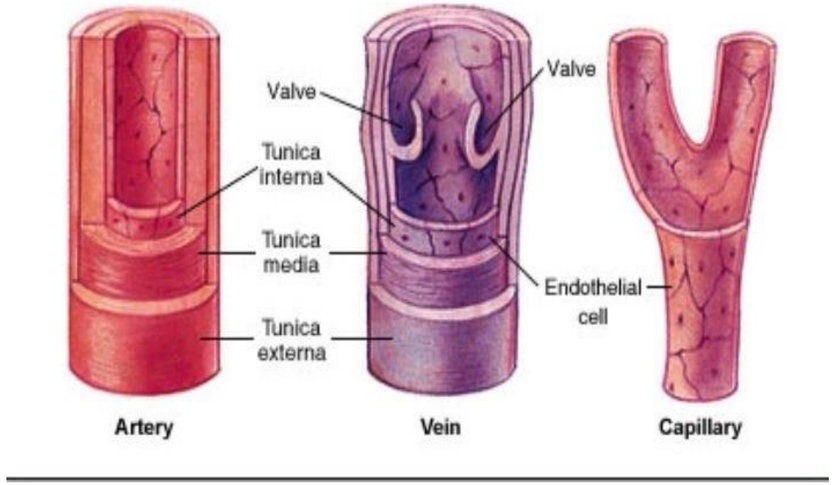


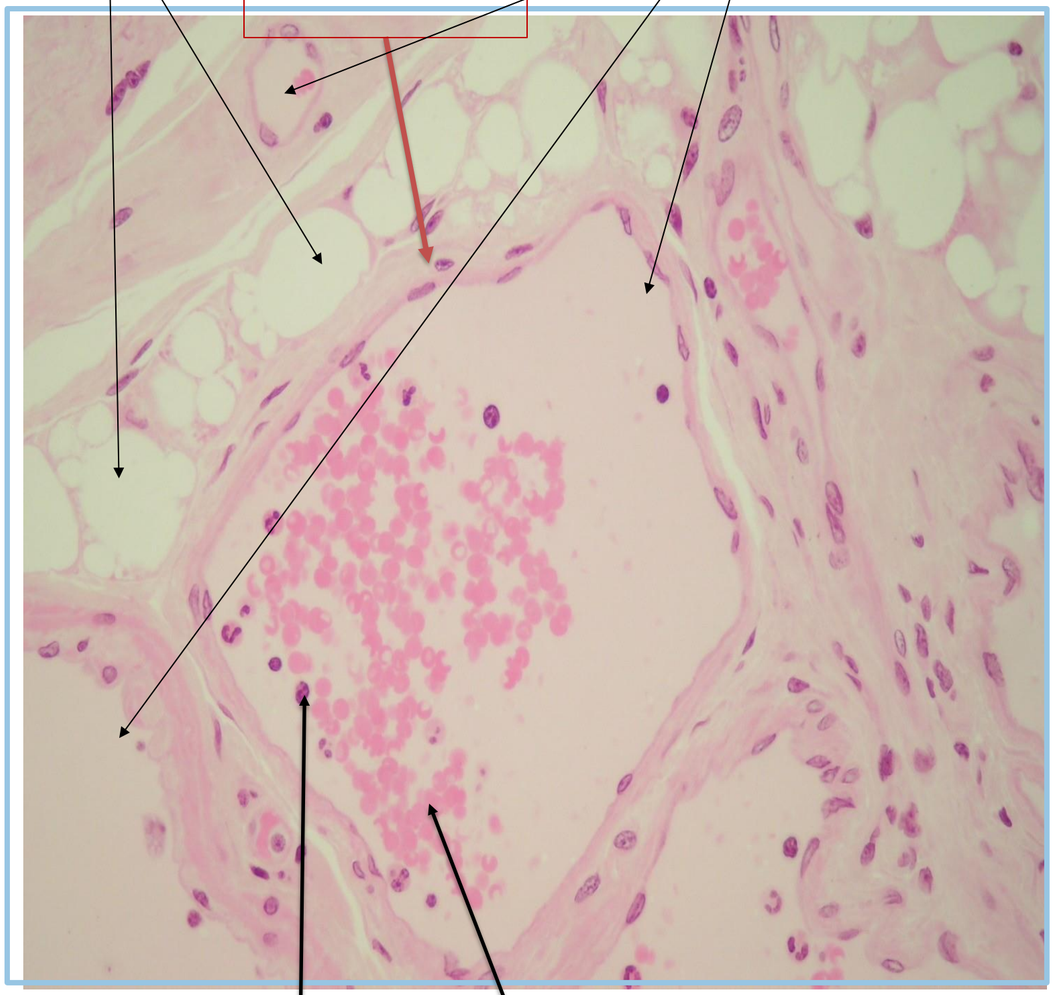
Blood vessels

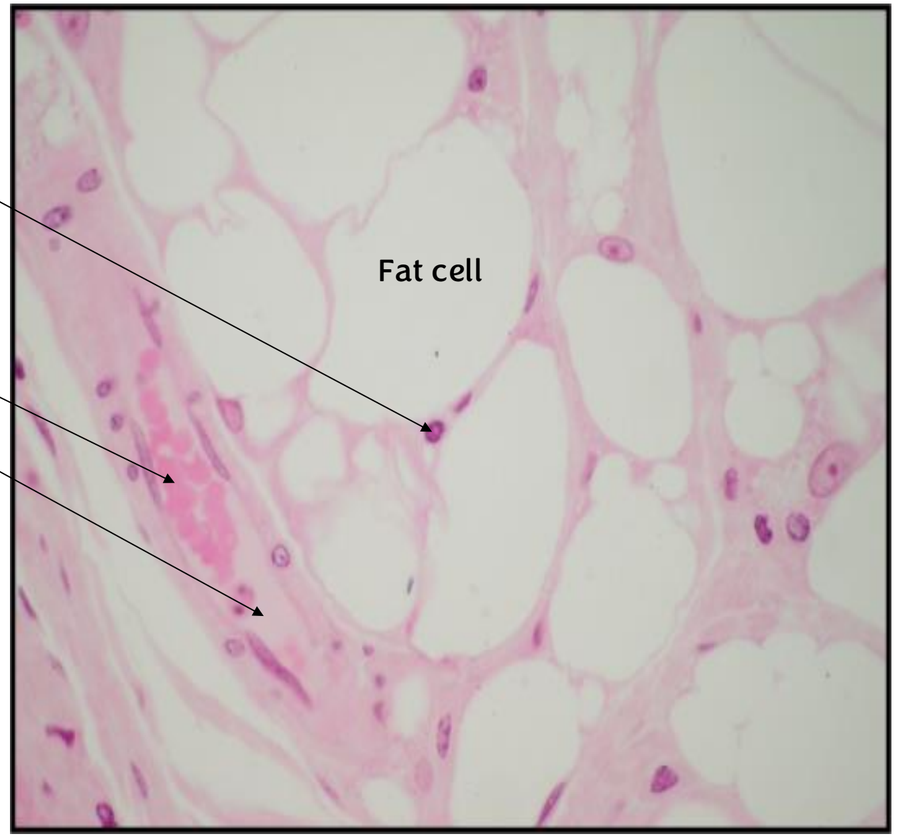
Distinctive features of this type:

- Thin cells
- Nuclei are the thickest structure and most noticeable
- Regulate passages of substances.

The incoming slides are taken from the (epithelium images) file

ENDOTHELIUM





Both images were taken using bright-field microscopy, which is one of the light microscope techniques. The stains used are Hematoxylin and Eosin (H&E). Hematoxylin stains the nuclei, while Eosin stains the rest of the cytoplasm

the structure of the endothelium as simple squamous epithelium, lining the interior of blood vessels. The cells should appear thin and flattened, forming a smooth surface for efficient blood flow.

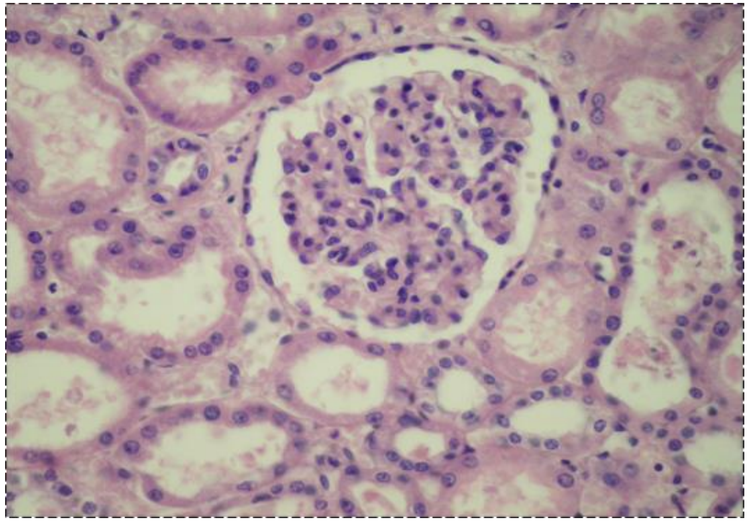
Notes related to the images above

-Why don't many squamous cells appear in the endothelium?
Answer: This depends on the cross-section taken from the sample during the slicing process. Some cells might not appear because the blade did not cut through them properly.
-How can I identify the epithelial tissue in the image?
Answer: you sometimes need to look for empty spaces, because epithelial tissue lines ducts, blood vessels, and cavities, such as the lumen of blood vessels and urinary bladder.
-Why do fat cells appear as white spaces?
Answer: During the sample preparation process, alcohol is used, which dissolves fat, leaving behind empty white spaces in the tissue section.
- Why do blood vessels appear circular in some images but elongated in others?
Answer: This depends on how the cross-section was taken. If the vessel appears circular, it means the cut was made as a cross-section (as seen in the left image). If the vessel appears elongated, it was cut longitudinally, making it looks like a tube.

SIMPLE SQUAMOUS EPITHELIUM

Stain: H&E
Microscope: Bright field light microscope
Section of the kidney (kidneys consist of millions of filtering units and the picture shows a cross section of these units)

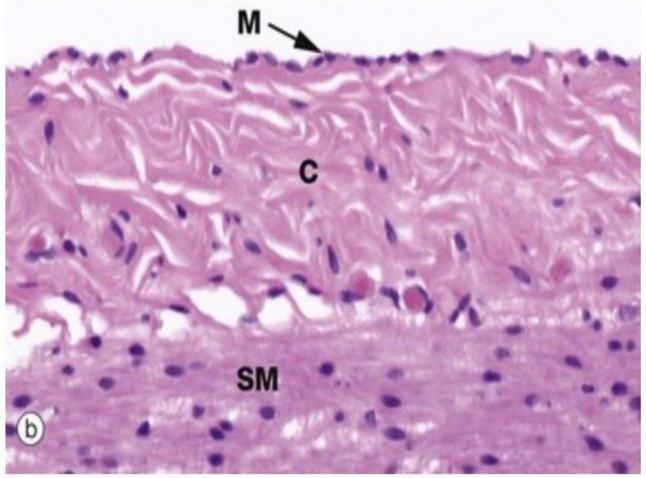
We can see flattened nuclei in one row lining a lumen -> simple squamous epithelium



Stain : H&E
Section of the GI tract

Notice that there are two different tissues in this section, C is connective tissue and SM is smooth muscle tissue and to find the epithelial tissue we look for a lumen or we look for cells in contact with a surface so it is the upper most layer of cells here (mesothelium) the nuclei are flattened and they are one layer -> simple squamous epithelium

This type of epithelium(mesothelium) cover organs and line cavities.
Visceral mesothelium-> covering of organs. Parietal mesothelium->lining of cavities



Types of mesothelium:
Pleura: lining the thorax cavity and covering the lungs
Peritoneum :lining the abdominal cavity and cover organs of the abdomin
Pericardium : covering the heart And lining the heart cavity
There is also a region between the lungs called the mediastinium that contains mesothelium

Abdominal and pelvic cavities are connected to each other while abdominal and thoracic cavities separated by diaphragm muscle.

During our development organs grew inside balloons and that is how the sacs inside these cavities where formed

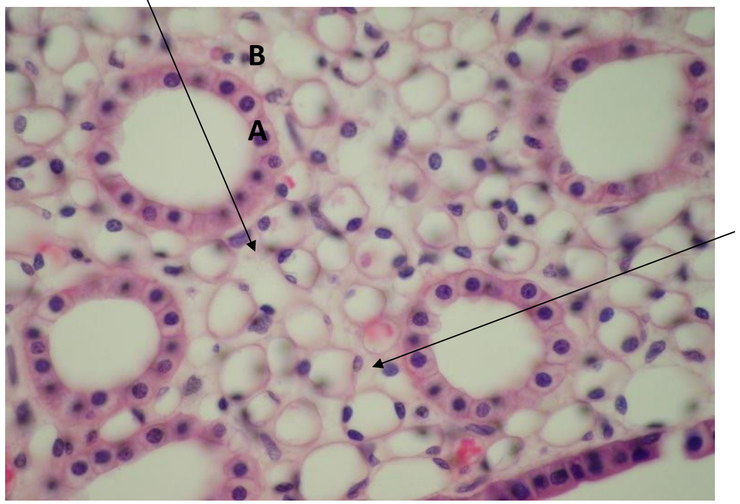
SIMPLE CUBOIDAL EPITHELIUM

Section of the kidney

Notice that there are lumens so there is definitely an epithelial tissue. One row of nuclei and they are perfectly rounded, cytoplasm is roughly equal between the cells ->simple cuboidal epithelium

A: apical surface B: basal surface and the surface between adjacent cells is the lateral surface

These cells do have nuclei but the section didn't cross them that's why we can't see them here.

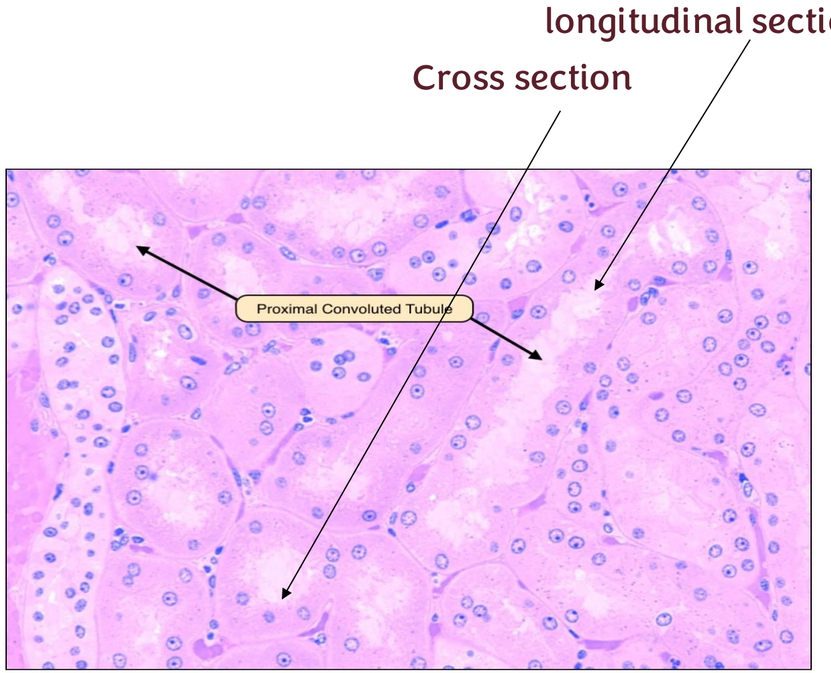


These are simple squamous epithelial cells

Section of the kidney.

There are longitudinal sections and cross sections here.

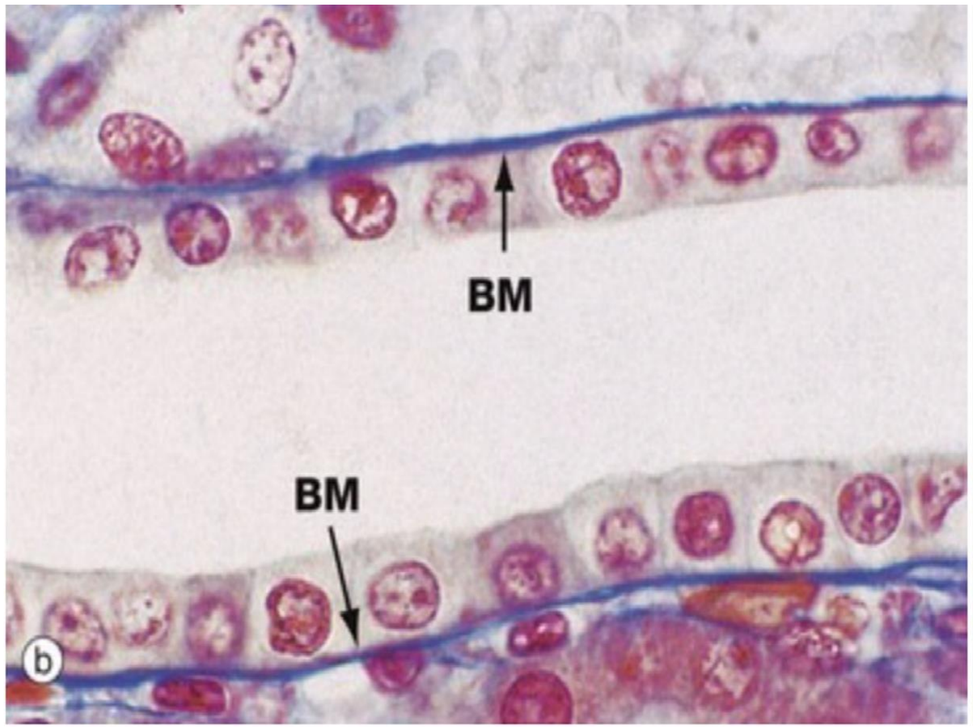
Nuclei lining the lumens are cuboidal.



SIMPLE CUBOIDAL EPITHELIUM

Longitudinal section

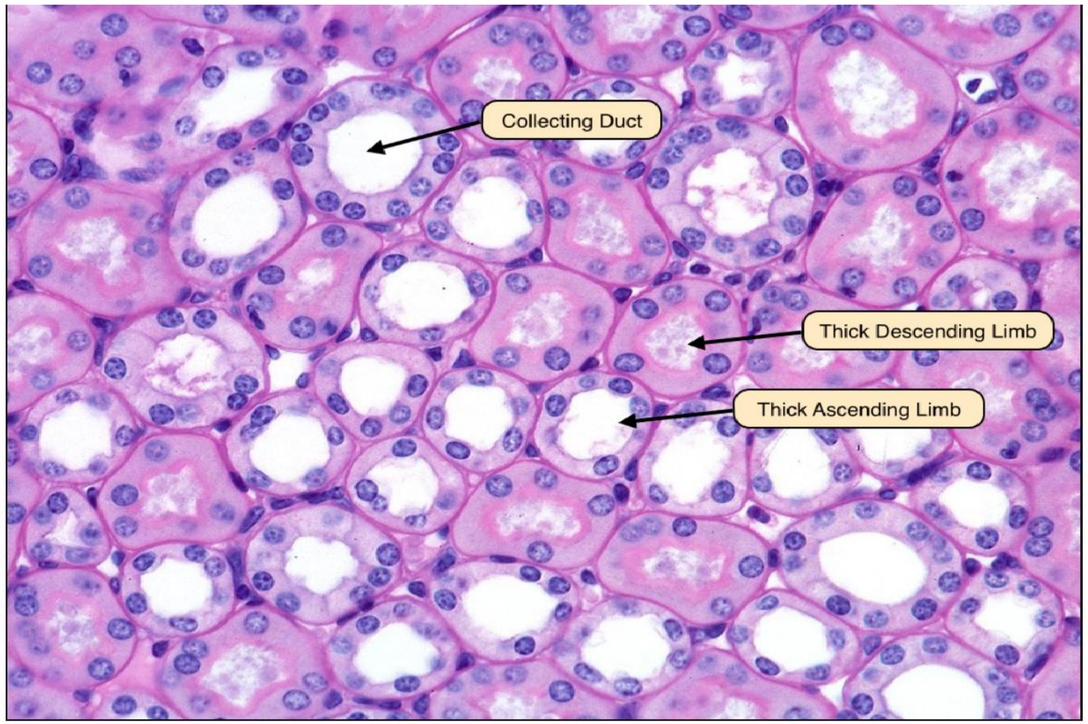
Stain: not H&E because the basement membrane is blue, if it was H&E it would appear pinkish.



Cross section

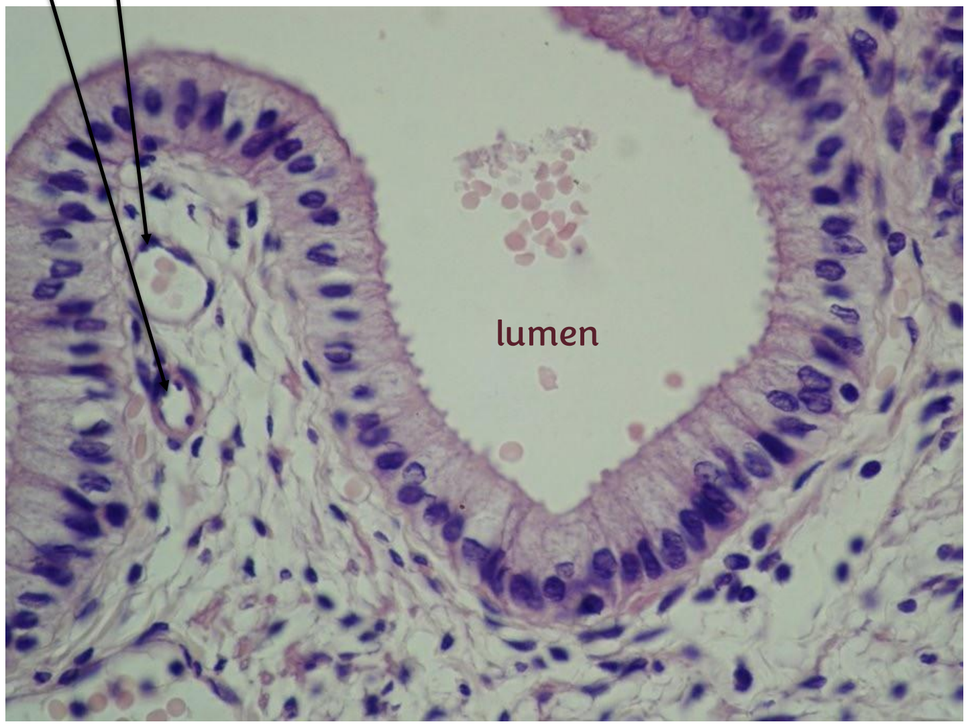
Stain: not H&E because the basement membrane is too dark (or defined compared to the picture on the right on the previous slide).

All the cells in this section are simple cuboidal.



SIMPLE COLUMNAR EPITHELIUM

Notice that there is simple squamous lining lumens of blood vessels here.



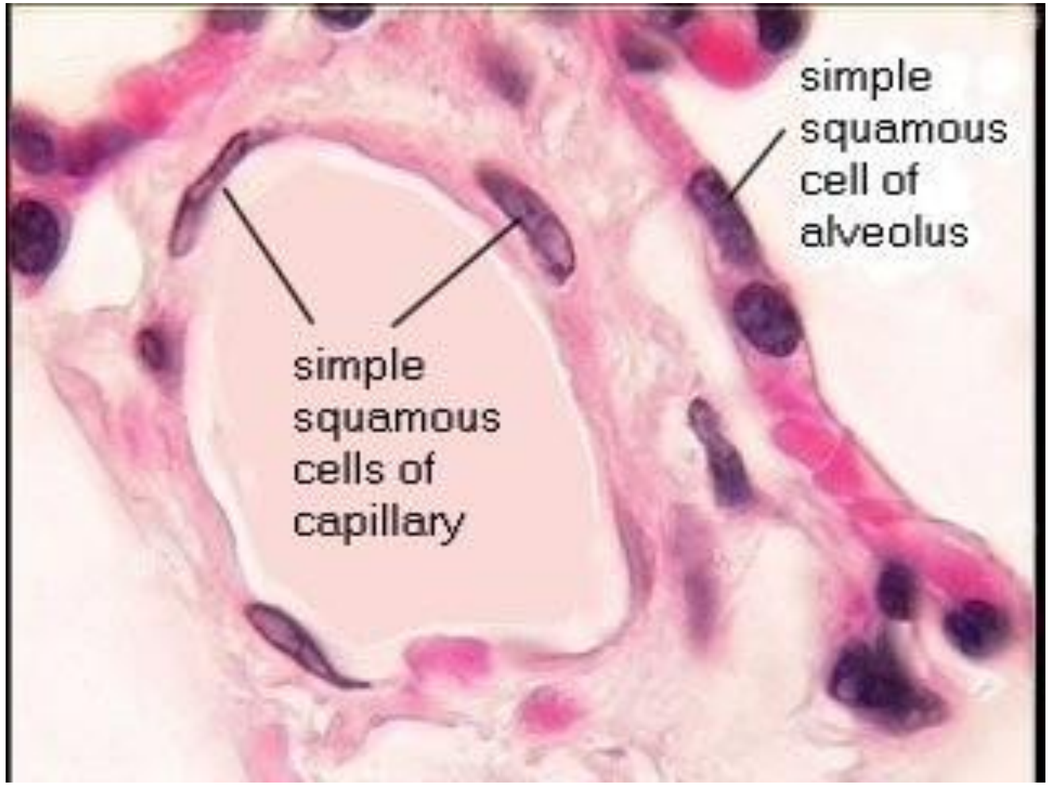
Under the row of epithelial cells there is a connective tissue.

SIMPLE COLUMNAR EPITHELIUM

To make sure that it is simple columnar (and not confuse it with pseudostratified for example) look for a region where it is clear that the nuclei are on the same level, here it is this area.

There are microvilli on the apical surface of these cells, they appear lighter that the cytoplasm.

Simple squamous epithelium
2. lung alveoli



3. Mesothelium

Simple squamous epithelium.

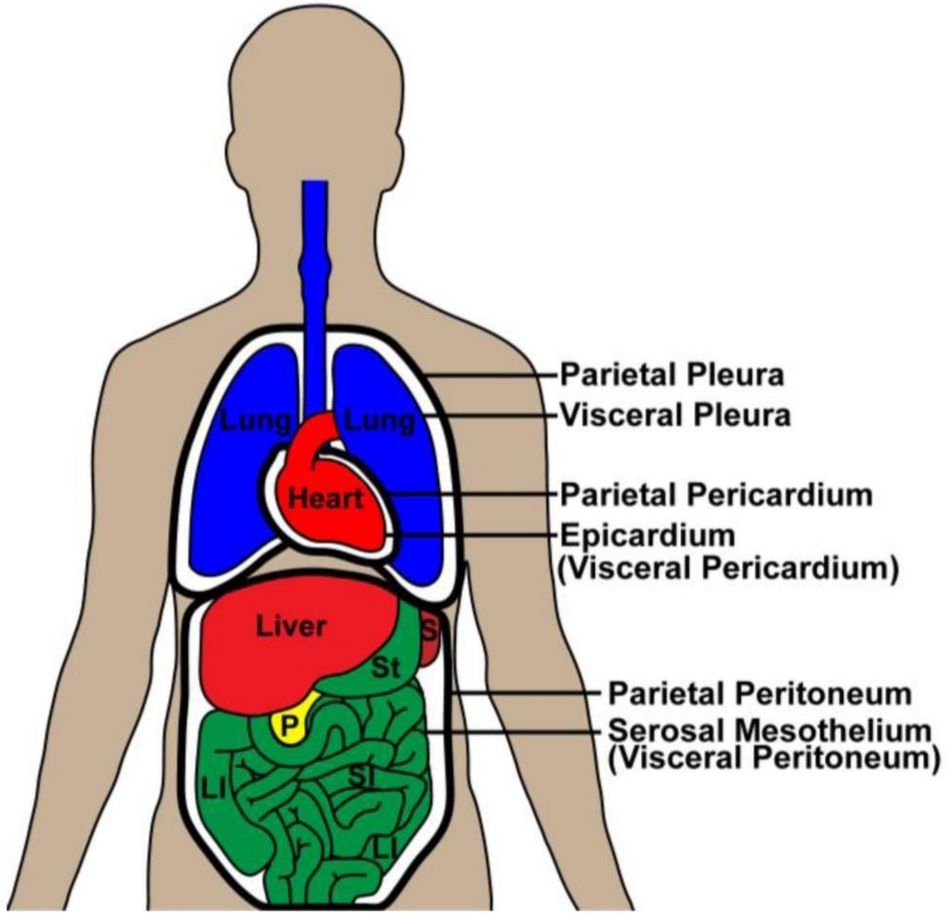
Covering of organs and lining of cavities--visceral and parietal layers.

1 Pleura

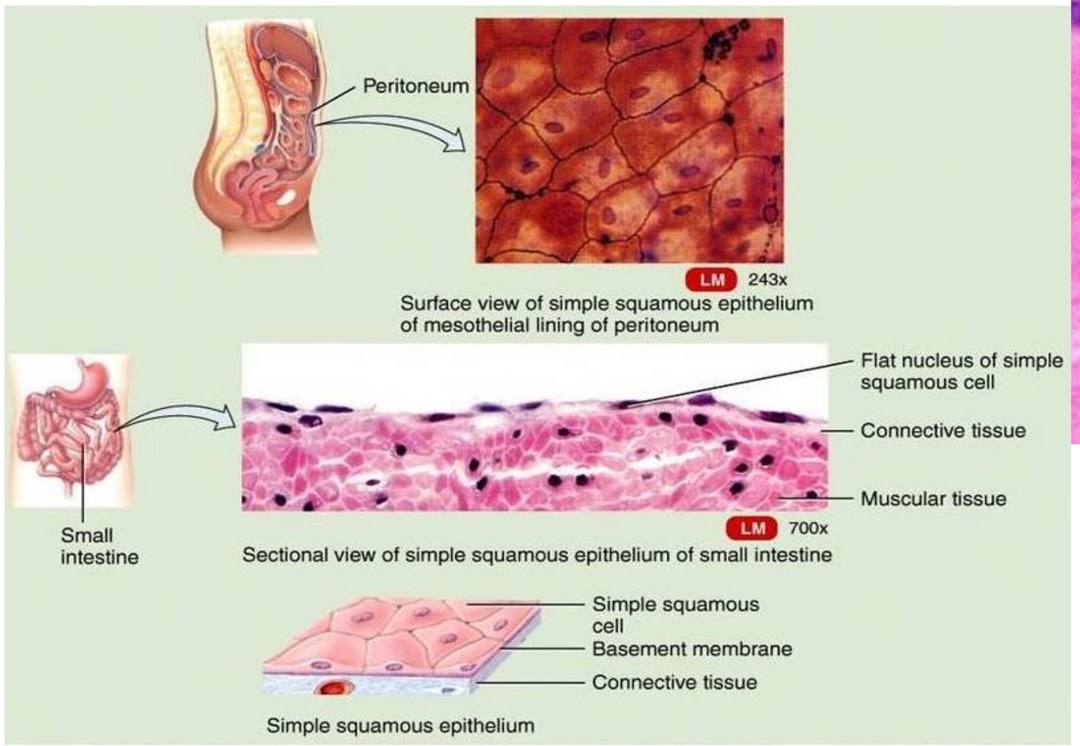
2 Peritoneum

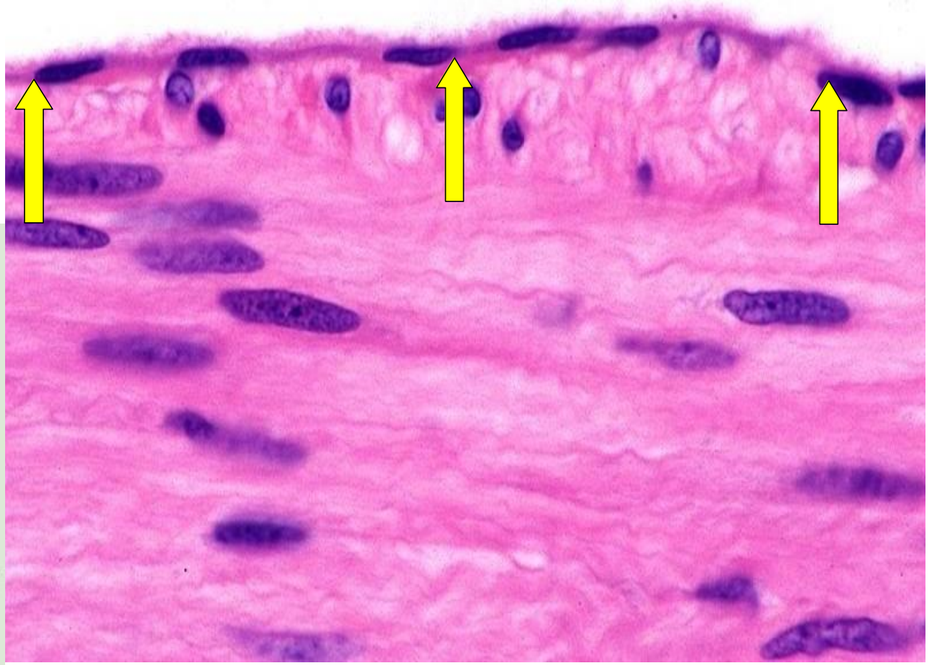
3 Pericardium

4 Mediastinum



Mesothelium



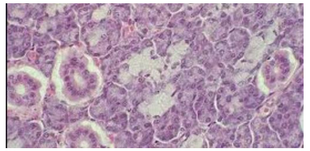


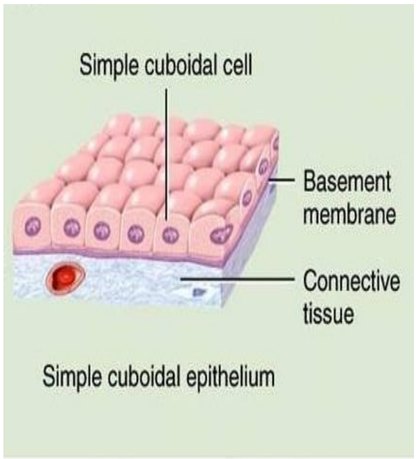
Simple cuboidal epithelium

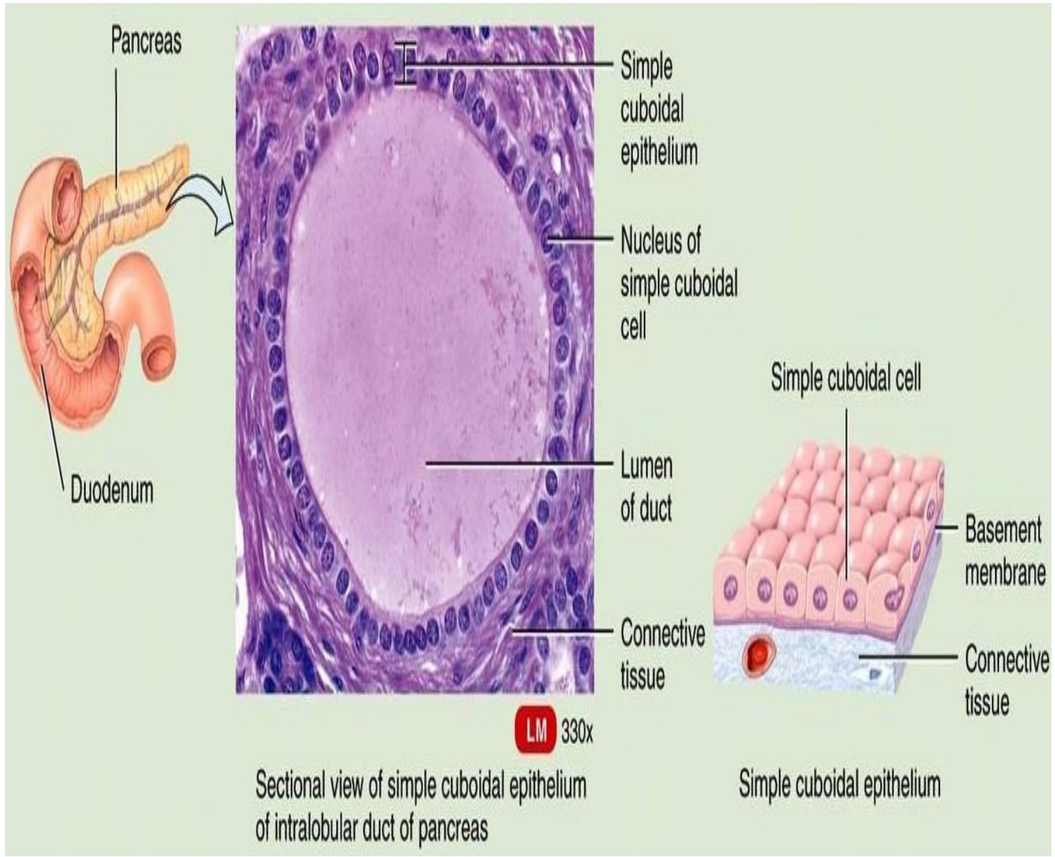
- Width and height are similar.
- Rich with organelles.
- High level of active transport.

Location

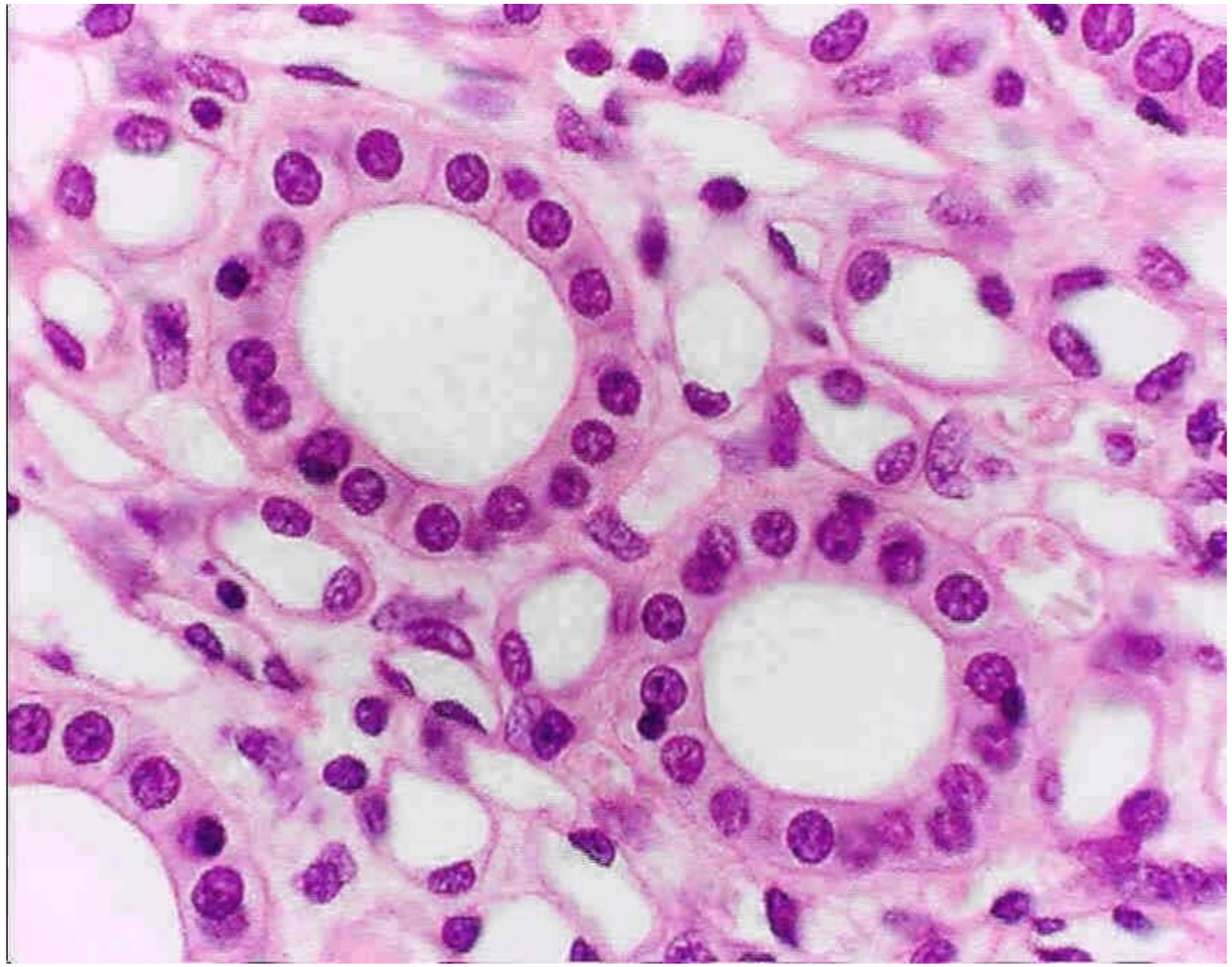
- Small collecting ducts of kidney
- Glands and ducts :
- (pancreas & salivary)
- Kidney tubules
- Covering of ovaries
- Thyroid glands





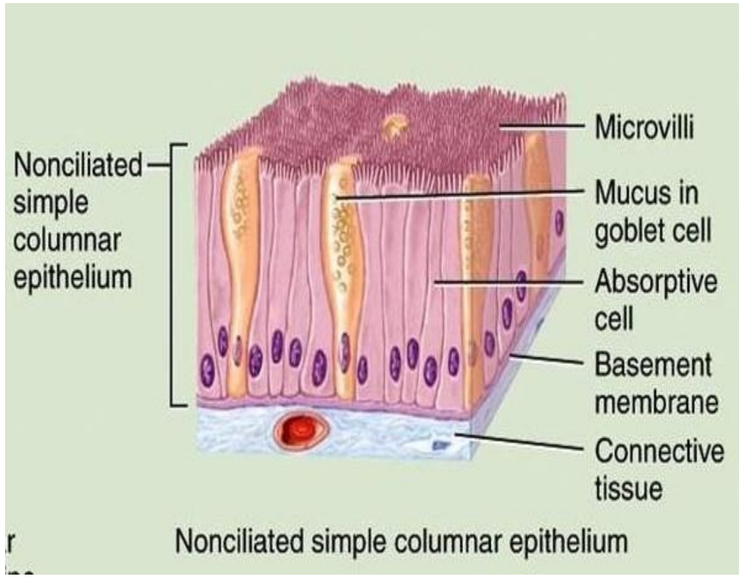


Simple cuboidal Epithelium



Simple columnar epithelium

- Cells are tall.
- Usually with microvilli or cilia.
- Engaged in the protection of wet surfaces, absorption (microvilli) and secretion.
- Forms major ducts of exocrine glands.
- When ciliated (**fallopian tube, uterus)**, it helps in movement of fluid in the female genital tract.

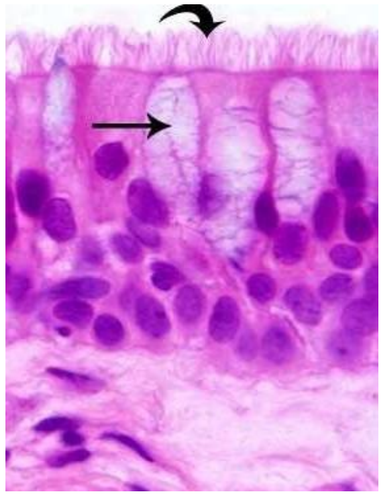


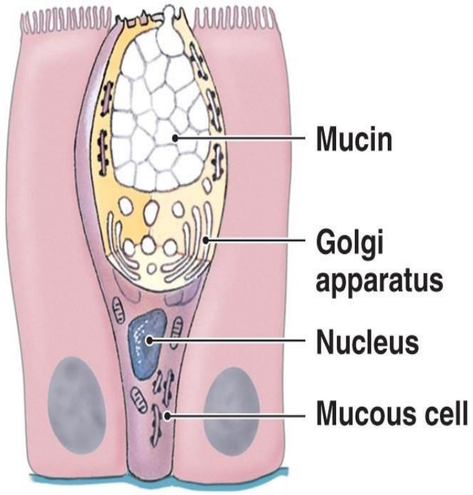
Location

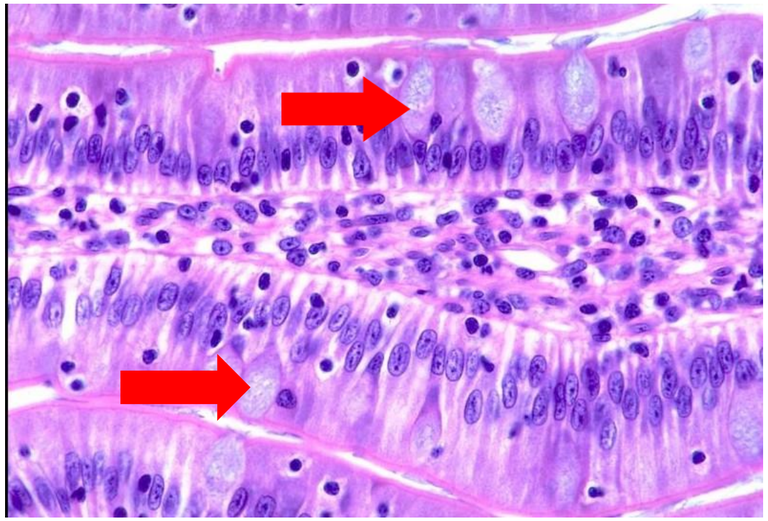
- Small intestine
- Stomach
- Gall bladder
- Oviduct lining
- Renal collecting ducts

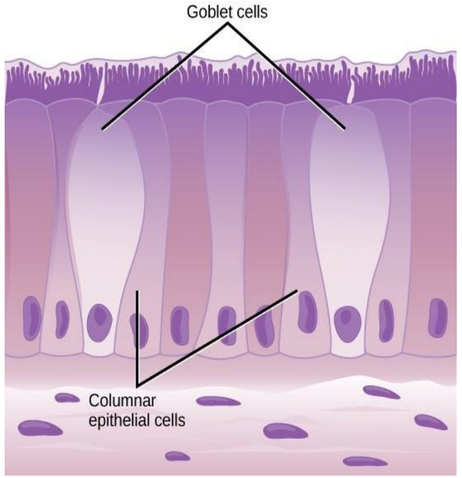
Goblet Cells

- **Goblet cells:** produce mucus.
- **Cilia** (larger than microvilli): sweep mucus.
- Associated mainly with columnar, pseudostratified, and stratified columnar (conjunctiva) epithelia



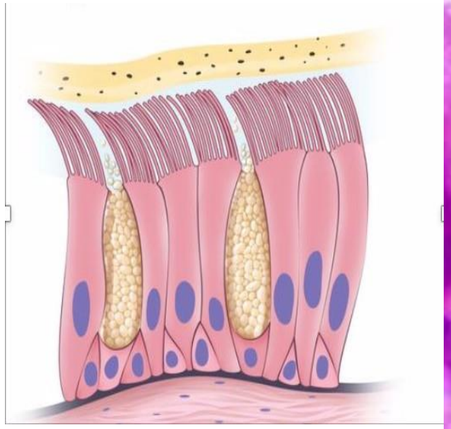


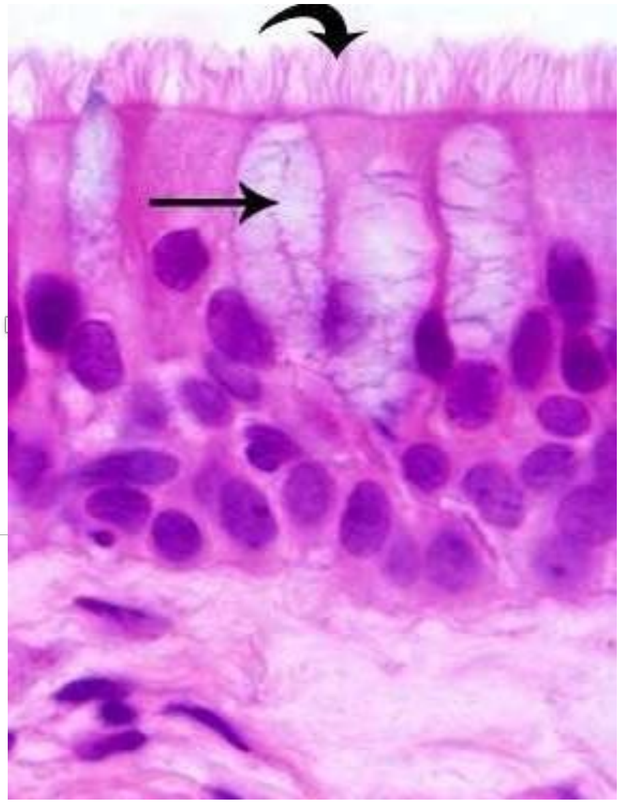




Pseudostratified columnar epithelium

- Small basal cells and taller apical ones; nuclei
- At different levels----false stratifications.
- All cells are attached to the basement membrane.
- **Locations**:
- 1. Respiratory tract (trachea and bronchi; Ciliated with goblet cells)
- 2. Male genital tract.
- Goblet cells: are usually seen in respiratory tract to produce mucus mucous: it entraps foreign particles in the respiratory tract





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			Slides 14-21 were added
V1 → V2	Slide 9 only the right most text box	Types of mesothelium: Pleura: lining the thorax cavity Peritoneum :lining the abdominal cavity Pericardium : covering the heart There is also a region between the lungs called the mediastinium that contains structures surrounded by mesothelium	Types of mesothelium: Pleura: lining the thorax cavity and covering the lungs Peritoneum :lining the abdominal cavity and cover organs of the abdomin Pericardium : covering the heart And lining the heart cavity There is also a region between the lungs called the mediastinium that contains mesothelium Abdominal and pelvic cavities are connected to each other while abdominal and thoracic cavities separated by diaphragm muscle. During our development organs grew inside balloons and that is how the sacs inside these cavities where formed