

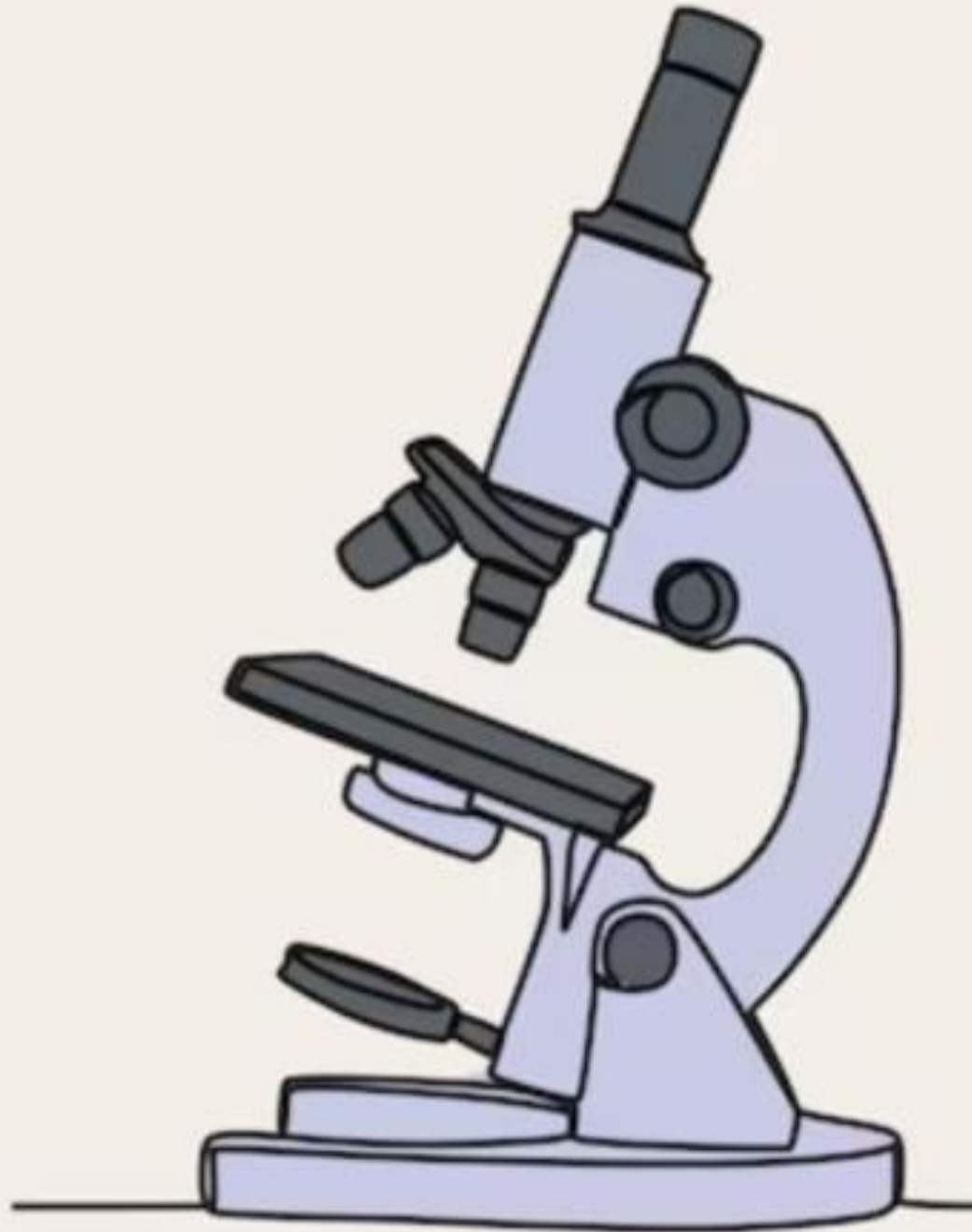
Histology

Modified n. 5



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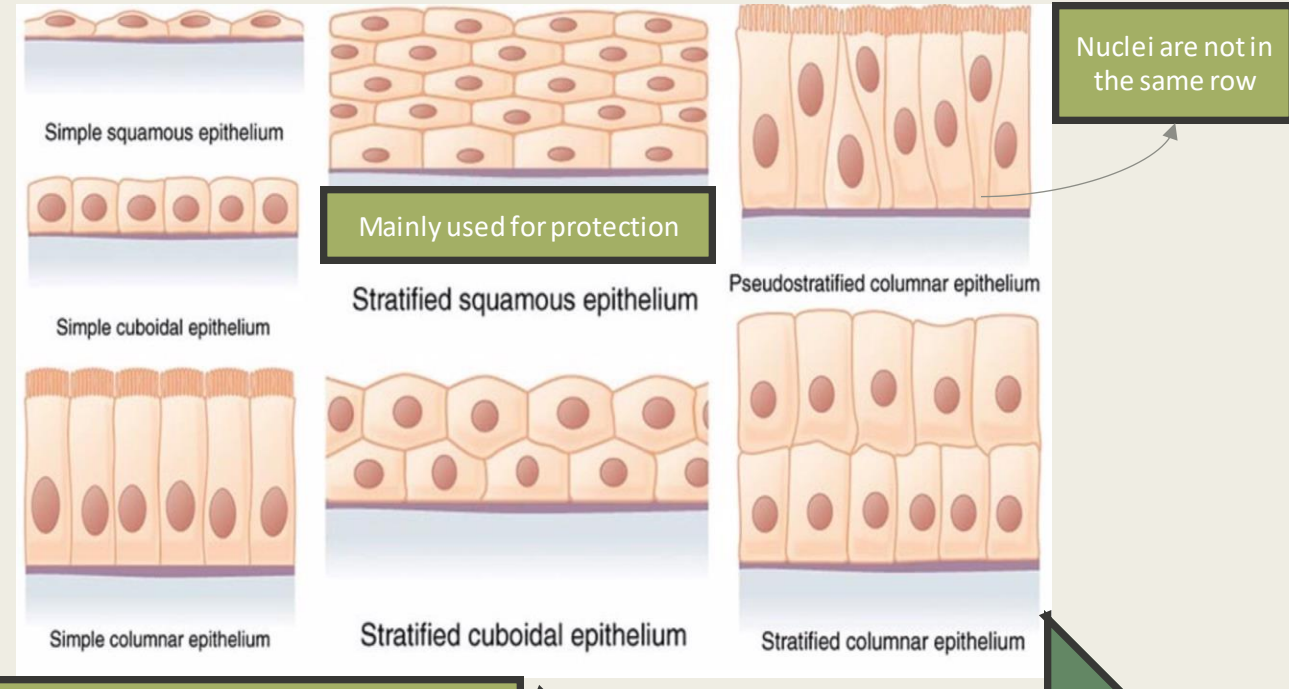
Types of epithelium

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

- Simple squamous epithelium
- Simple cuboidal epithelium
- Simple columnar epithelium
- Pseudostratified columnar epithelium *Atypical*

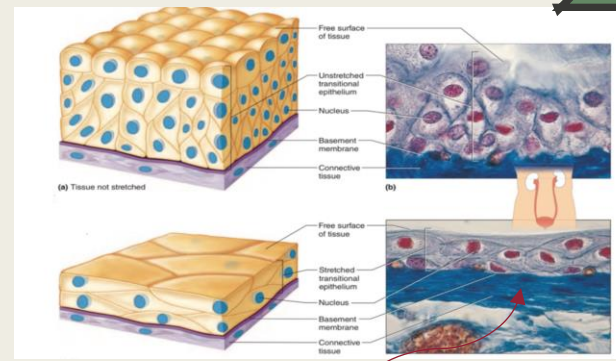
Based on shape

Regarding the distribution in the human body
Squamous > cuboidal > columnal
Squamous is the most spread out because it's used for protection



In simple columnar epithelium all cells reach the lumen & they'll touch the basement membrane also they're in the same row

When determining the type of epithelium based on shape → look at the apical cells



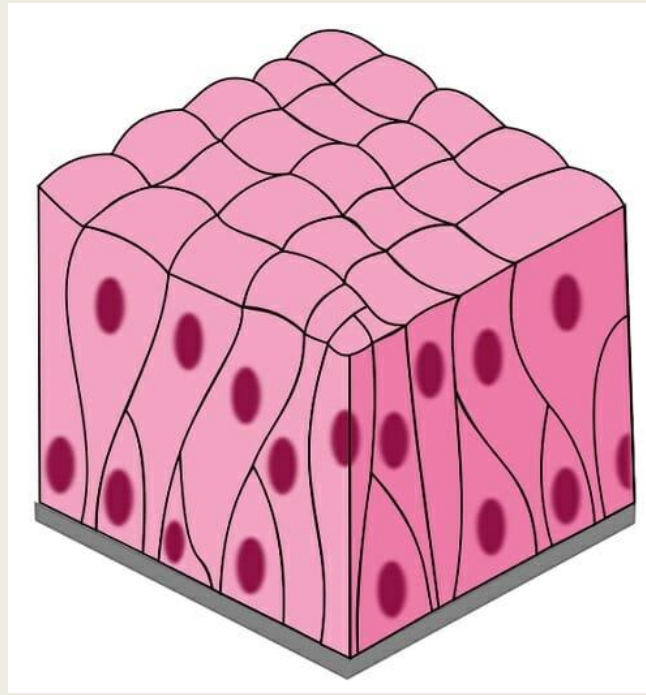
- Stratified squamous epithelium
- Stratified cuboidal epithelium
- Stratified columnar epithelium
- Transitional epithelium

When the urinary bladder is full, the epithelium will become shorter

Light microscope → bright-field

Types of epithelium

- Pseudostratified columnar epithelium



Pseudo means fake "كاذب"
This means that this tissue is a simple epithelium since all cells rest on the BM

Pseudostratified (layers of cells with nuclei at different levels; not all cells reach the surface but all adhere to the basal lamina)
At first glance, it appears as one layer (using a microscope)

In pseudostratified columnar epithelium, all cells reach the basal lamina but not all of them reach the apical lamina meaning more basal cells than apical cells
Apical cells → have basement attachment and reach the apical surface

It can be seen in the male genital tract and the respiratory tract
(there are differences between them regarding what other types of cells we have in each)

• Transitional cuboidal epithelium

Trans means it moves from one side to another → Here it means that it changes its shape based on the physiological state of the organ
It has a different shape when stretched or relaxed

The transitional epithelium can be seen in the urinary tract exactly the urinary bladder which stores urine up to a certain point and after that it would no longer stretch which forces it to empty

When it's empty or full it → it has different volumes

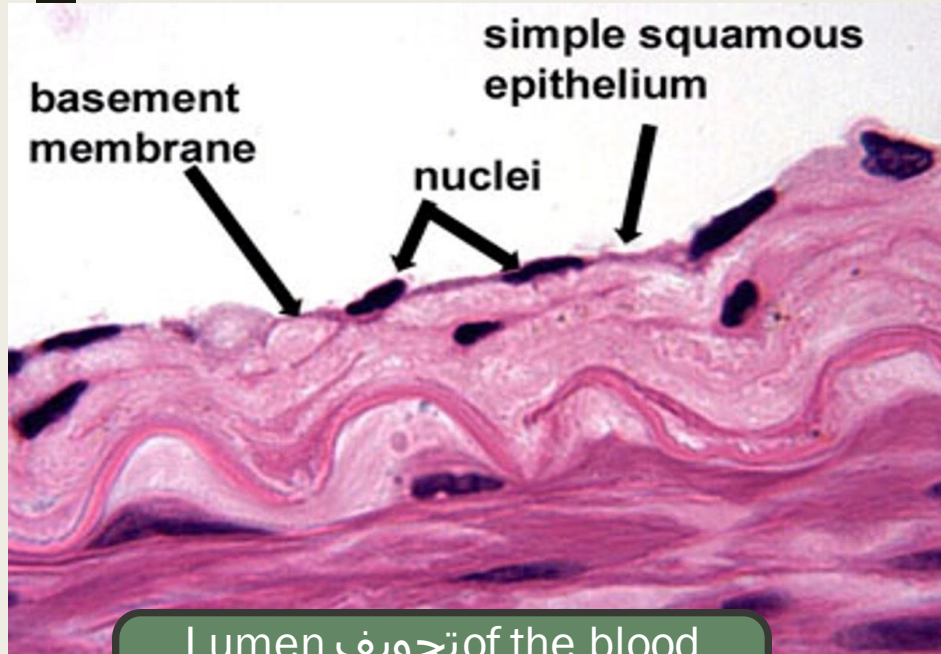
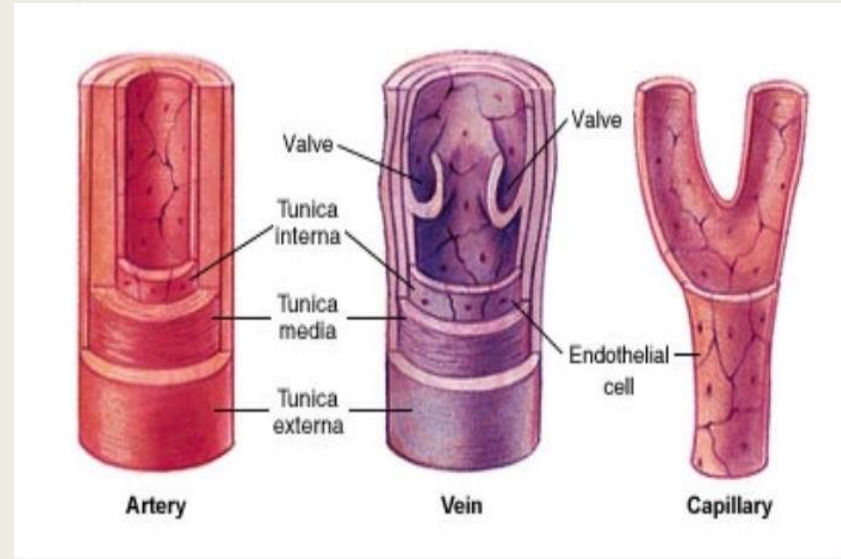
When it's empty the lining of the epithelium is thick and when it's full the muscles relax and the urine pushes against hydrostatic pressure. The walls of the epithelium cause it to stretch which makes it thinner as the lining of the epithelium would accommodate the urine and this will make it look squamous when it's actually cuboidal

Simple squamous epithelium:

Simple squamous → the shortest and is seen in many locations

1. Endothelium

Endothelium → called the simple squamous epithelium of blood vessels so regarding of the type of blood vessels the lining will always be endothelium



Lumen تجویف of the blood vessels is filled with blood cells

Capillaries are closer to the cell than the big blood vessels

Blood vessels

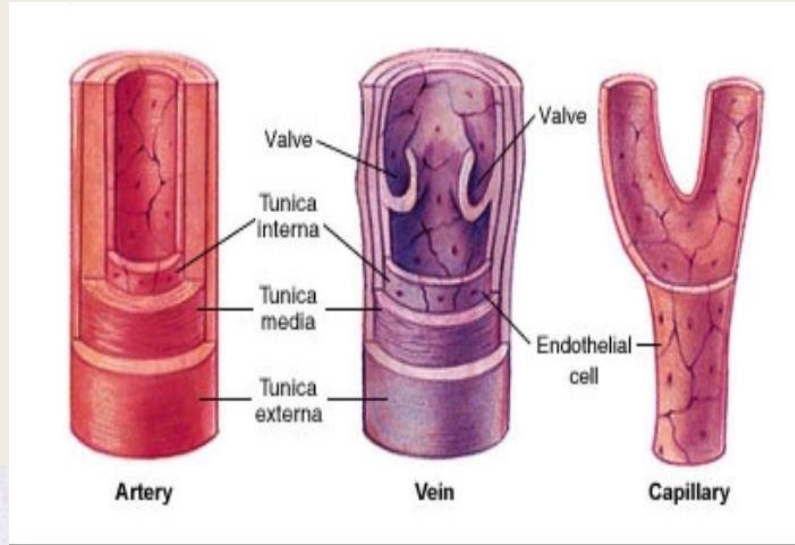
- Thin cells
- Nuclei are the thickest structure and most noticeable
- Regulate passages of substances.

This image is taken by light microscope (bright-field) we can notice it is on white background,

Simple squamous epithelium:

1. Endothelium

The lining of the blood vessels are endothelium while the lining of the heart was endocardium

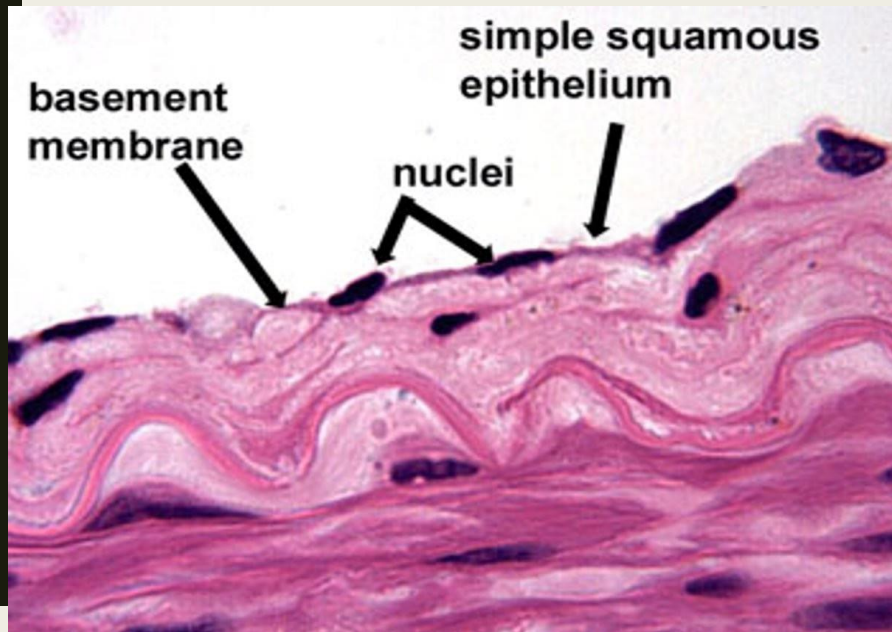


The blood flows on the same smooth surface without interruptions meaning there are no apical modifications

Blood vessels

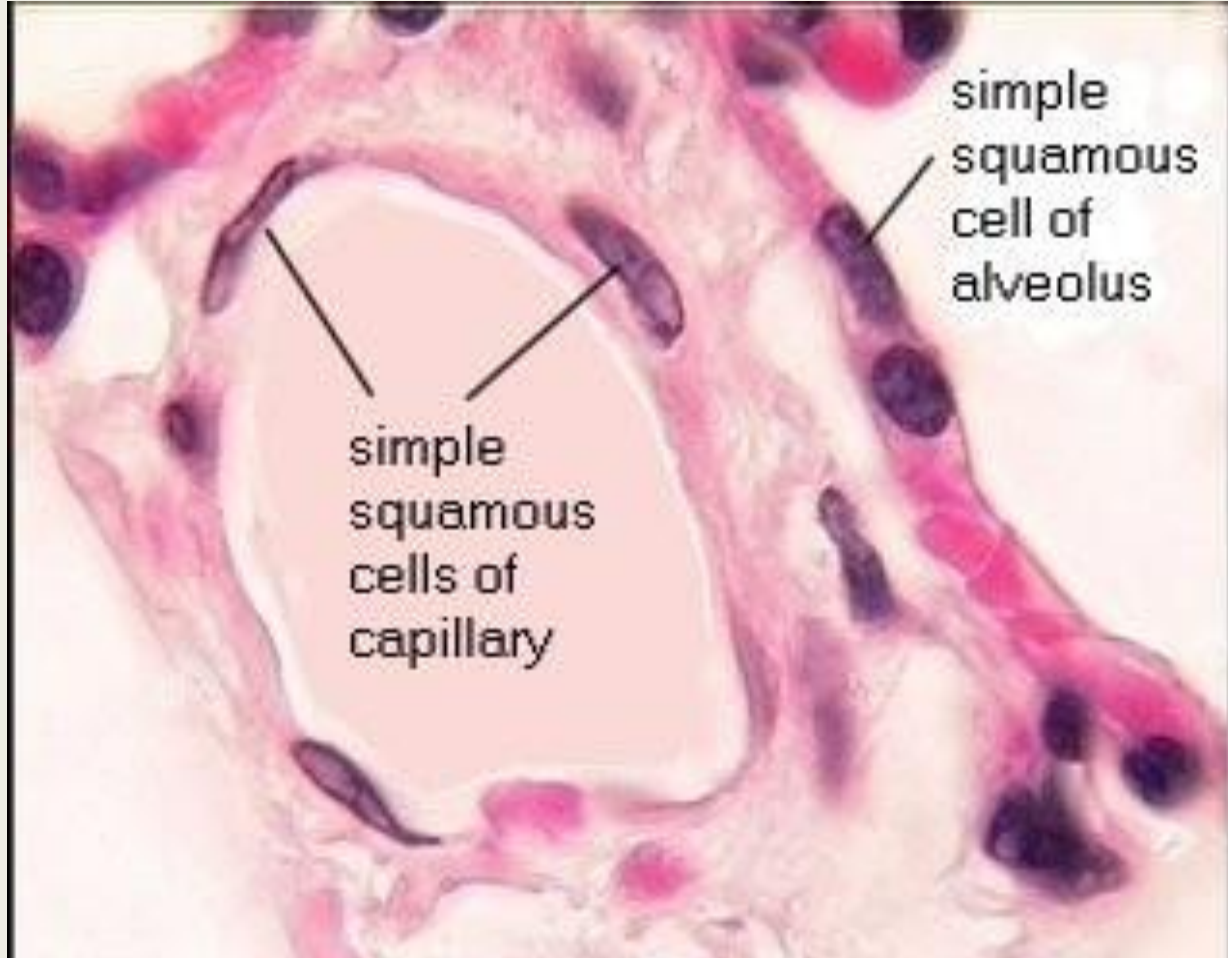
- Thin cells
- Nuclei are the thickest structure and most noticeable
- Regulate passages of substances.

Wide cell → high surface area → nuclei are away from each other
in cuboidal and columnal → nuclei are closer to each other because they do not have a wide surface area



Simple squamous epithelium

2. lung alveoli حويصلات

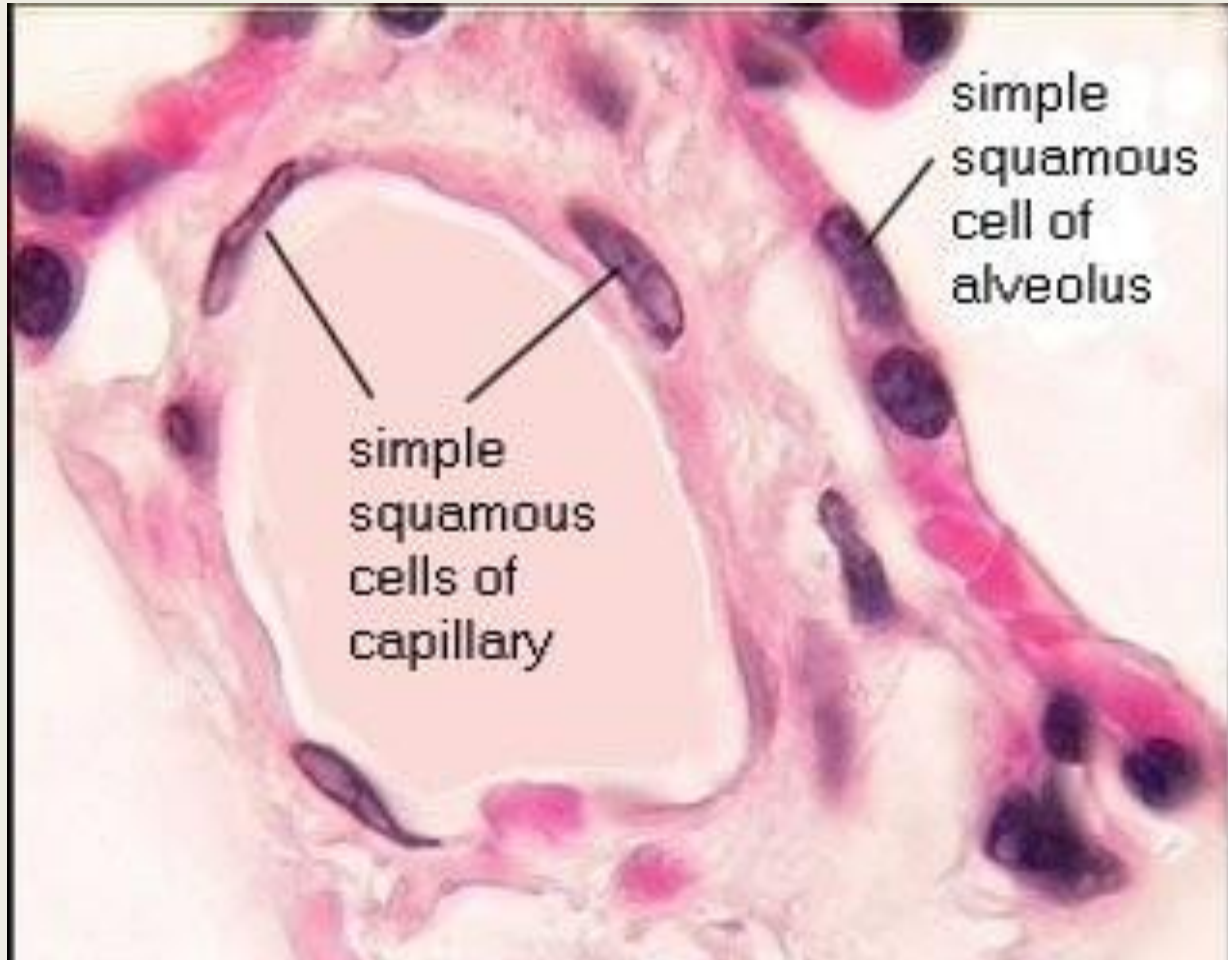


A simple squamous epithelium in one location is different from a simple squamous epithelium in another as they perform different functions

In the respiratory tract → there is respiratory epithelium → The respiratory epithelium is a simple squamous epithelium
Flattened Cells in alveoli → type 1 specialized cells → the cytoplasm of these cells is where the gas exchange will occur through the lining of the alveoli

Simple squamous epithelium

2. lung alveoli



There is no gas exchange in the nose nor the trachea but it occurs in the alveoli which are located in the respiratory bronchiole

Gas exchange occurs in the alveoli due to its structure → the lining is simple squamous which allows gas exchange to occur efficiently

3. Mesothelium

Mesothelium → represents the lining and covering of cavities and organs

The trunk → consists of the thoracic cavity and the abdominal and pelvic cavity
Epithelium cover surfaces and line cavities

Simple squamous epithelium.

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

- 1 Pleura lining the thoracic cavity
- 2 Peritoneum lining the abdominal cavity
- 3 Pericardium
- 4 Mediastinum

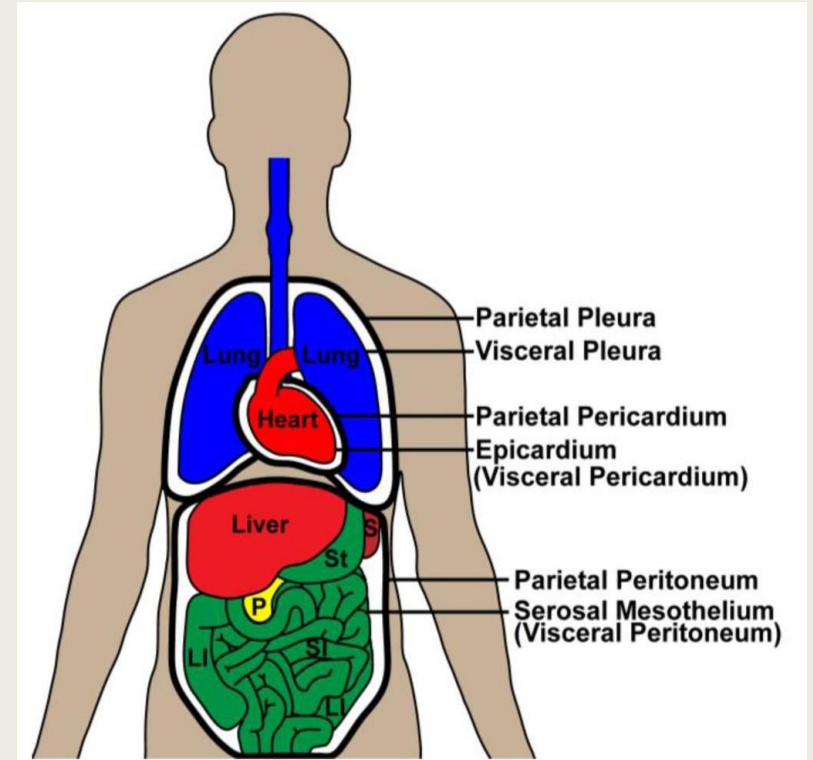
Cavities

Thoracic → respiratory system + heart+ large blood vessels

Abdominal → GI tract+part of the urinary system

Pelvic → pelvis and genit

The mesothelium is simple squamous that lines organs and cavities and it also secrete serous fluid



3. Mesothelium

What lines the cavities: parietal
What covers the cavities: visceral

Simple squamous epithelium.

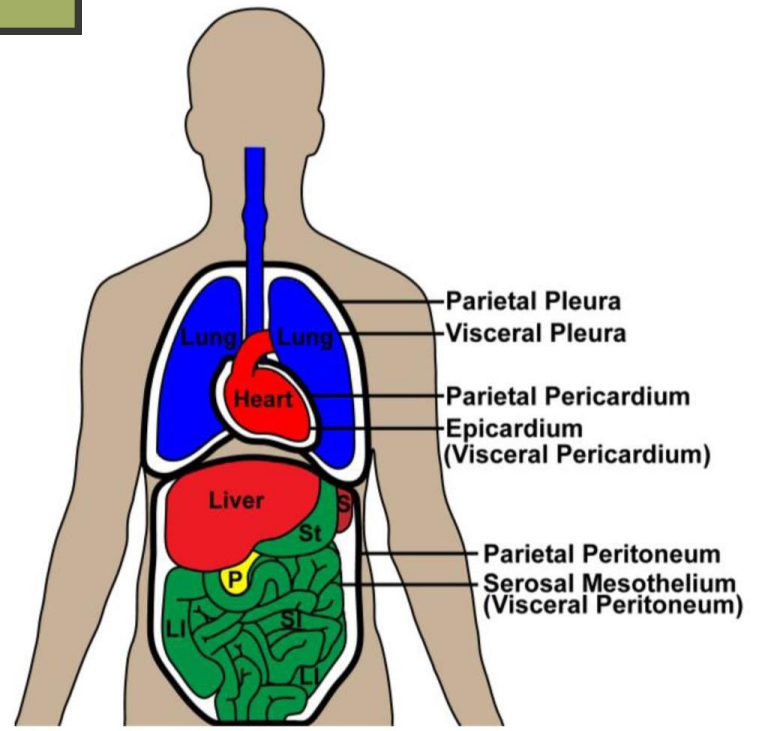
Covering of organs and lining of cavities--visceral and parietal layers.

- 1 Pleura lining the thoracic cavity
- 2 Peritoneum lining the abdominal cavity
- 3 Pericardium The heart does not have a direct cavity around it
- 4 Mediastinum

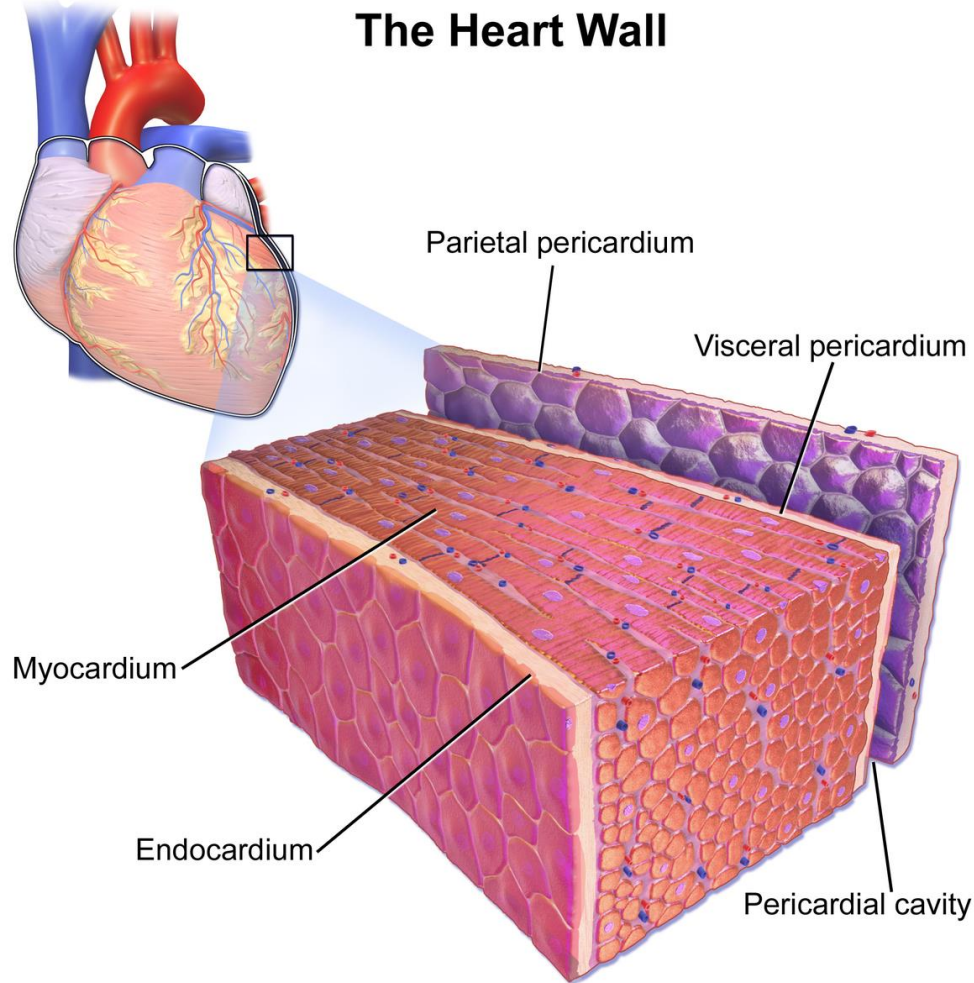
Serosa=visceral peritoneum

We need cavities to surround the movement of organs

Fibrous pericardium: the outside layer of the pericardium made up of connective tissue and it's in between two layers of mesothelium (parietal pericardium and epicardium) **so it's three layers**




3. Mesothelium



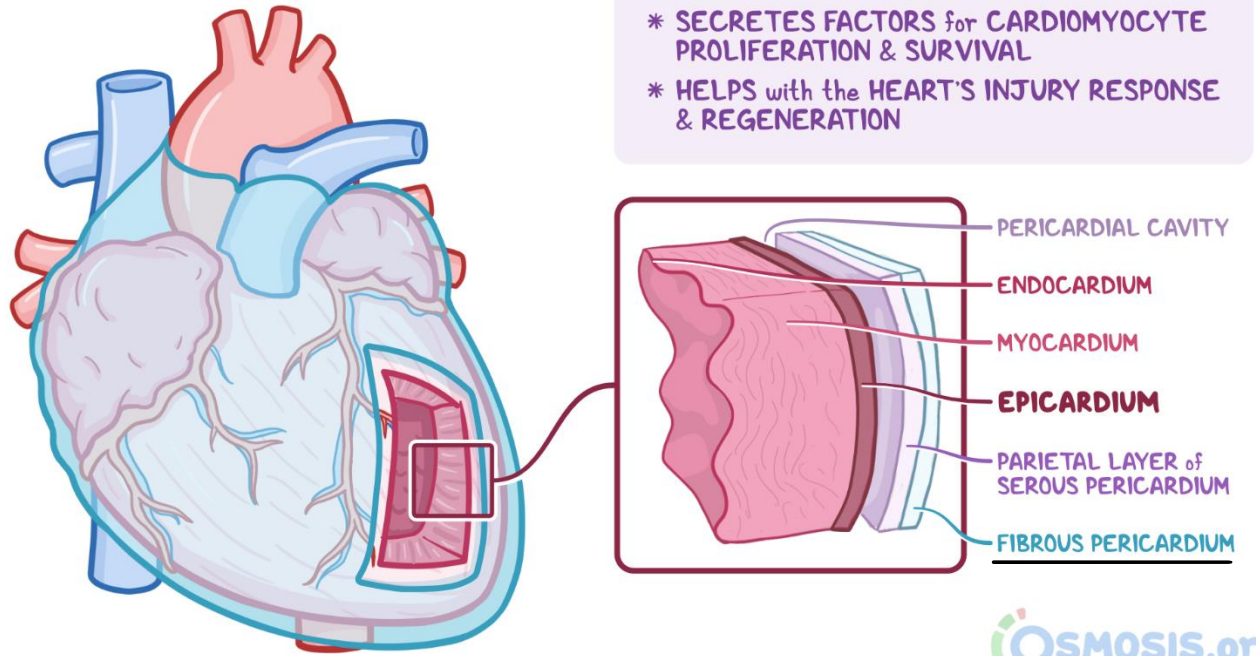
BACKGROUND

- * **OUTERMOST LAYER** of the **HEART**
~ **VISCERAL LAYER** of **SEROUS PERICARDIUM**
- * **SURROUNDS** the **HEART & ROOTS** of the **CORONARY VESSELS**

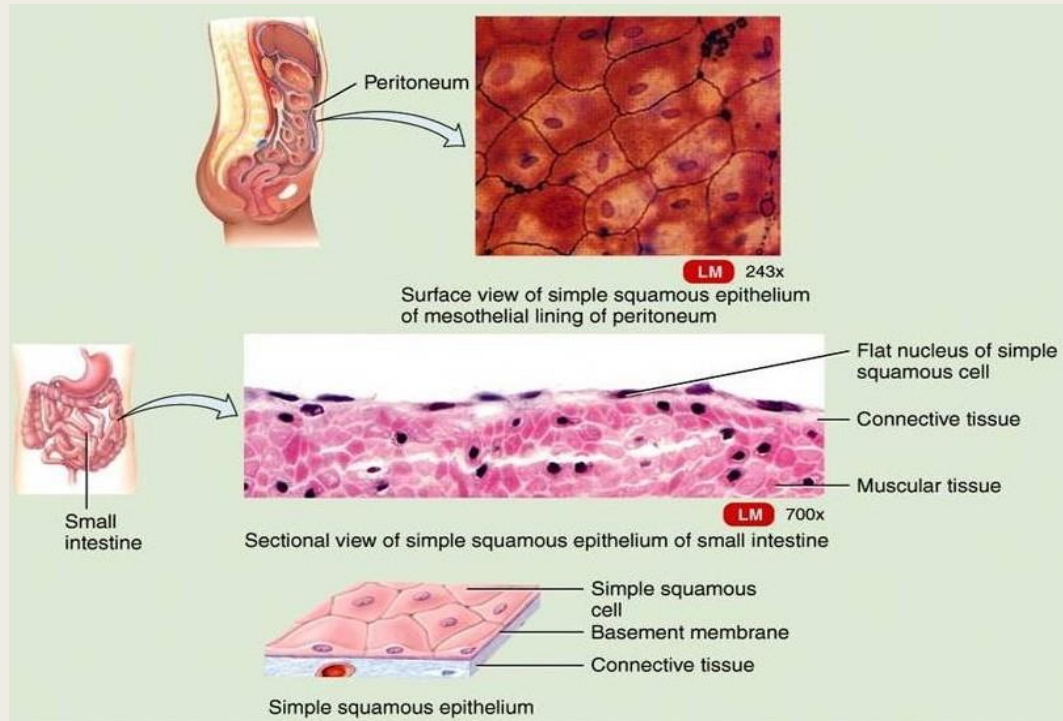
FUNCTION



- * **PROTECTS** the **HEART**
- * **PROVIDES SIGNALS** for **EMBRYONIC HEART FORMATION & MATURATION**
- * **SECRETES FACTORS** for **CARDIOMYOCYTE PROLIFERATION & SURVIVAL**
- * **HELPS** with the **HEART'S INJURY RESPONSE & REGENERATION**



Mesothelium



Loose connective tissues → deeper tissue → and the outermost of the organ

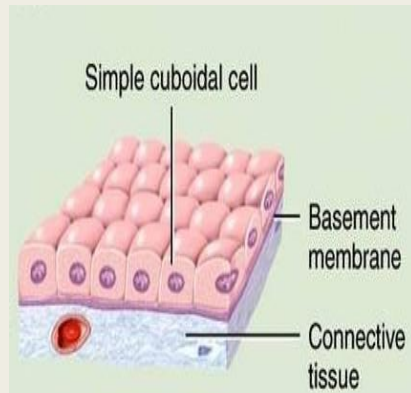
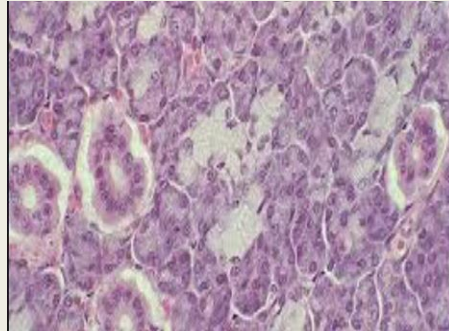
From the apical view, the epithelial cells look wide and the cross-sectional look flat

Simple cuboidal epithelium

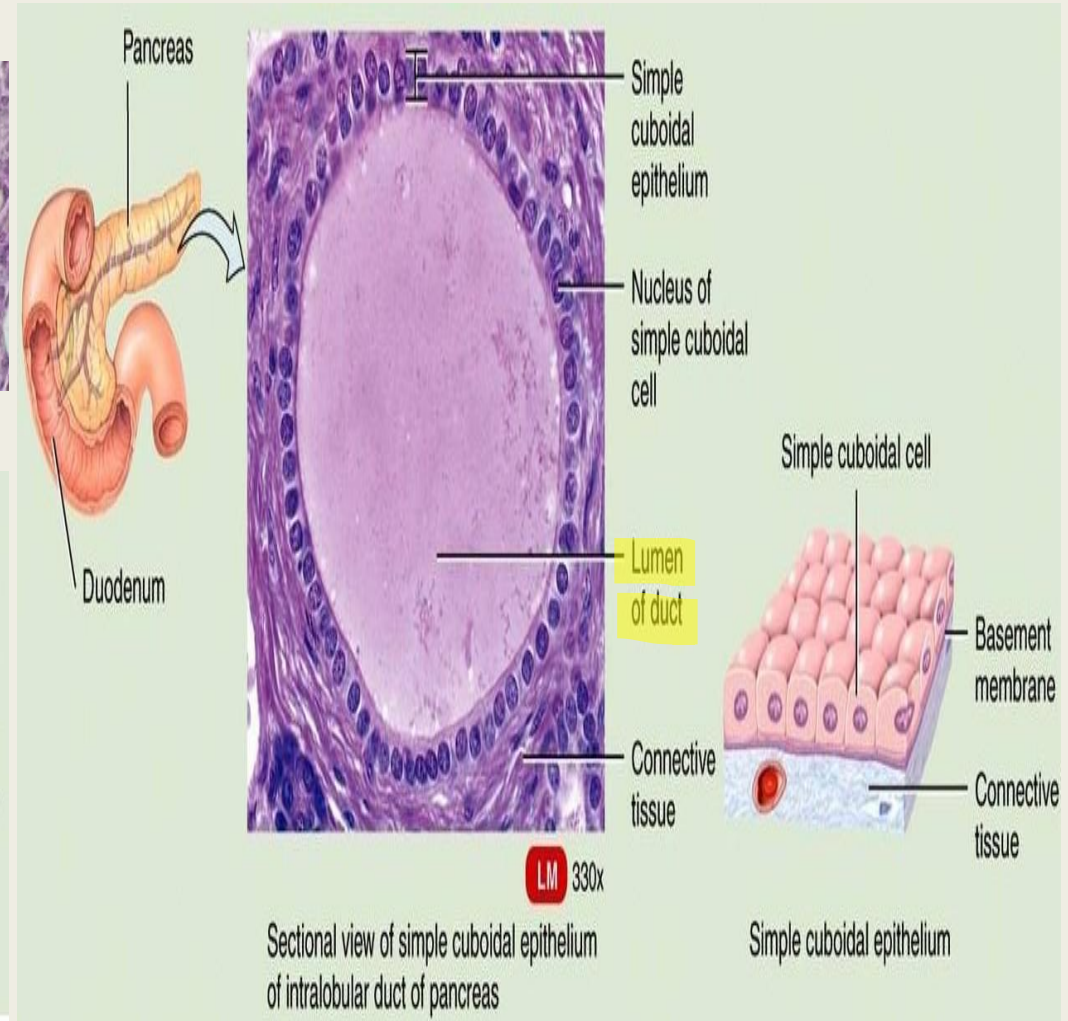
- Width and height are similar.
- Rich with organelles.
- High level of active transport.

Location

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



Simple cuboidal epithelium



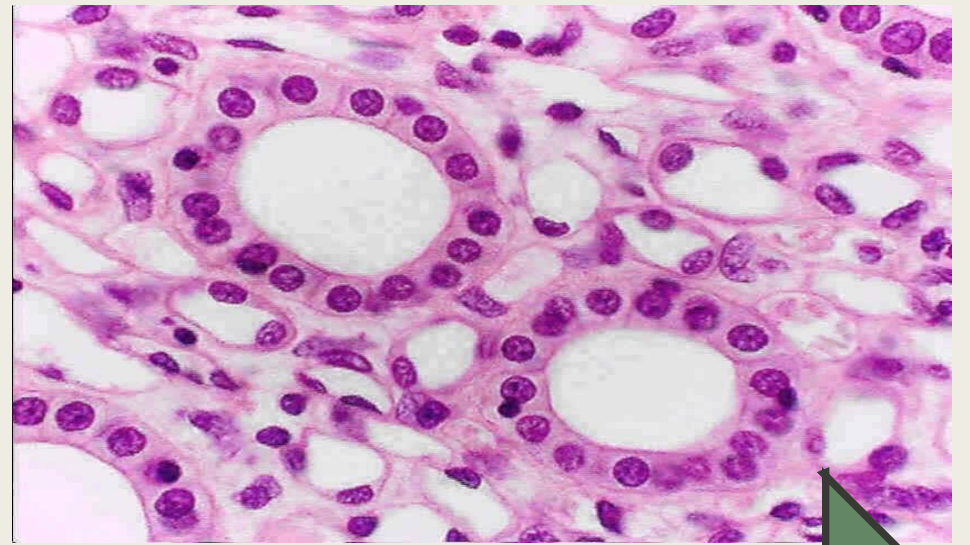
Sectional view of simple cuboidal epithelium of intralobular duct of pancreas

Simple cuboidal epithelium

Simple cuboidal Epithelium

The bigger the cell → the more organelles it contains → as a result the cell would have higher activity
The cuboidal tissue can be found in:
Lining of kidney
spherical thyroid follicles
An exception → covering of ovaries

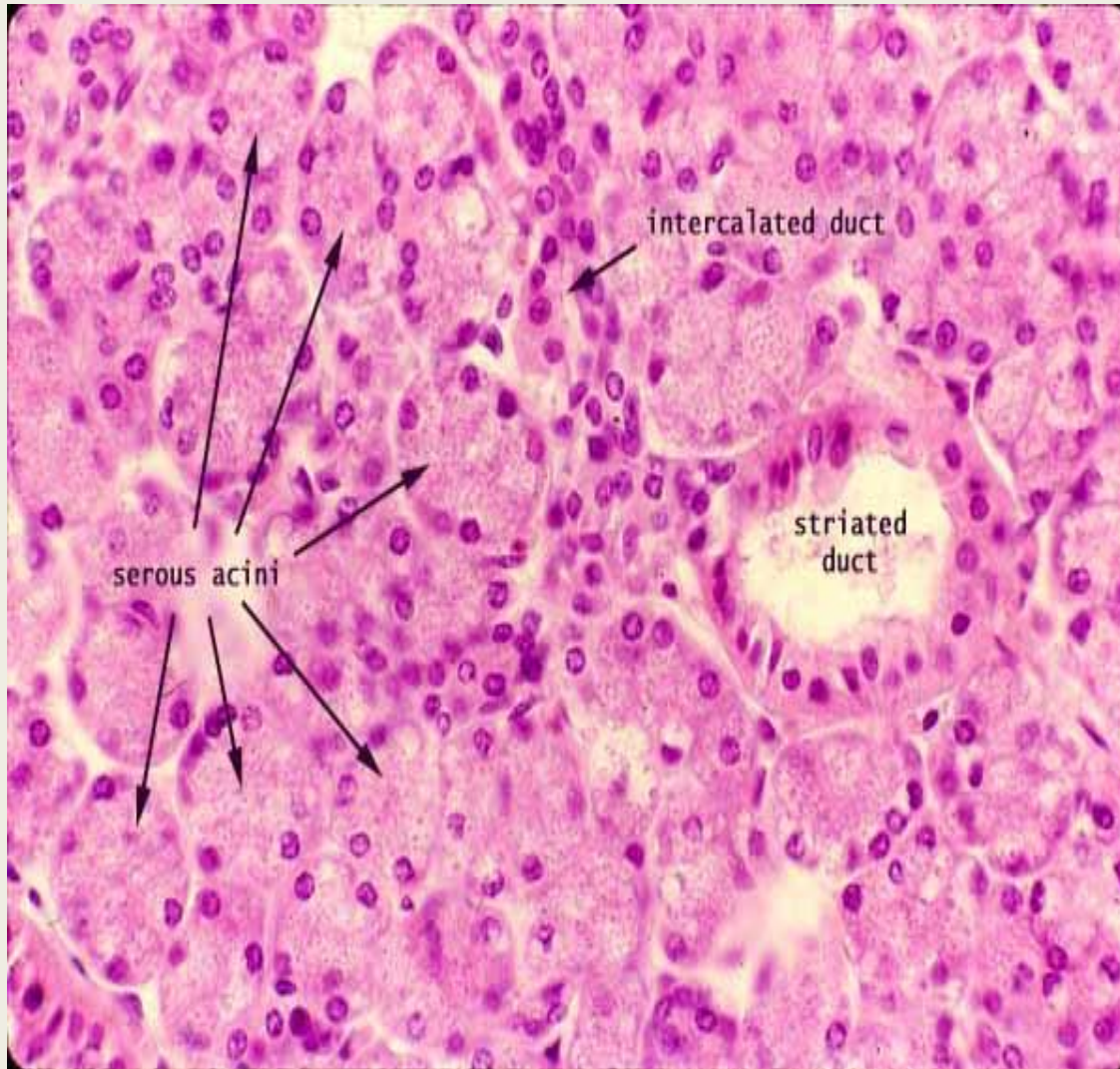
In simple cuboidal cells, → the amount of cytoplasm is relatively the same for both apically and basally surfaces
There is a special case → if the cell cuboidal cells were long but not as long as columnar then there would be more cytoplasm apically



The nucleus is spherical and can be slightly elongated or flattened but not to a point to be squamous or columnar

Both cuboidal and columnar epithelium are more active than squamous epithelium as it doesn't have a direct active non-stop function

Simple cuboidal Epithelium



There are two different types of glands :

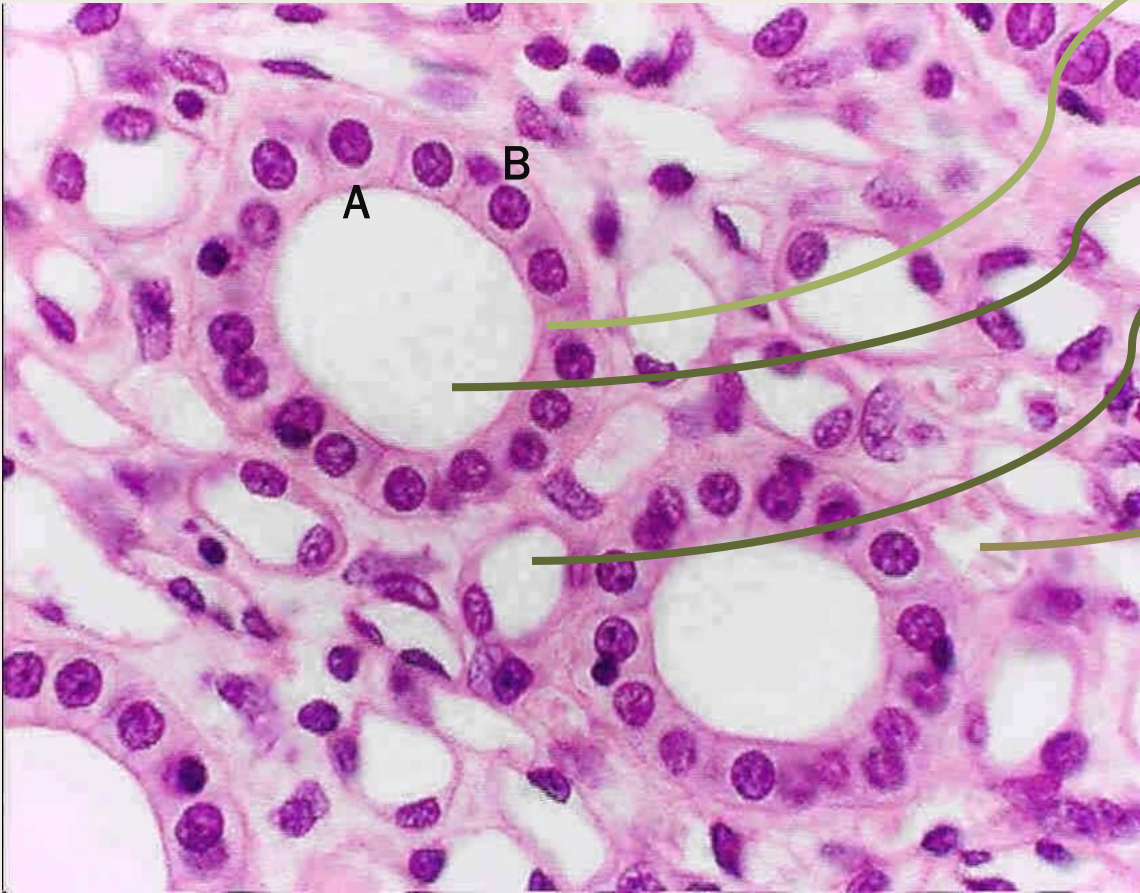
Exocrine glands which secrete their substances through ducts onto your body's surfaces and endocrine glands which secrete their substances directly into your bloodstream

In exocrine glands(**salivary glands for example**)→there are two types of cells which are secretory cells that secrete substances and ductal cells that carry the saliva

However: the saliva produced by the secretory cells is different from the saliva in the oral cavity → meaning that ductal cells modify the composition of the saliva
That is why it's called active transport→ they modify the electrolyte composition of the saliva

Simple cuboidal Epithelium

kidney tubules



Simple cuboidal epithelium

lumen

Squamous epithelium

Kidney → blood is pumped to the kidney and enters the Glomerulus
The blood will be filtered however there would still be many molecules that must be reabsorbed and this is the function of these tubules

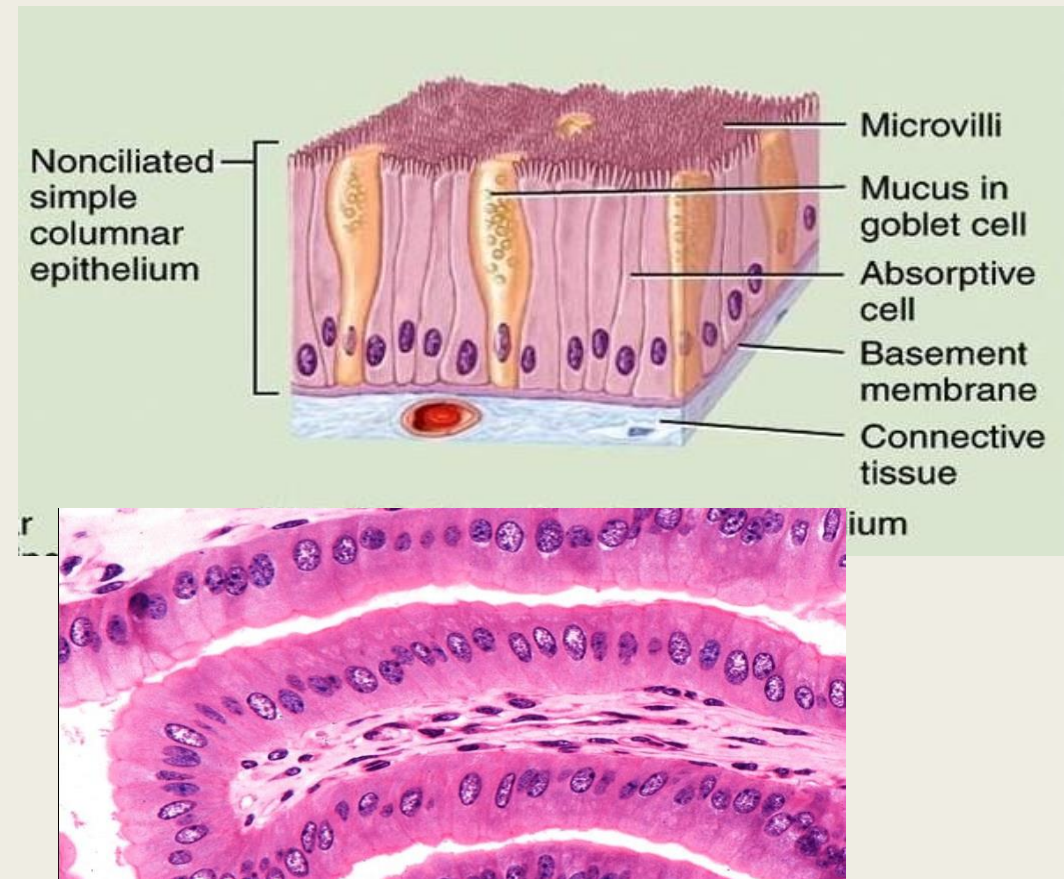
These cells have a good amount of cytoplasm which means more organelles → more functions
A : apical
B : basal

Simple columnar epithelium

- Cells are tall.
- Usually with microvilli or cilia. rarely seen with no modifications since they are larger cells with more organelles as a result more functions to do so these apical structures help them with these functions
- 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 the movement of fluid in the female genital tract.

Location

- Small intestine
- Stomach
- Gall bladder stores and concentrates bile which is released by the liver
- Oviduct lining
- Renal collecting ducts in the kidney



The cytoplasm is not distributed evenly(apically is more than basally)

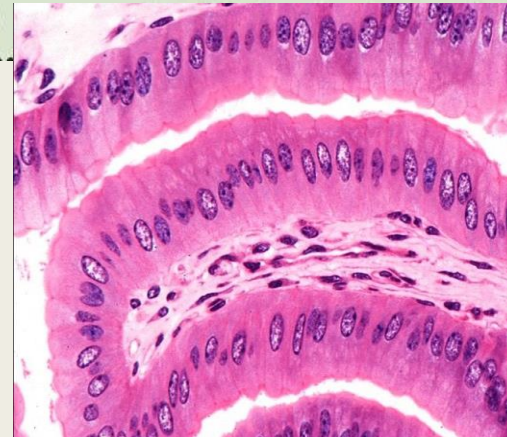
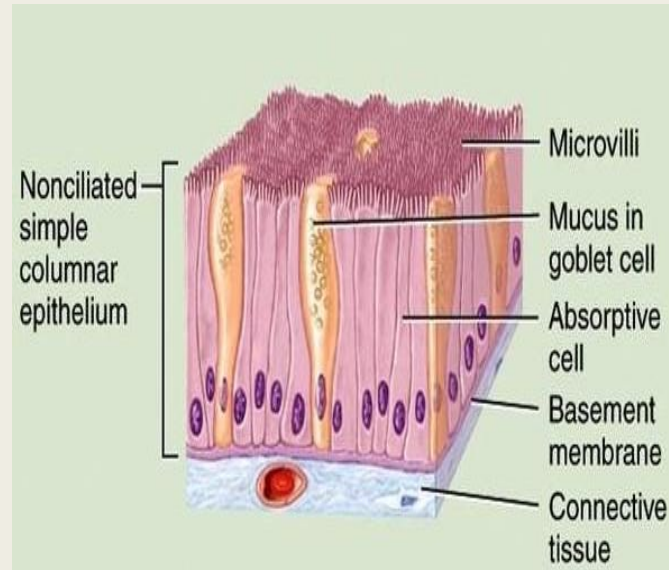
Columnar is the least seen epithelium in the body and can be seen in the eyes(conjunctival epithelium)

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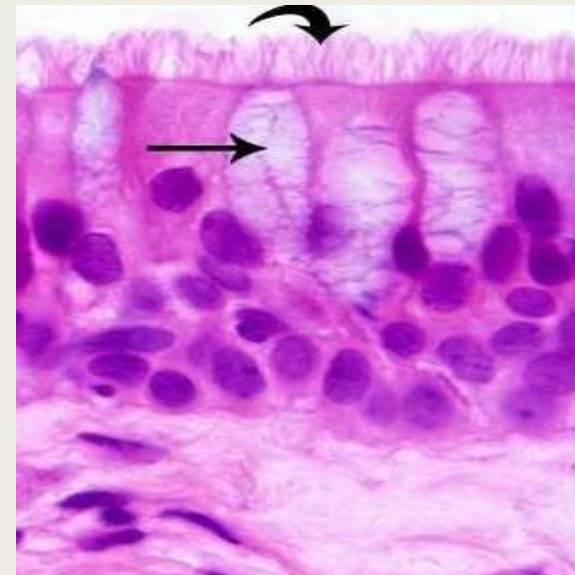
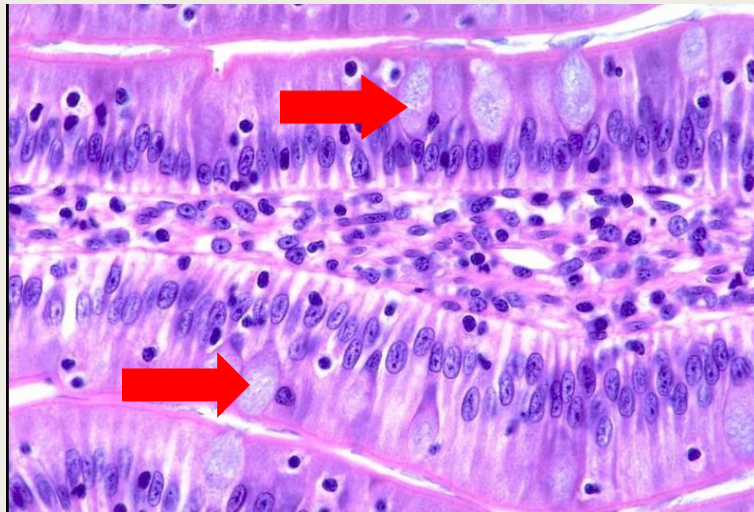


Ciliated columnar epithelium → can be found in the female genital tract and the respiratory tract

The bigger the cells → the more protection it provides
So columnal can be found in the stomach where we need a lot of protection than blood vessels where we find squamous epithelium

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

