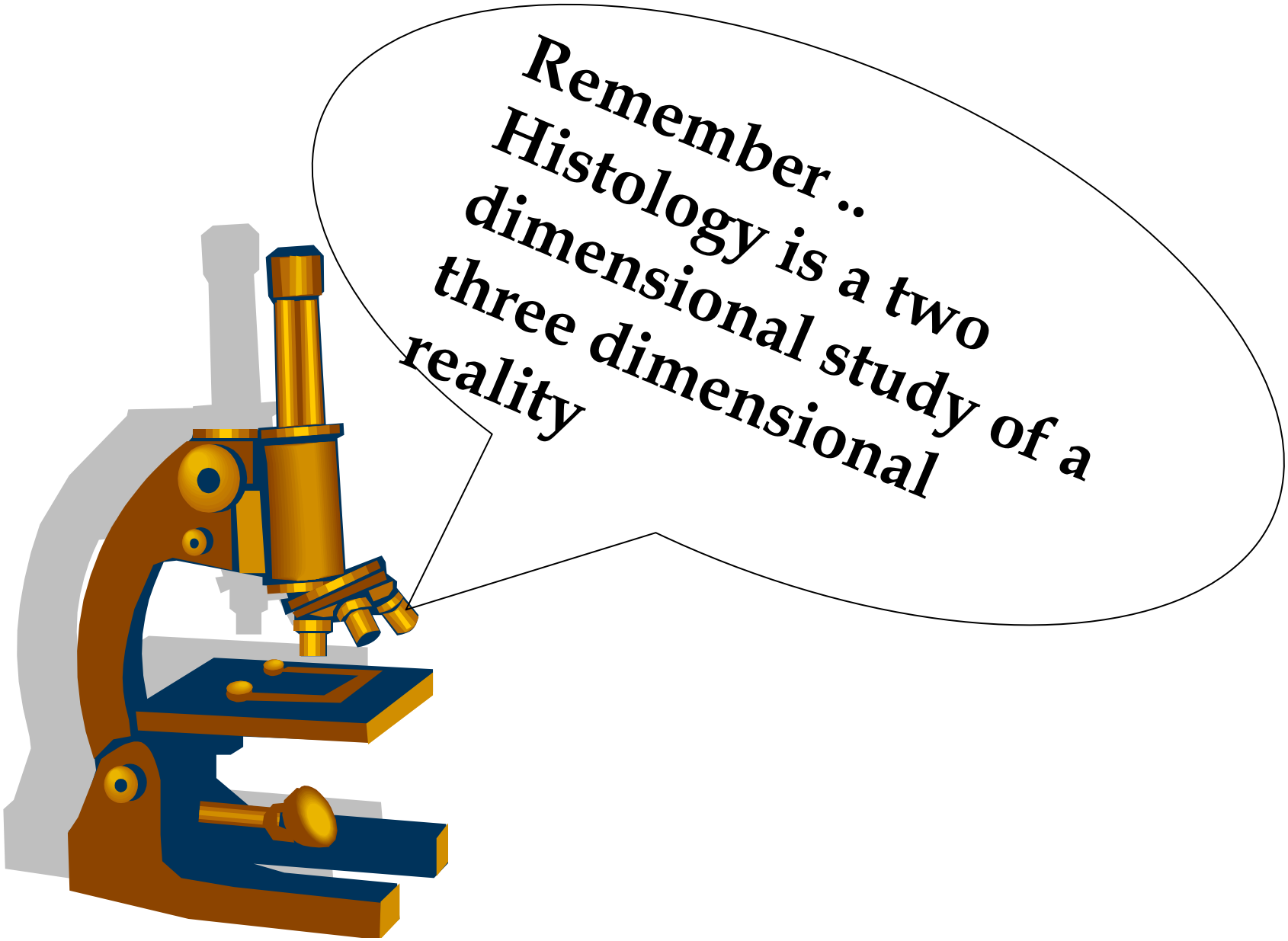
Histology lab 3
Dr. heba kalboneh

Epithelium

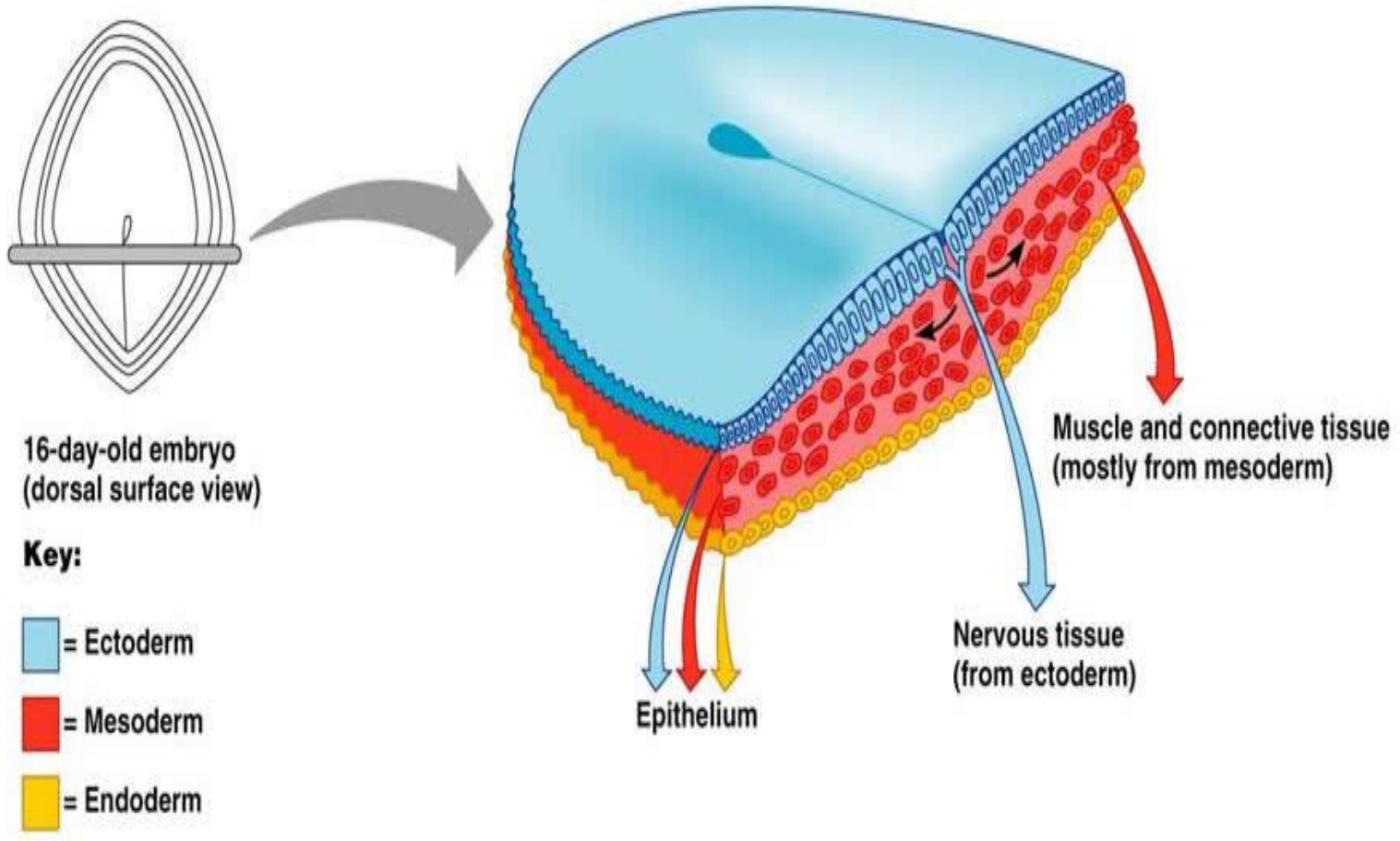
النسيج الطلائي (الظهاري)


Remember ..
Histology is a two dimensional study of a three dimensional reality

Features of Epithelium

- Epithelium occurs in the body as a sheet of cells that covers a body surface, lines a cavity, or forms a gland.
- *Coverings, linings, glands.*

- Derived from any embryonic layer.



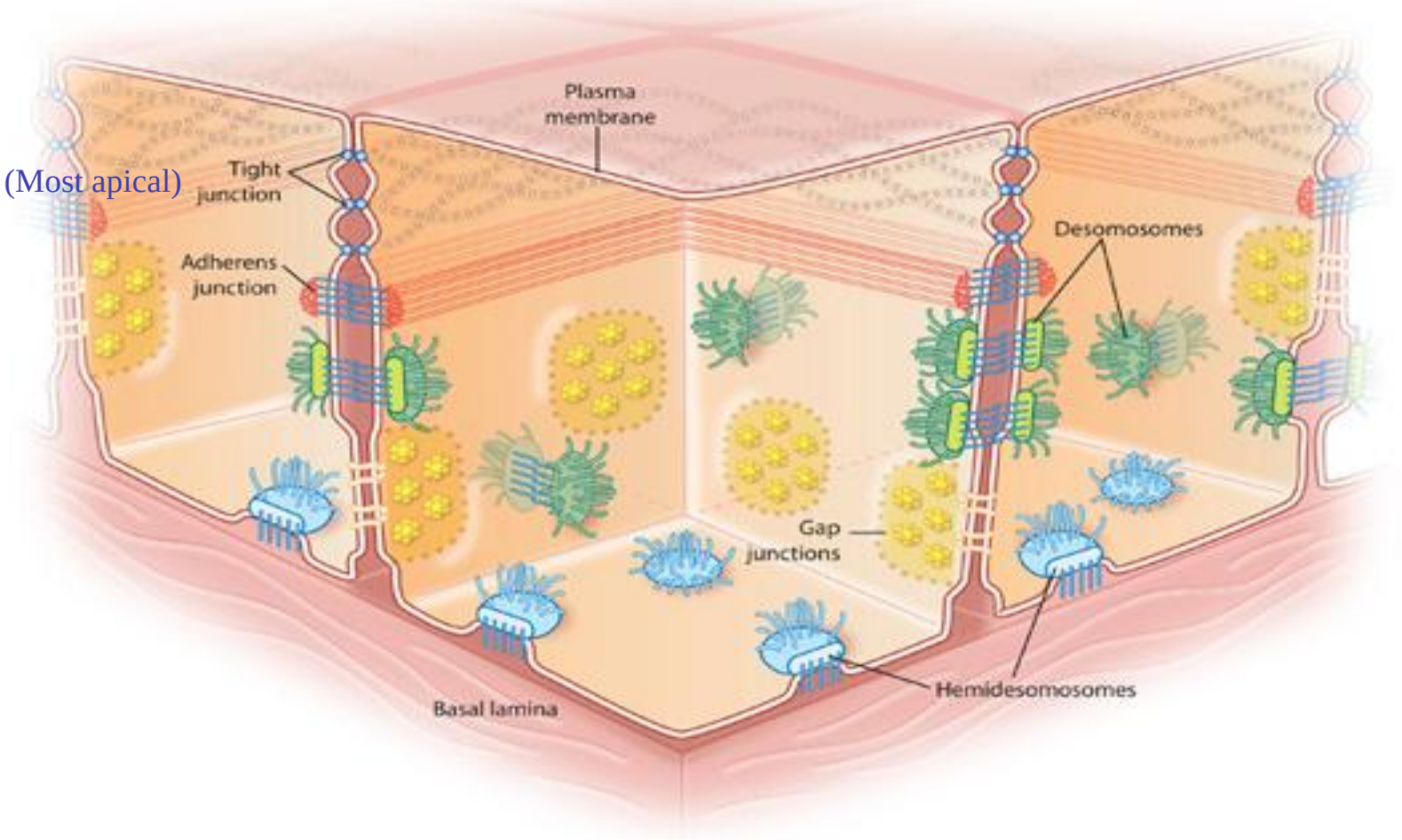
Derived from any embryonic layer.

Special Characteristics of Epithelium

- Composed of closely packed cells with little extracellular material between.

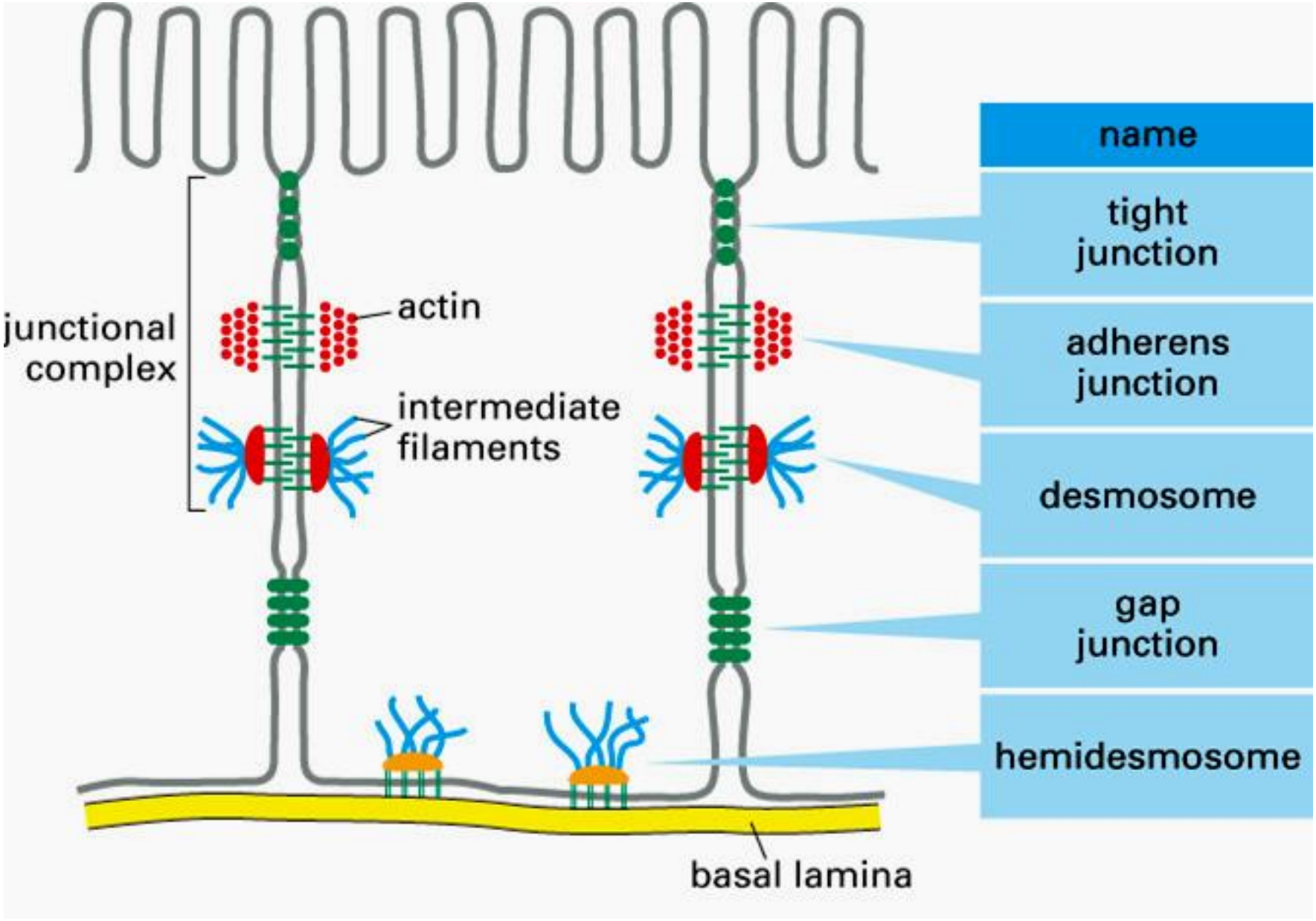
- Adjacent epithelial cells are bound together by specialized contacts such as desmosomes and tight junctions.

Intercellular Junctions

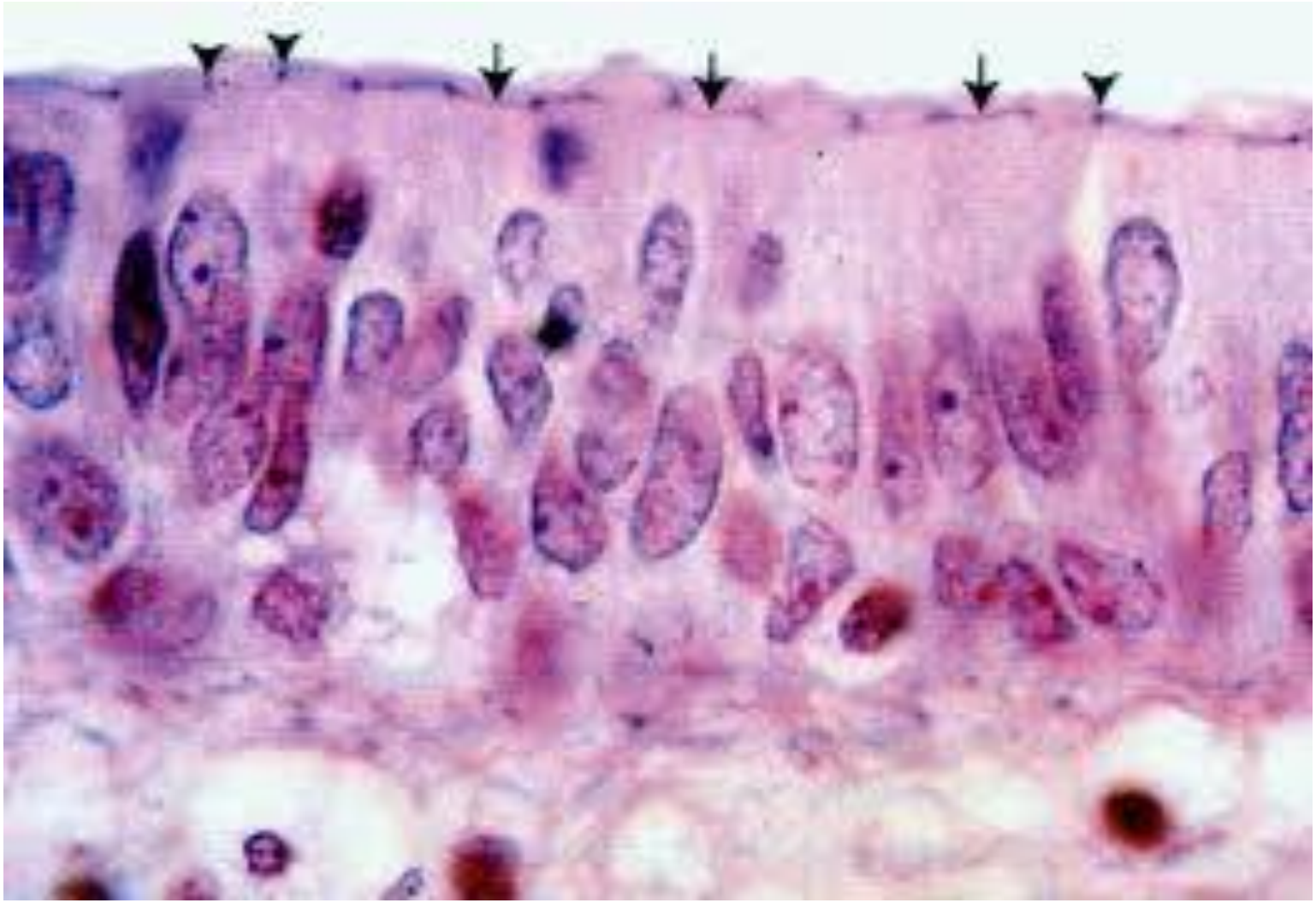


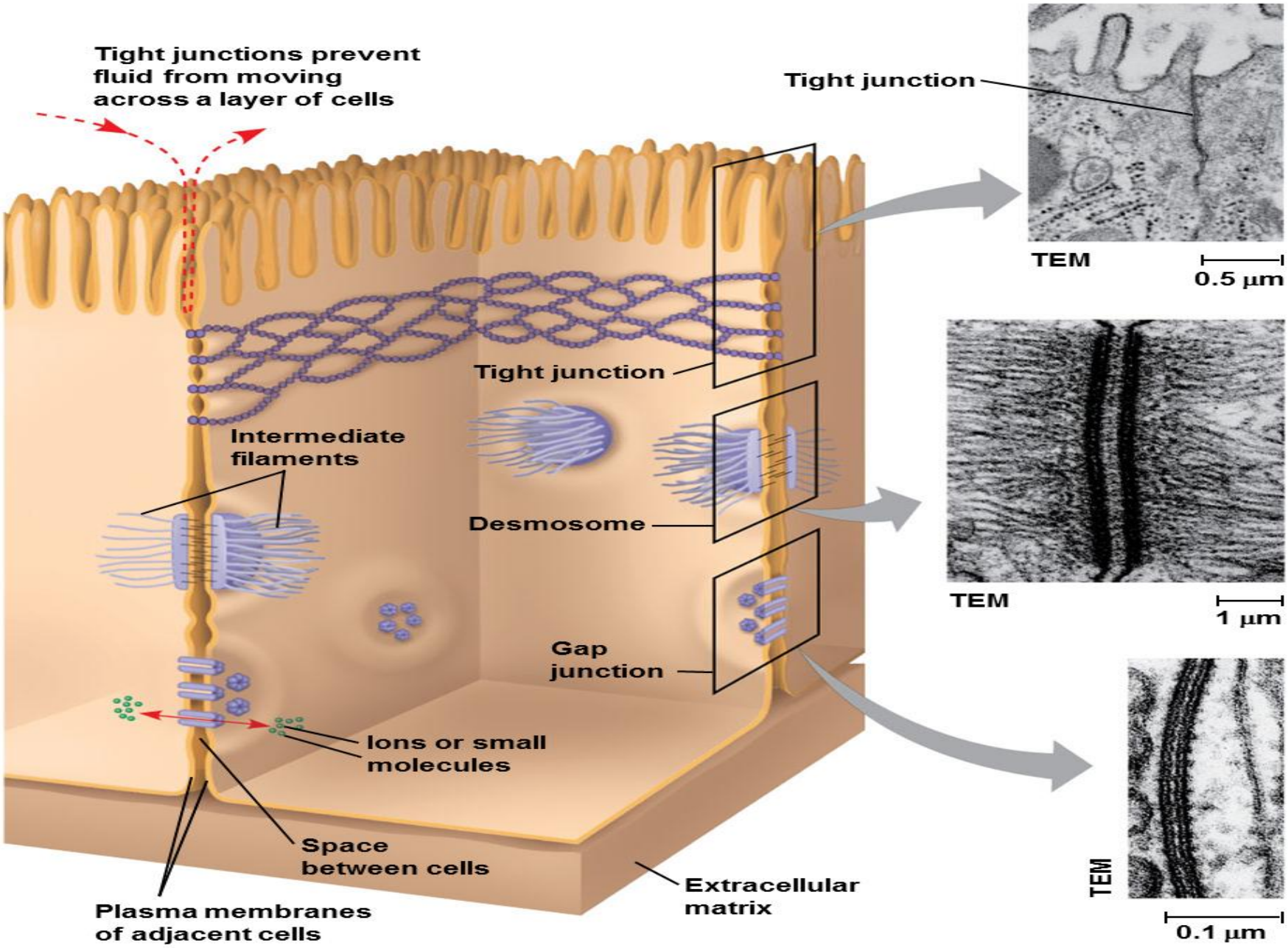
(Most apical)

(Desomosomes > Adherens junction > Tight junction)


junctional complex
actin
intermediate filaments
basal lamina
name
tight junction
adherens junction
desmosome
gap junction
hemidesmosome

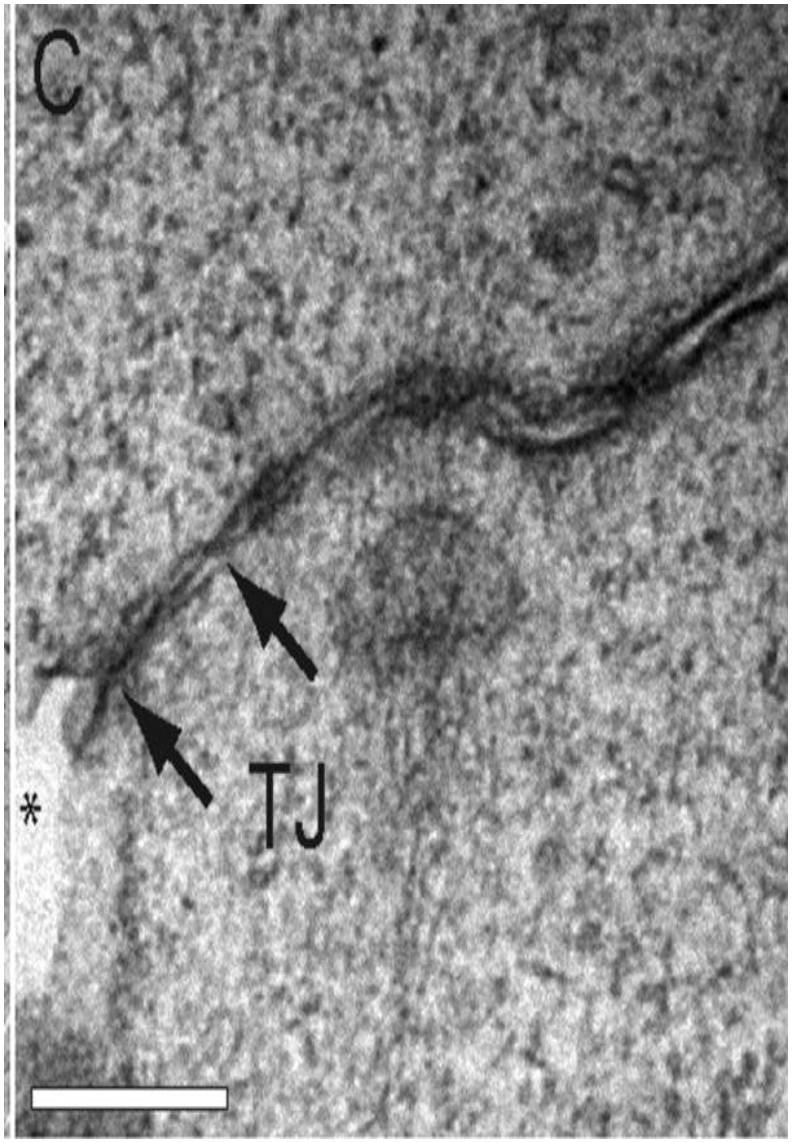
Terminal bar and Terminal web

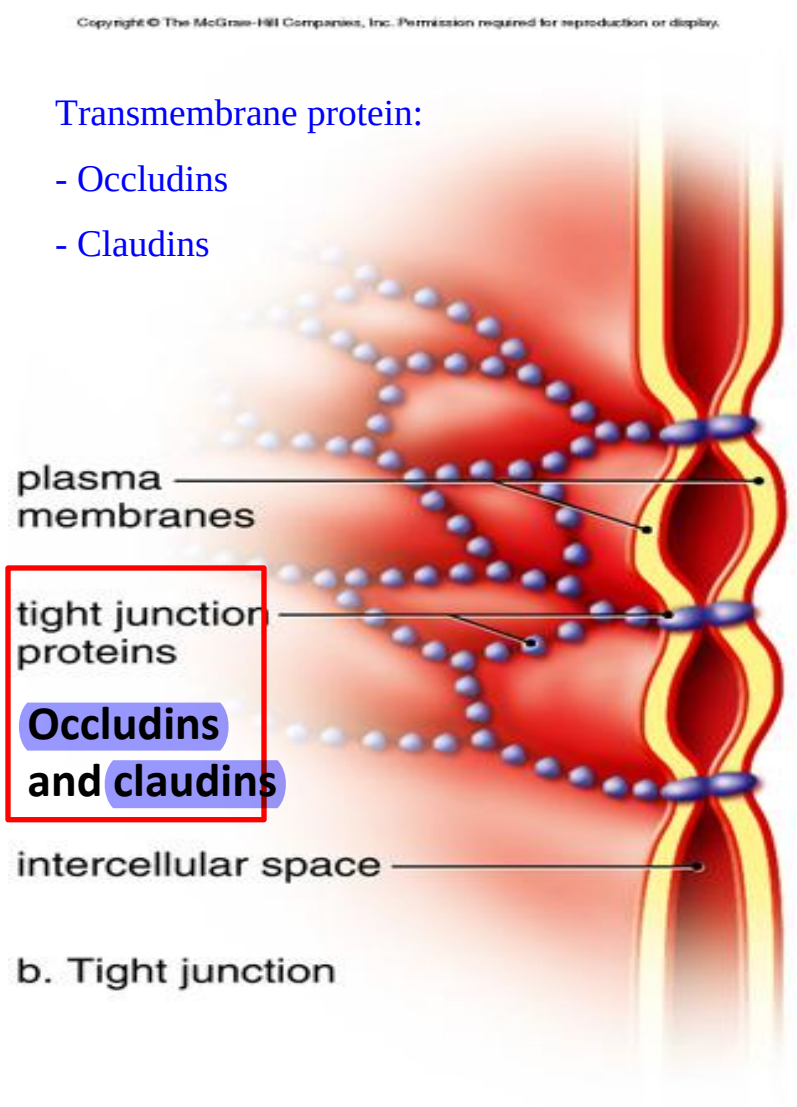




Tight Junction (Zonula occludens)

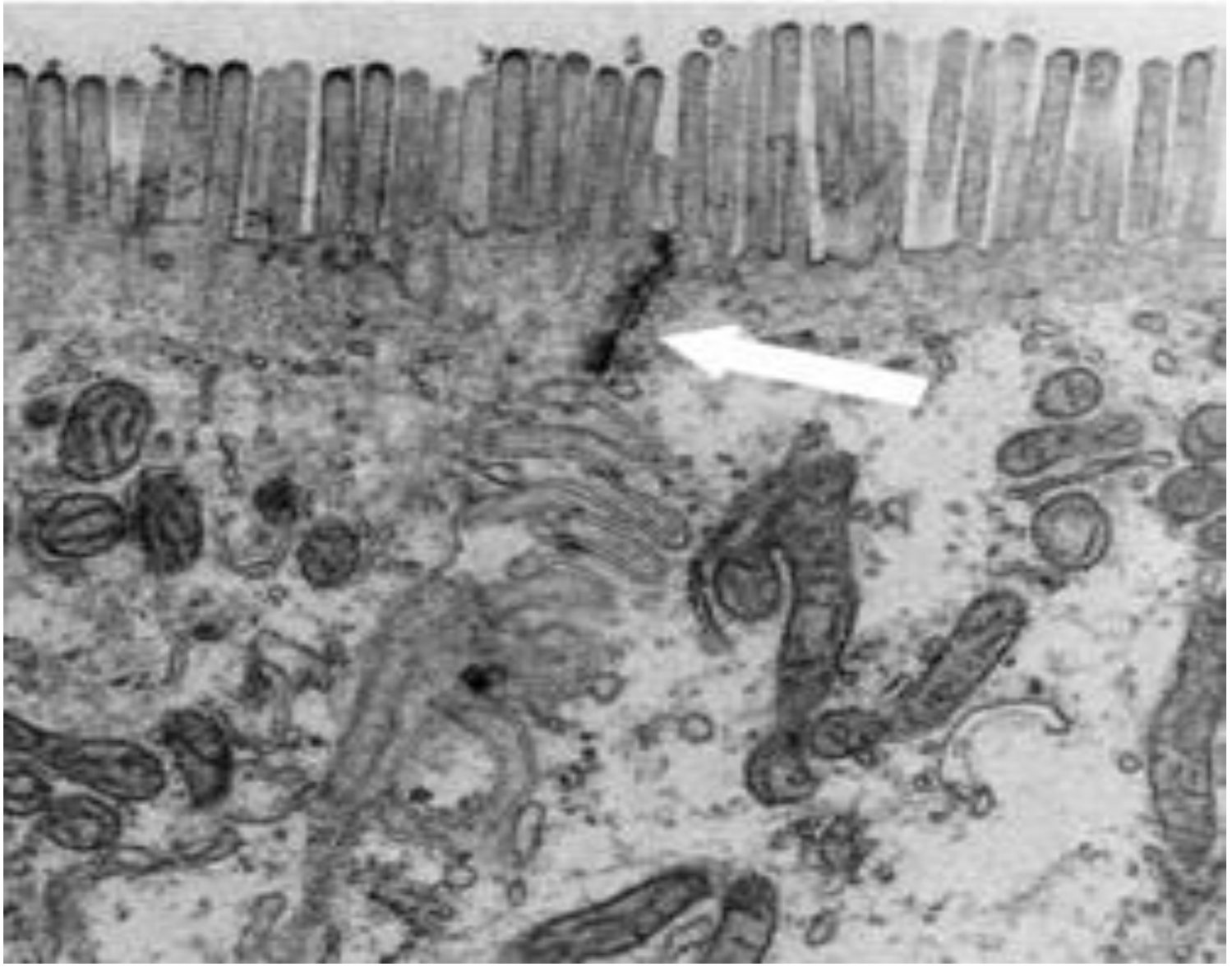
(Belt like)





Transmembrane protein:

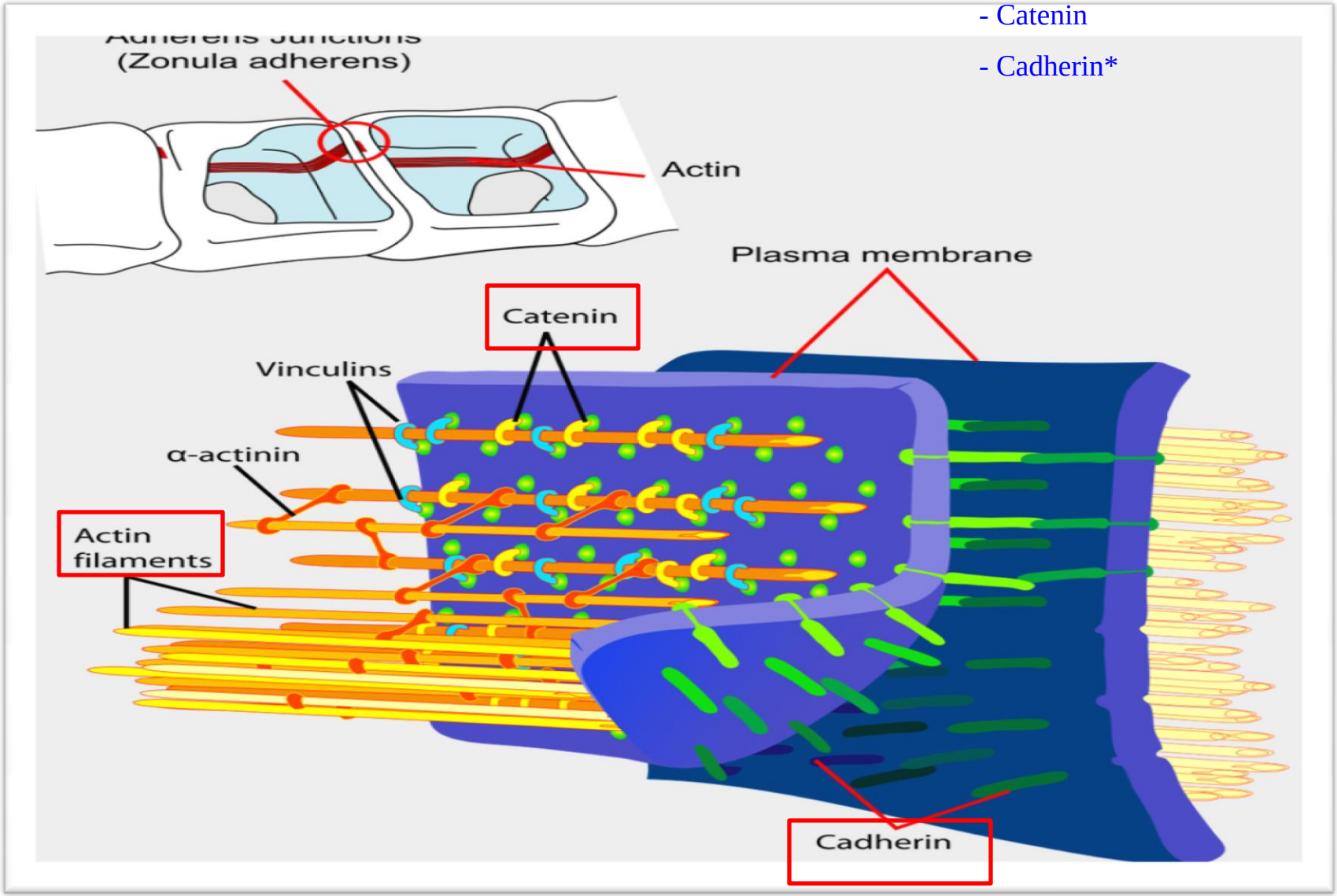
- Occludins
- Claudins



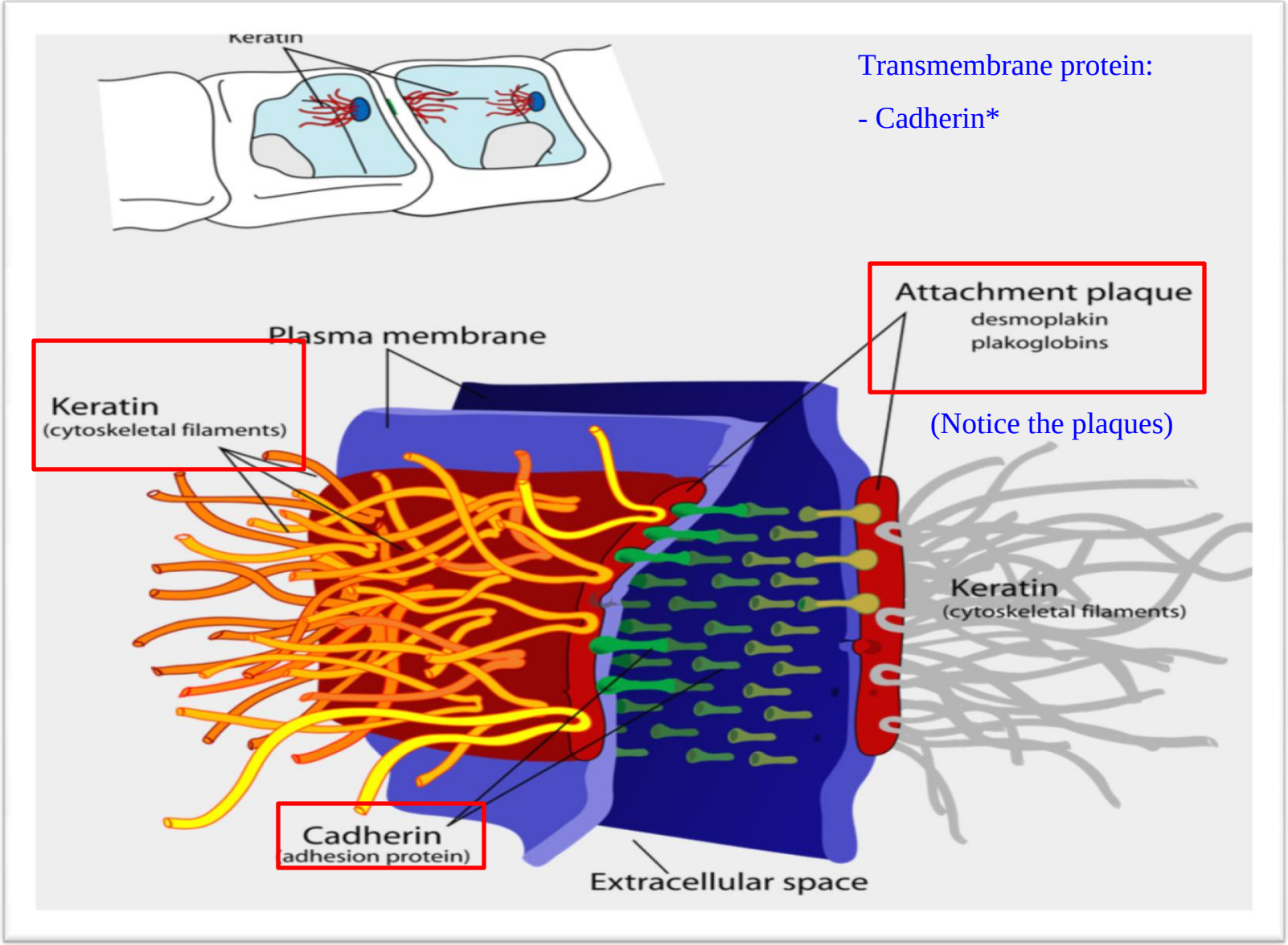
Zonula adherens

Transmembrane protein:

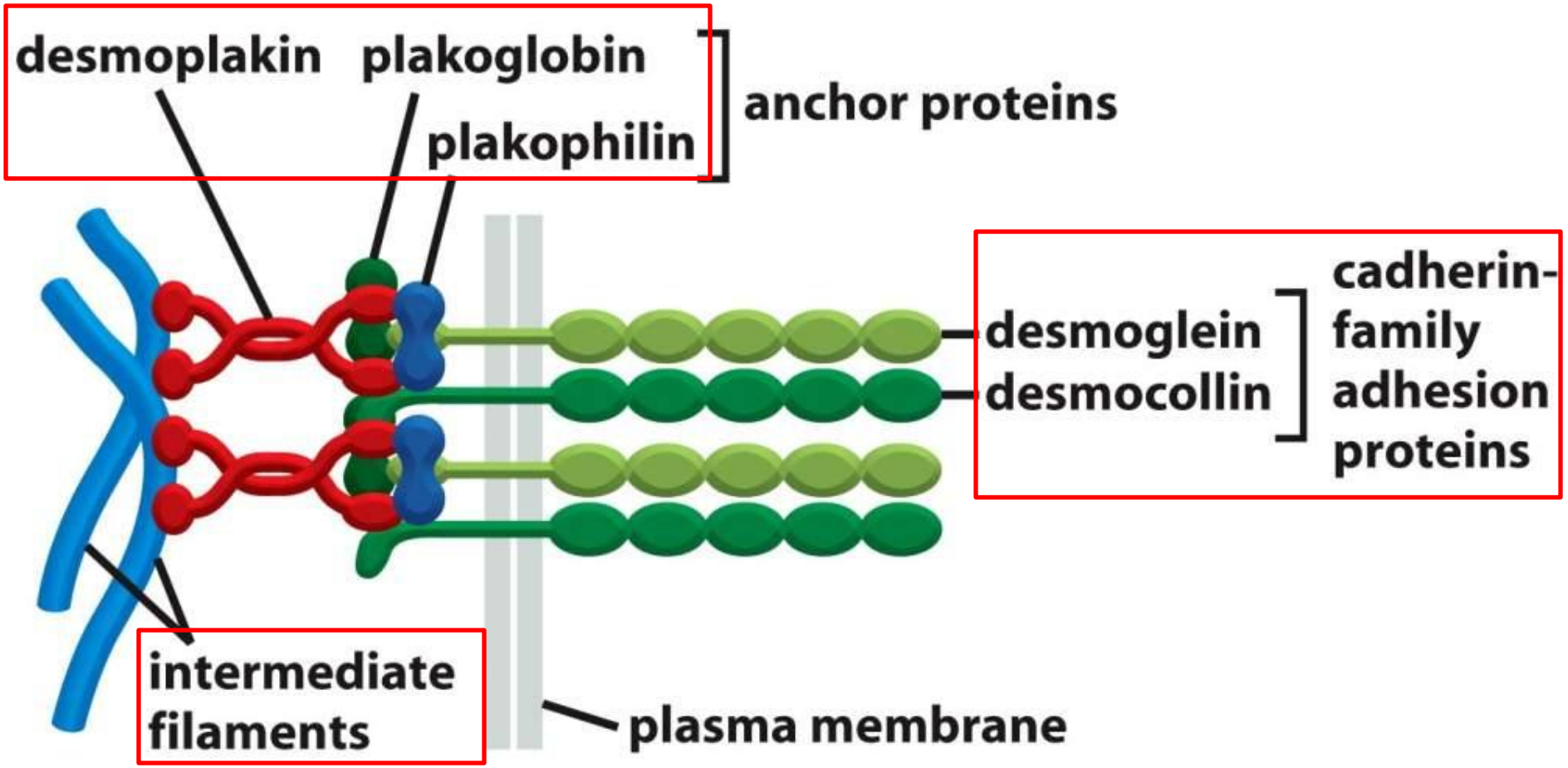
- Catenin
- Cadherin*

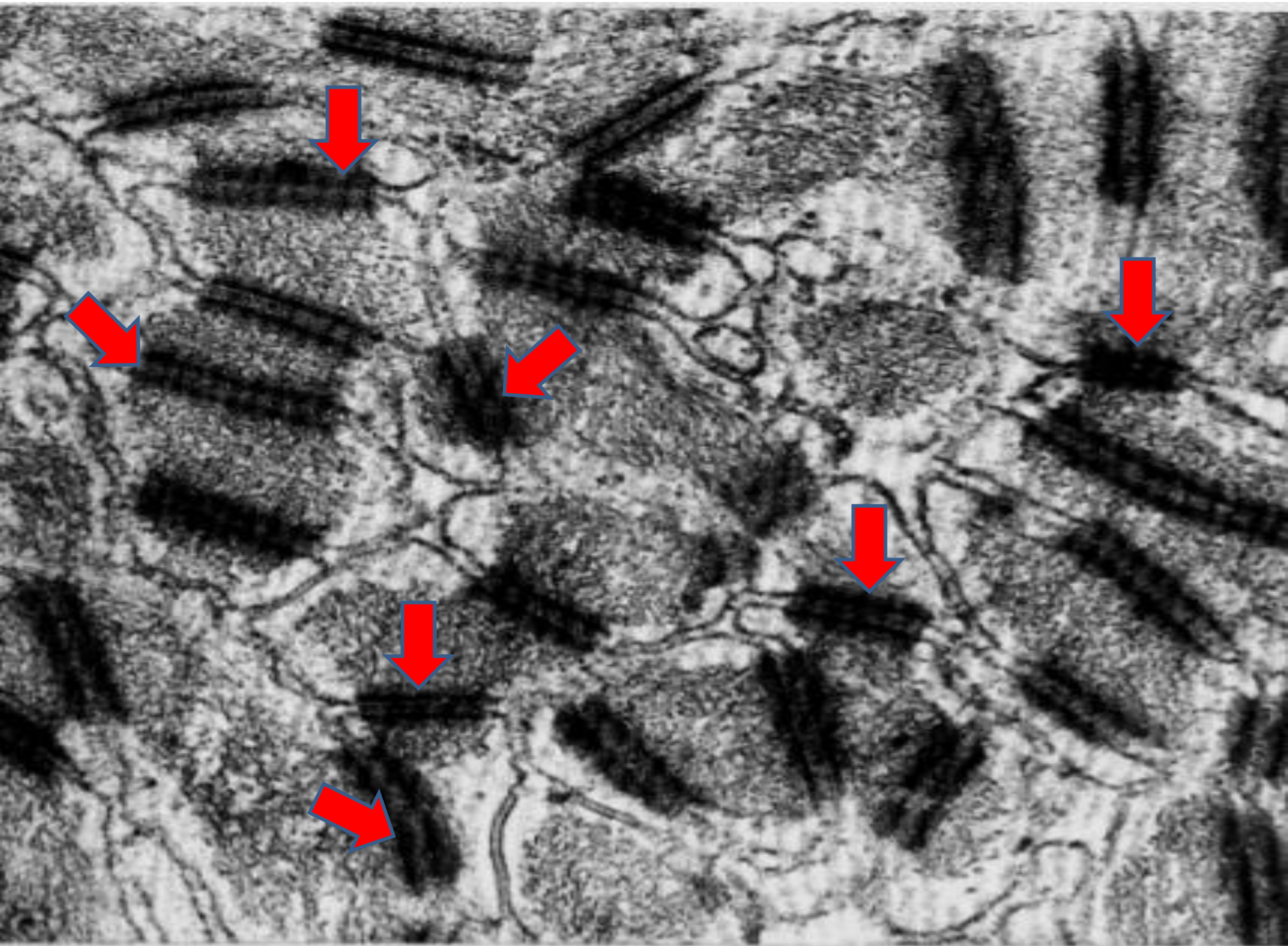


Desmosome (Macula adherens)



(Notice the plaques)

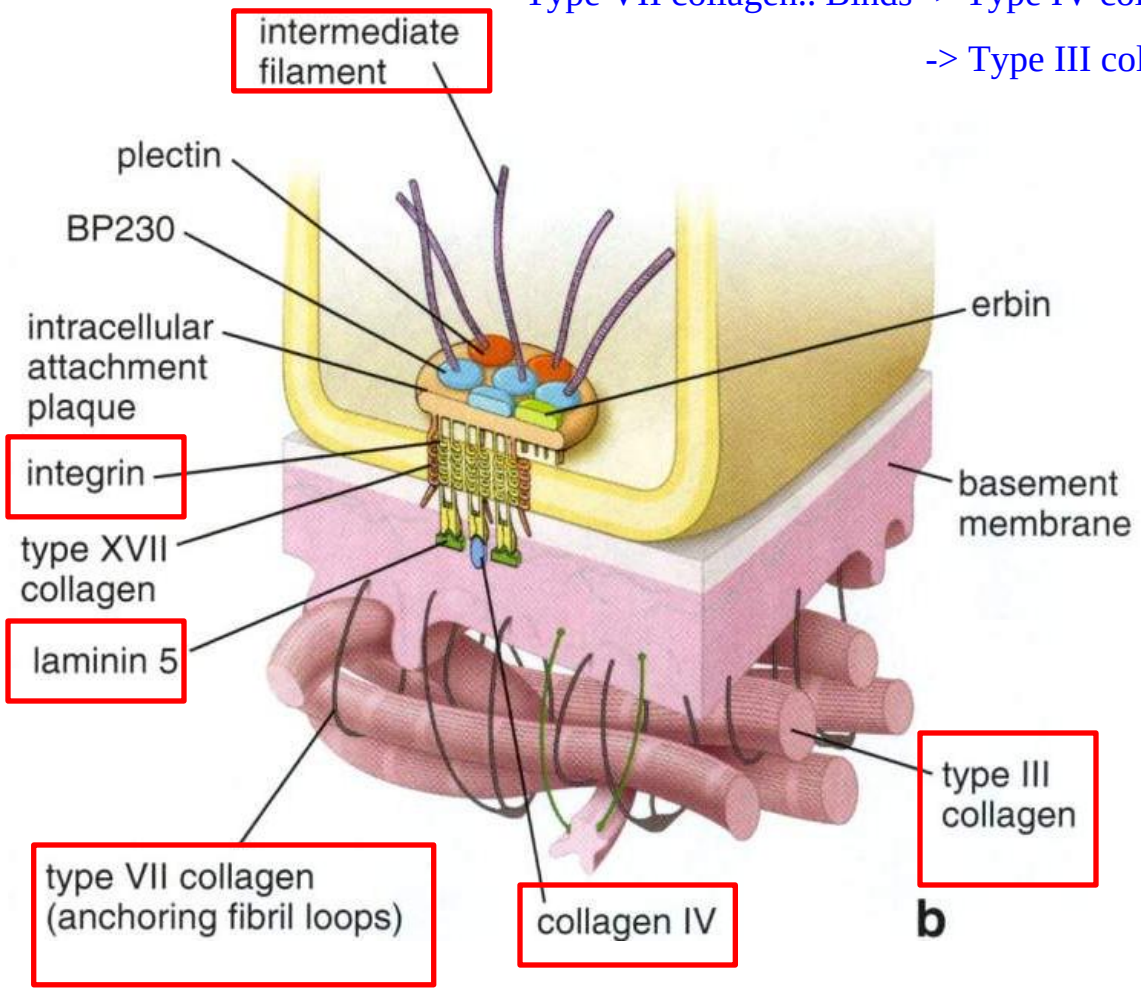


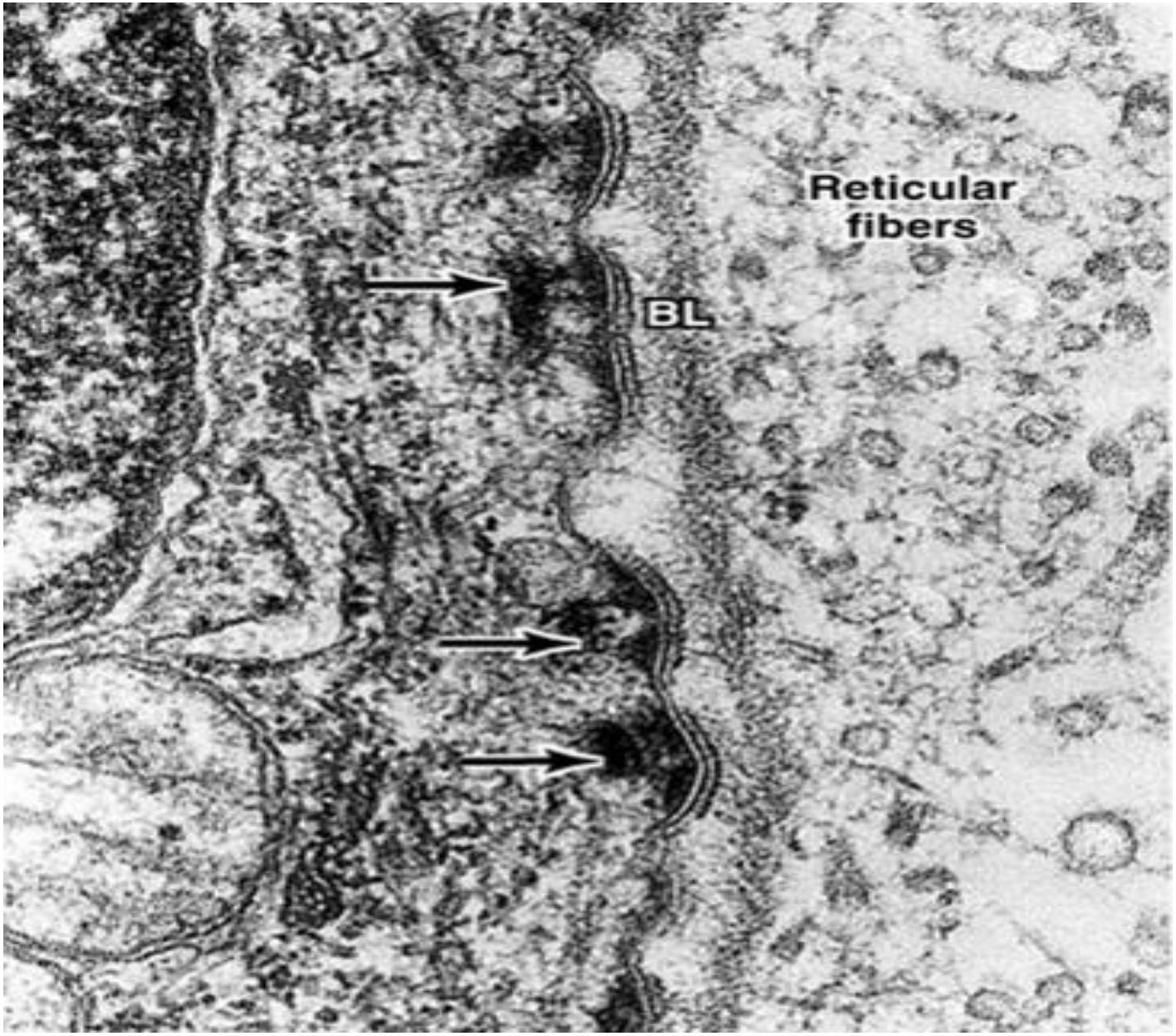


Hemidesmosme (Anchoring cell in basal membrane)

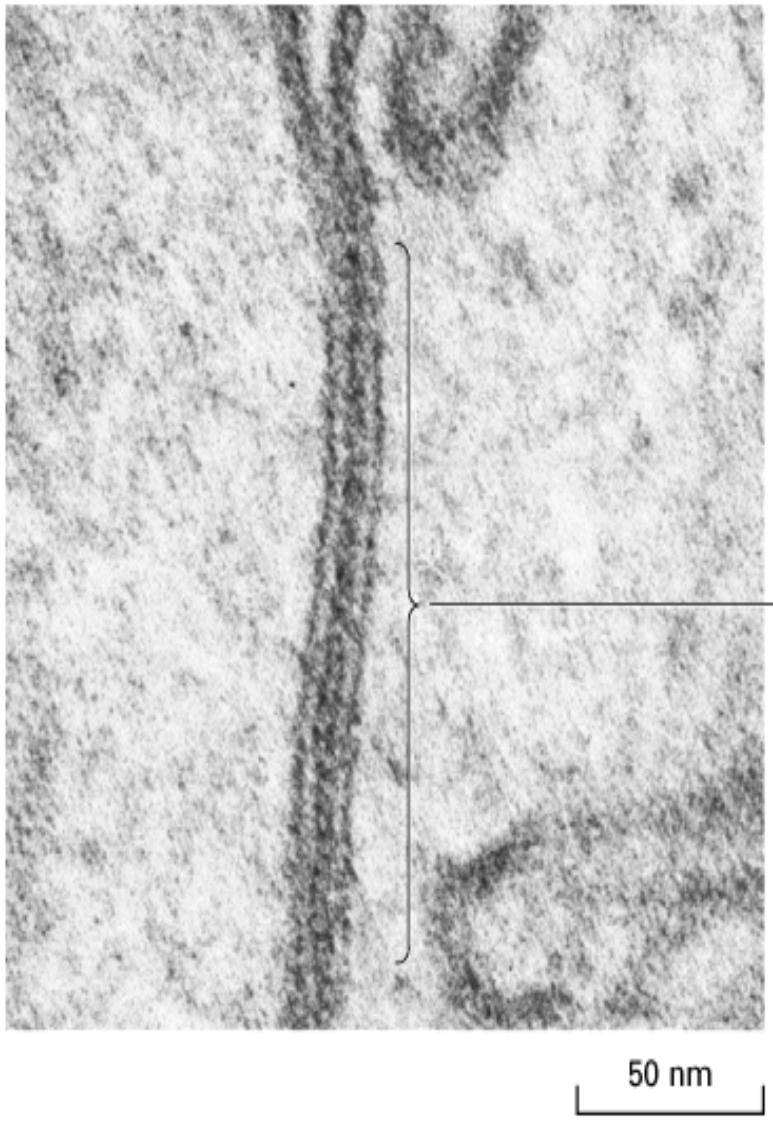
Type VII collagen.. Binds -> Type IV collagen (Basal lamina)

-> Type III collagen (Reticular lamina)



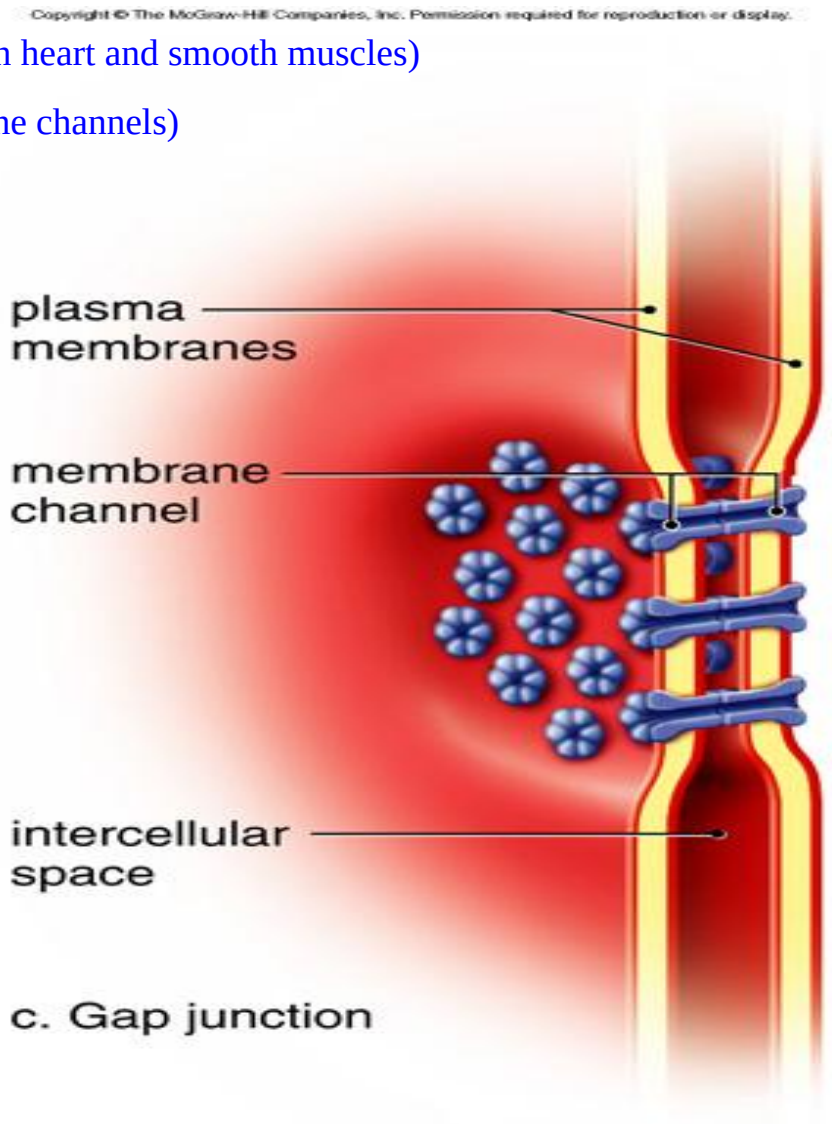

Reticular
fibers
BL

Gap (Communicating) Junction



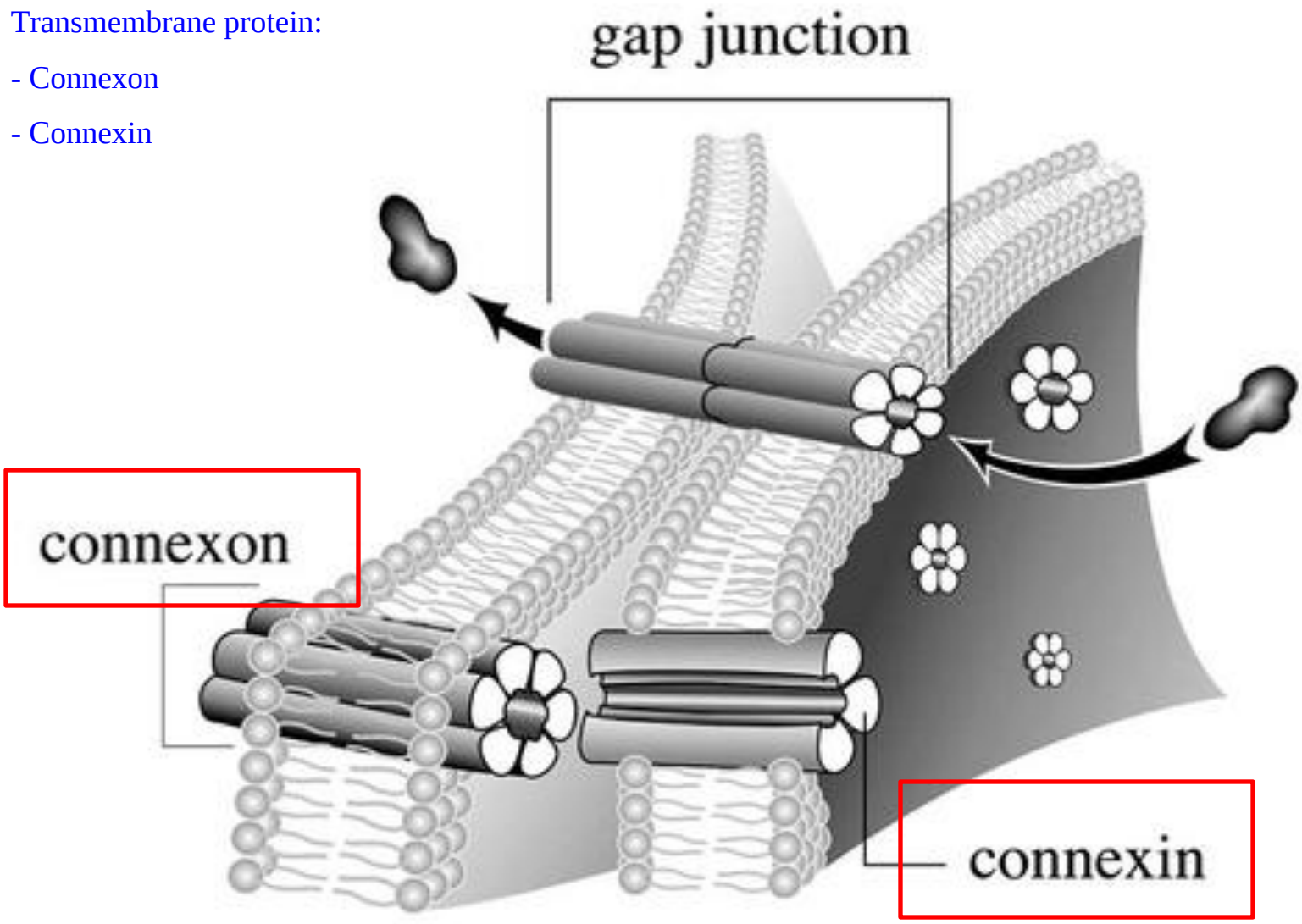
(Mostly in heart and smooth muscles)

(Membrane channels)



Transmembrane protein:

- Connexon
- Connexin



!!

Every thing that enters or leaves the body must cross an epithelial sheet.

- Exhibits polarity by having an apical surface (free) and a basal surface (attached)

- Supported by the underlying connective tissue.
- **Innervated** (has nerves) but **avascular** (no blood vessels); blood supply is in supporting connective tissue

- Has a high regeneration capacity

  (Because of the high mitotic activity of the cells of basal surface)

Functions of Epithelium

Protection

Transcellular transport

Secretion

Absorption

Selective permeability

Detection of sensations

Terms referring to the cell shapes

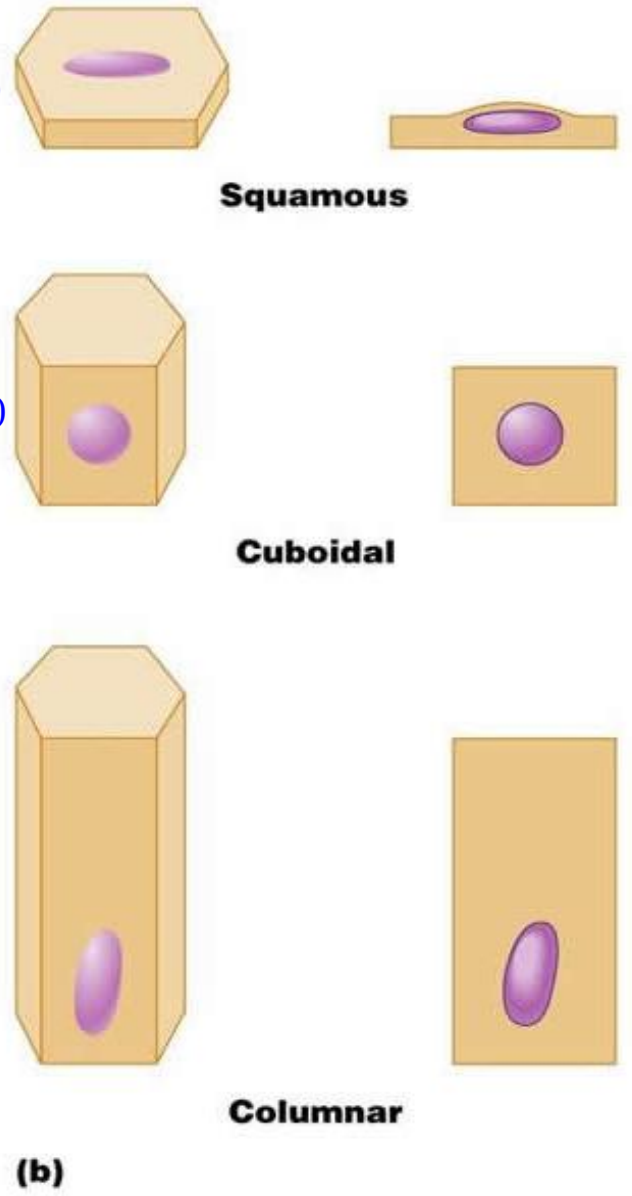
(We actually observe the shape of the nucleas)

Squamous = flat

Cuboidal = cube

Columnar = rectangular (column)

Transitional = ability to change shape

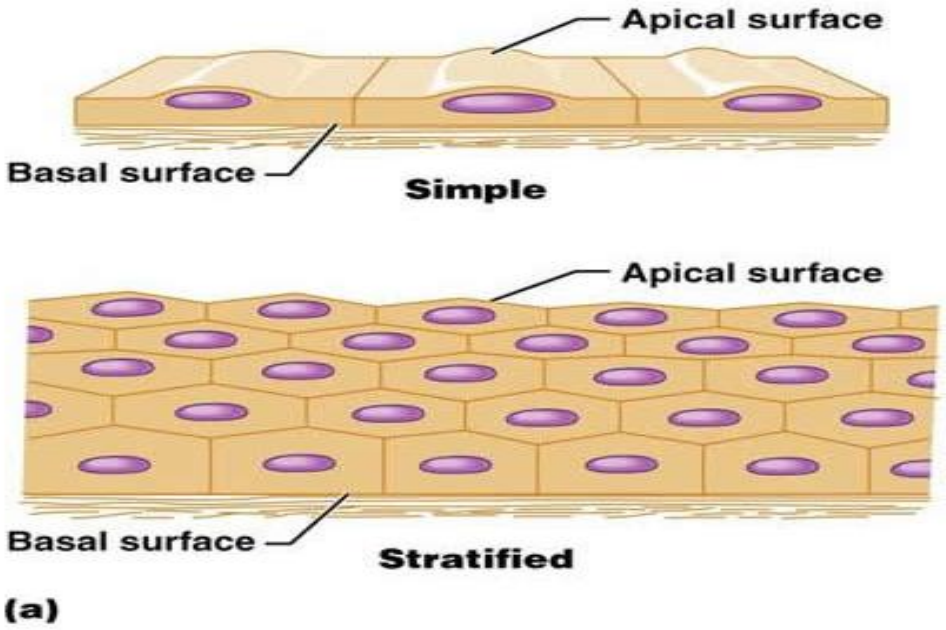


Terms referring to the layers

Simple = one layer

Stratified = more than one layer

Pseudostratified = false layered (appears to be more than one layer, but only one); ciliated = with cilia



Classification of Epithelium

According to the number of cell layers, epithelium is classified into:

- Simple
- Stratified

Simple epithelium is named according to the shape of its cells.

Stratified epithelium is named according to the shape of the cells in the outermost layer.

Types of Simple Epithelium

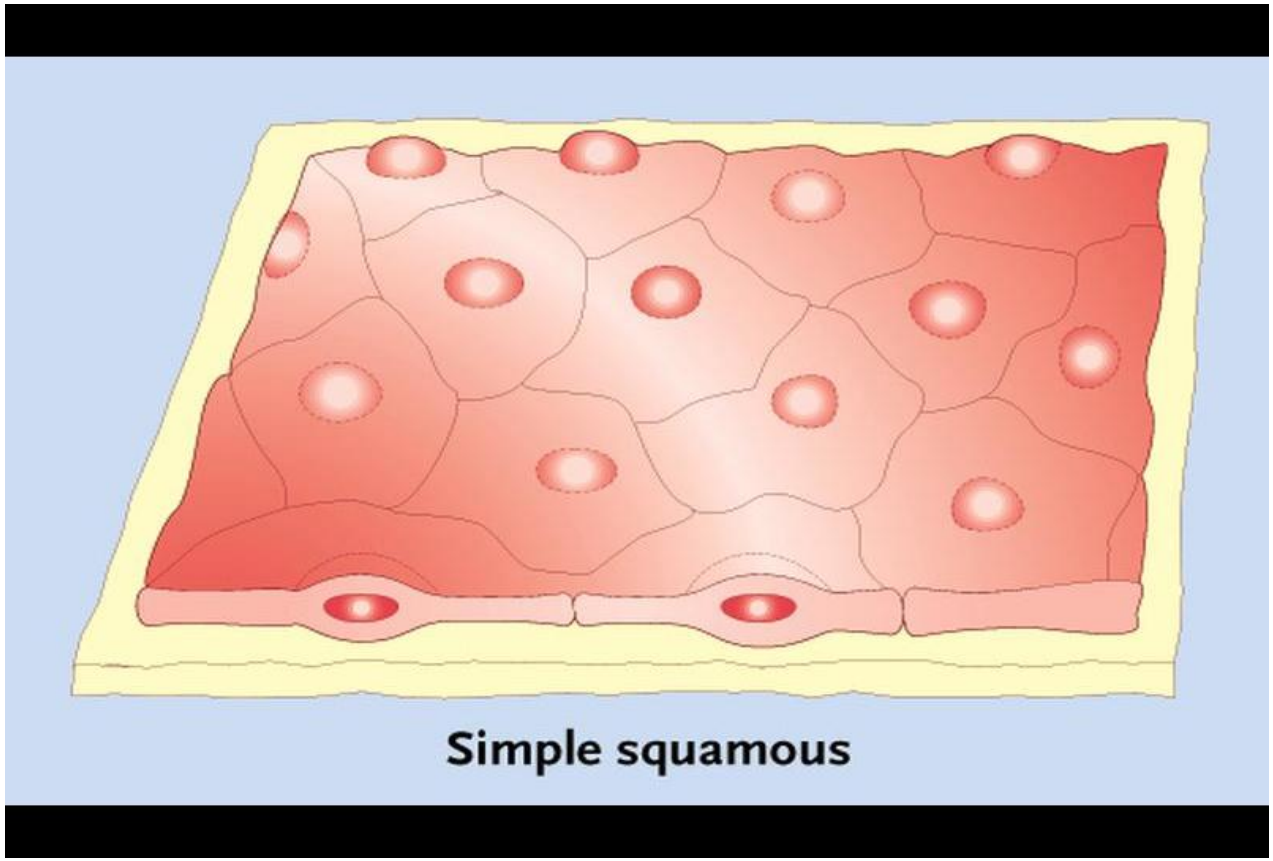
Simple squamous	Simple cuboidal	Simple columnar	Pseudostratified columnar
Mesothelium		Ciliated	Ciliated
Endothelium		Non Ciliated (Microvilli)	Stereocilia

Simple Epithelium

Simple Squamous Epithelium

-Mesothelium

-Endothelium



Functions of Simple Squamous Epithelium

Participates in the formation of blood tissue barriers

Permits and bidirectional movement of gases, fluids and nutrients from the free surface to underlying tissue

Naming of the simple squamous epithelium depends on the location:

- **Endothelium** is the lining of the blood vessels, lymph vessels and the heart.
  (inside)

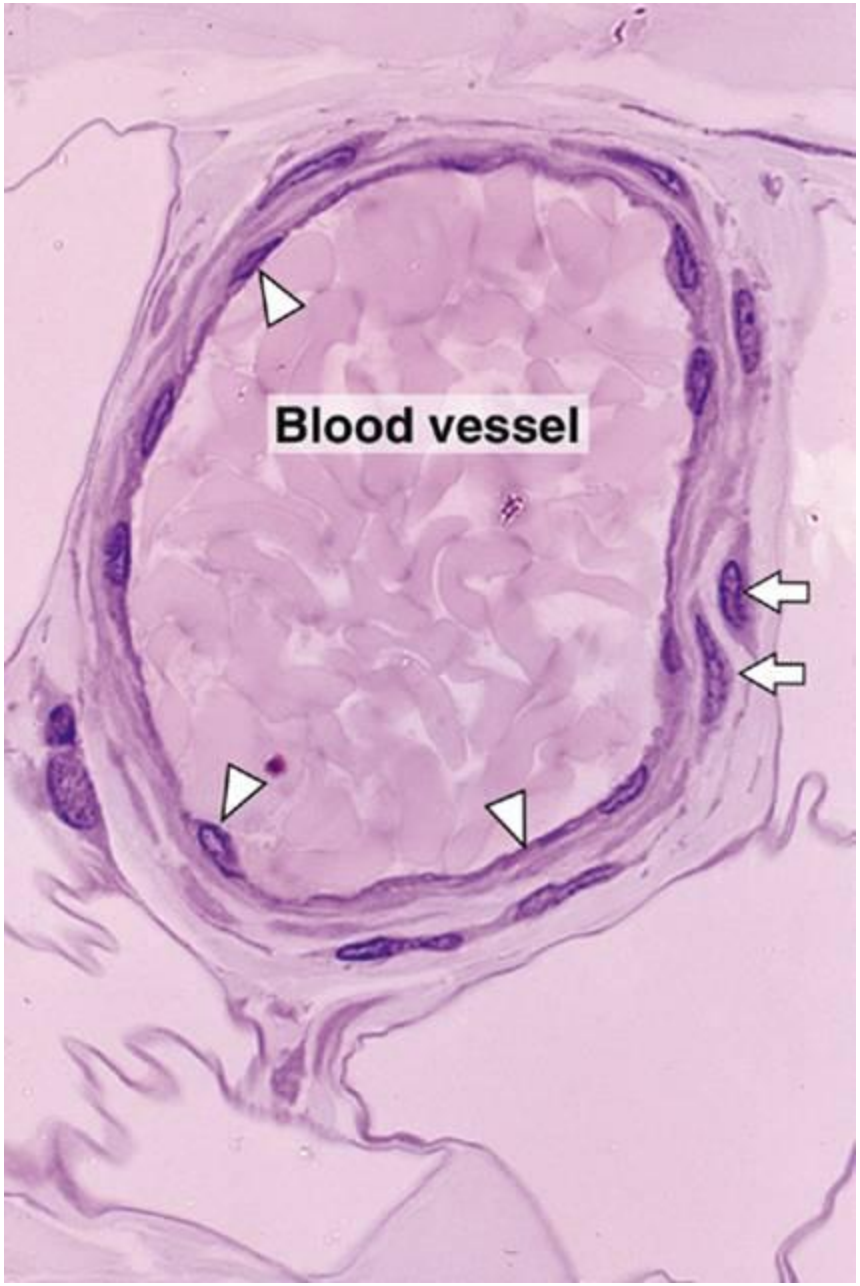
- **Mesothelium** is the epithelium forming serous membrane lining internal body cavities:

  Peritoneum, **Pleura** and **Pericardium**.
  lines Abdomin lines Lungs lines Heart(outside)

  (In the figures, if above the layers does not contain blood cells the it is Mesothelium)

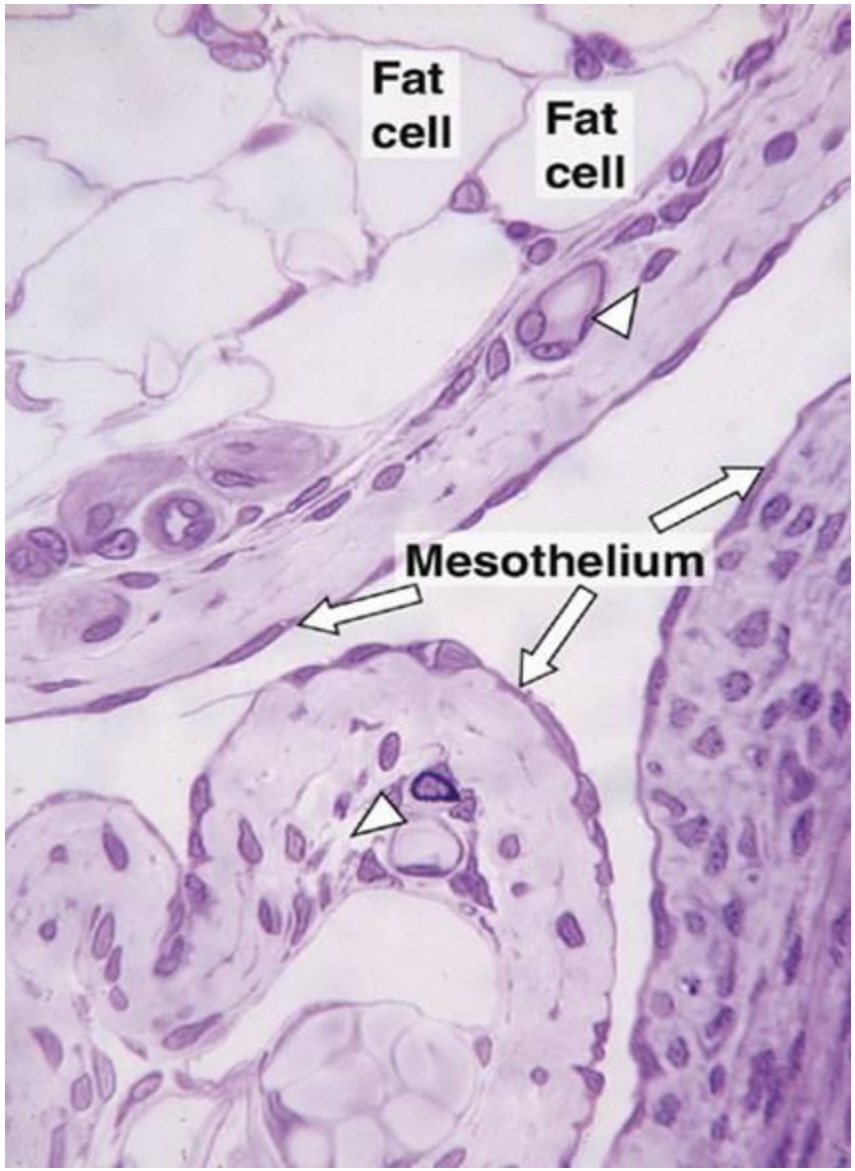
(It is a section from a blood vessel
because of the RBCs in the center)

Endothelium is the simple squamous epithelium that lines the lumen of the cardiovascular system

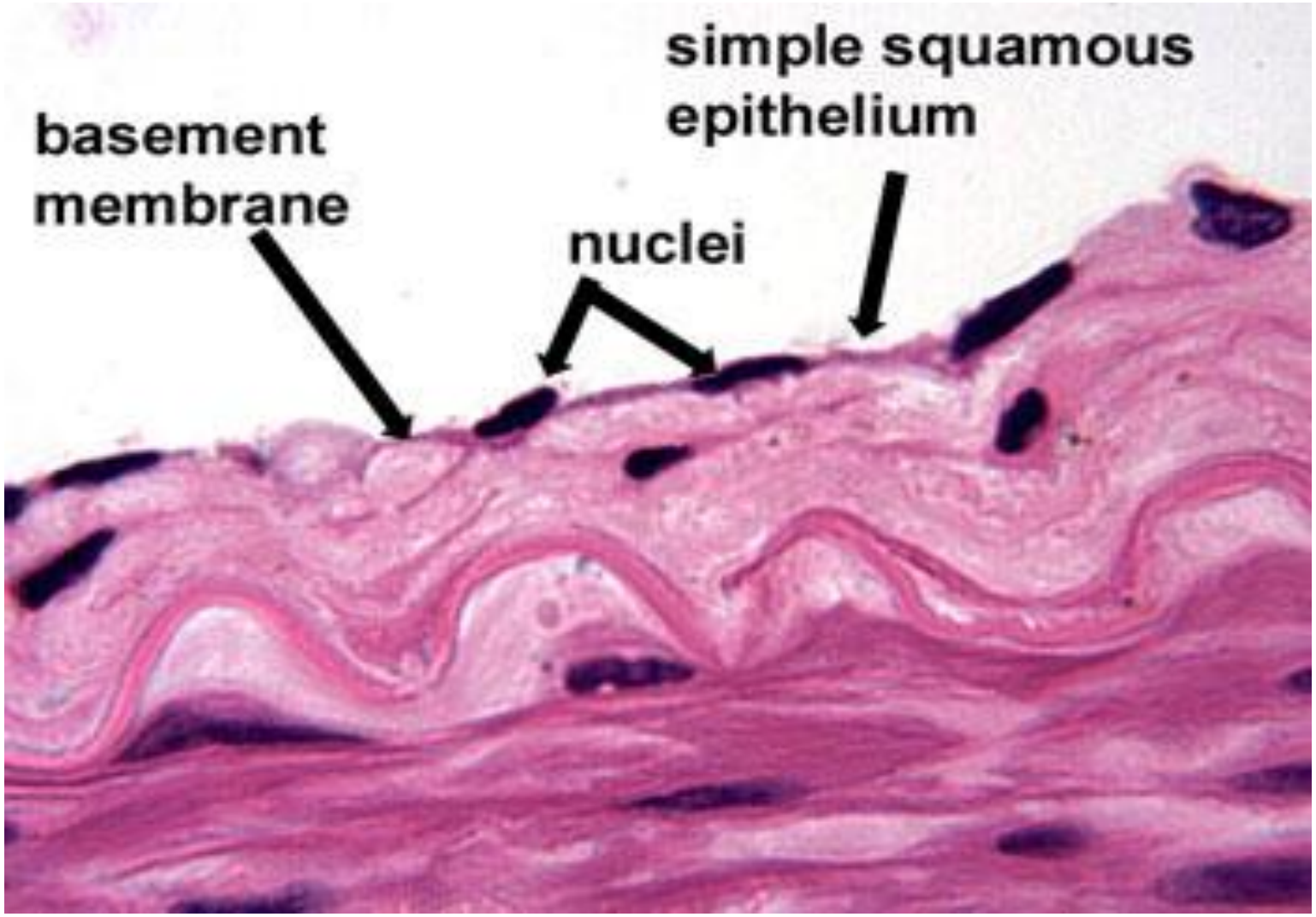


(This was taken from the peritoneum)

Mesothelium is the simple squamous epithelium that lines serous cavities (peritoneal, pleural, and pericardial cavities) and coats many of the organs in these cavities



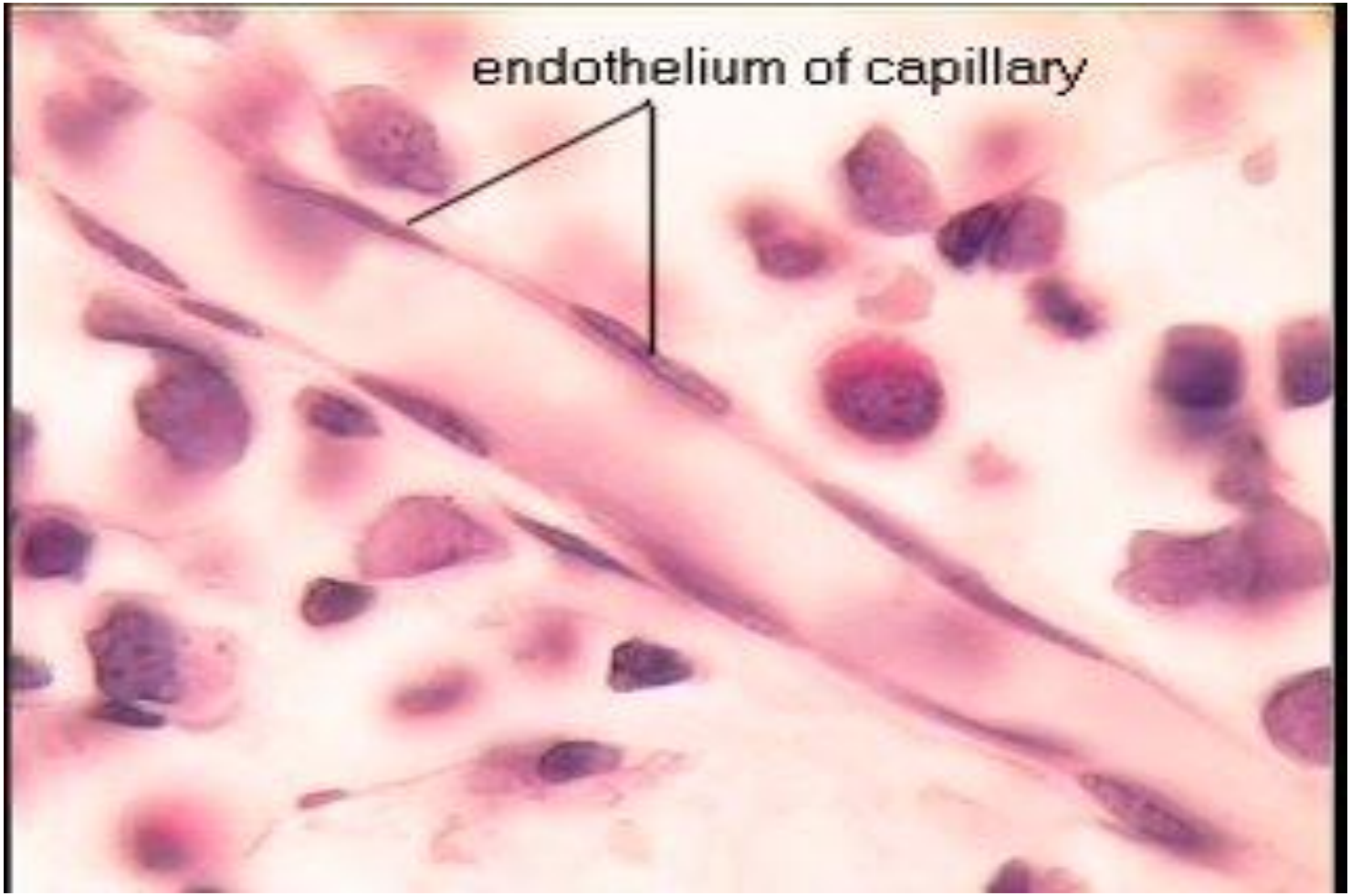
(This is a section from a large blood vessel -artery-)



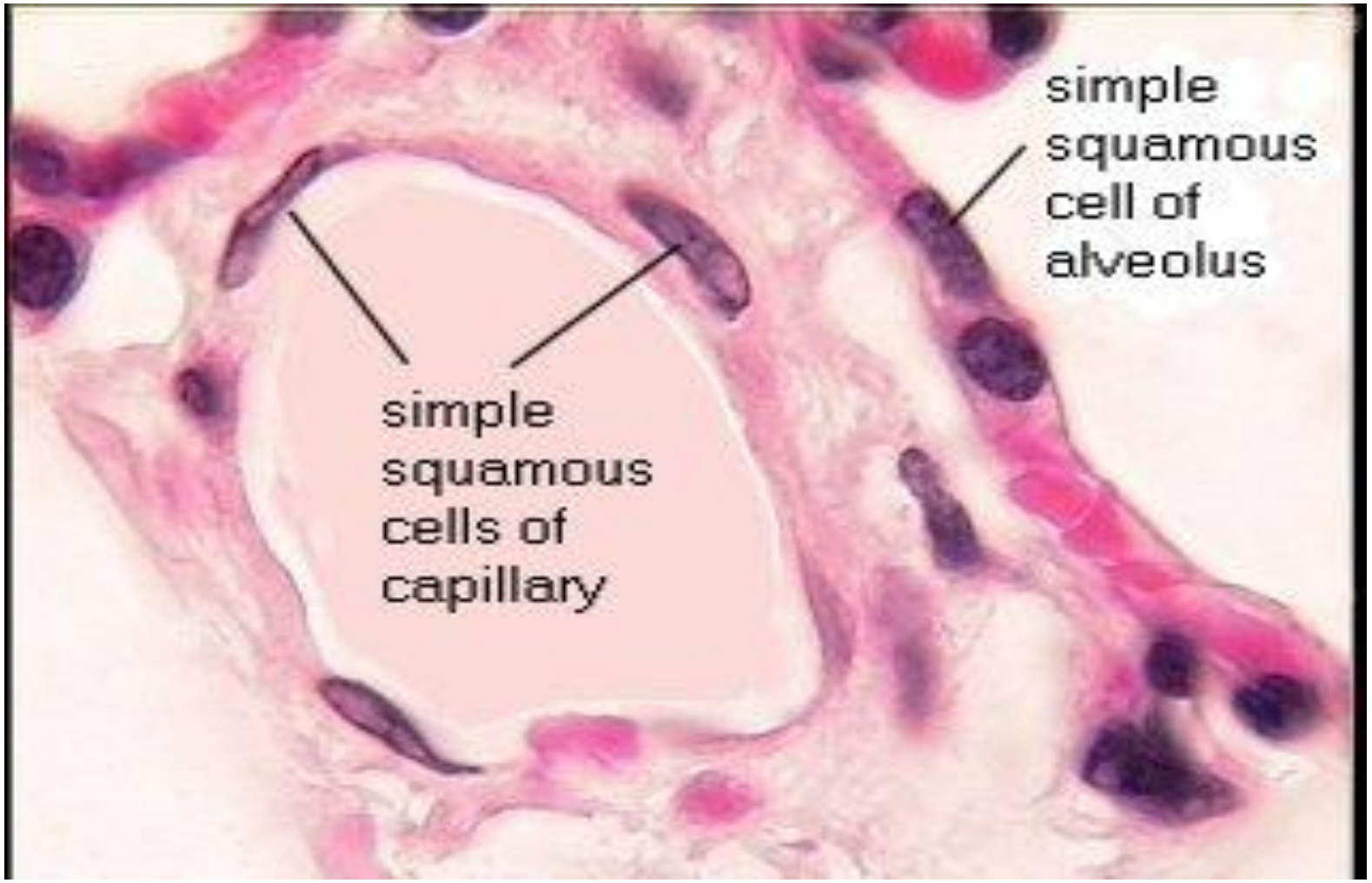
Attention this section is against the rule **Endothelium**

Although there is not any blood above the layer, this is Endothelium.

(Because of the existence of the elastic lamina to help with the high blood pressure in the arteries)

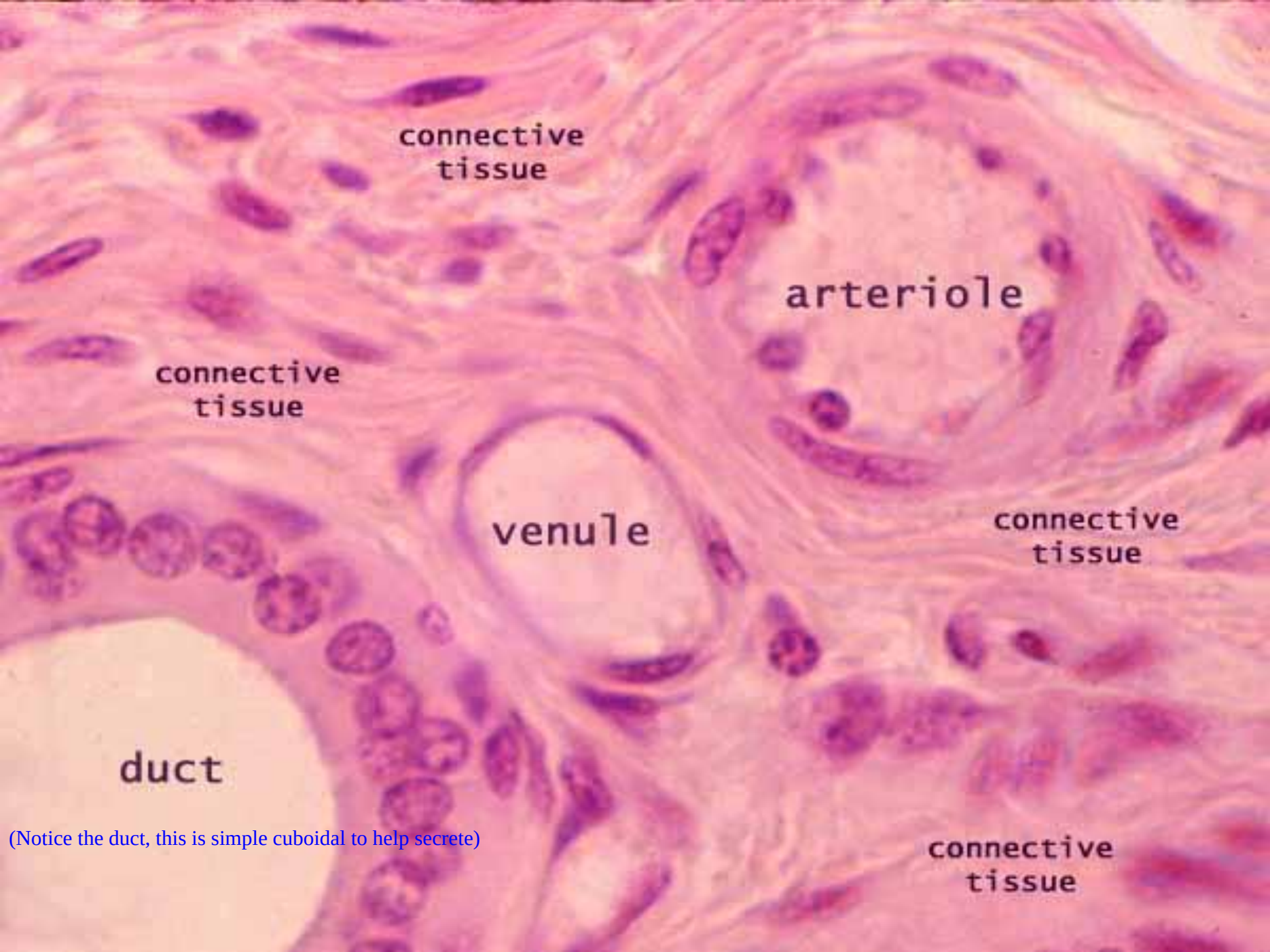

endothelium of capillary

(This is a section from a large vein, inside are RBCs thus it is Endothelium)



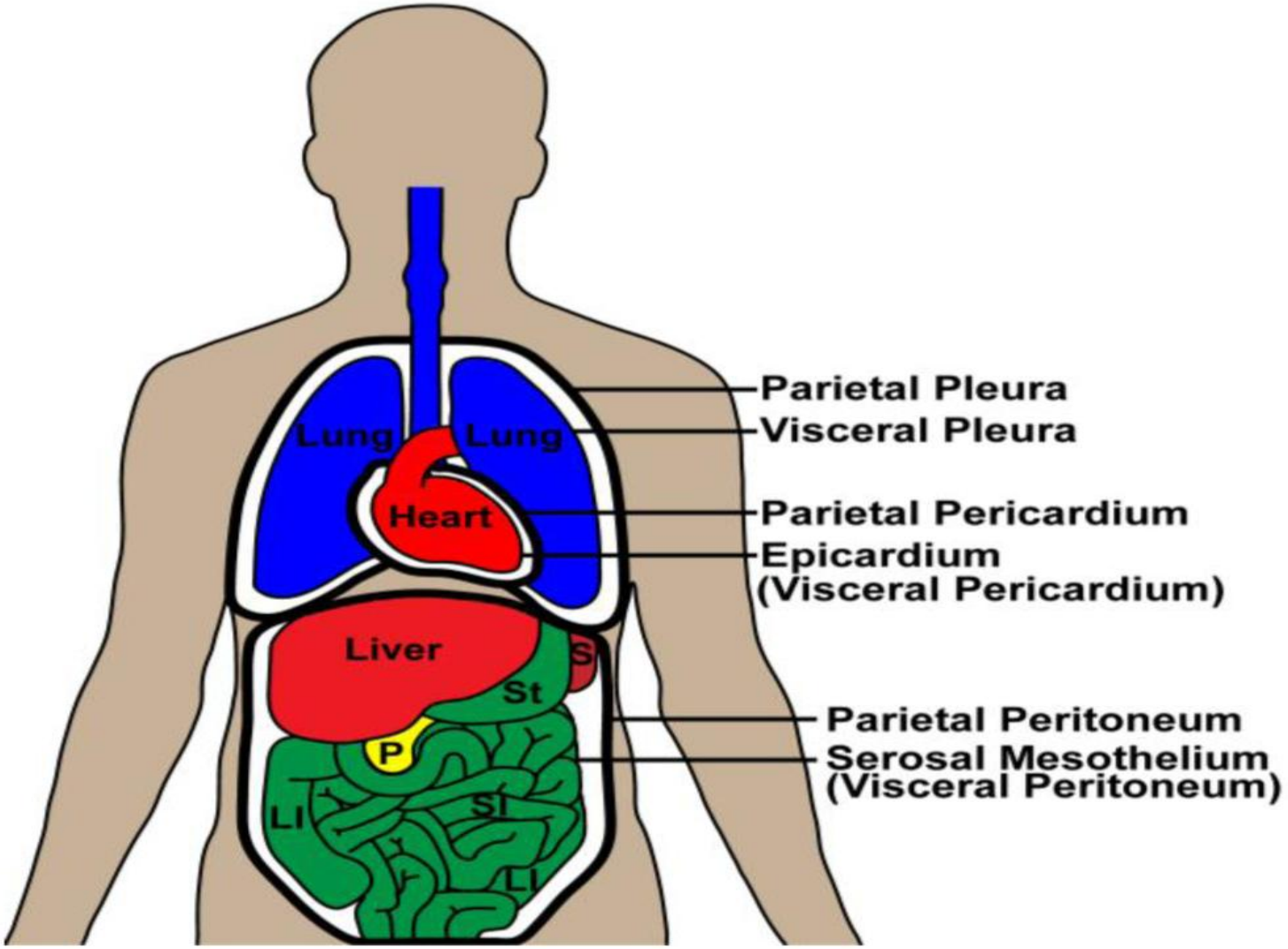
Simple squamous epithelium :

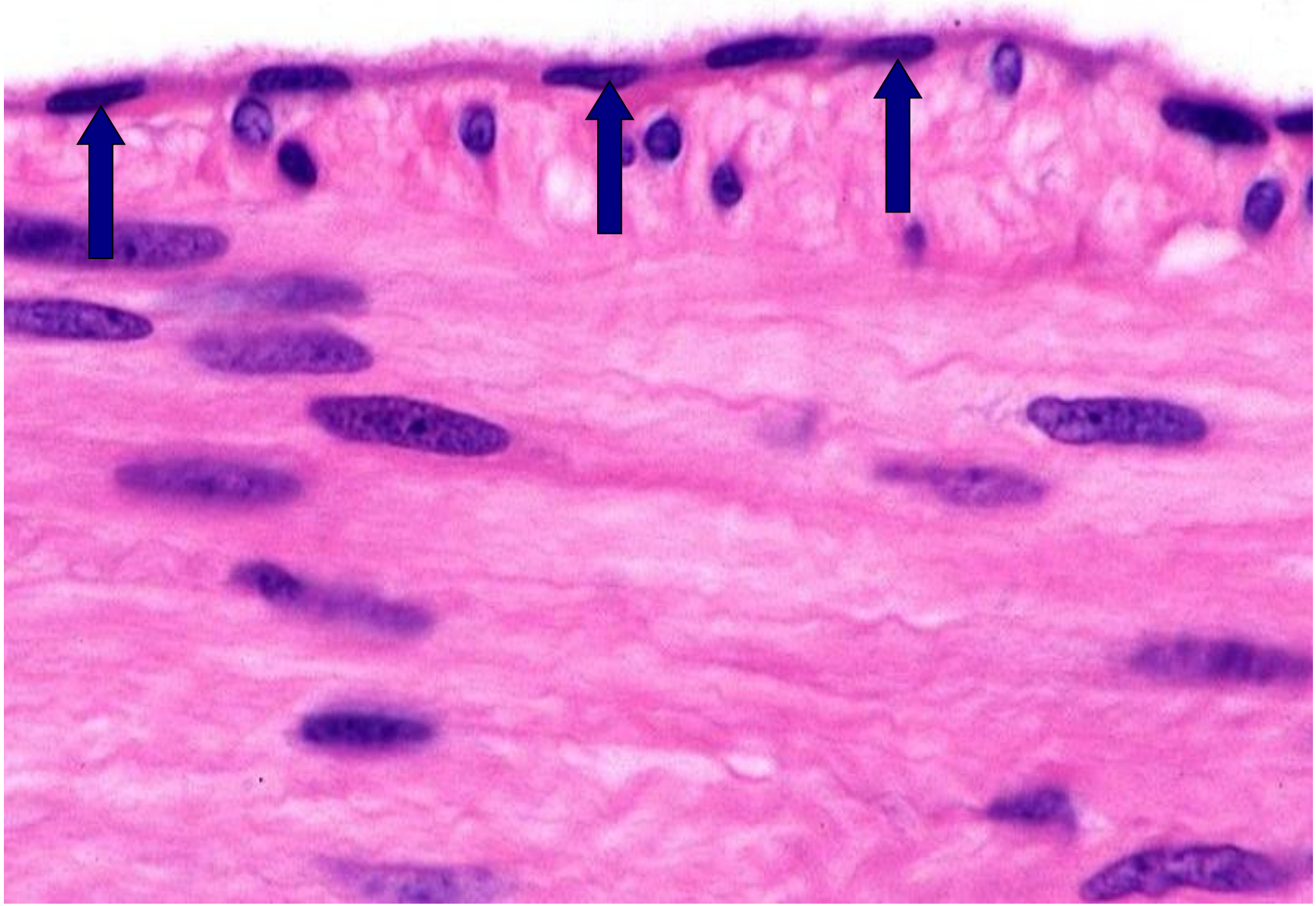
Lung alveoli, Loop of Henle (To help exchange substances)



(Notice the duct, this is simple cuboidal to help secrete)

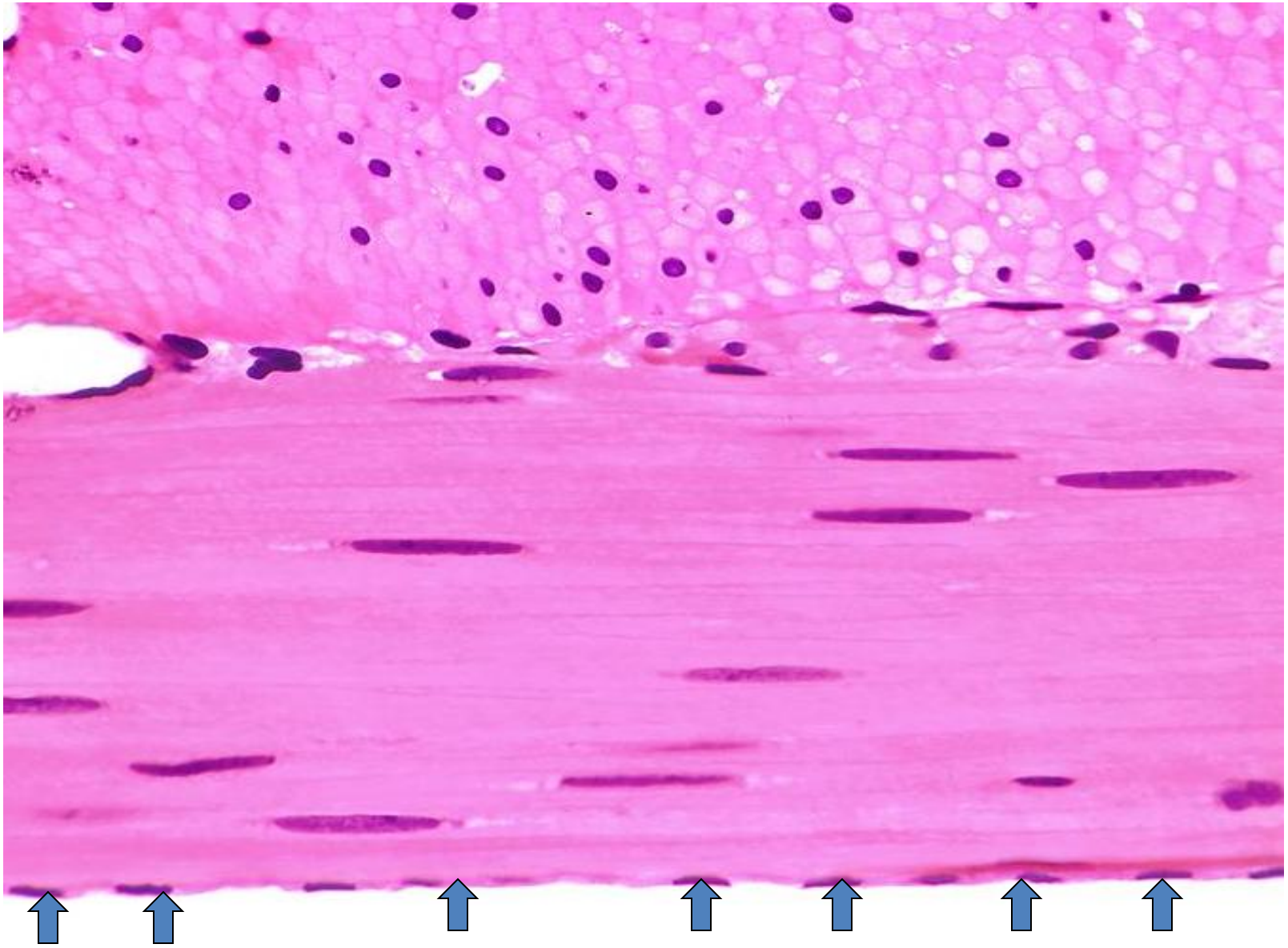
Mesothelium



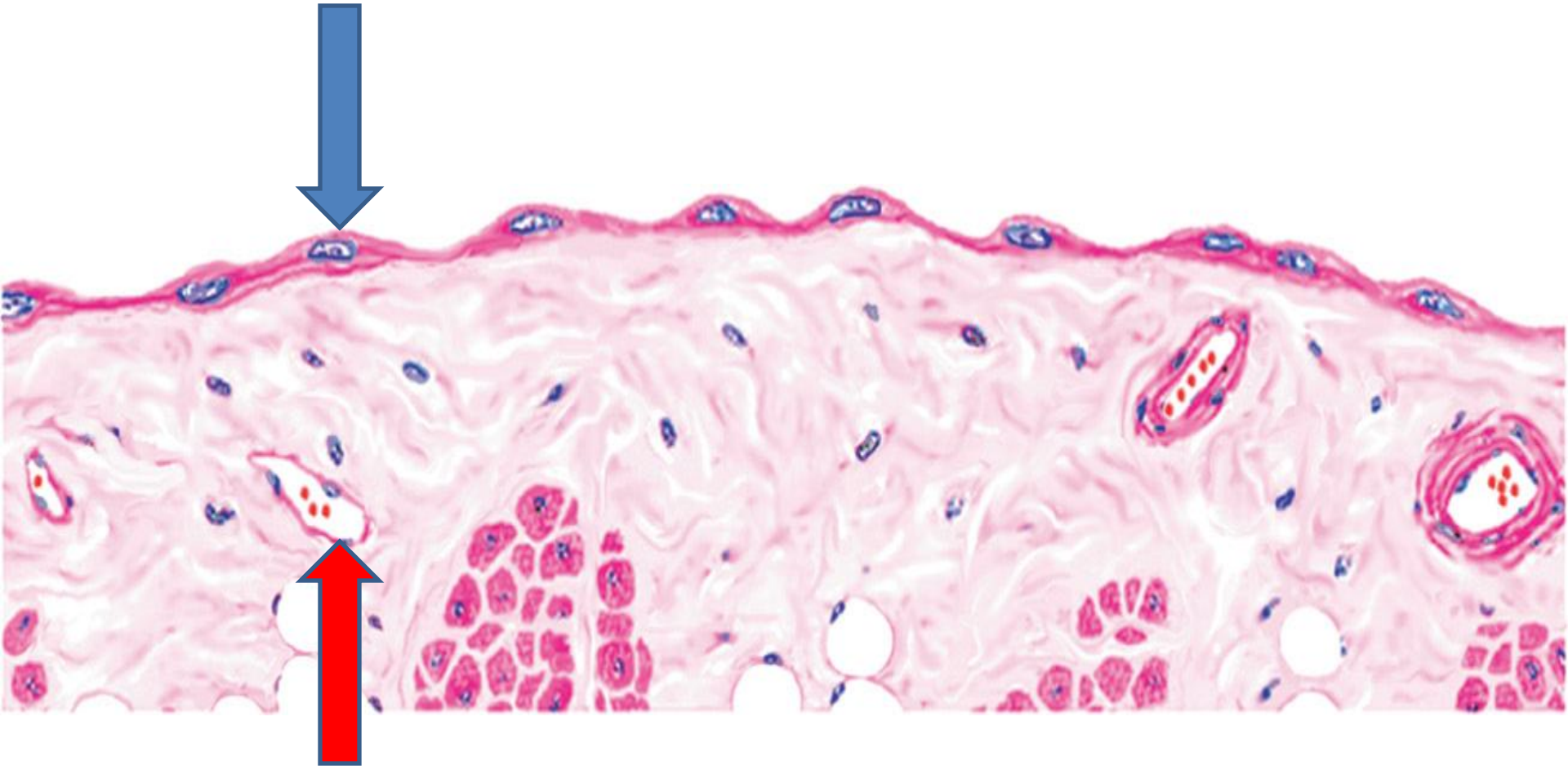


Mesothelium

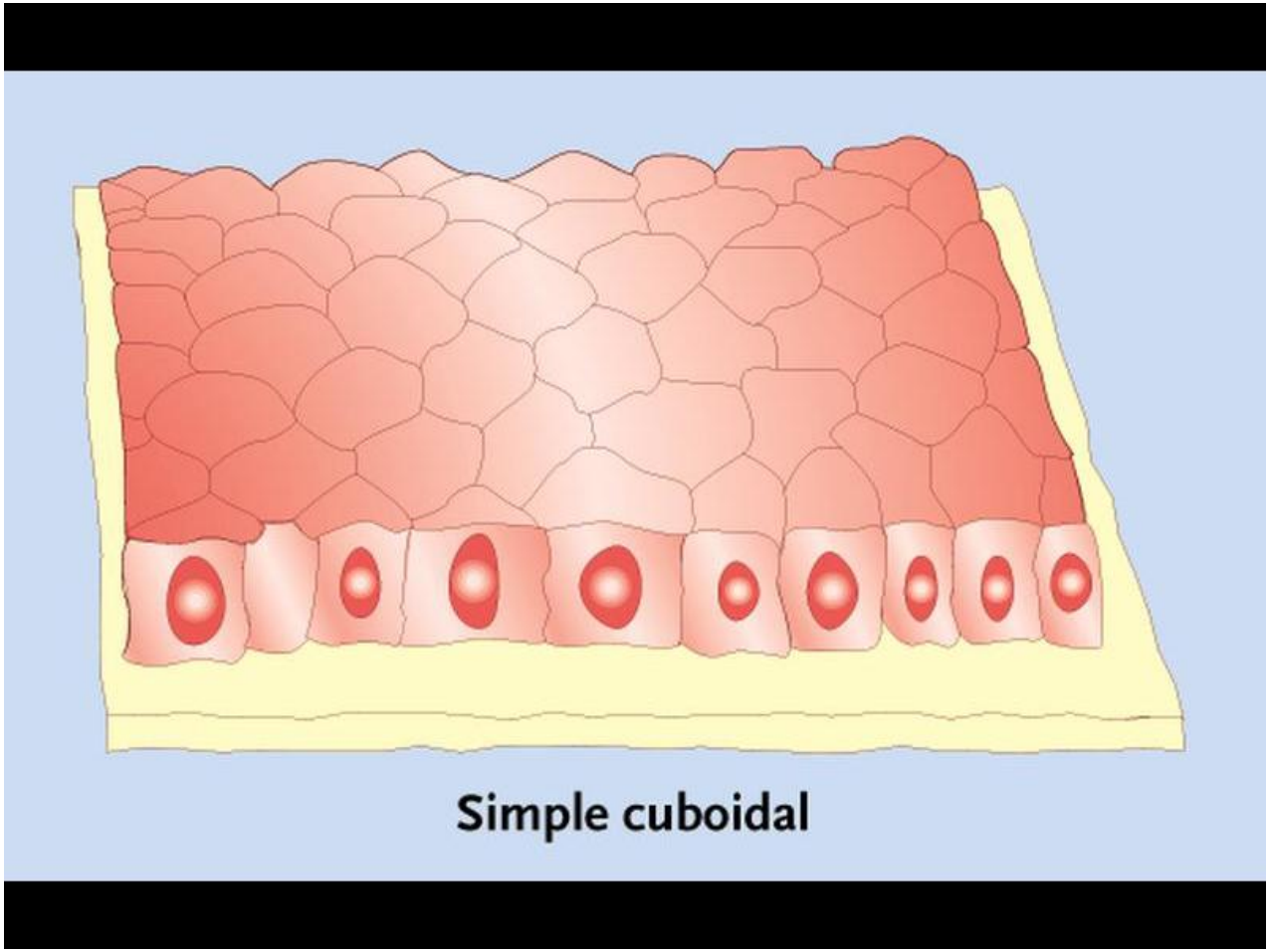
(Notice that above the layers of cells, there are not any RBCs, thus it is Mesothelium)



Mesothelium

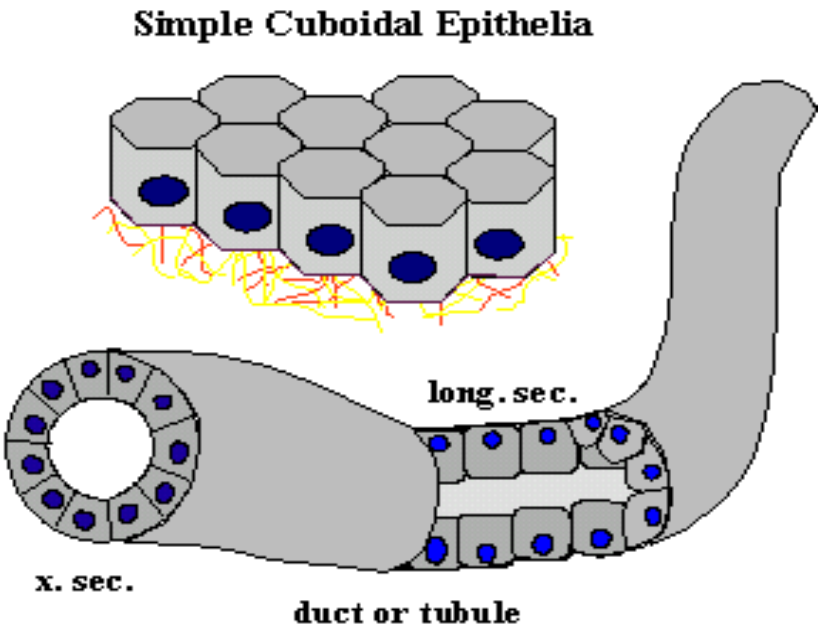


Simple Cuboidal



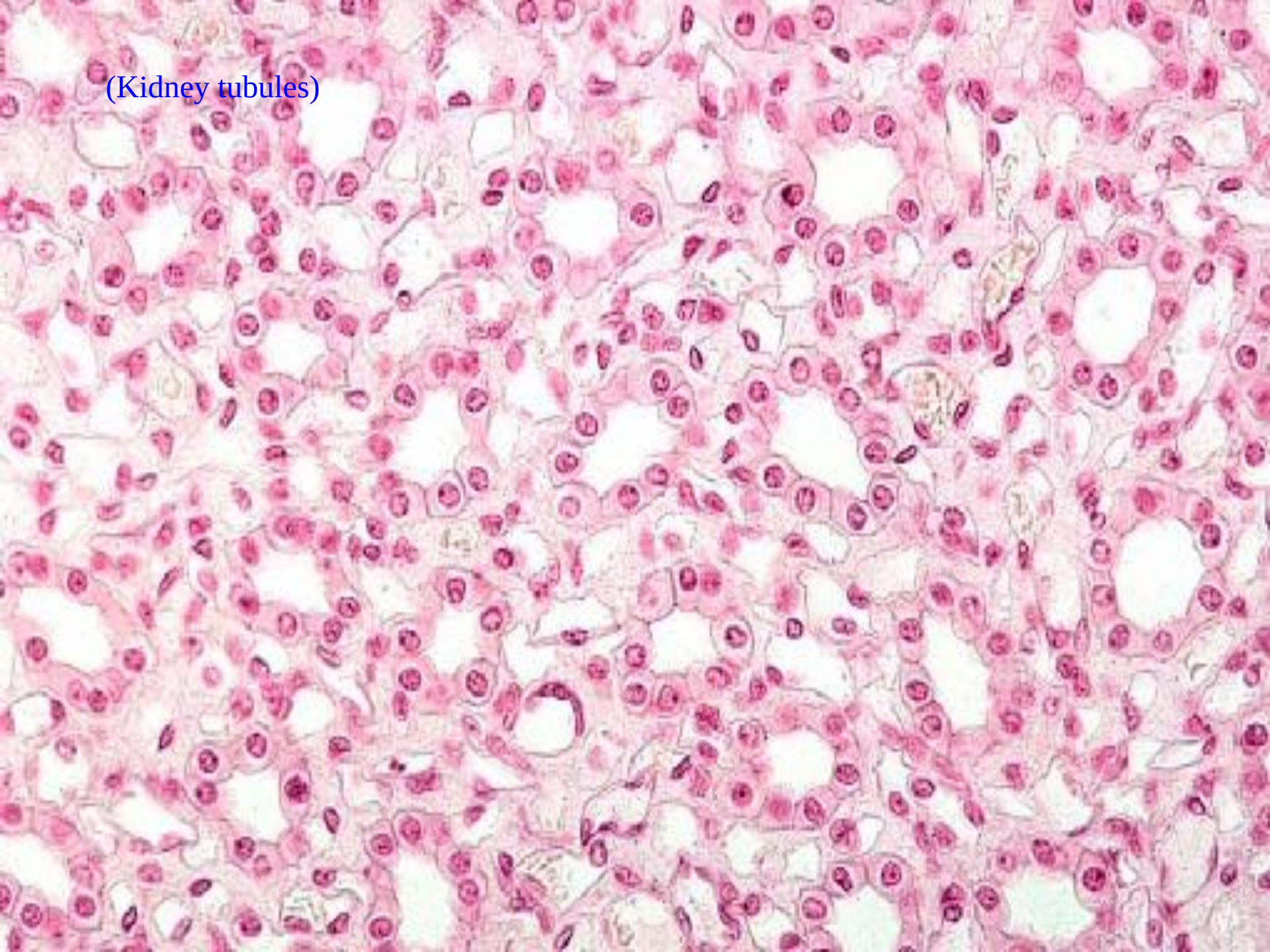
Simple Cuboidal Epithelium

- **Structure**
  - Single layer of cube shaped cells
- **Function**
  - Secretion and absorption.
- **Location**
- Small collecting ducts of kidney, small ducts of certain glands (pancreas & salivary), kidney tubules, covers ovaries

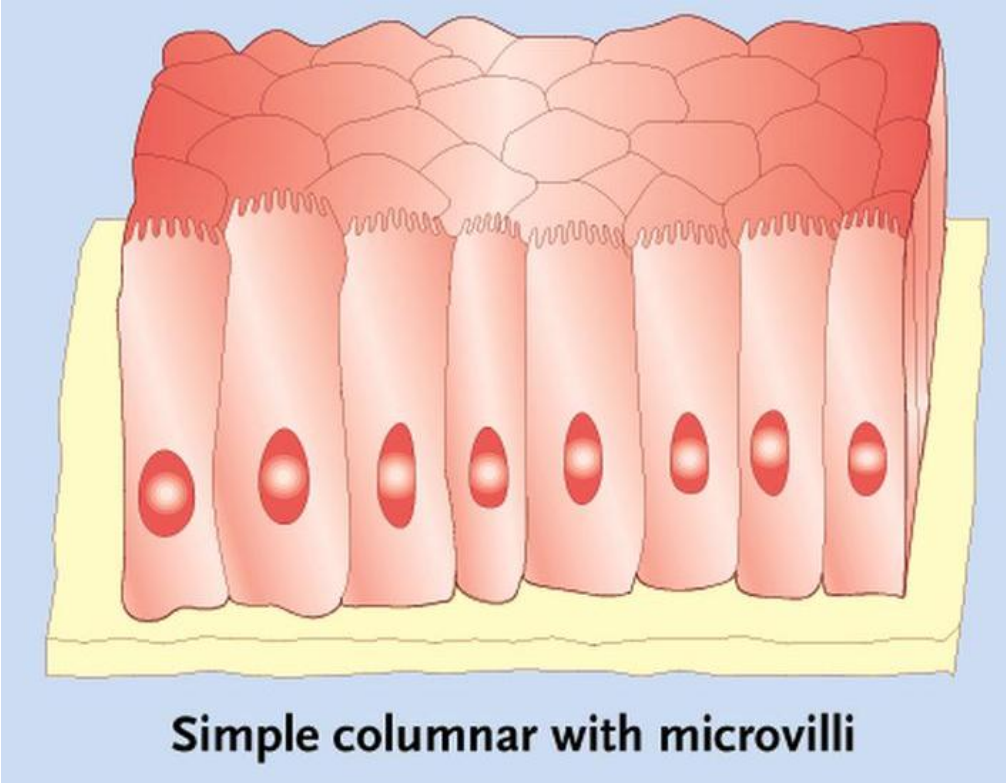


(This is a section from a kidney tubule)


(Notice rounded nucleas
(Small cells with white cavities
could be considered loop of Henley
so the have simple squamous tissue)


(Kidney tubules)

Simple Columnar Epithelium



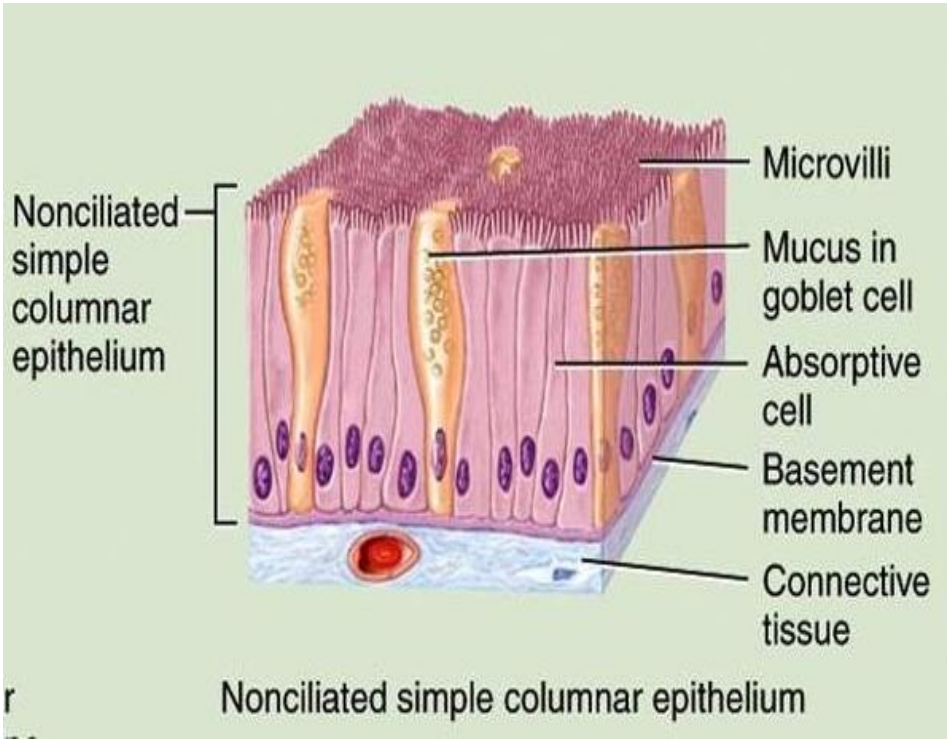
Simple Columnar Epithelium

- **Structure**
  - –Elongated layer of cells with nuclei at same level.
- **Function**
  - – Absorption, Protection & Secretion.

by secretion of mucus

– **Location**

Small intestine, Stomach, Gall bladder, major ducts of certain exocrine glands.

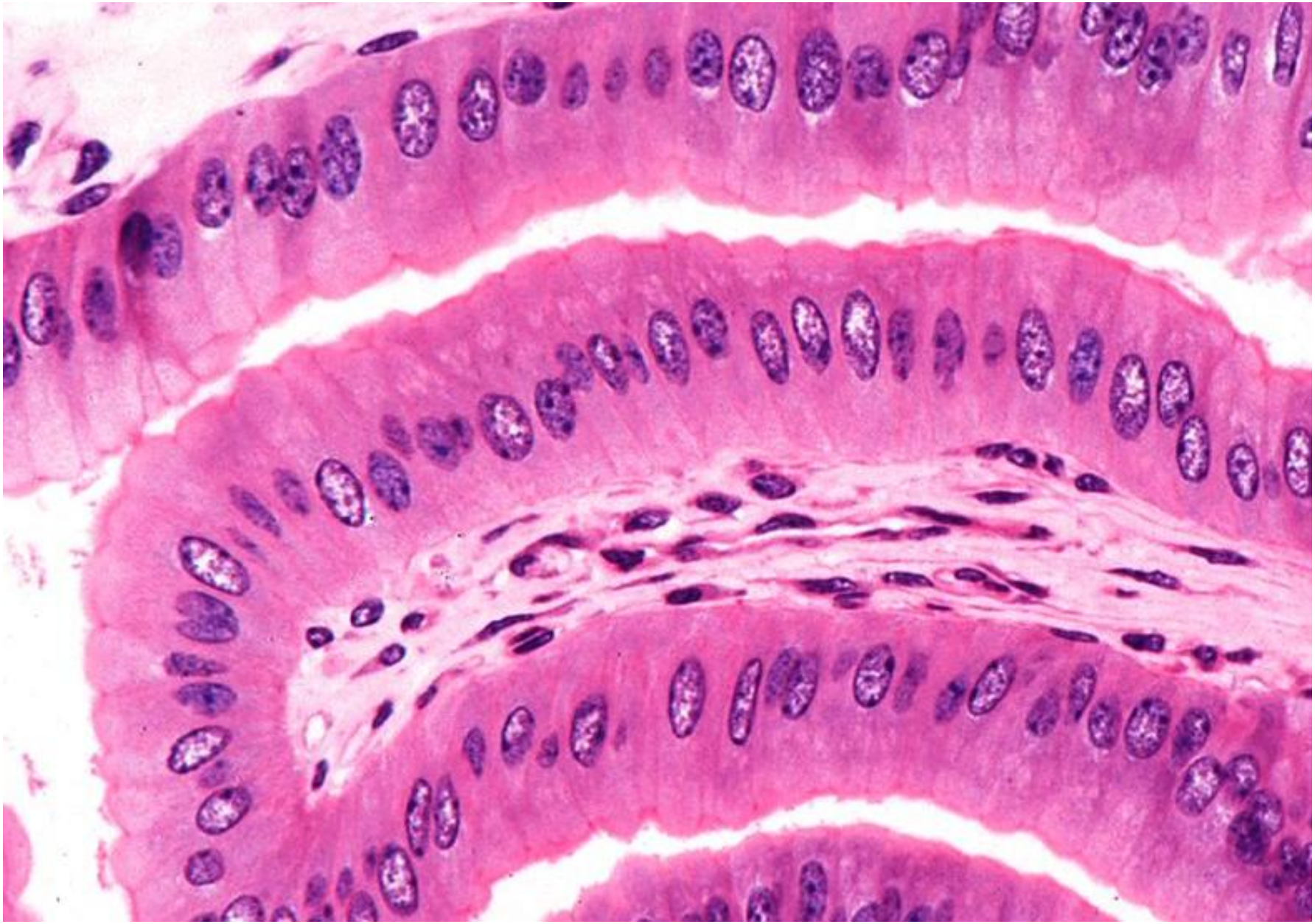


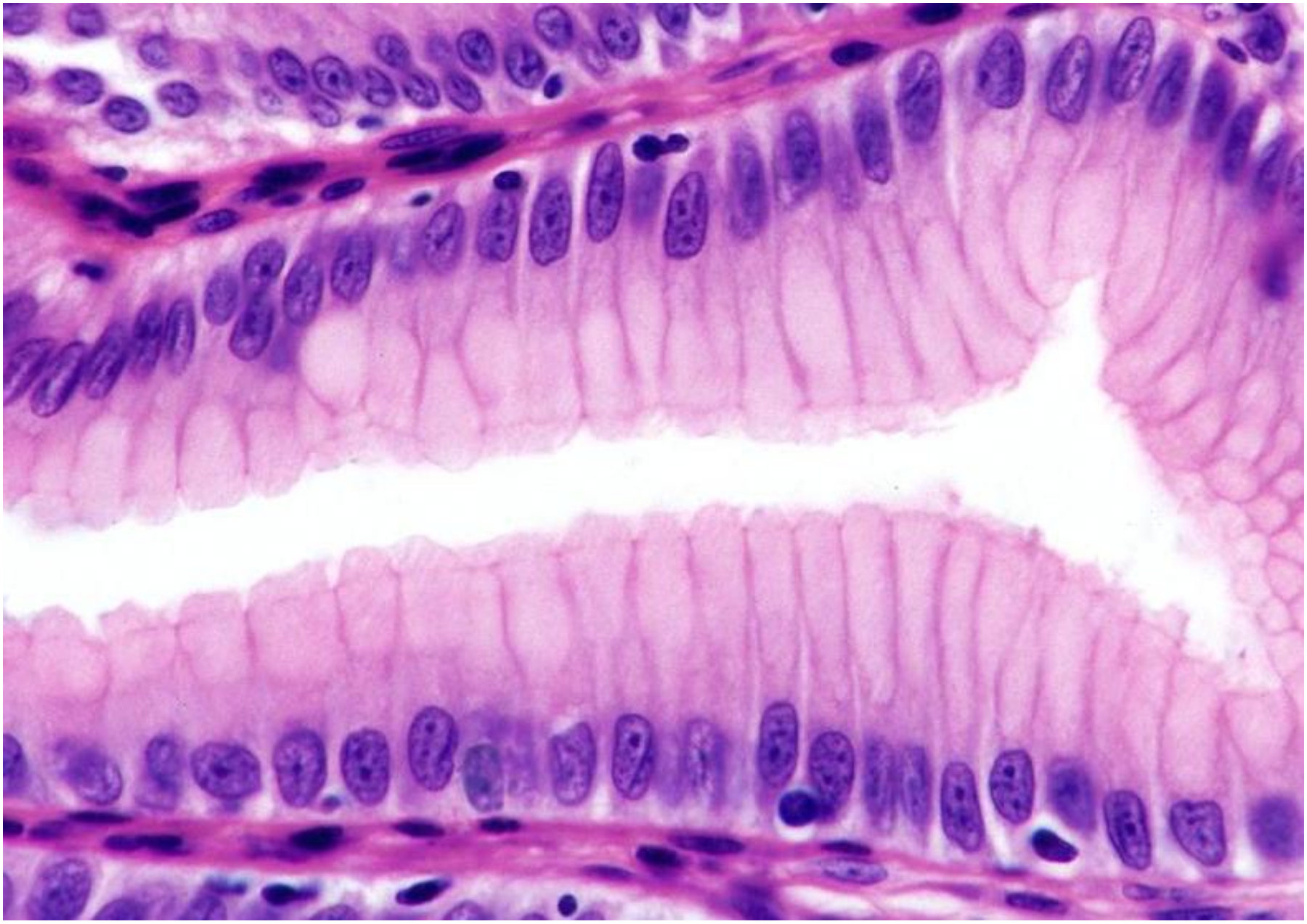
Function of Simple Columnar Epithelium

Engaged in the protection of wet surfaces, absorption and secretion.

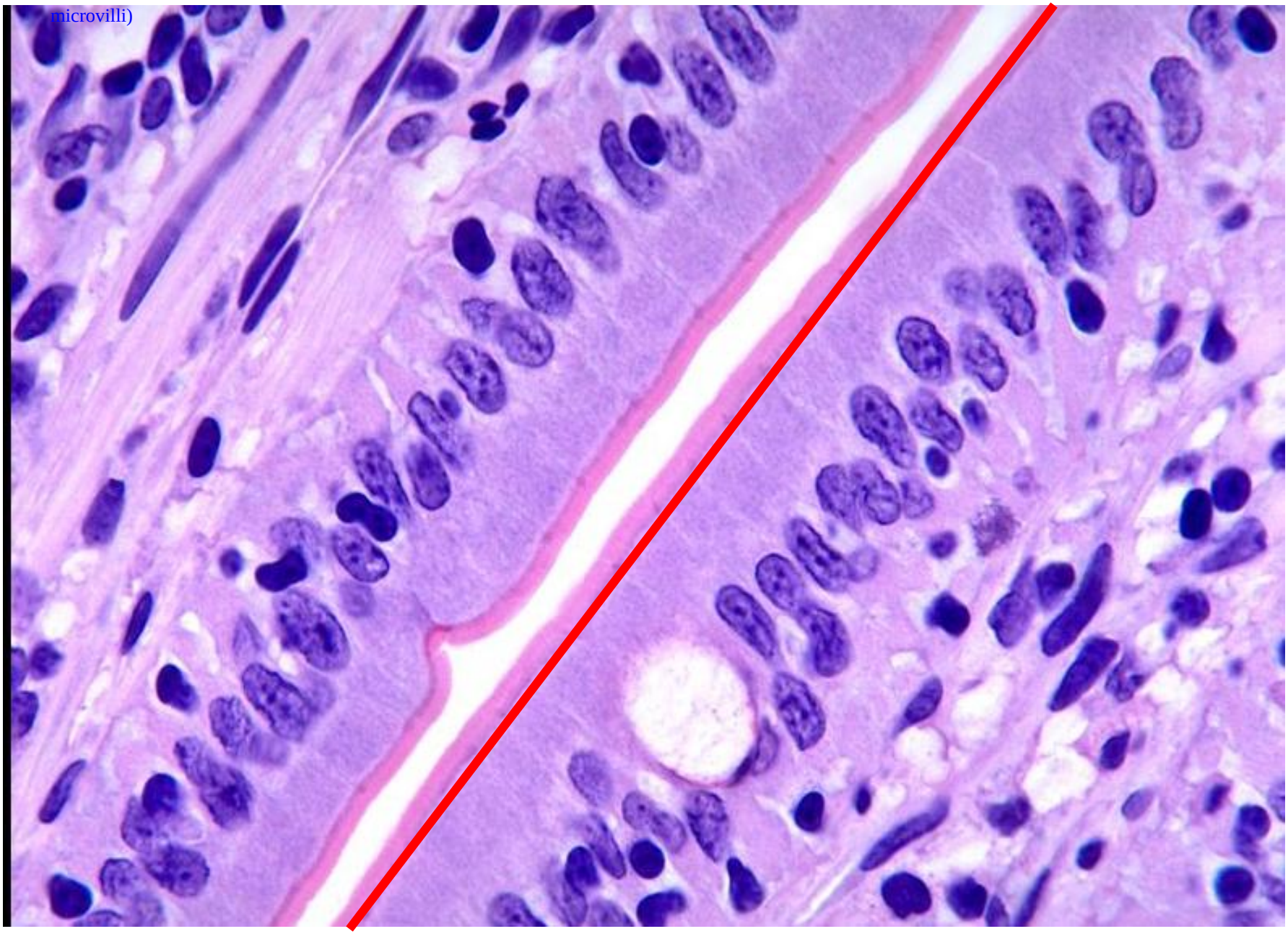
When ciliated **(Fallopian tube)**, it helps in movement of fluid in the female genital tract.

(This is a section from intestine) (Under the LM the microvilli appear as a brushlike border)

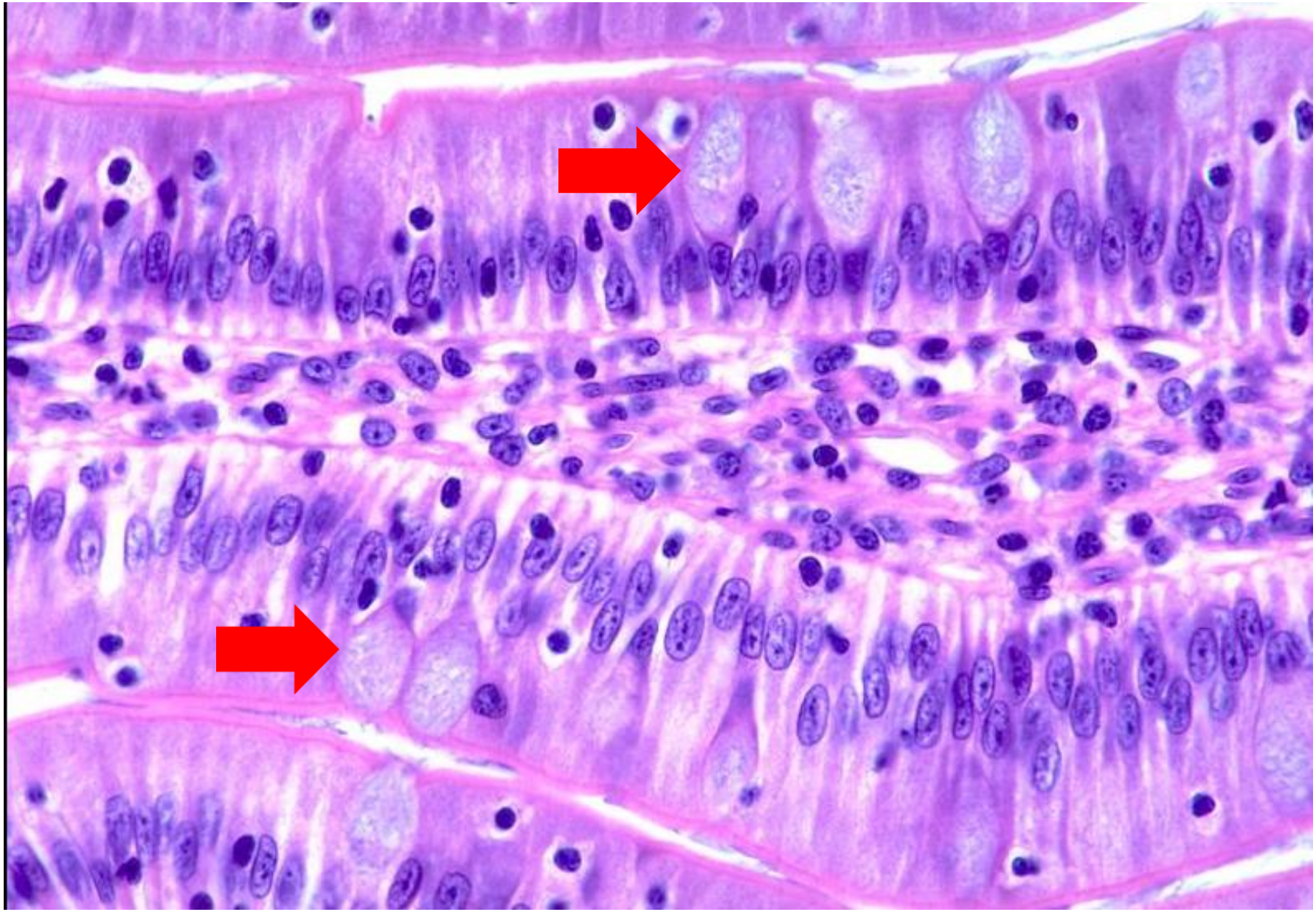




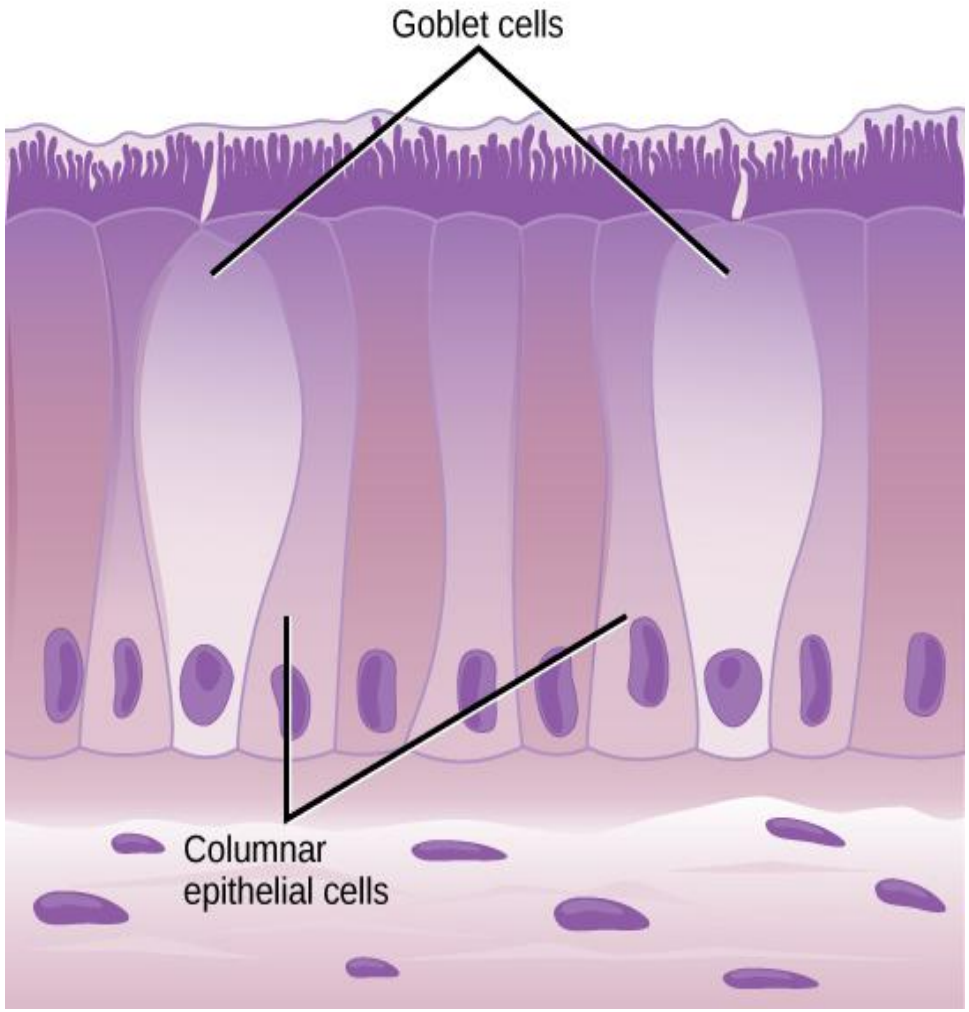
(Notice the brushlike border microvilli and the apical surface contains a terminal web cytoskeletal components of actin and intermediate filaments support microvilli)

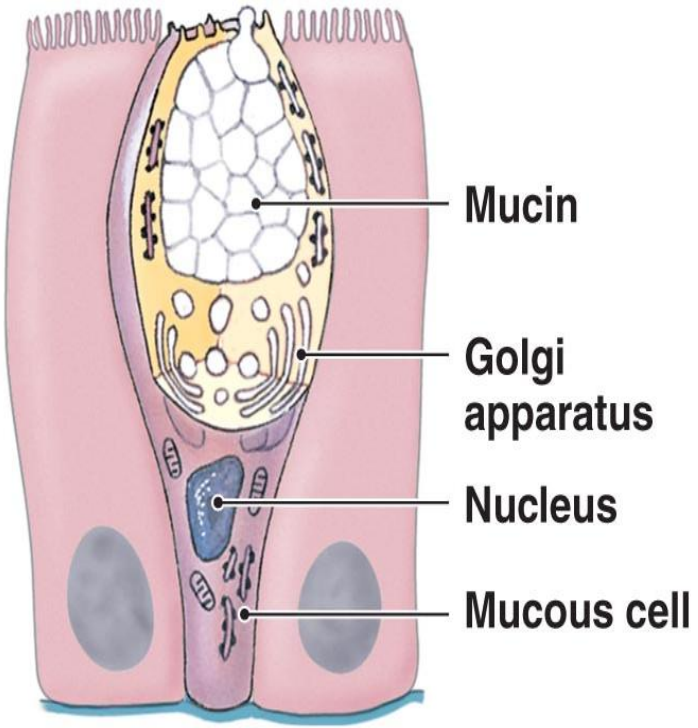


(Red arrows point at Goblet cells)

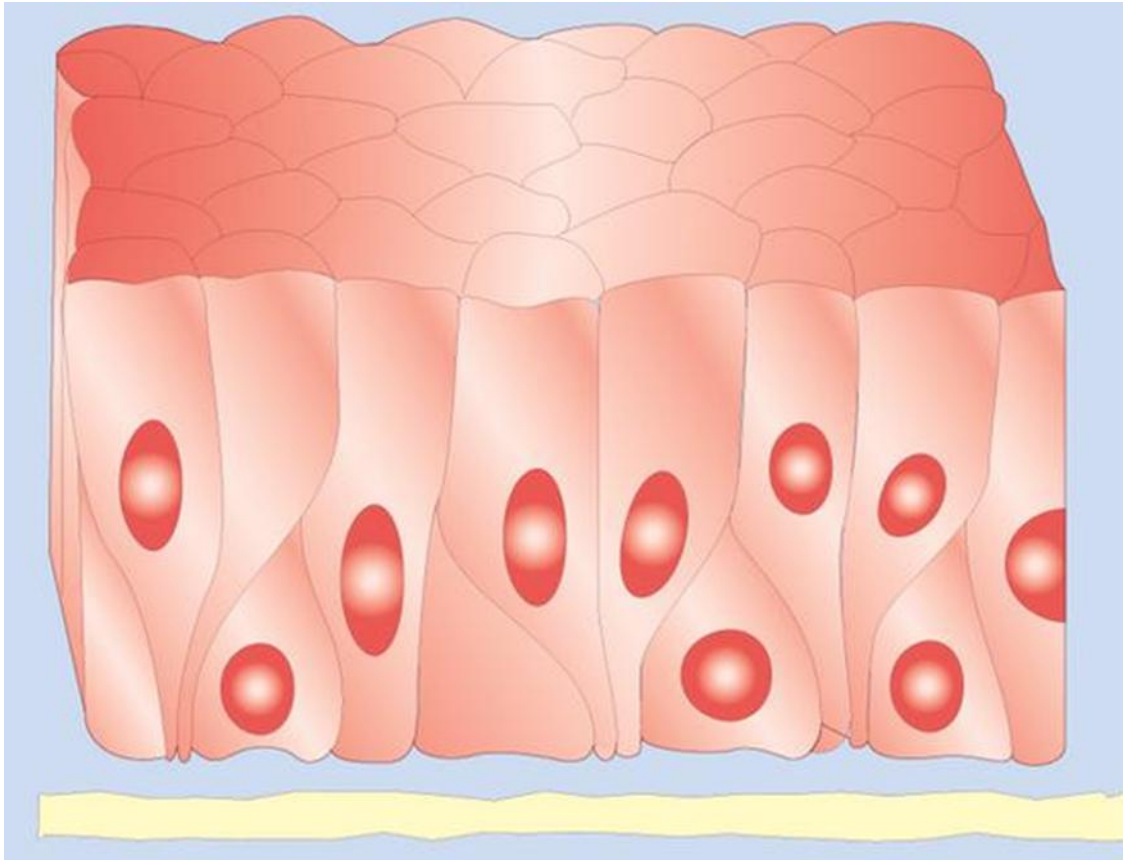


Goblet Cells



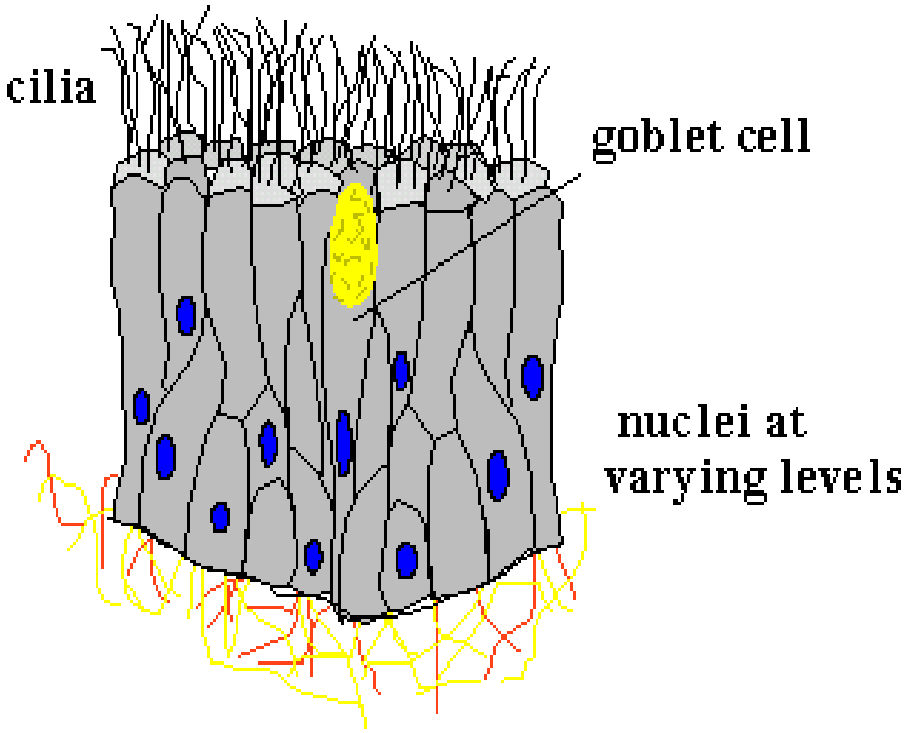


Pseudostratified Columnar Epithelium



Pseudostratified columnar Epithelium

- **Structure**
  - Irregularly shaped cells with nuclei at different levels – appear stratified, but aren't.
  - All cells reach basement membrane
- **Function**
  - Absorption and Secretion



Function of Pseudostratified Columnar Epithelium

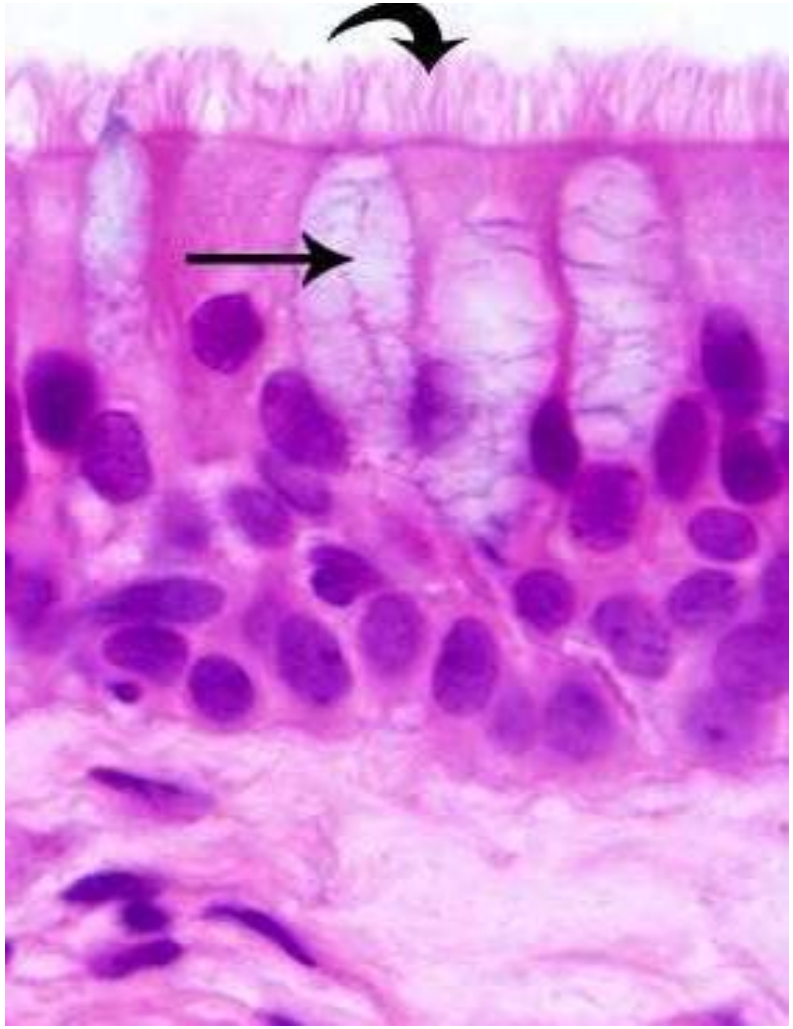
It entraps foreign particles in the respiratory tract.

Some of its types perform a secretory and absorptive functions.

– **Goblet cells** produce mucus

– **Cilia** (larger than microvilli) sweep mucus

- **Location**
  – Respiratory tract
  (trachea and bronchi)



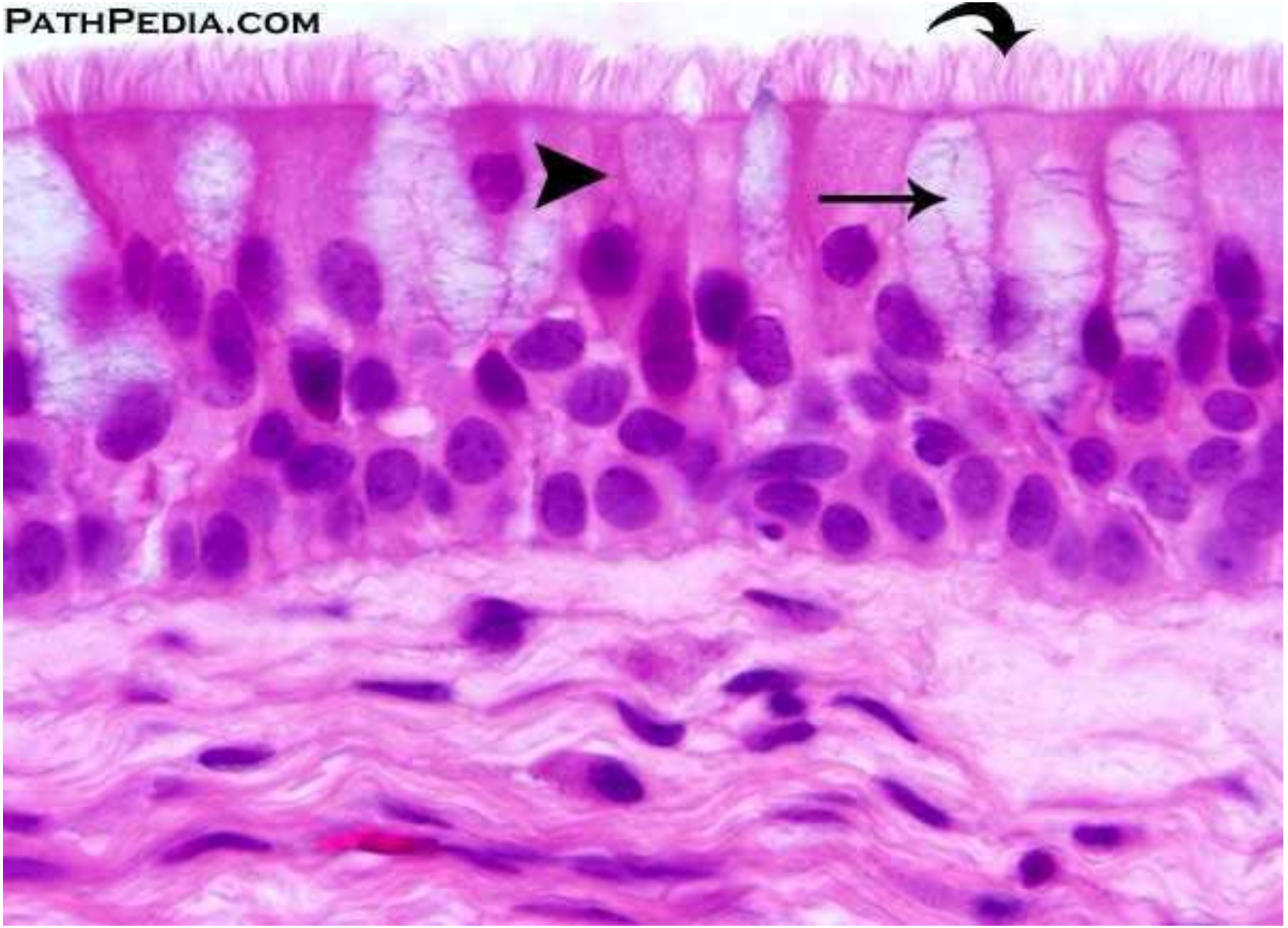
Cilia Vs Microvilli

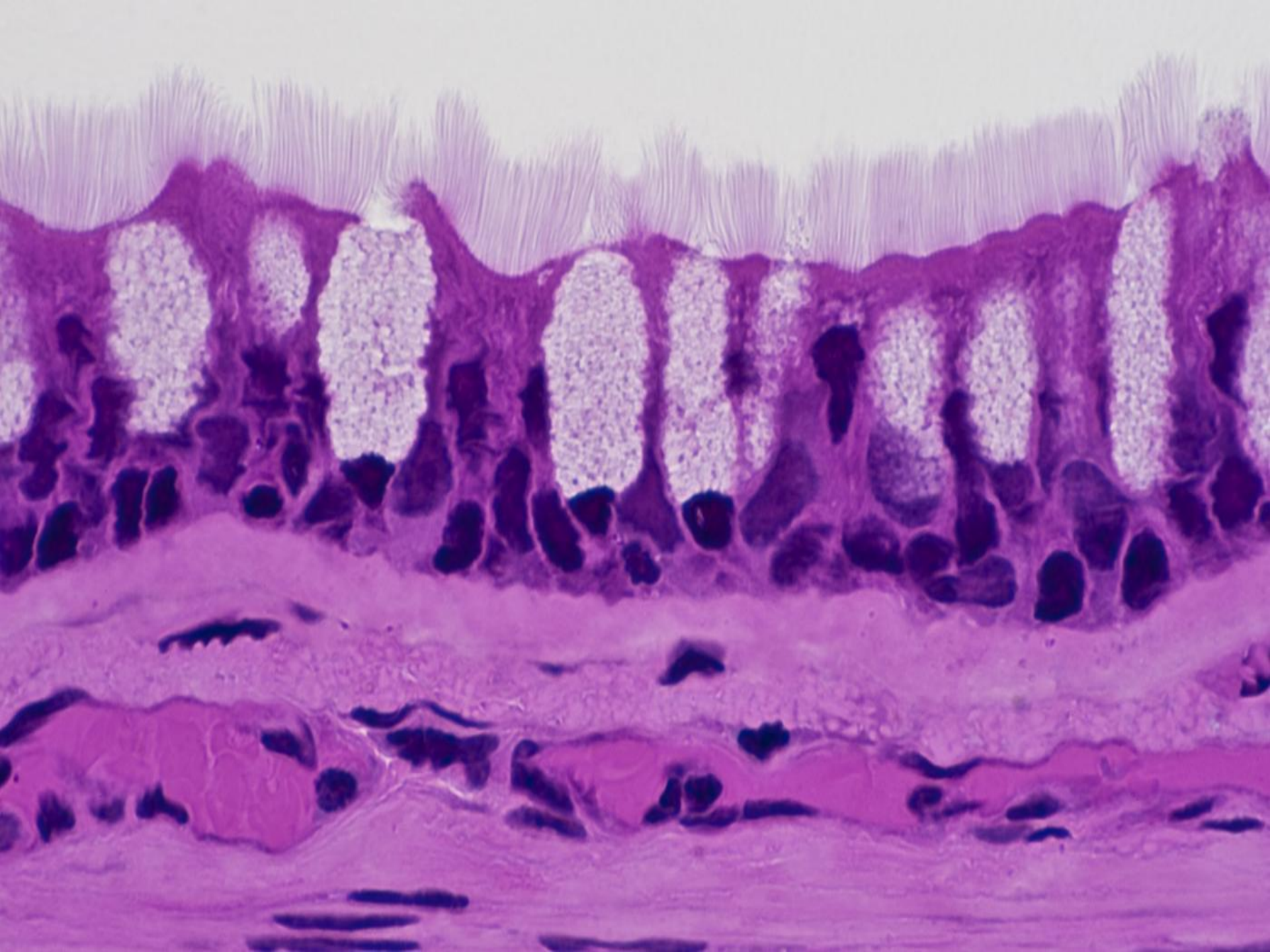
Longer	Shorter
Discontineous	Continuous

(PAS stain used in this section)

Respiratory Epithelium

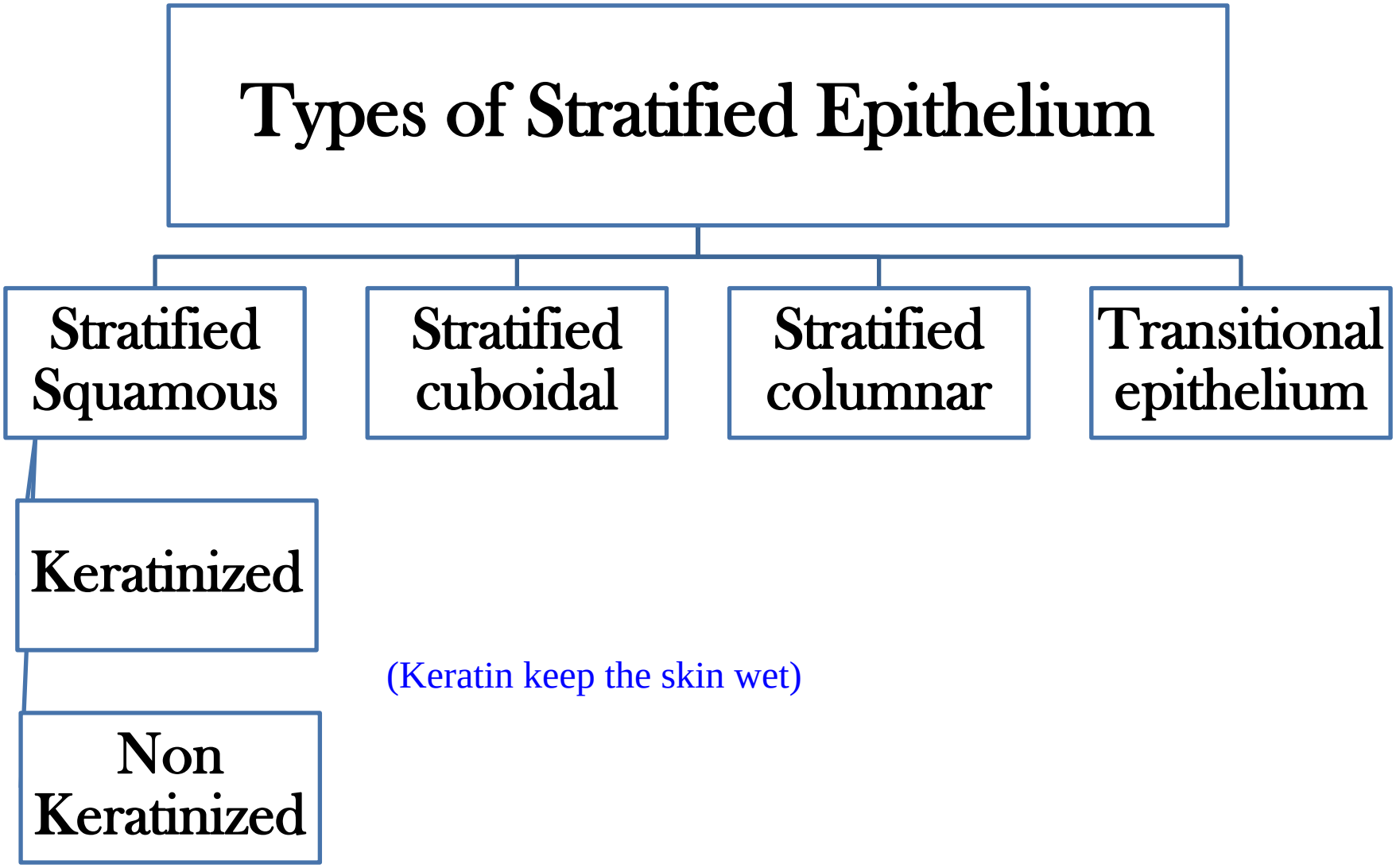
(Mucin in Goblet cells is not stained)



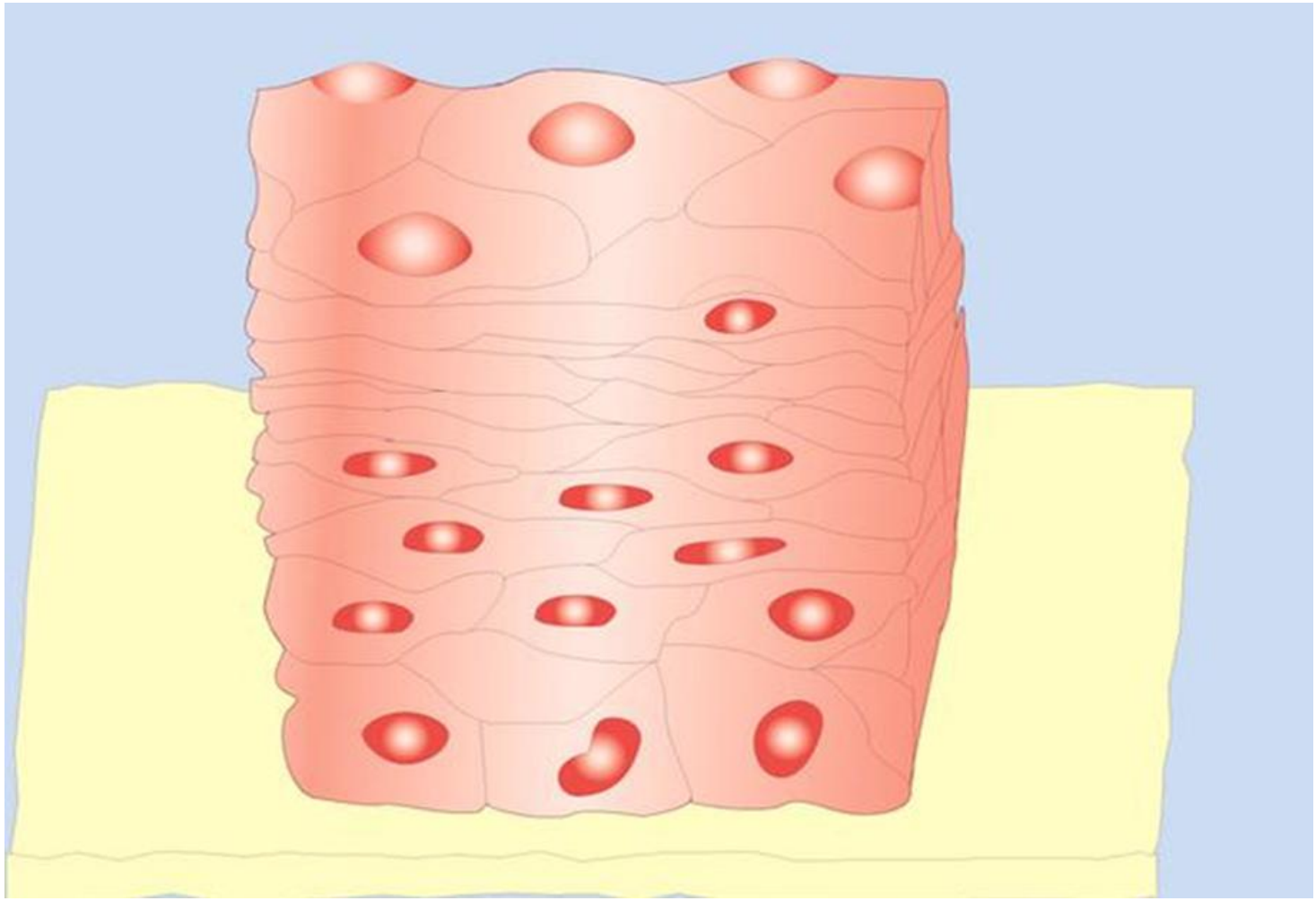



(Notice the discontinuous cilia in this slide and the previous one)

Stratified Epithelium


Types of Stratified Epithelium
Stratified Squamous
Stratified cuboidal
Stratified columnar
Transitional epithelium
Keratinized
Non Keratinized
(Keratin keep the skin wet)

Stratified Squamous Non keratinized Epithelium



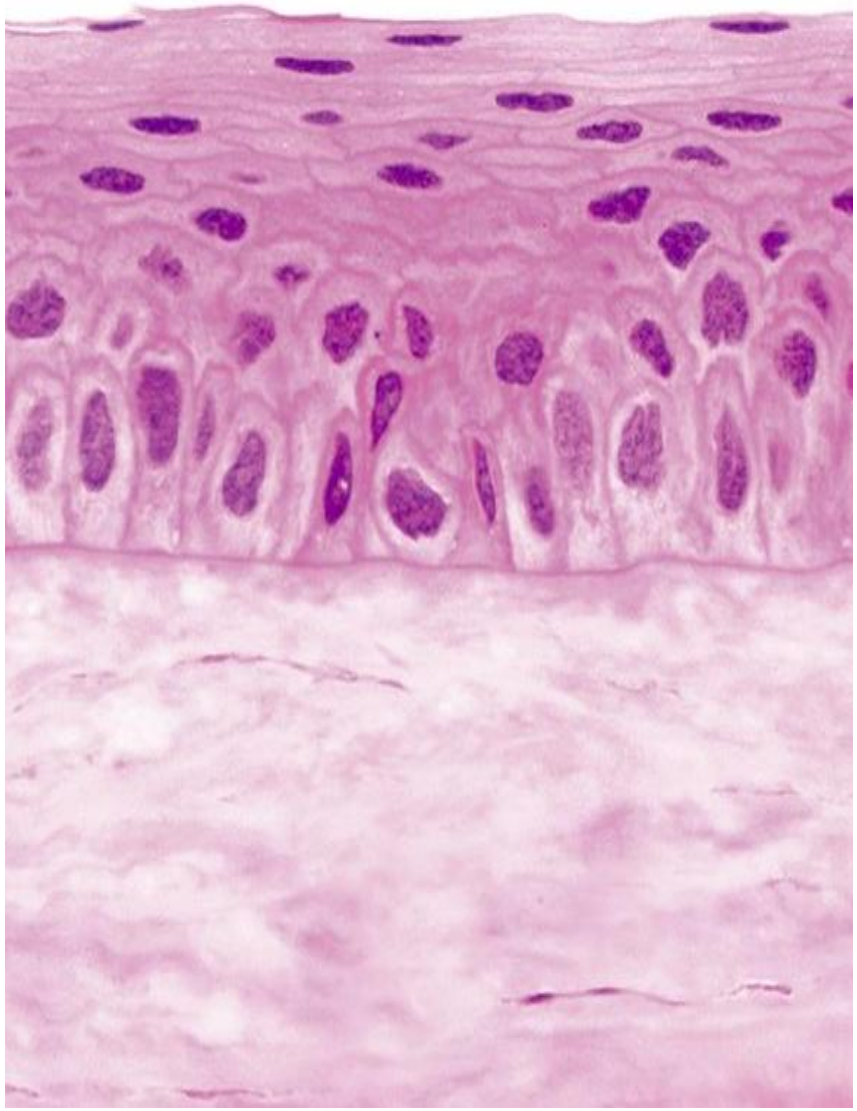
- **Location:**

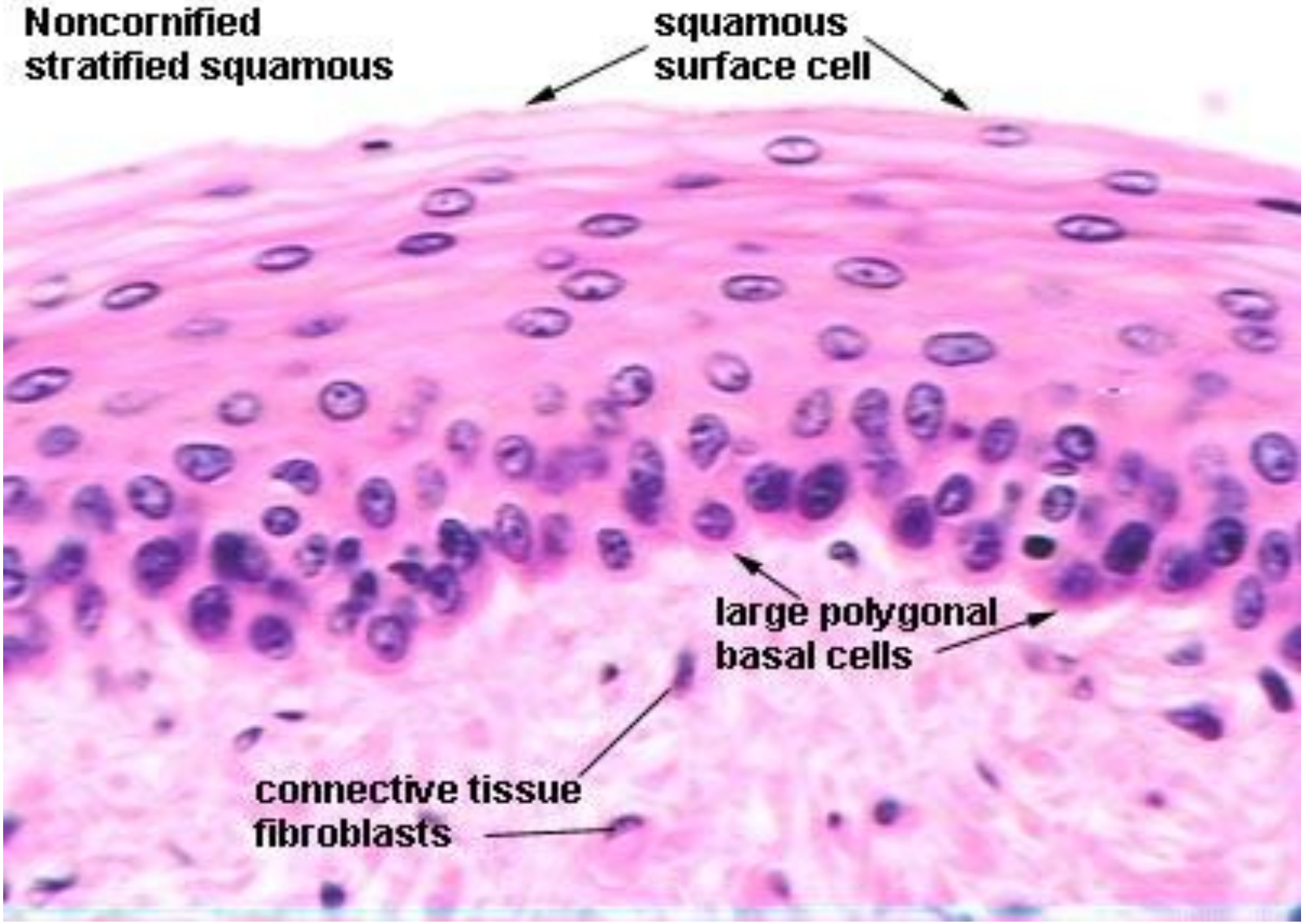
Oral cavity, Pharynx

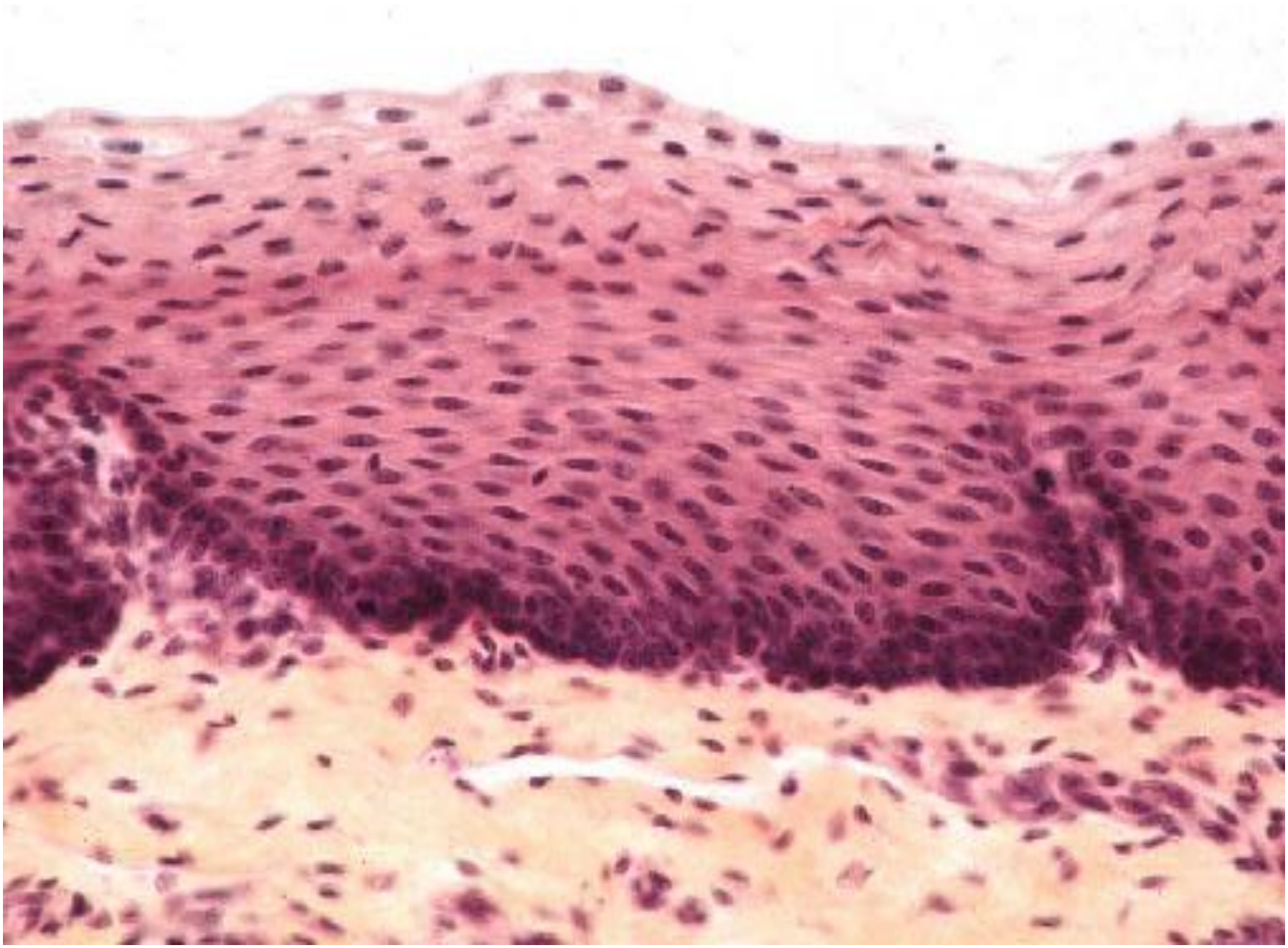
Oesophagus, Anal canal

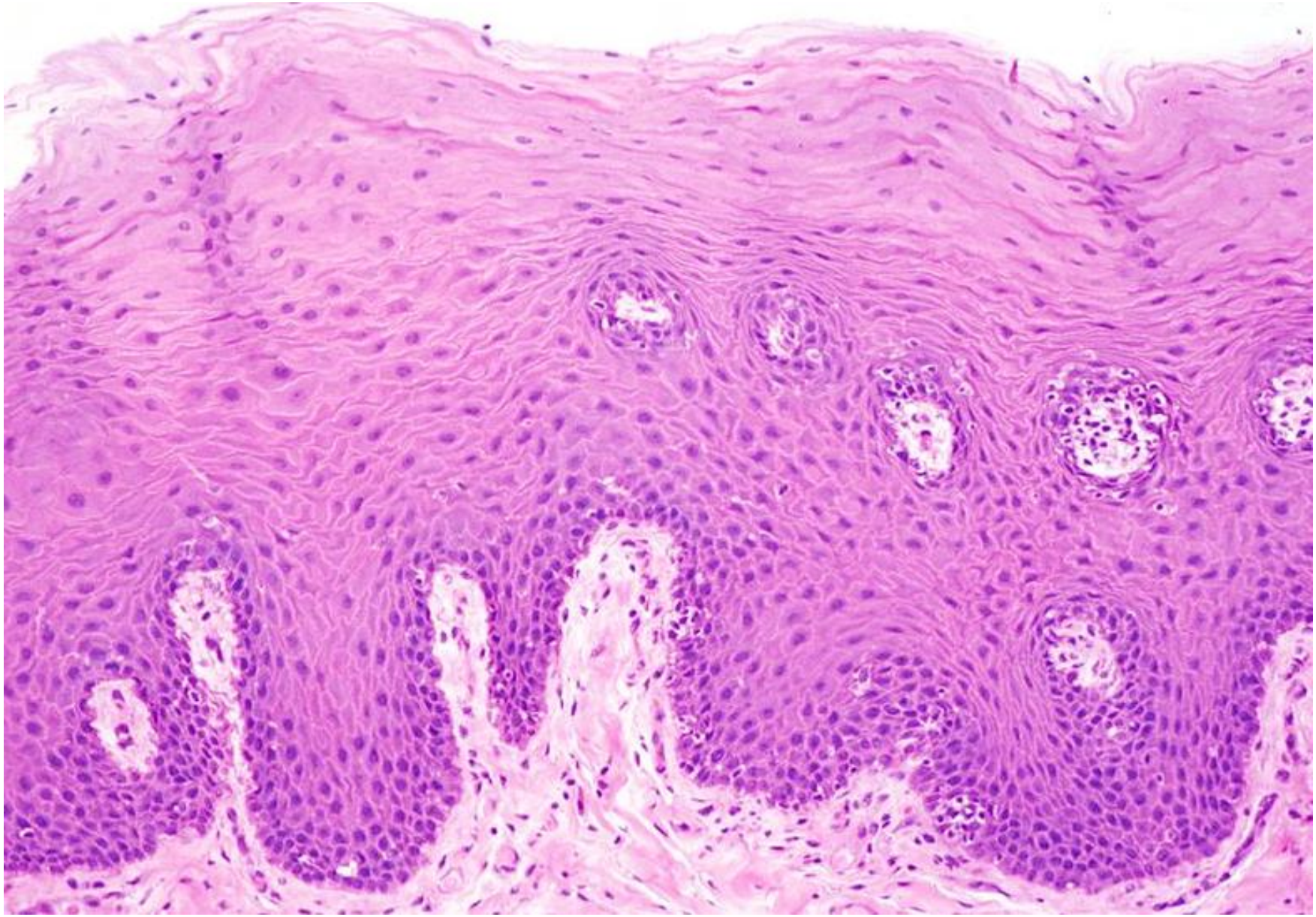
Uterine cervix, Vagina

(In the coming four slides the cells have nuclei, thus non-keratinized)



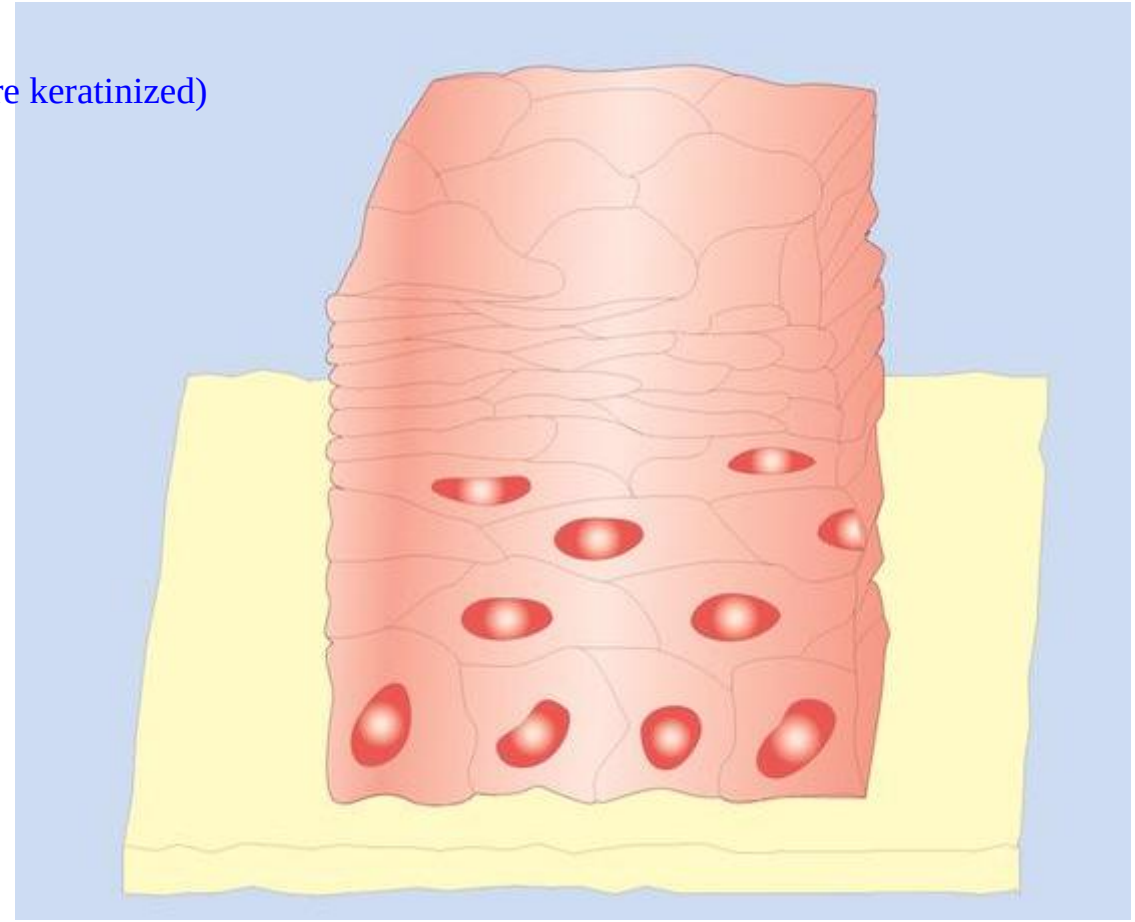

Noncornified
stratified squamous
squamous
surface cell
large polygonal
basal cells
connective tissue
fibroblasts

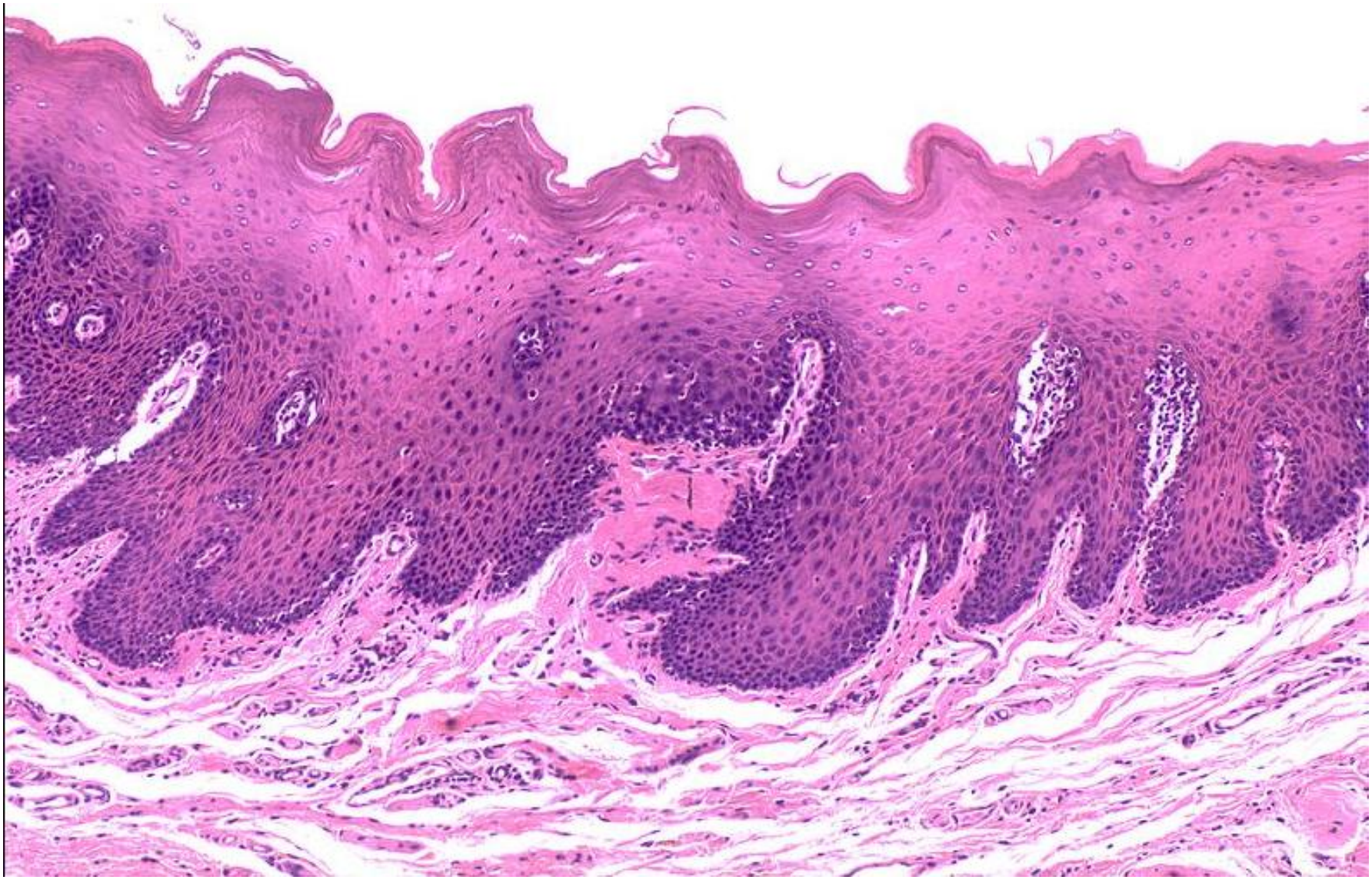




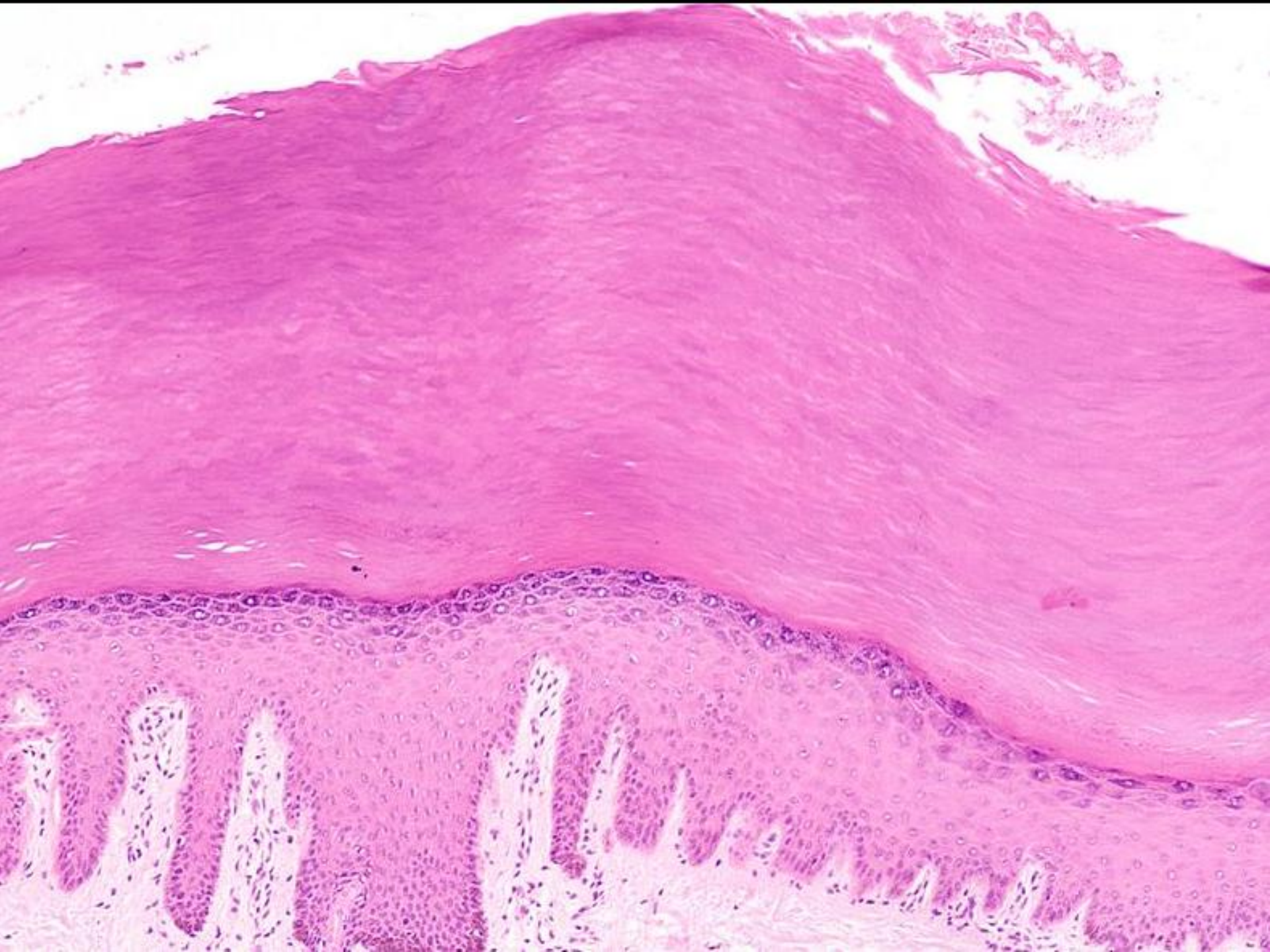
Stratified Squamous Keratinized Epithelium

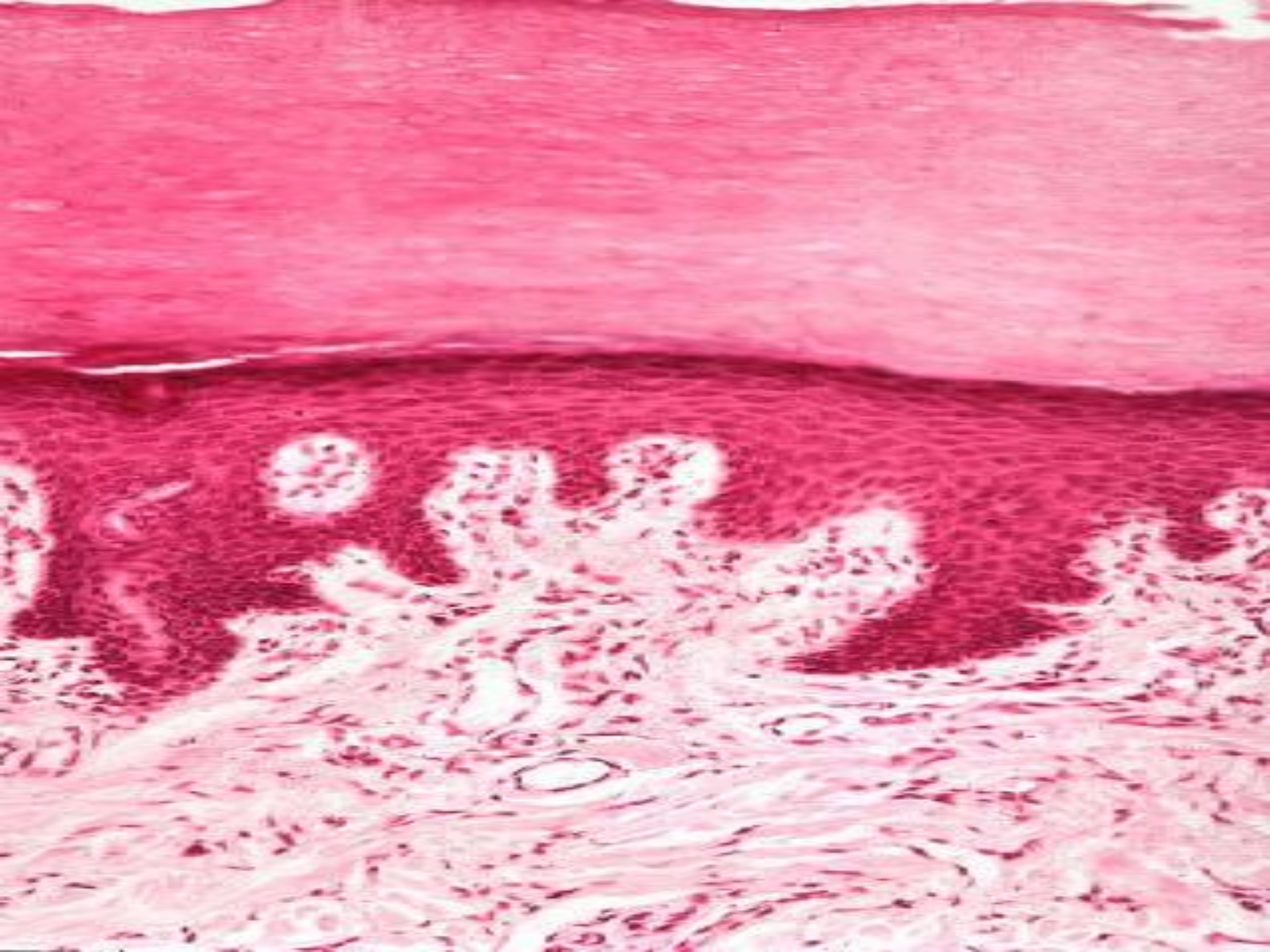
(Cells with no nuclei are keratinized)



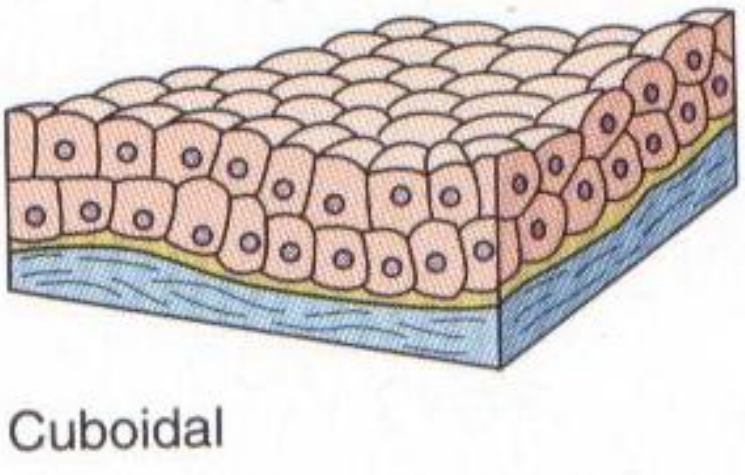


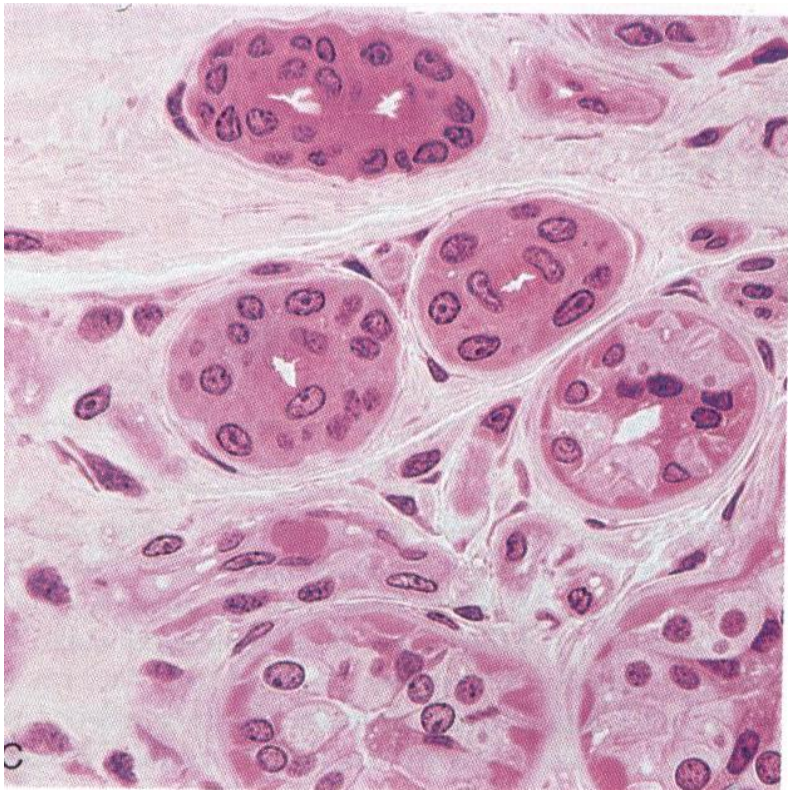
Location: Epidermis of skin



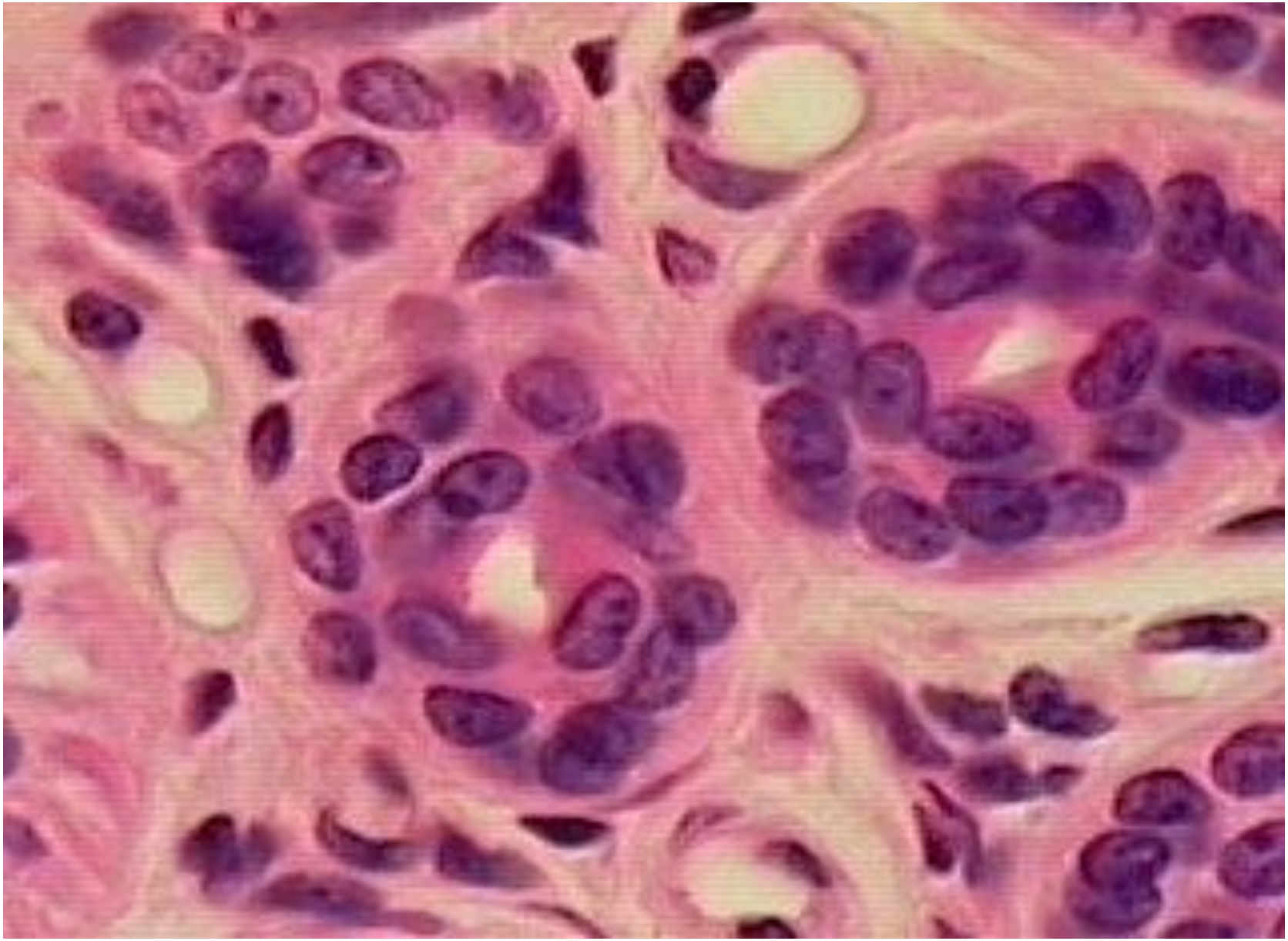


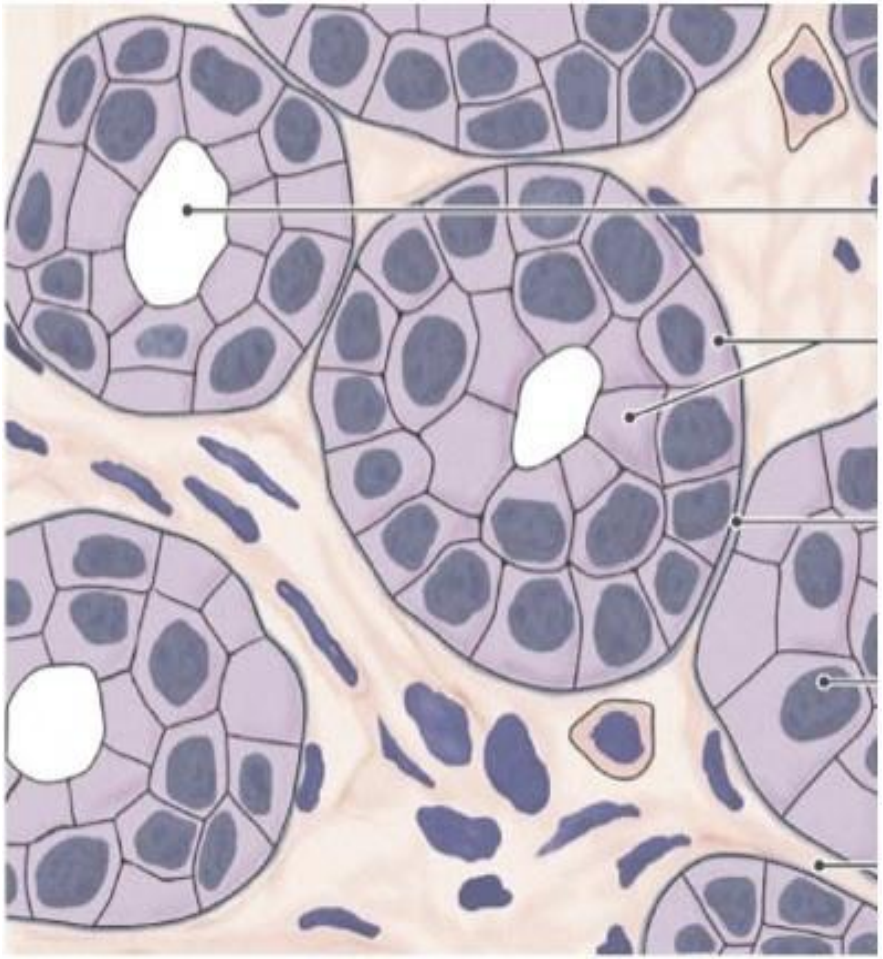
Stratified Cuboidal Epithelium

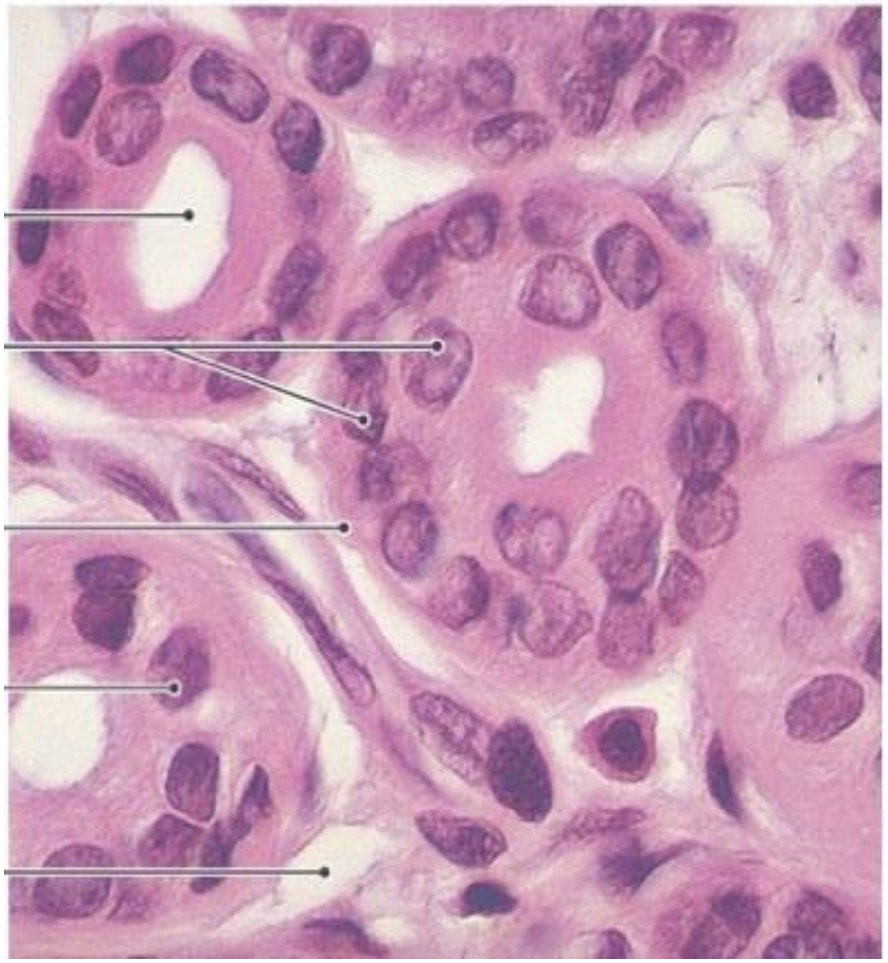


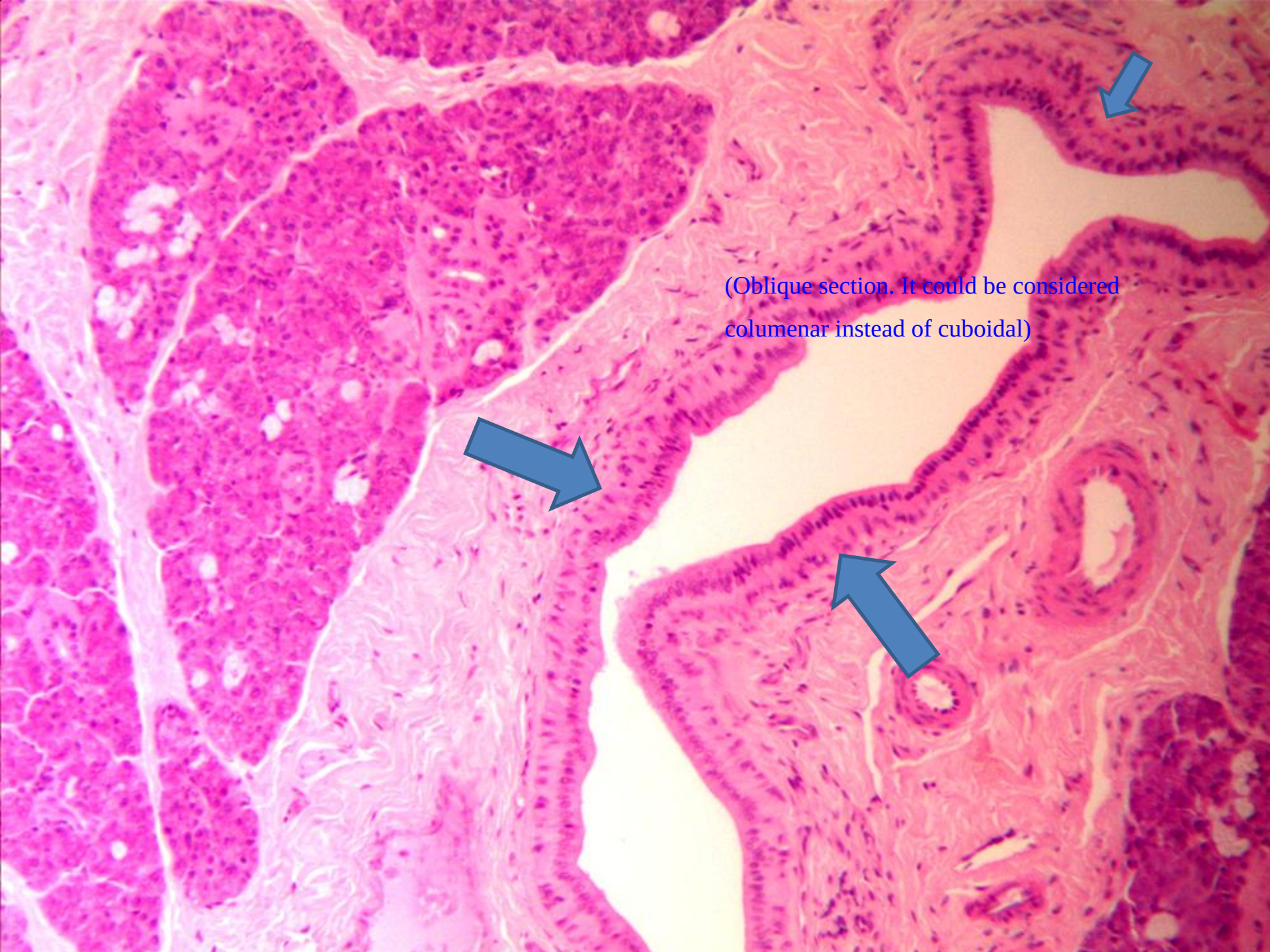


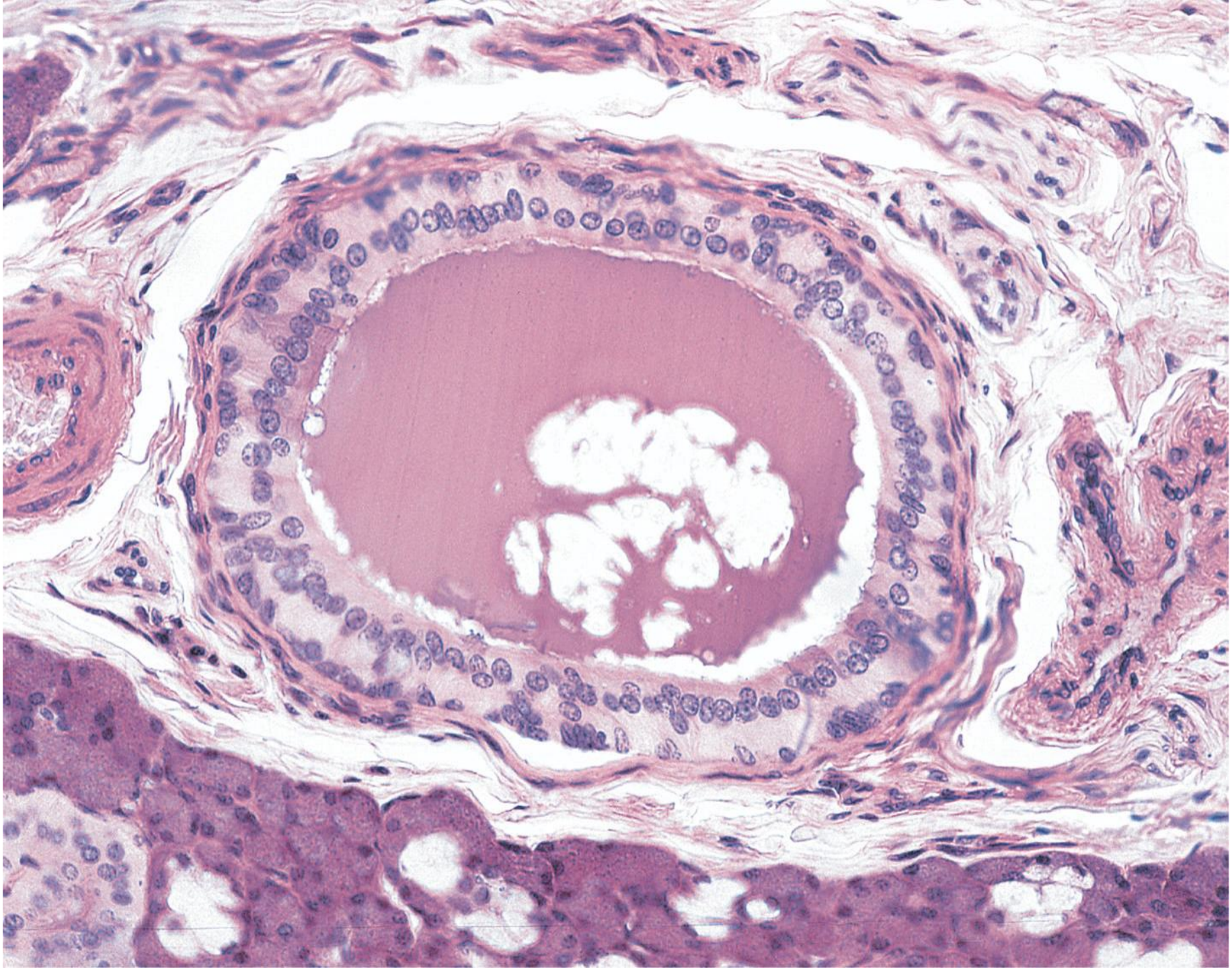
Location : Larger ducts of certain exocrine glands







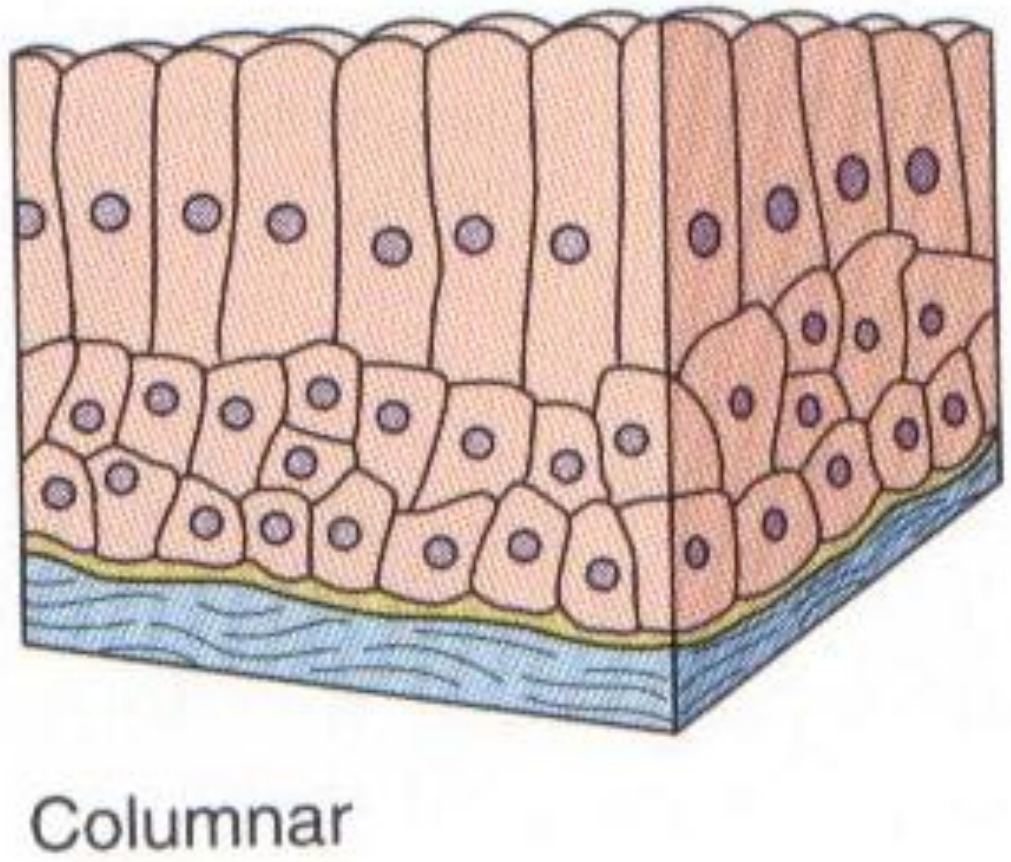

(Oblique section. It could be considered
columenar instead of cuboidal)

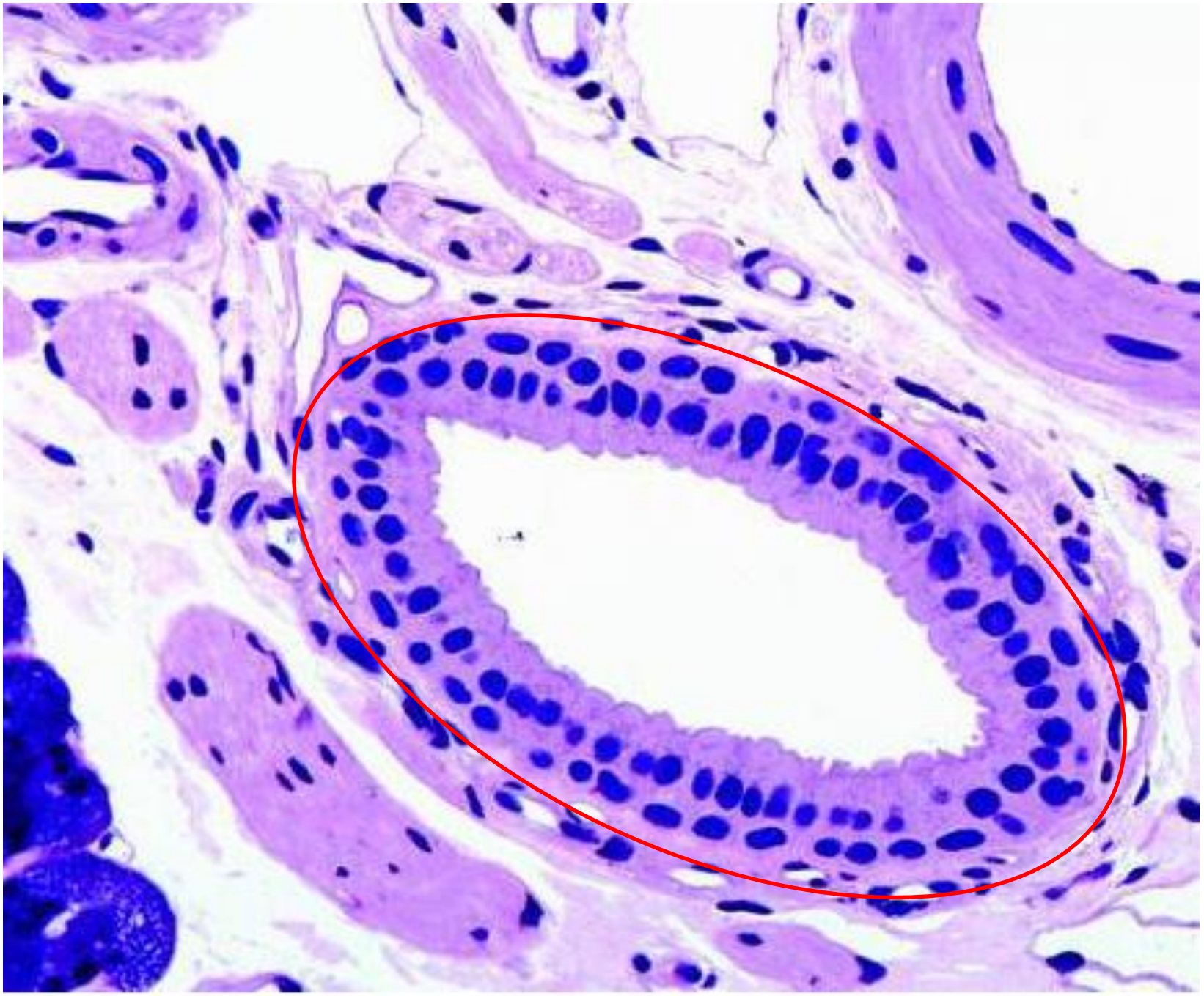


Stratified Columnar Epithelium

Location :

Conjunctiva , lining the eyelids.





Transitional Epithelium

- **Structure**

  Many layers

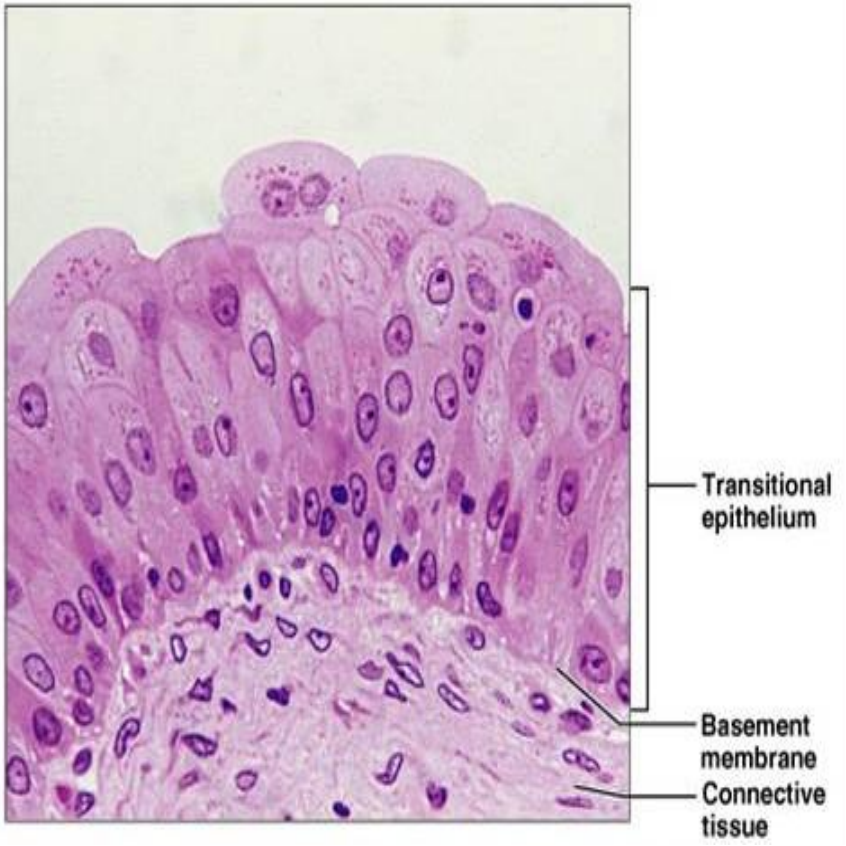
- **Function**

  Allows stretching (change size)

  Protection

- **Location**

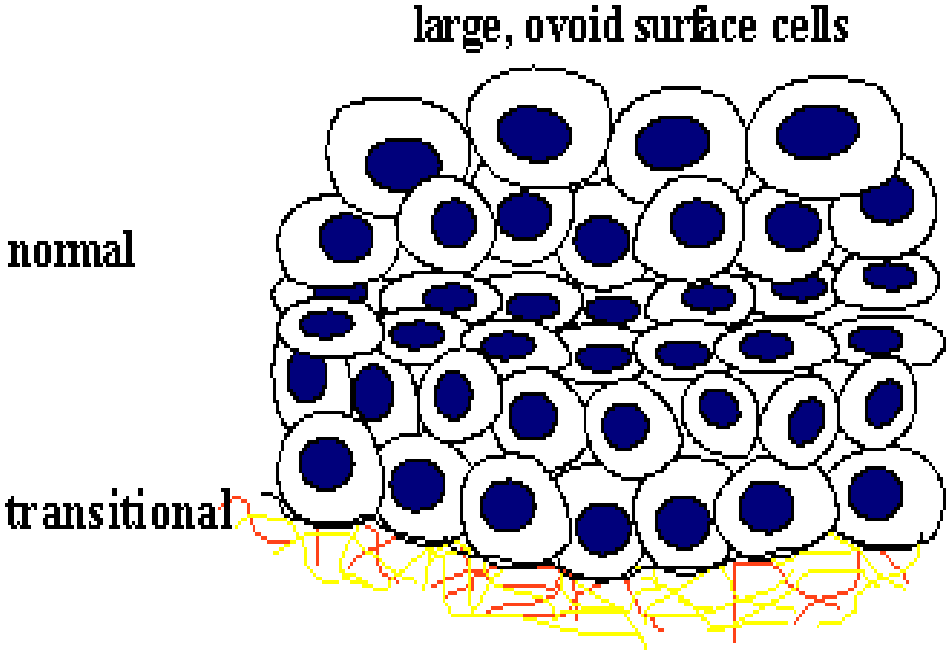
  Urinary tract (urinary bladder, ureters &



Transitional Epithelium

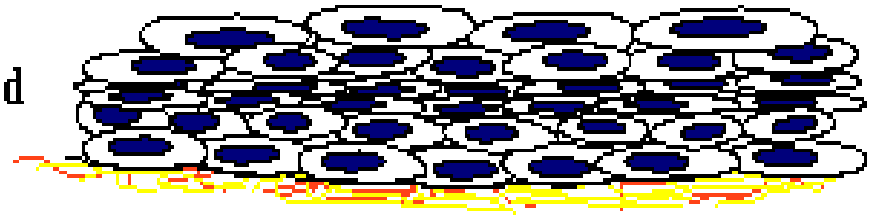
Unstretched (empty organ)

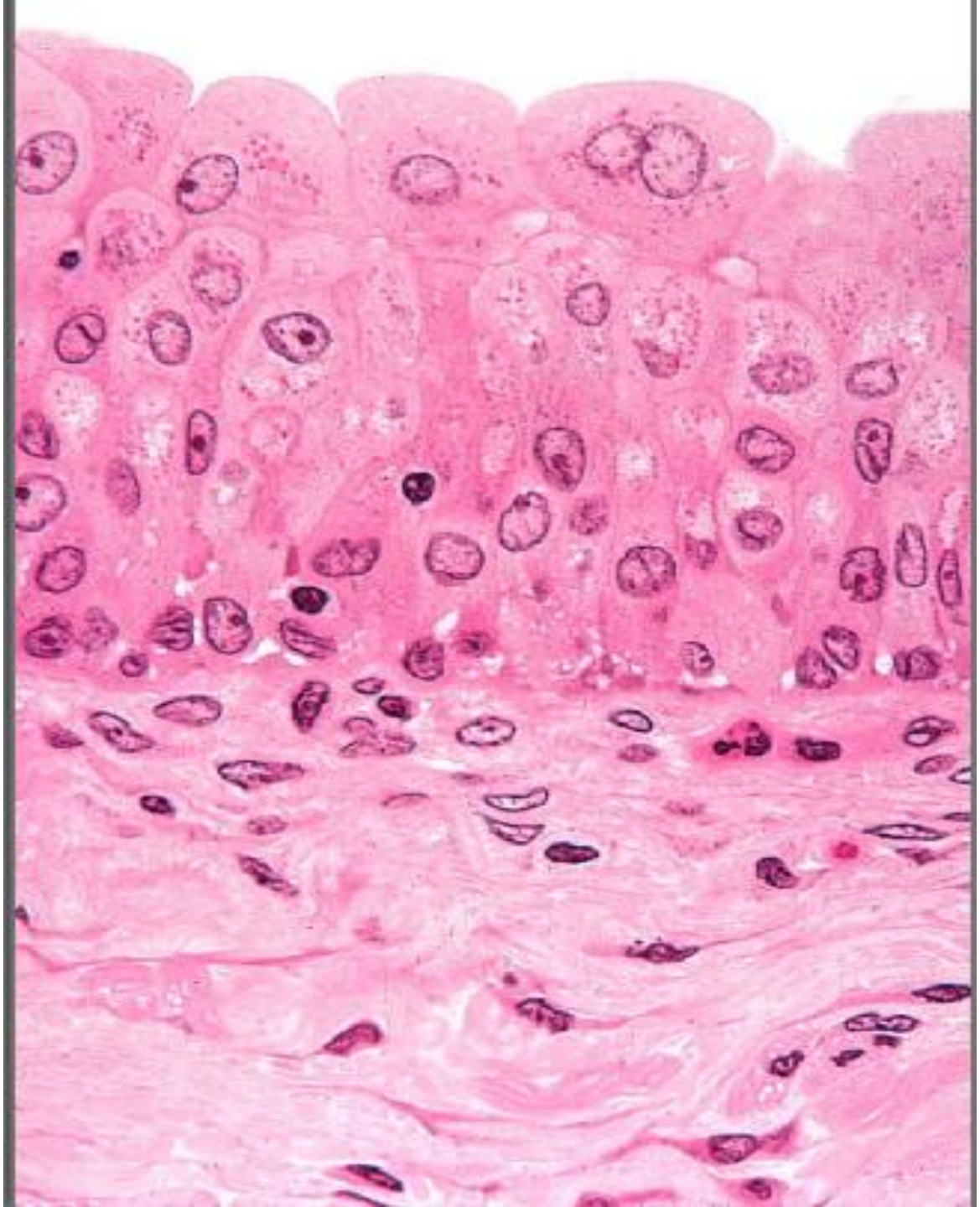
Superficial layer of dome/umbrella-shaped cells

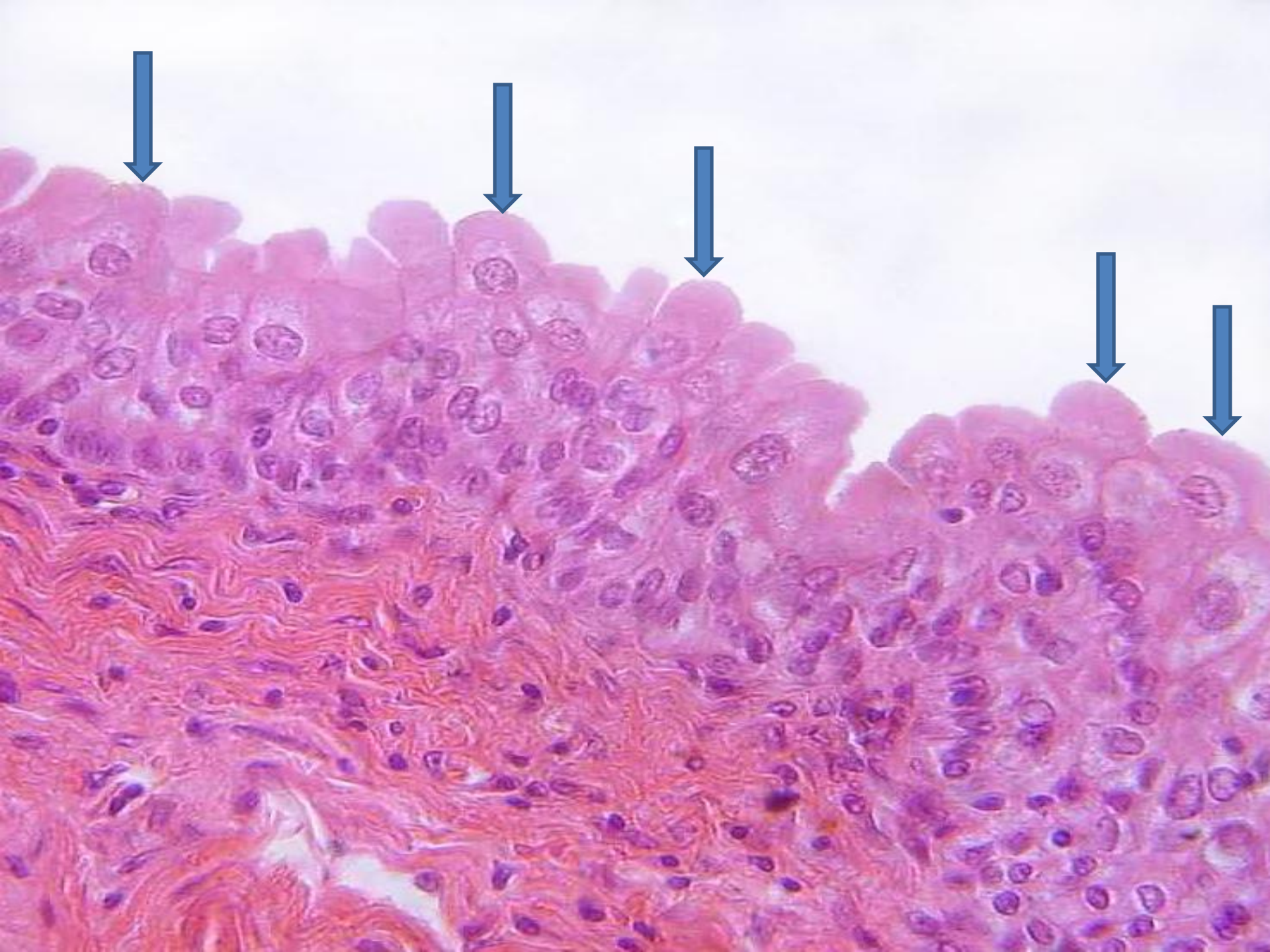


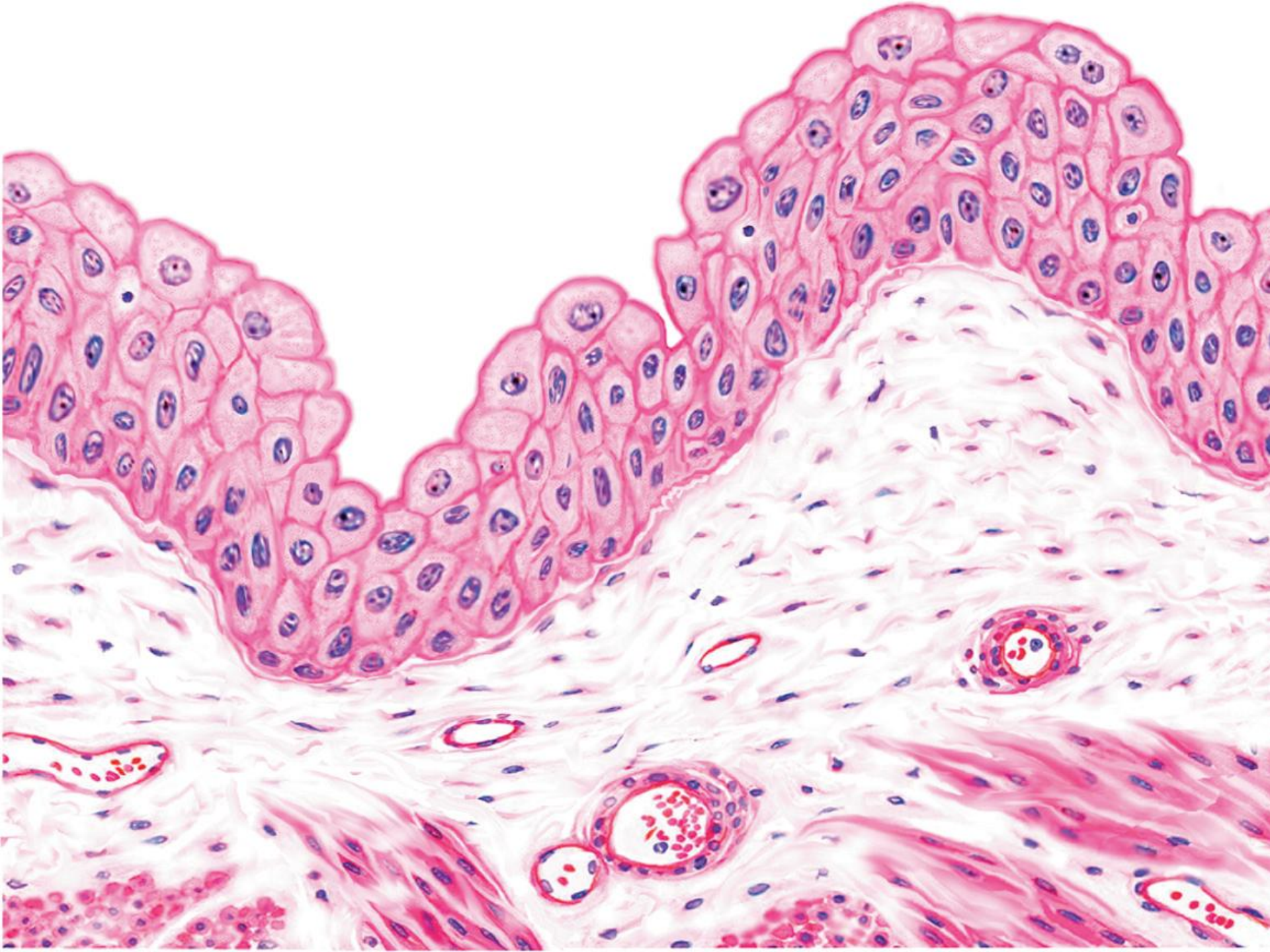
Stretched (distended organ)

Fluid pressure







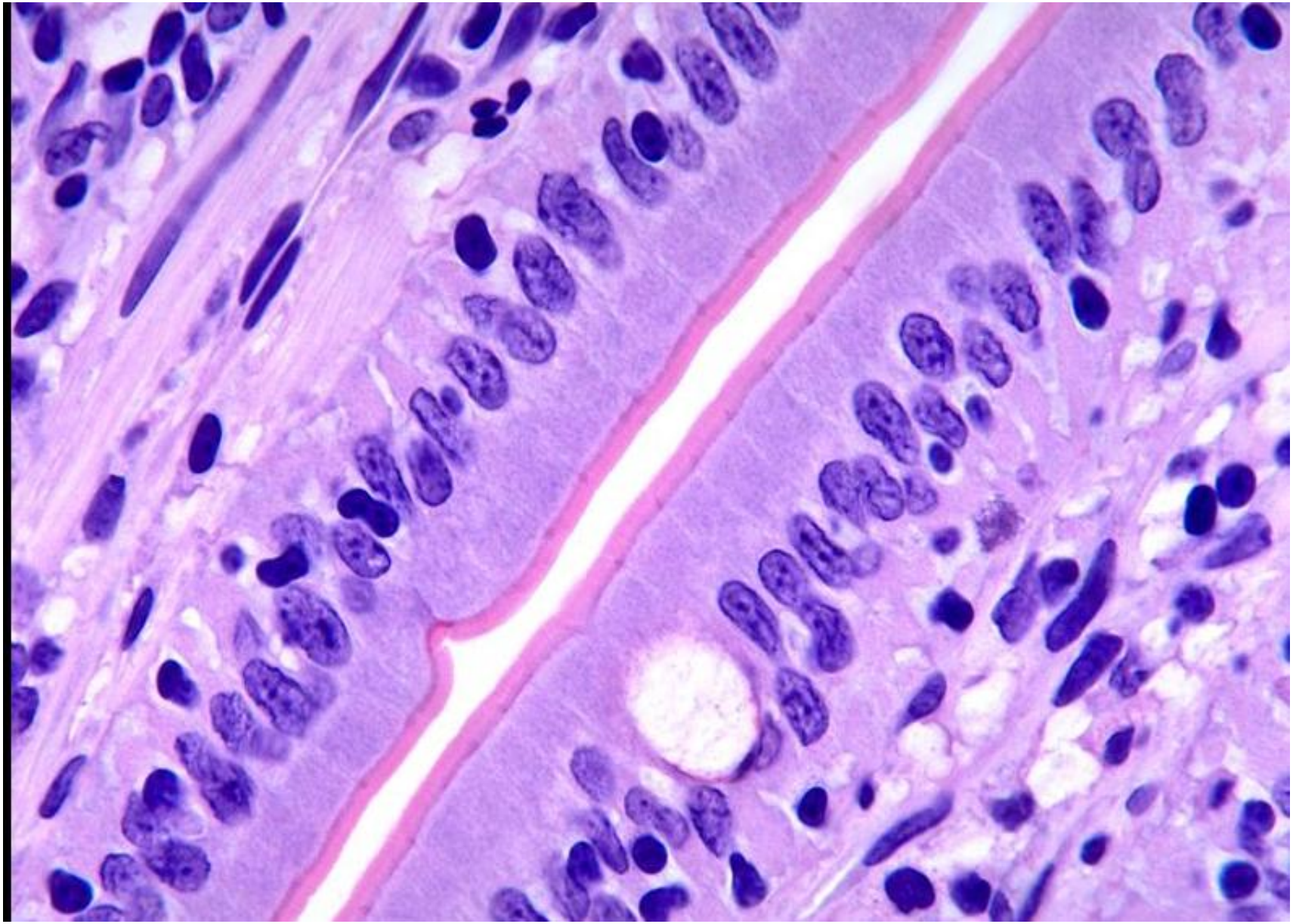


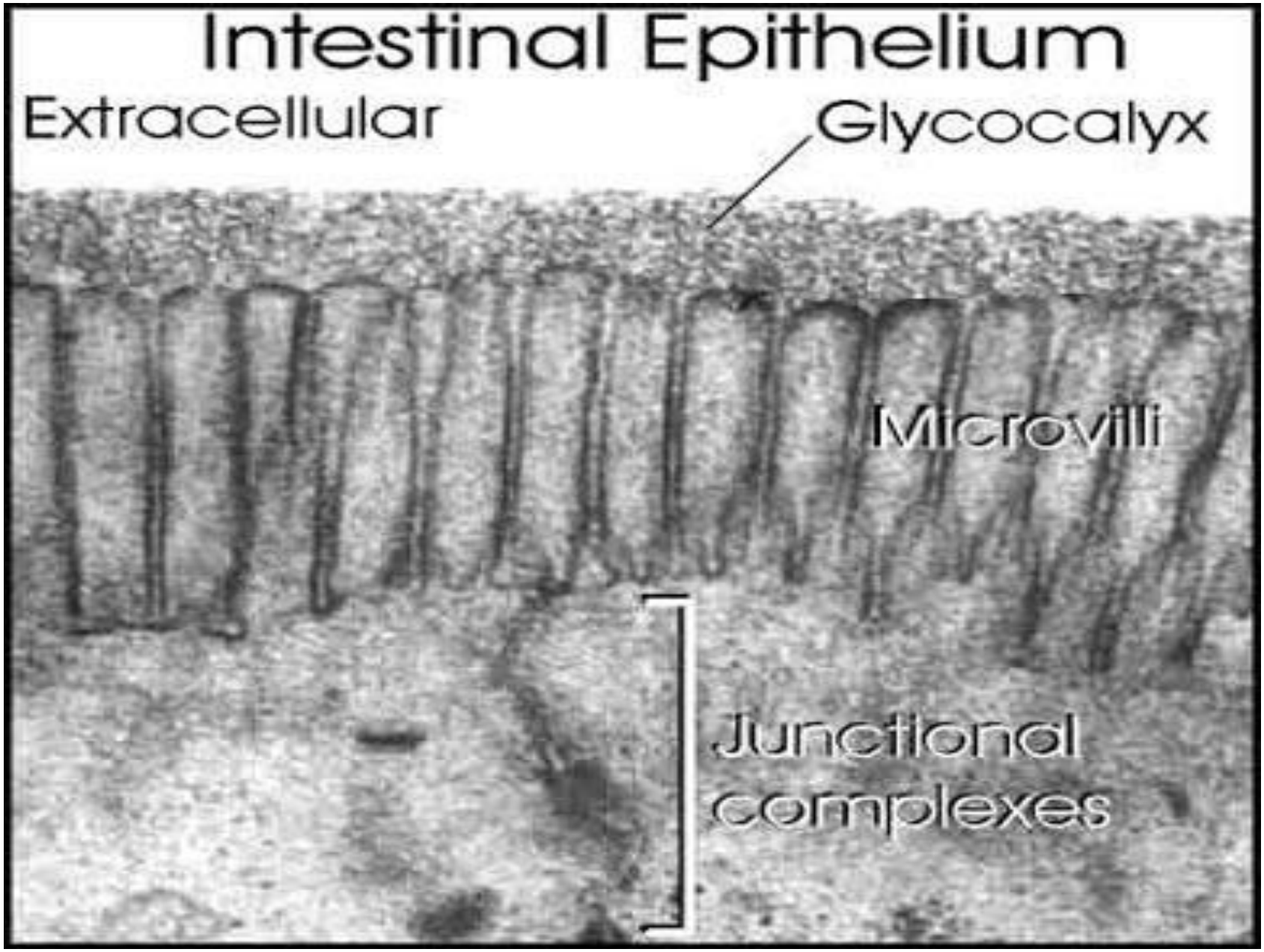
Features of Apical surface of Epithelium

Microvilli

- Finger-like extensions of plasma membrane of apical epithelial cell
- Increase surface area for absorption
- BRUSH/STRIATED BORDER: seen in L.M
- Terminal web: supports microvilli

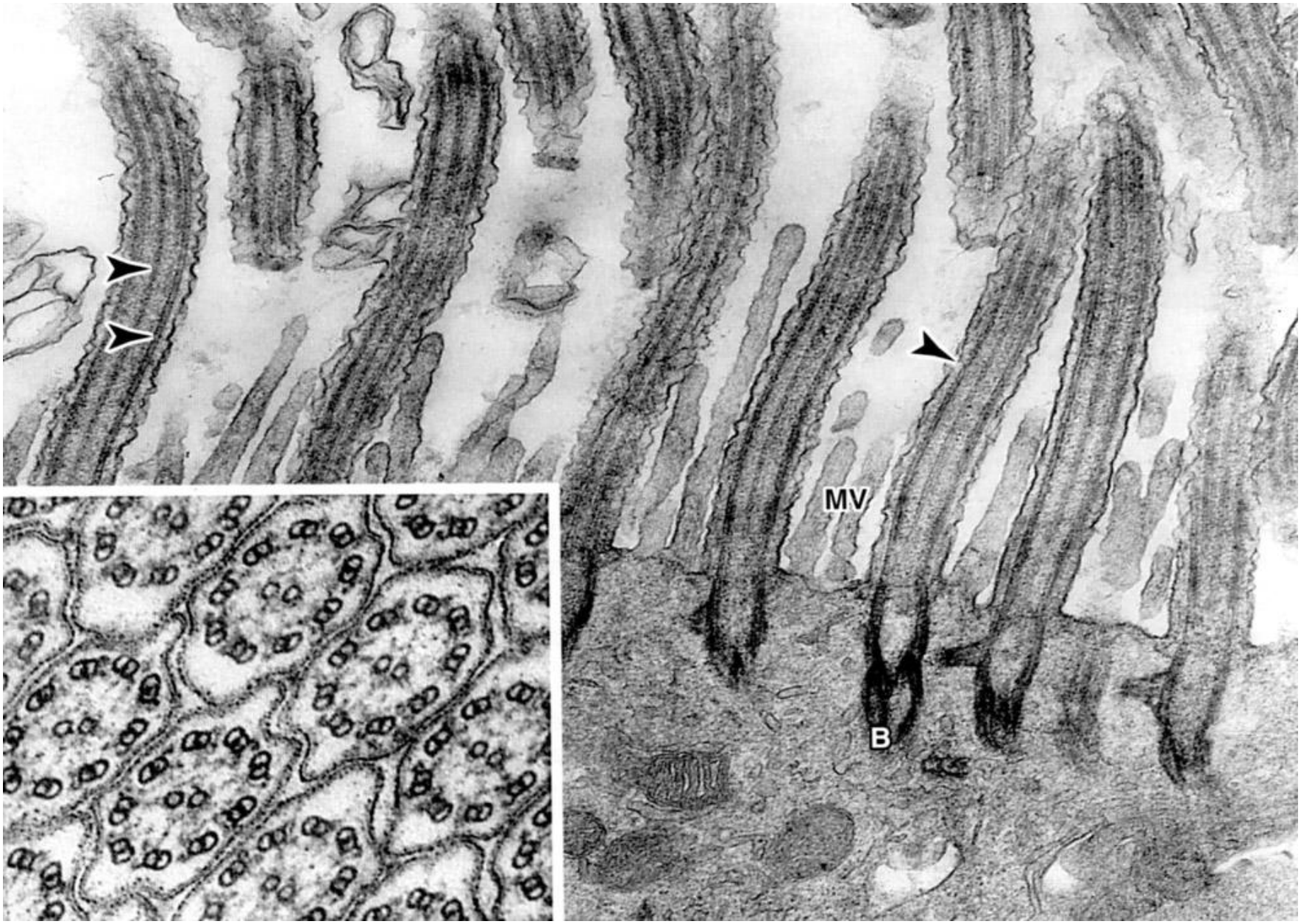
- Microvilli are non motile. But they have many actin-containing microfilaments and large amounts of myosin !!!.



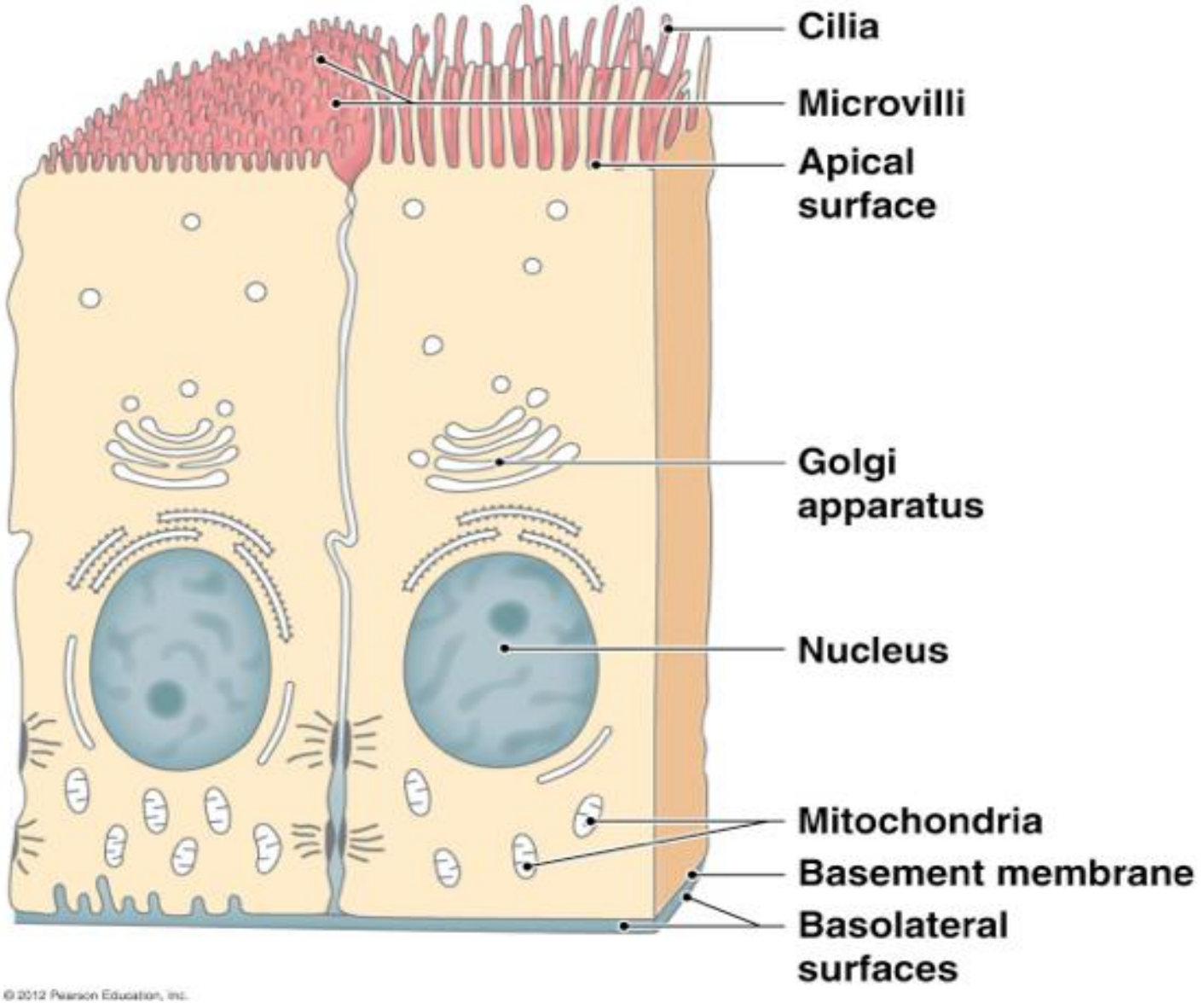

Intestinal Epithelium
Extracellular
Glycocalyx
Microvilli
Junctional
complexes

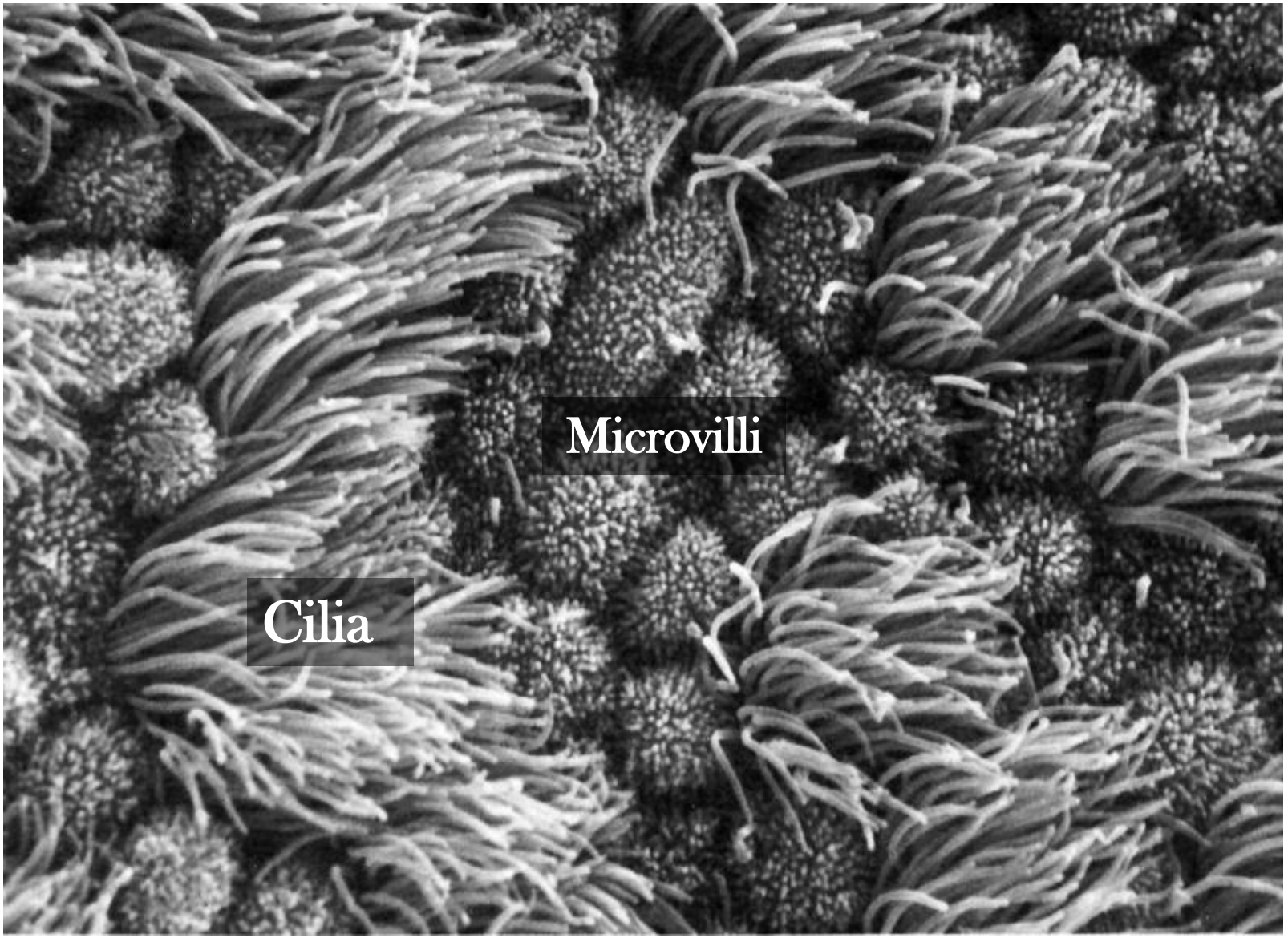
Cilia

- Motile cytoplasmic hair like projections capable of moving fluid and particles along epithelial surfaces
- The core of the cilium is called ***axoneme***
- The axoneme consists of longitudinal microtubules arranged as 9 (doublets) peripheral surrounding 2 (singlets) central (9+2).
- The singlets are separated by 13 protofilaments.
- The doublets are composed of 2 subunits A & B.
- Subunit A is formed of 13 protofilaments.
- Subunit B is formed of 10 protofilaments.


MV
B

- Neighboring doublets are connected by nexin.
- Doublets are connected to the singlets by ***radial spokes***.
- Dynein radiates form subunit A to subunit B.
- Dynein has ATPase activity.
- Cilia are attached to basal bodies similar in structure to centrioles



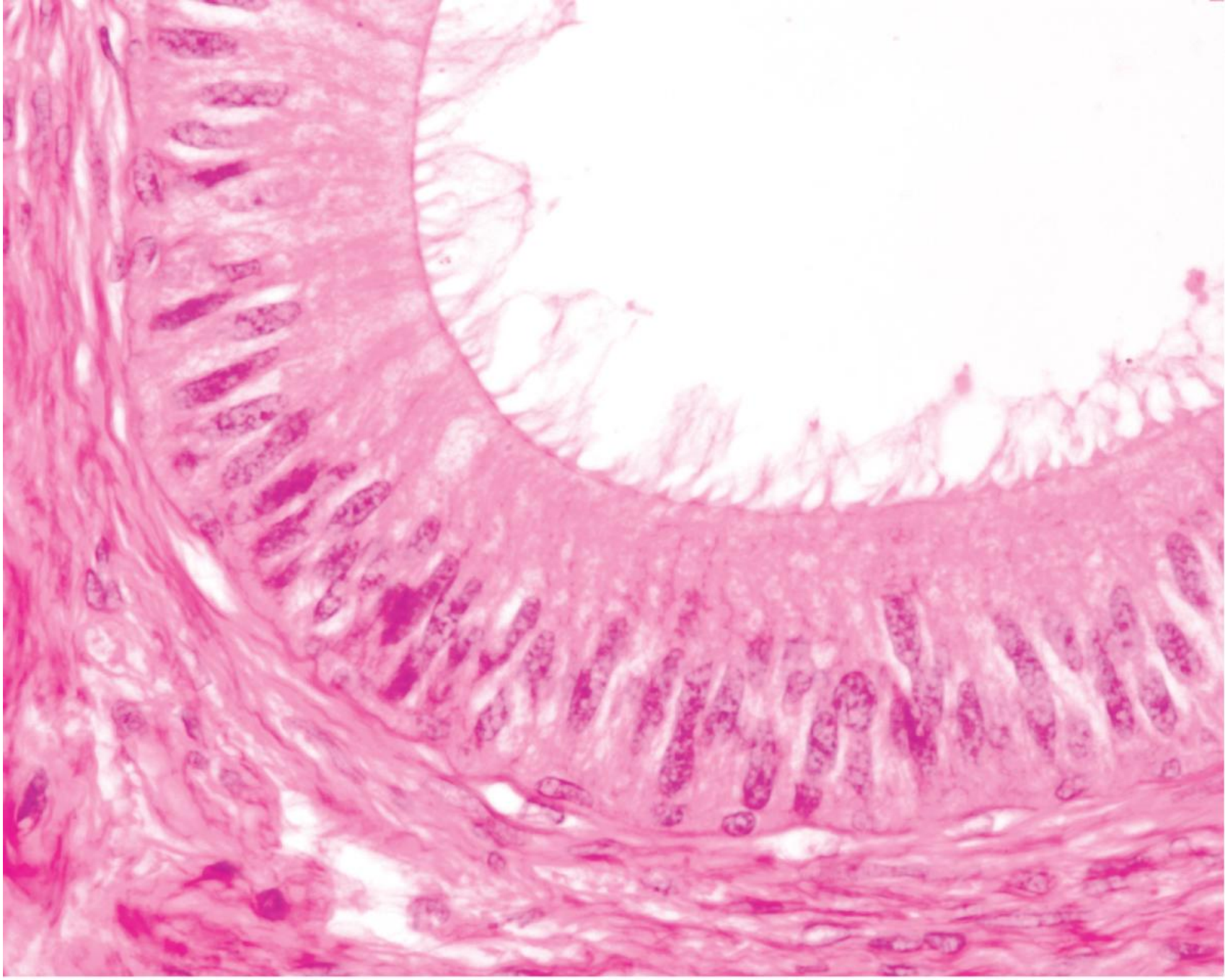

Microvilli
Cilia

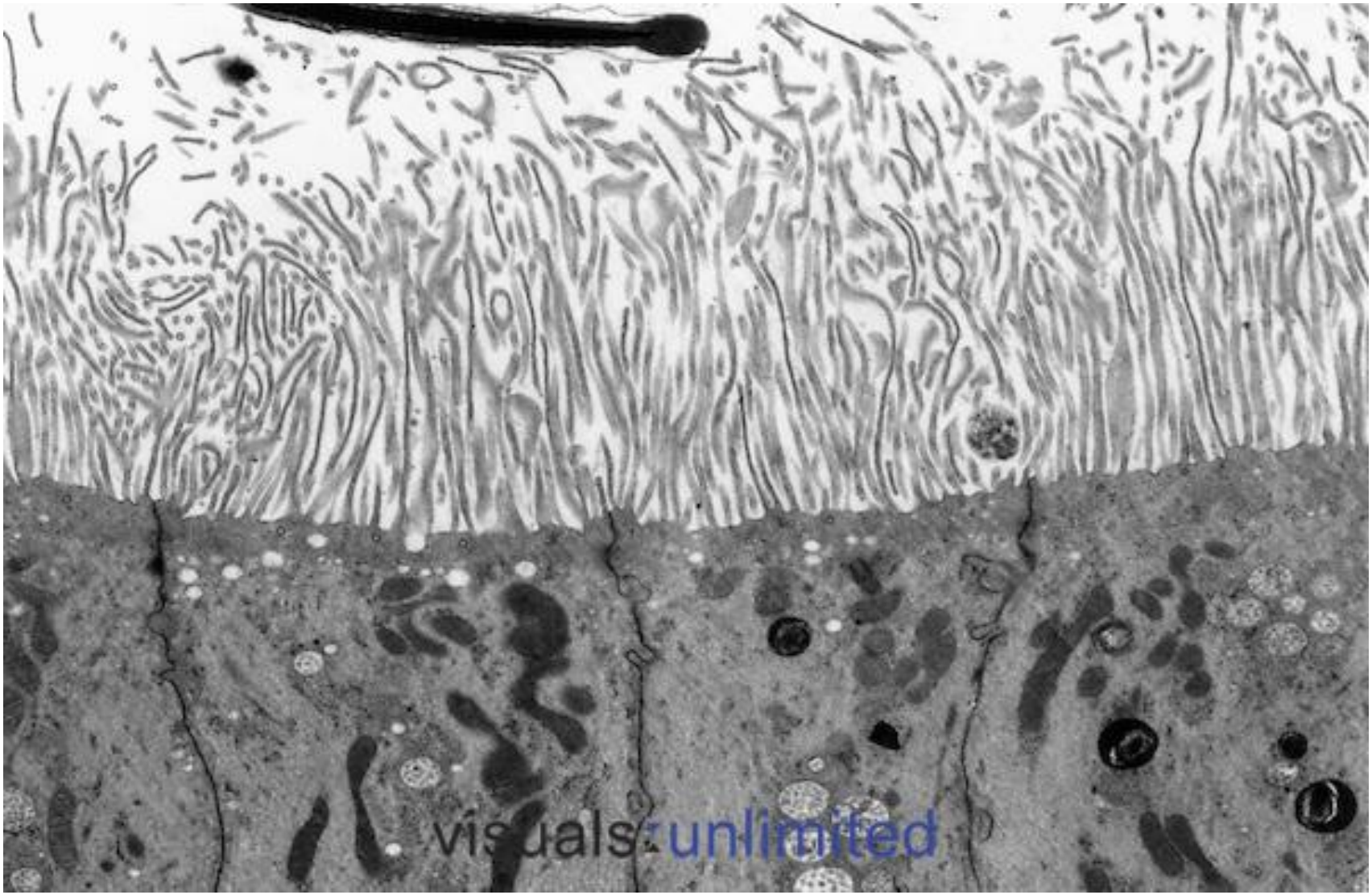
Stereocilia

In epididimus and ductus deferens they have an absorptive function,
In the internal ear they have a sensory function.

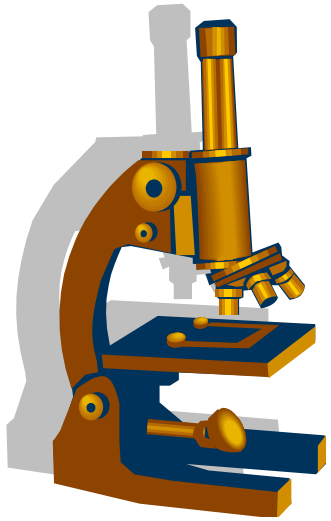
- **Longer than microvilli**
- **non motile**
- **Branched**

Location : Epididymis & ductus deferens





Clinical Application



Fact....

Most of the tumors after the age of 45 are of epithelial origin.

Peptic Ulcer

Villi

❖ **Villi** are finger like structures found in the wall of the intestine

❖increase the **surface area**

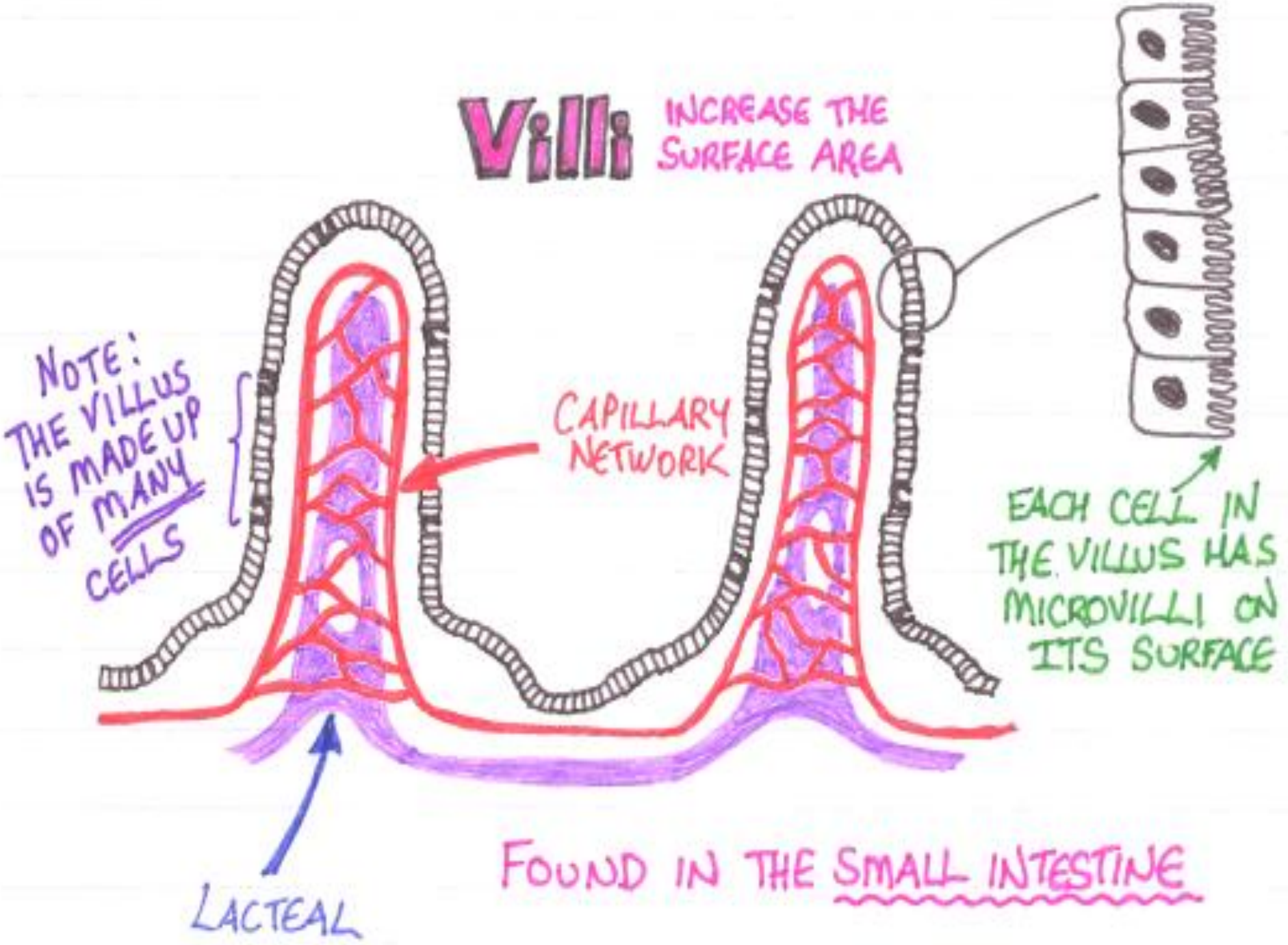
❖filled with **blood vessels** to take away the nutrients to the circulation

❖contain a structure called a **lacteal** which absorbs fats from the intestine for delivery to the blood stream

NOTE: VILLI DO NOT WIGGLE – THEY DO NOT MOVE FOOD THROUGH THE INTESTINE

Villi

INCREASE THE SURFACE AREA



FOUND IN THE SMALL INTESTINE