

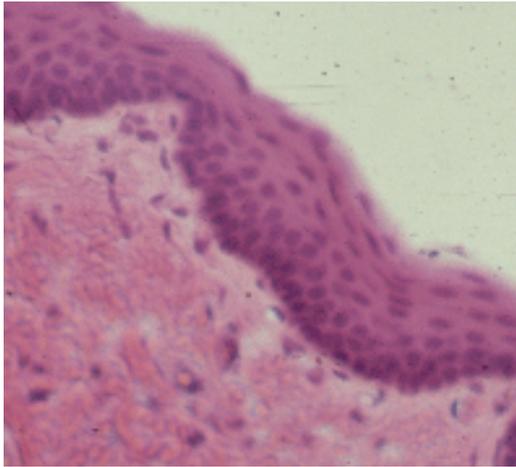
Tissues of adult organism

- ❑ A tissue is defined as a group of cells with their extracellular products, specialized in common direction and set apart for the performance of a common function
- ❑ Cells work together in functionally related groups called **tissues**

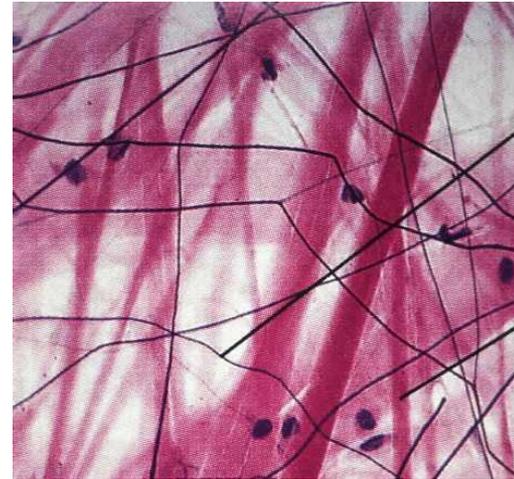
How is this done?

- ❖ Attachments
- ❖ communication
- ❑ About 200 types of specialized cells in adult human body are arranged into **4 main tissues:**
 - Epithelium
 - connective tissues
 - Muscular tissues
 - Nervous tissues

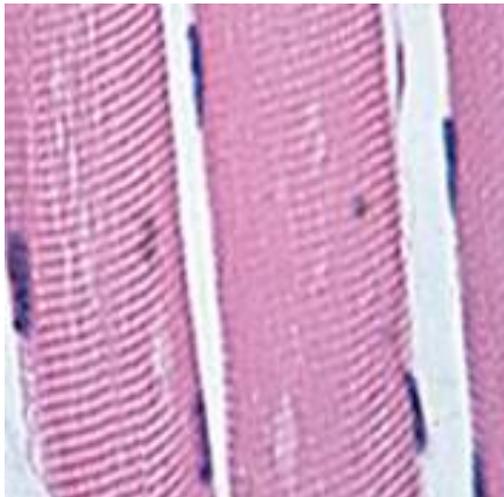
4 Basic Types of Tissues



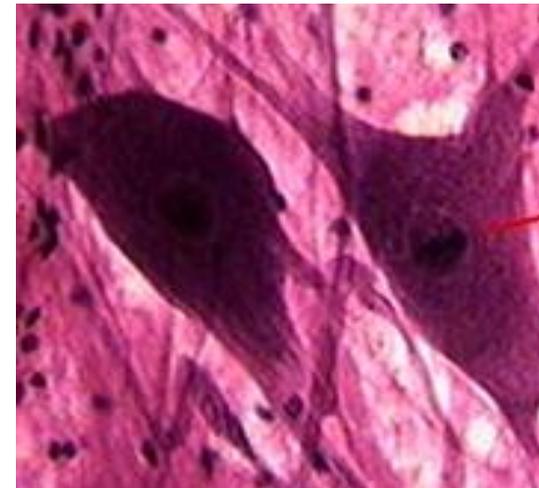
Epithelial tissue



Connective tissue



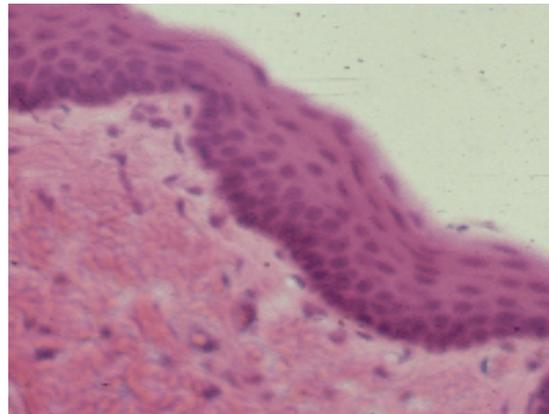
Muscular tissue



Nervous tissue

Epithelial Tissue

- ❑ Epithelium creates a selective barrier between the external environment and the underlying connective tissue
- ❑ The cells predominate, they are closely apposed and adhere to one another by means of special junctions
- ❑ Their basal surface is attached to an underlying basement membrane



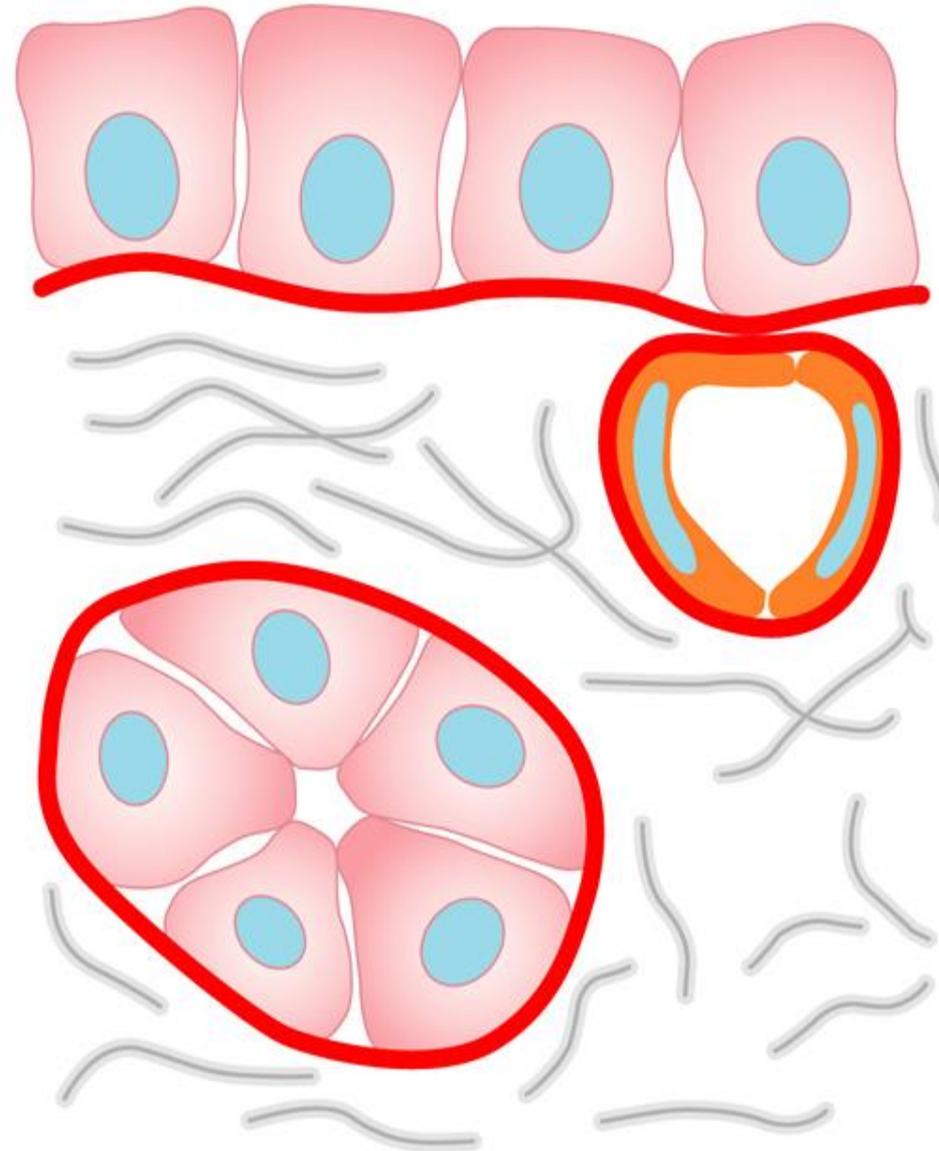
General morphological signs of epithelial tissues

Epithelial tissues are widespread throughout the body. They form the covering of all body surfaces, line body cavities and hollow organs, and are the major tissue in glands.

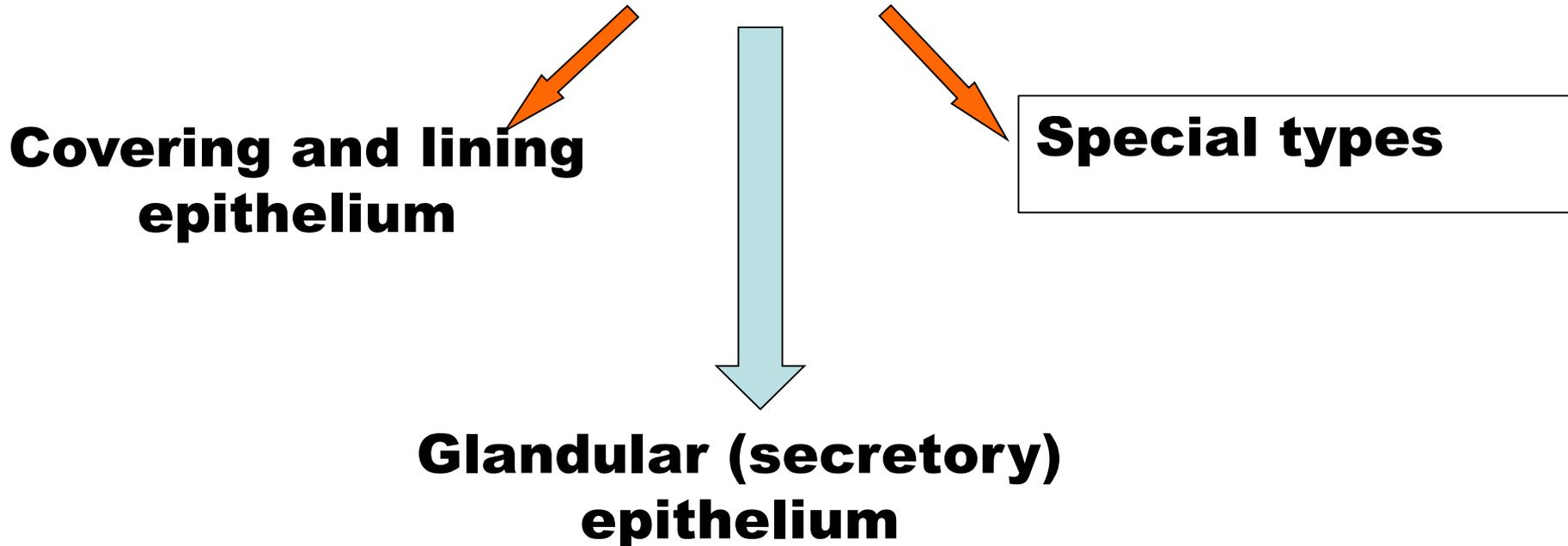
- 1) Cells are closely packed together.
- 2) Intercellular substance is reduced to a minimum.
- 3) Cells rest on the basal lamina.
- 4) Polarity of epitheliocytes (in the epitheliocytes there are apical and basal poles).
- 5) **All epithelia don't have blood vessels.** They derive their nutrition from the blood vessels of underlying connective tissue.
- 6) Availability of intercellular junctions.
- 7) High ability to regeneration.
- 8) Derived from three embryonic layers

General features of epithelium

- Derived from **3** embryonic layers .
- Closely aggregated cells
- Very little intercellular substances
- Regular shaped cells bind together by **junctional complexes**
- Basal lamina (**basement membrane**)
- Avascular
- Rich in nerve supply
- High renewal rate



Classification of epithelium



- Epithelium covers body surfaces, lines body cavities, and constistutes glands, therefore it is subdivided into lining , glandular and special types

Classification of covering = lining epithelium



Number of layers

□ Simple

One layer of cells

□ Stratified

More than one layer

Shape of cells

➤ Squamous

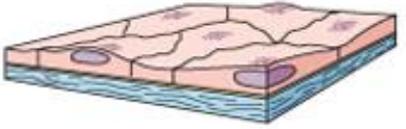
➤ Cuboidal

➤ Columnar

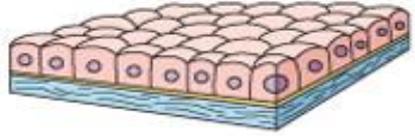
➤ Pseudostratified

Classification of lining epithelia

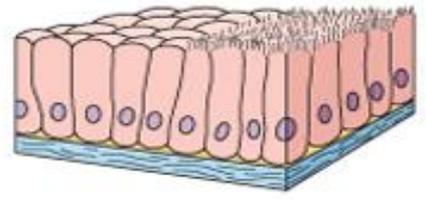
Simple



Squamous

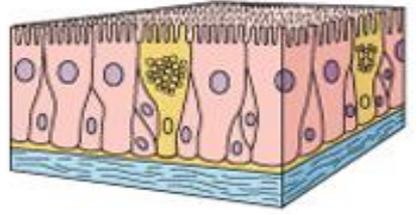


Cuboidal



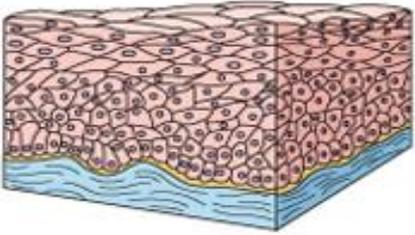
Columnar

Pseudostratified

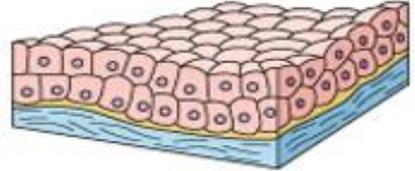


Pseudostratified columnar

Stratified

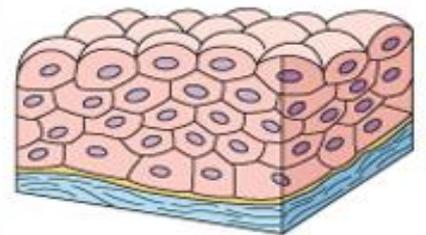


Squamous nonkeratinized

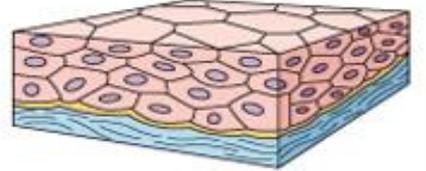


Cuboidal

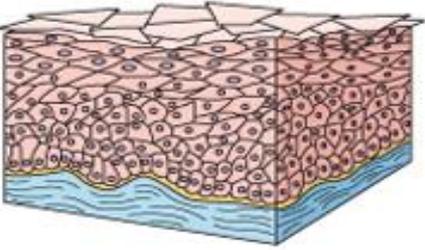
Transitional



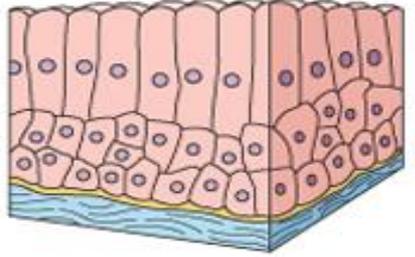
Transitional (relaxed)



Transitional (distended)



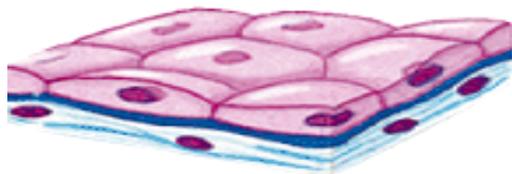
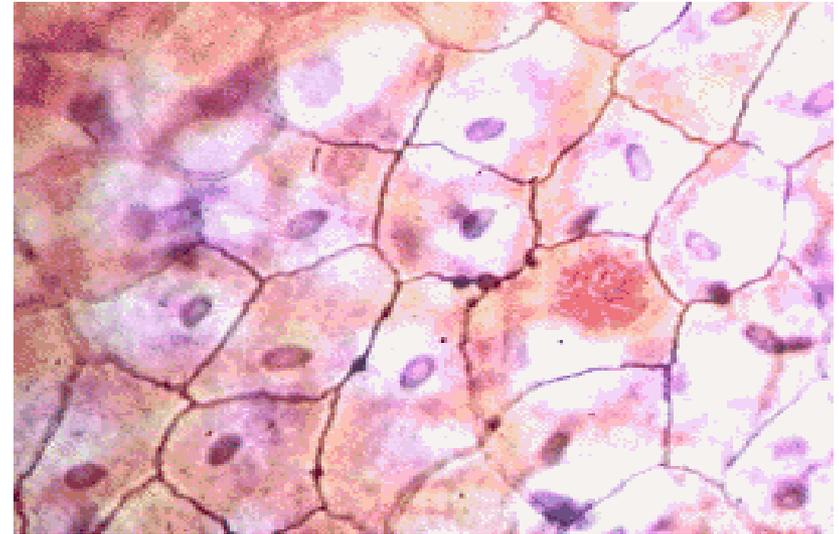
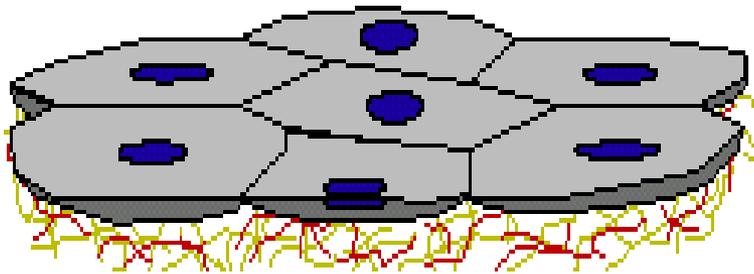
Keratinized



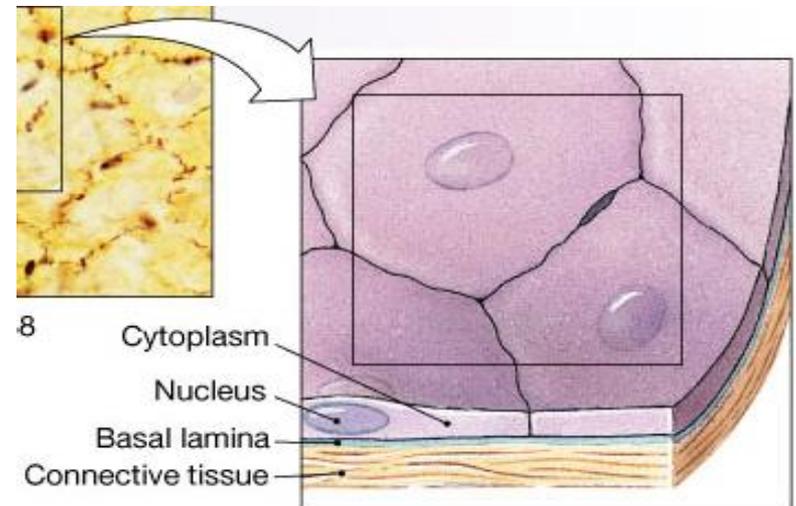
Columnar

1- Simple Squamous Epithelium

LM:



Simple squamous



8

Cytoplasm

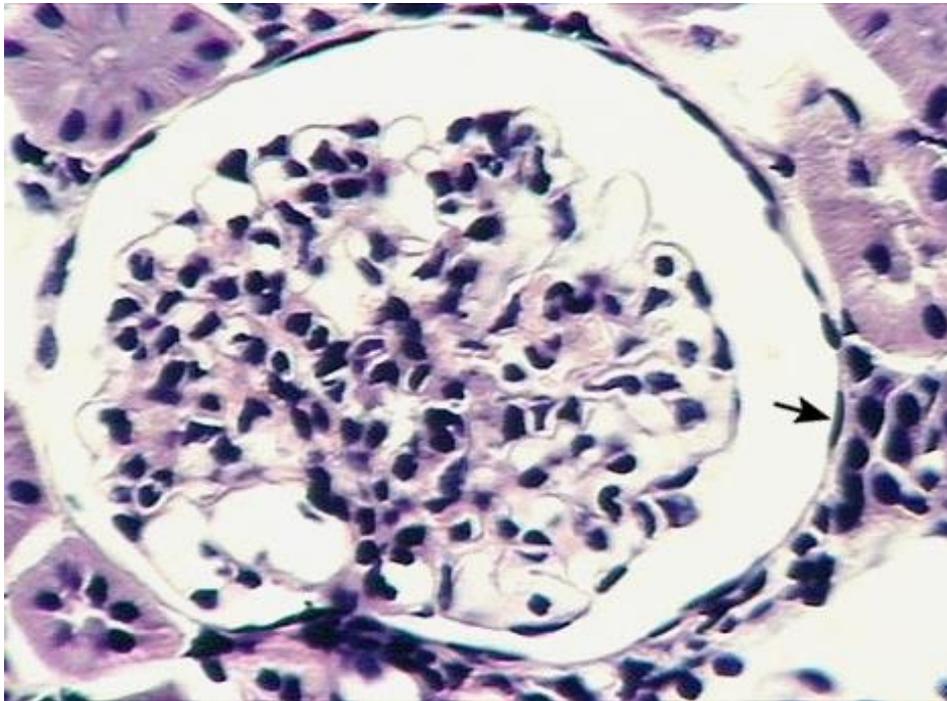
Nucleus

Basal lamina

Connective tissue

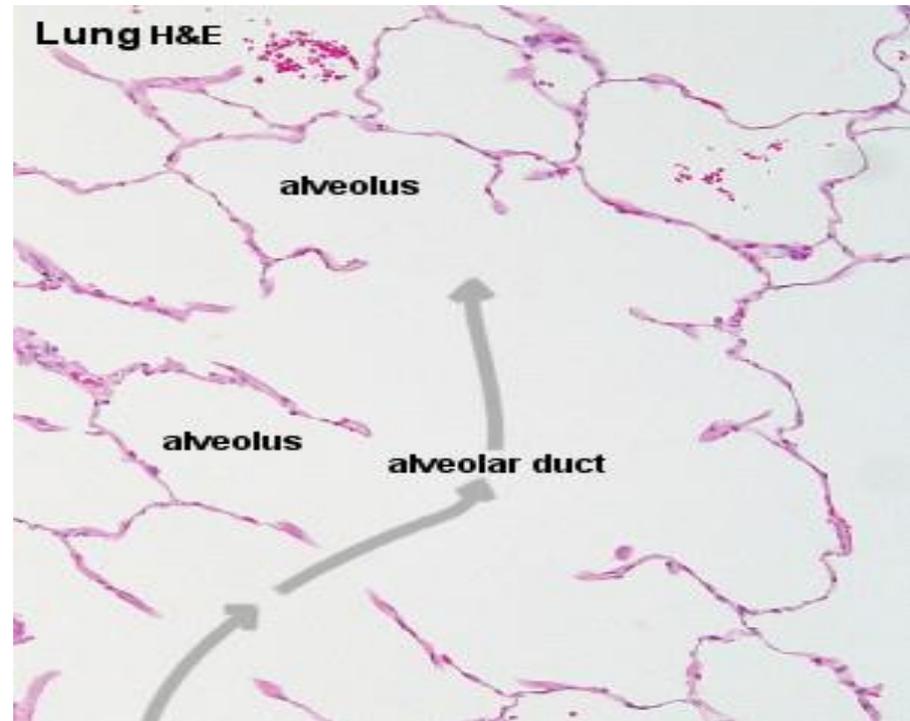
1- Simple Squamous Epithelium

(Bowman's capsule- kidney)



Function: Filtration of blood

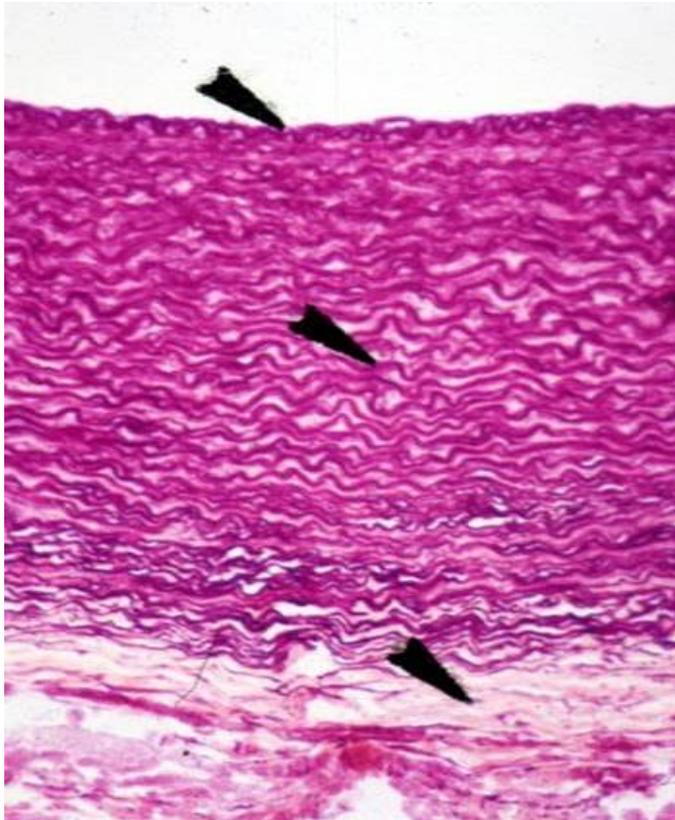
(Lung alveoli)



Function: gas exchange

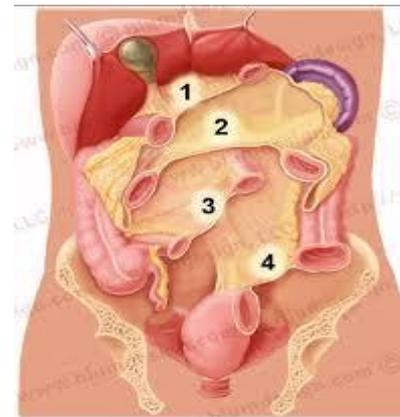
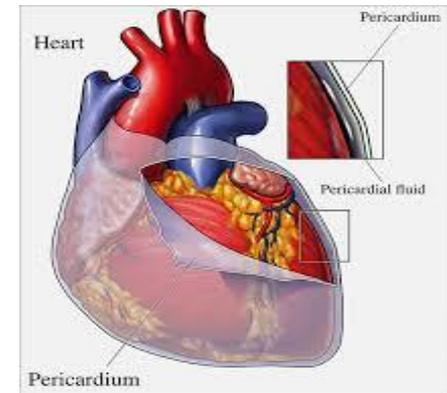
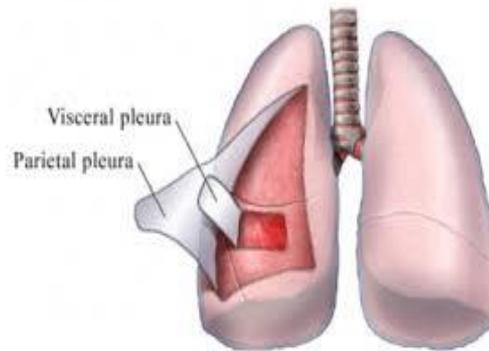
Simple Squamous Epithelium

Endothelium:
of the blood vessels

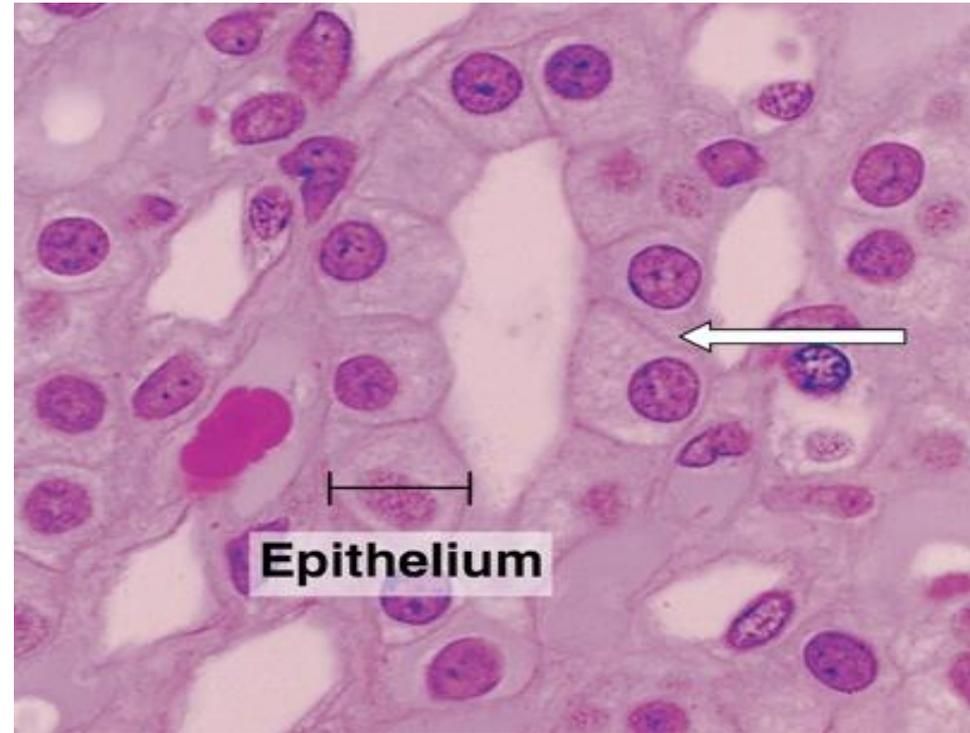
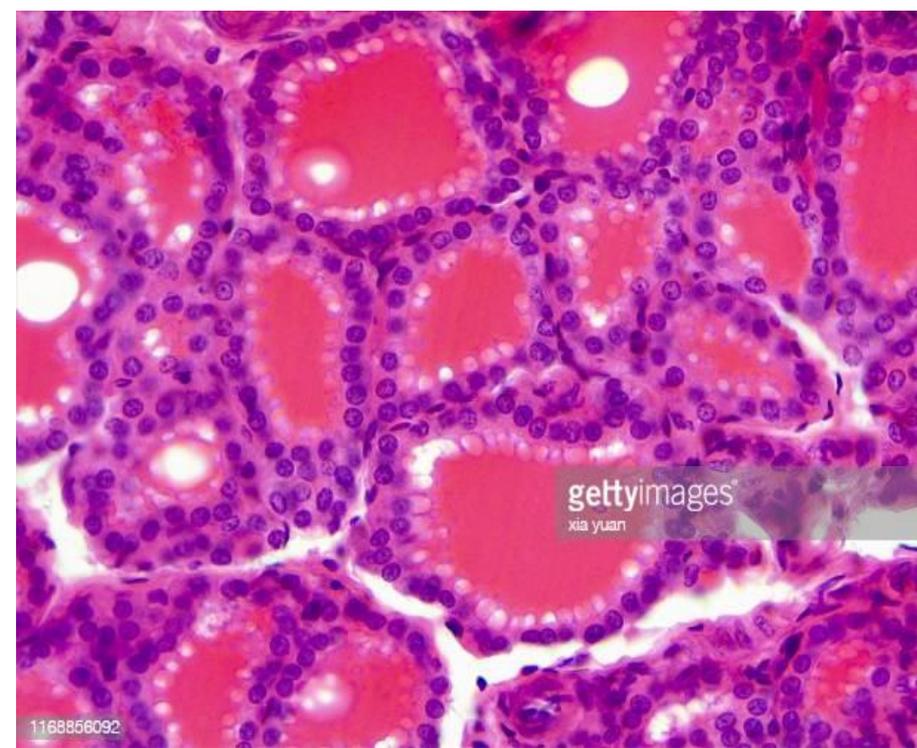


Methothelium :

Pericardium, pleura, peritoneum
Function : smooth surface

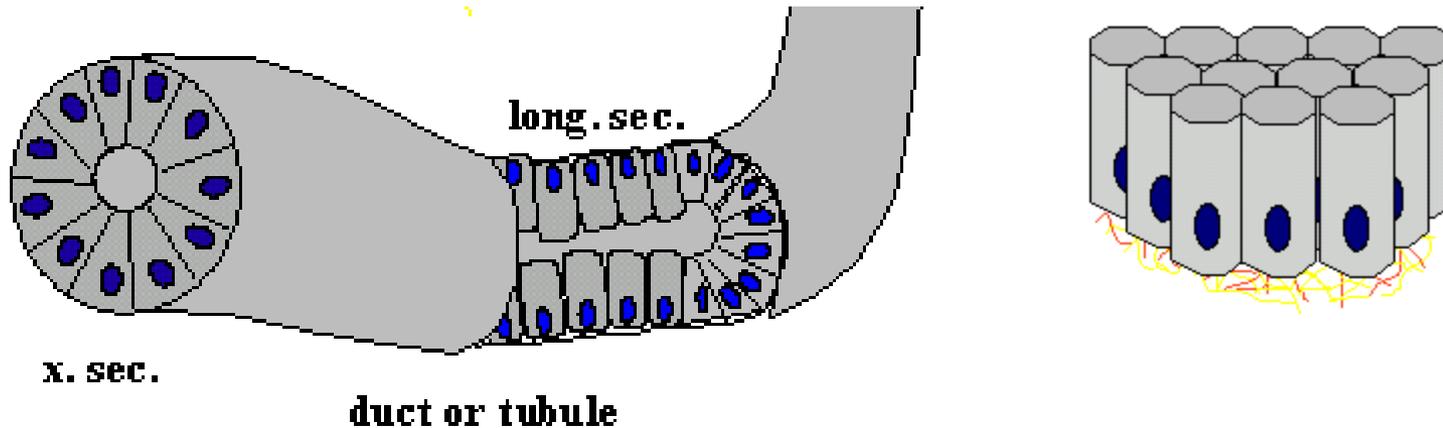


2- Simple cuboidal Epithelium



Site: Thyroid gland : secretion
kidney tubules :ion exchange

3- Simple Columnar Epithelium



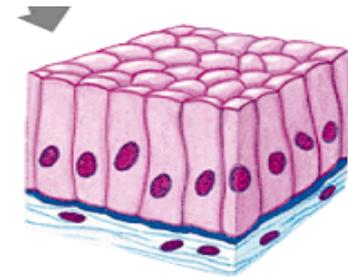
Types:

a. Non ciliated

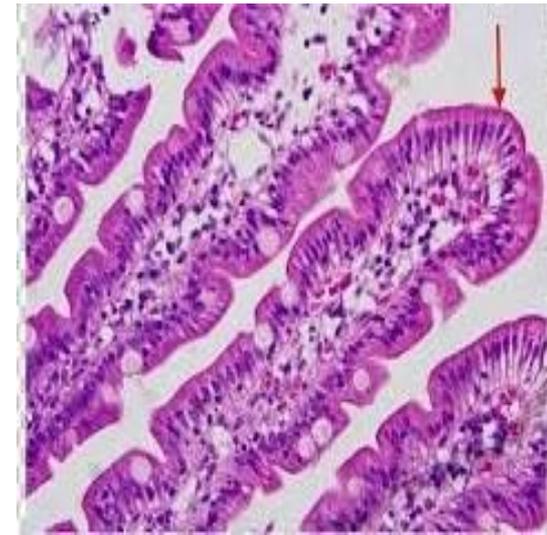
b. Ciliated

Simple columnar epithelium (non ciliated)

LM



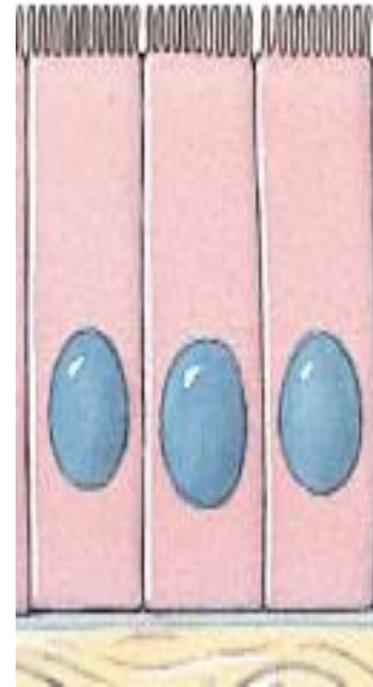
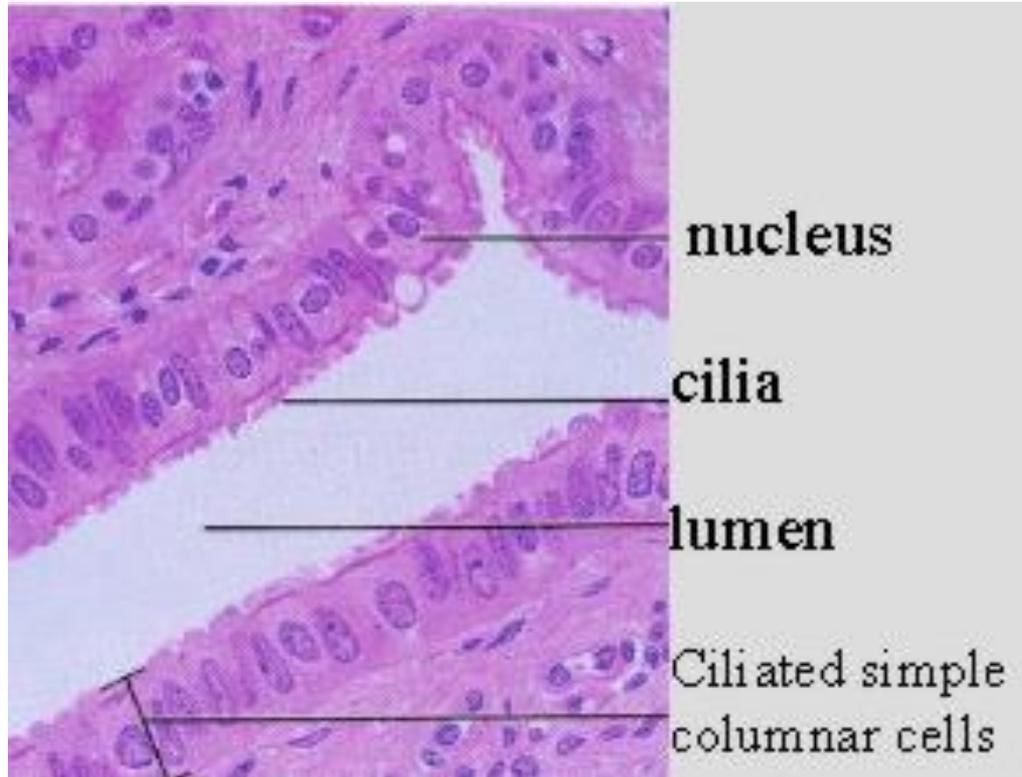
Simple columnar



Sites: ducts of glands: secretion
digestive tract : absorption

(

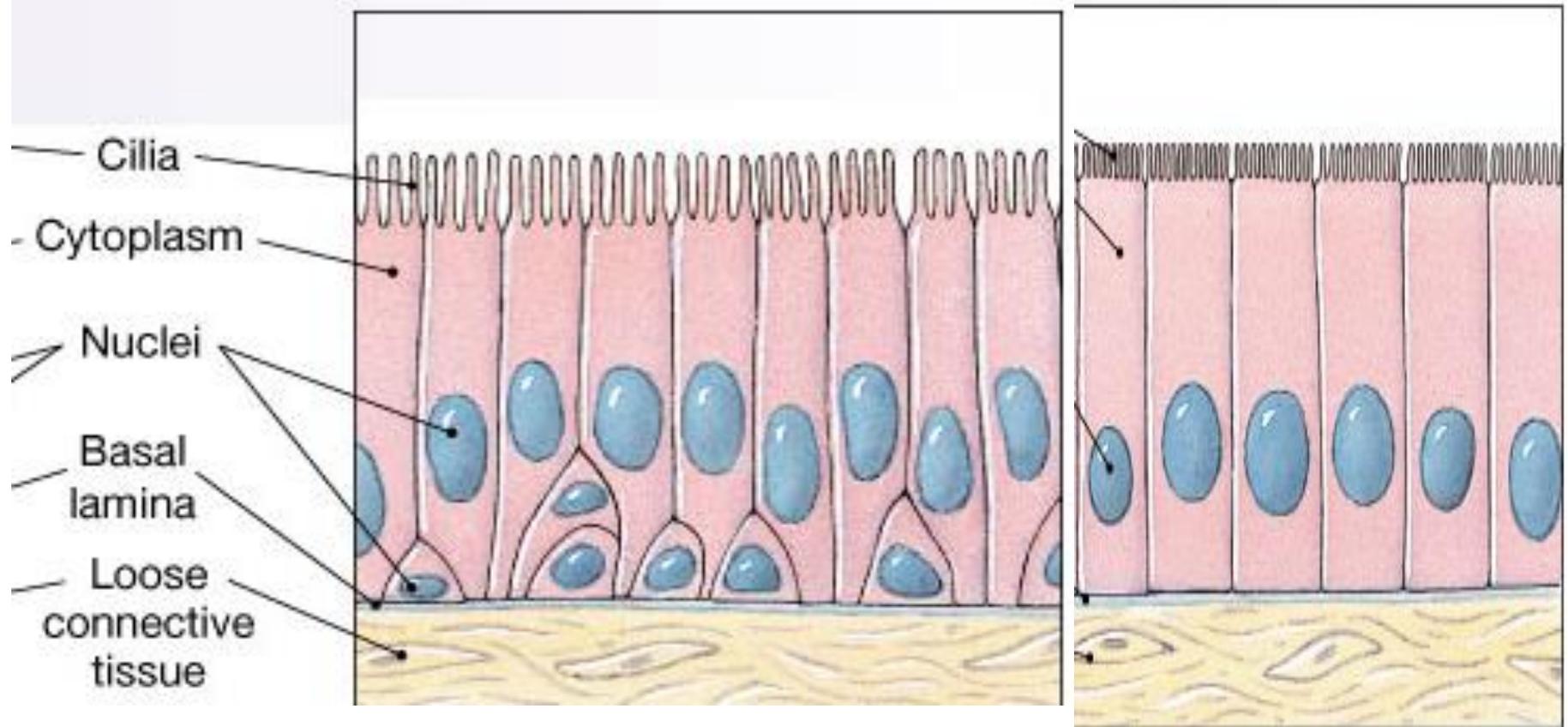
Simple columnar epithelium ciliated



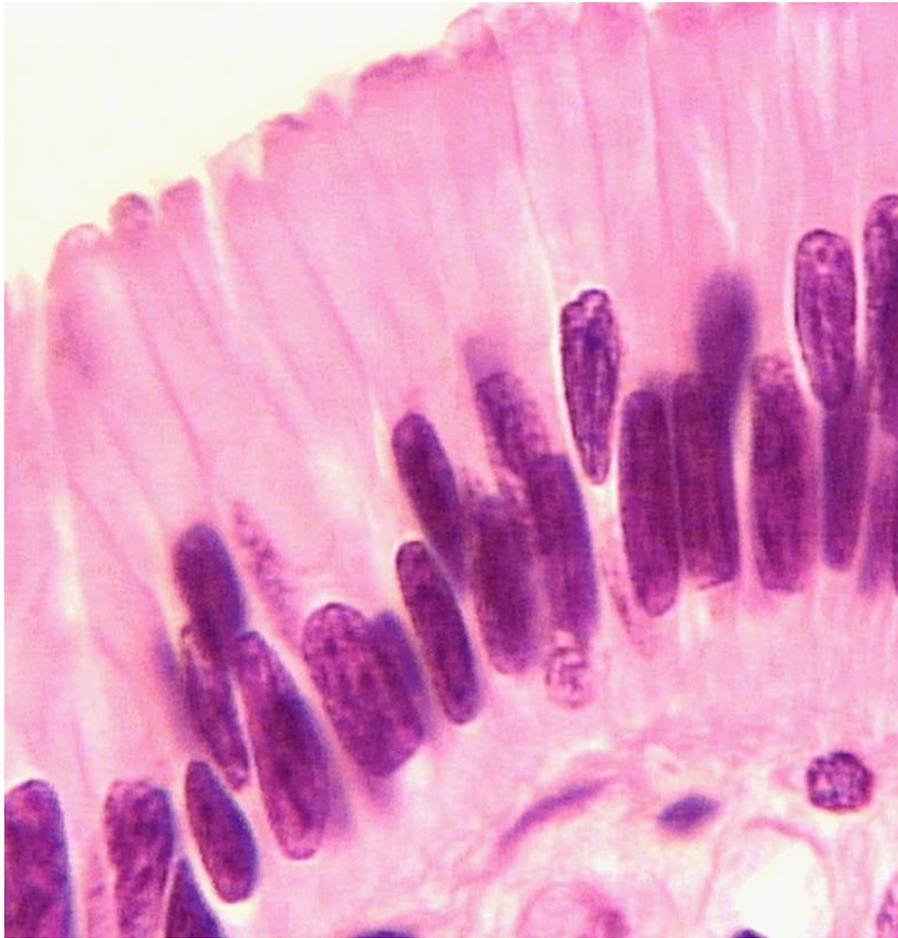
Sites: uterus, oviduct & bronchiole of the lung
(movement of luminal contents)

4- Pseudostratified columnar epithelium

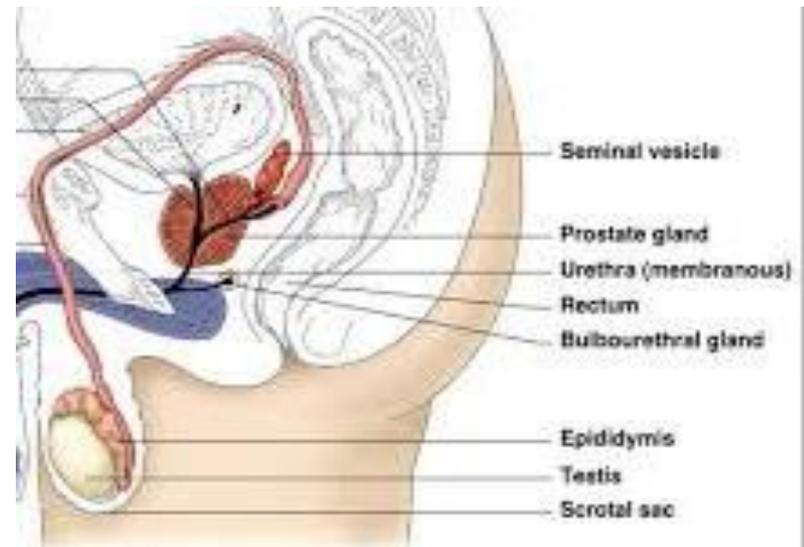
False



Pseudostratified columnar epithelium non ciliated



- **Sites:** Male genital tract – large ducts of glands: (secretion)



Pseudostratified columnar epithelium ciliated

Sites: Nose- Trachea

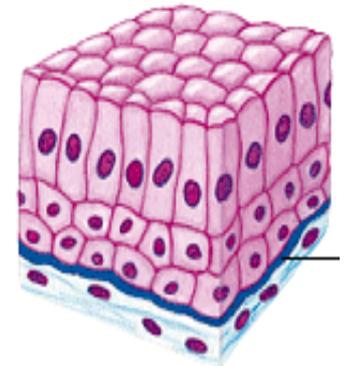
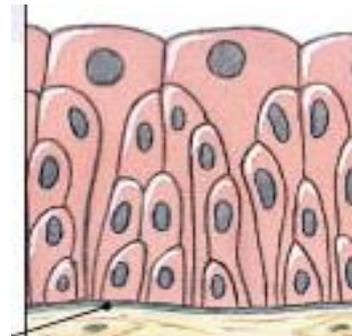
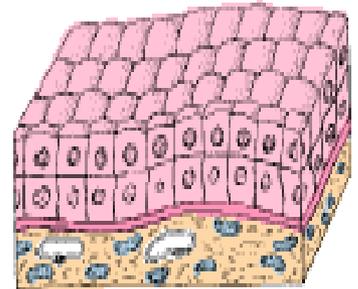
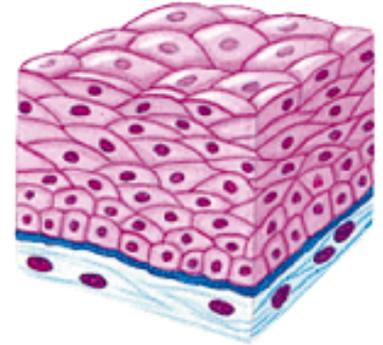


Type	Site	Function
Simple Squamous	<ul style="list-style-type: none"> • Bowman's capsule- kidney • Lung alveoli 	Filteration
Simple cuboidal	<ul style="list-style-type: none"> ❖ Thyroid follicles ❖ Kidney tubules 	<ul style="list-style-type: none"> ❖ Secretion ❖ Ions exchange
Simple Columnar non ciliated	<ul style="list-style-type: none"> ➤ Digestive tube ➤ Ducts of the glands 	<ul style="list-style-type: none"> ➤ Absorption ➤ Secretion
Simple Columnar ciliated	<ul style="list-style-type: none"> ▪ uterus, oviduct ▪ bronchiole of the lung 	<ul style="list-style-type: none"> ▪ Movement of luminal contents
Pseudostratified columnar ciliated	<ul style="list-style-type: none"> ✓ Nose- Trachea 	Movement of luminal contents
Pseudostratified columnar non ciliated	<ul style="list-style-type: none"> ☐ Male genital tract ☐ large ducts of glands 	Secretion

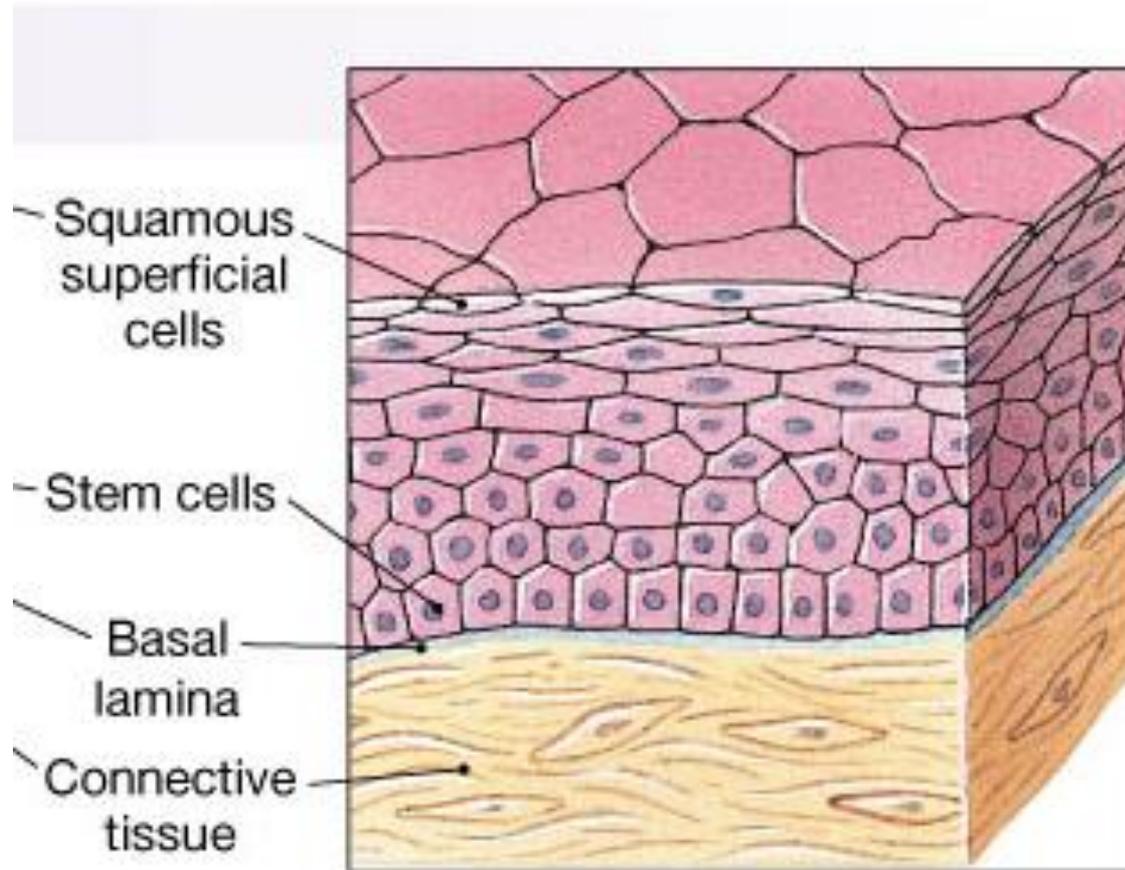
2- Stratified Epithelium

What cell is on the top layer?

- Classification according to shape of most superficial layer
- Stratified sqamous epithelium
- Stratified cuboidal epithelium
- Stratified columnar epithelium
- Transitional epithelium

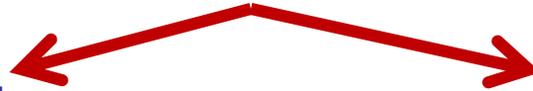


Stratified Squamous Epithelium

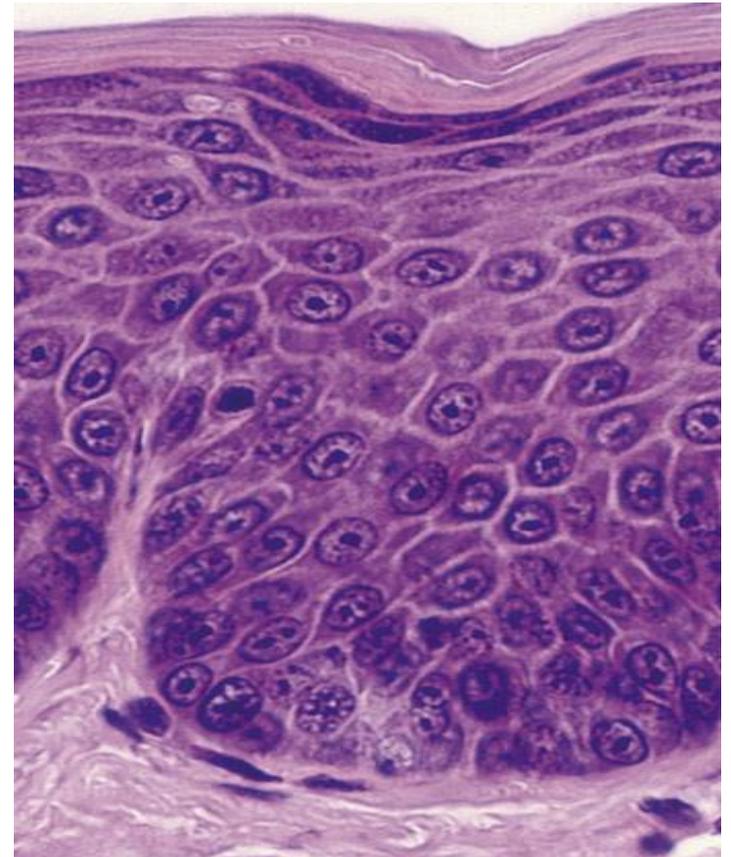
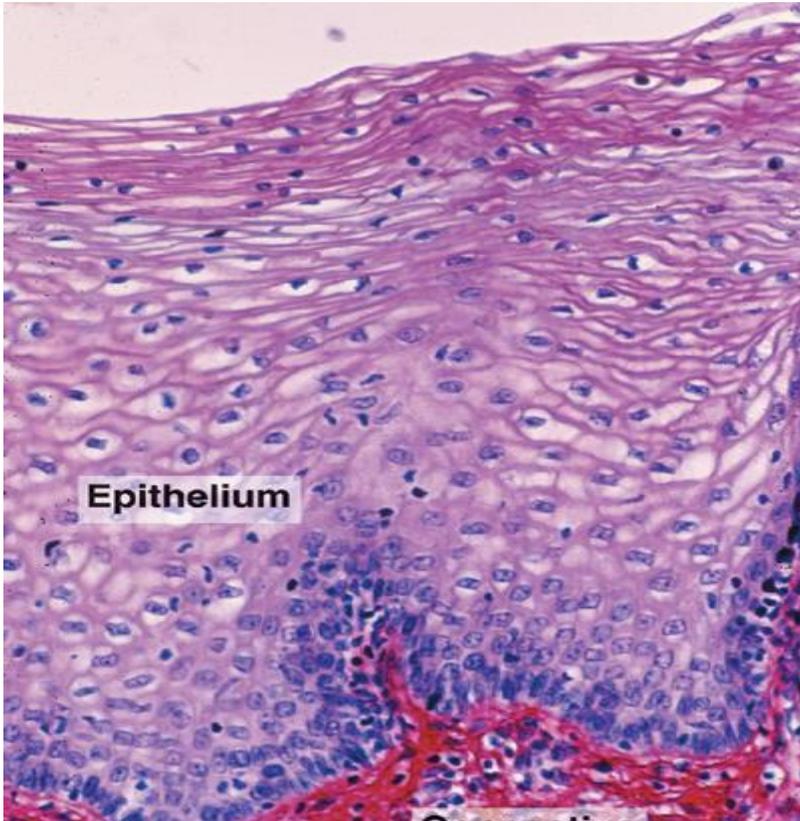


Stratified squamous epithelium

Non Keratinized



Keratinized

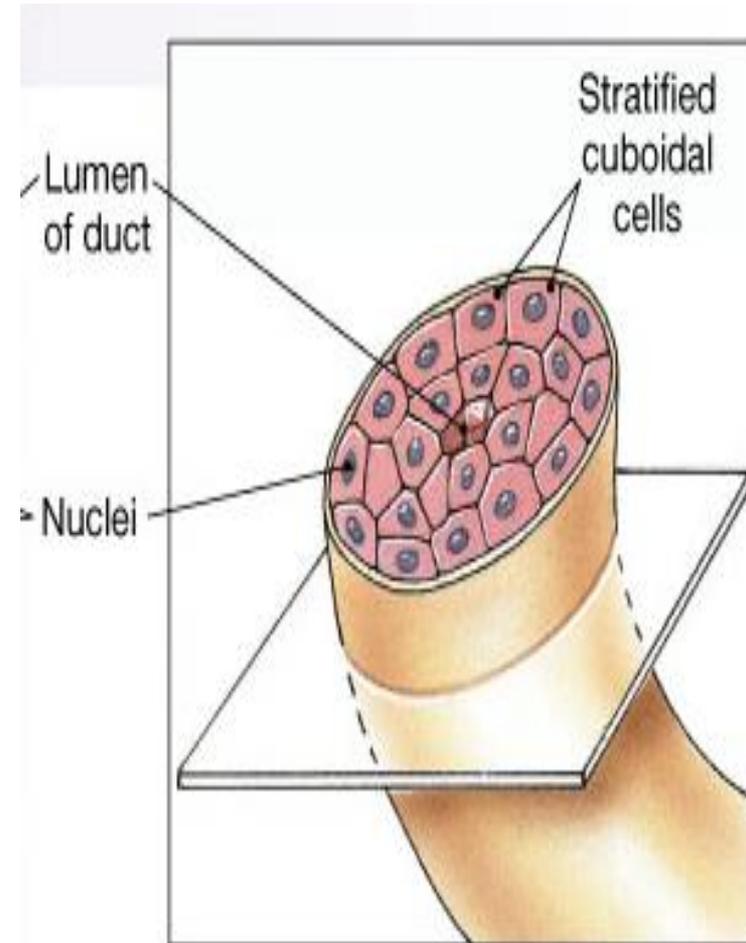
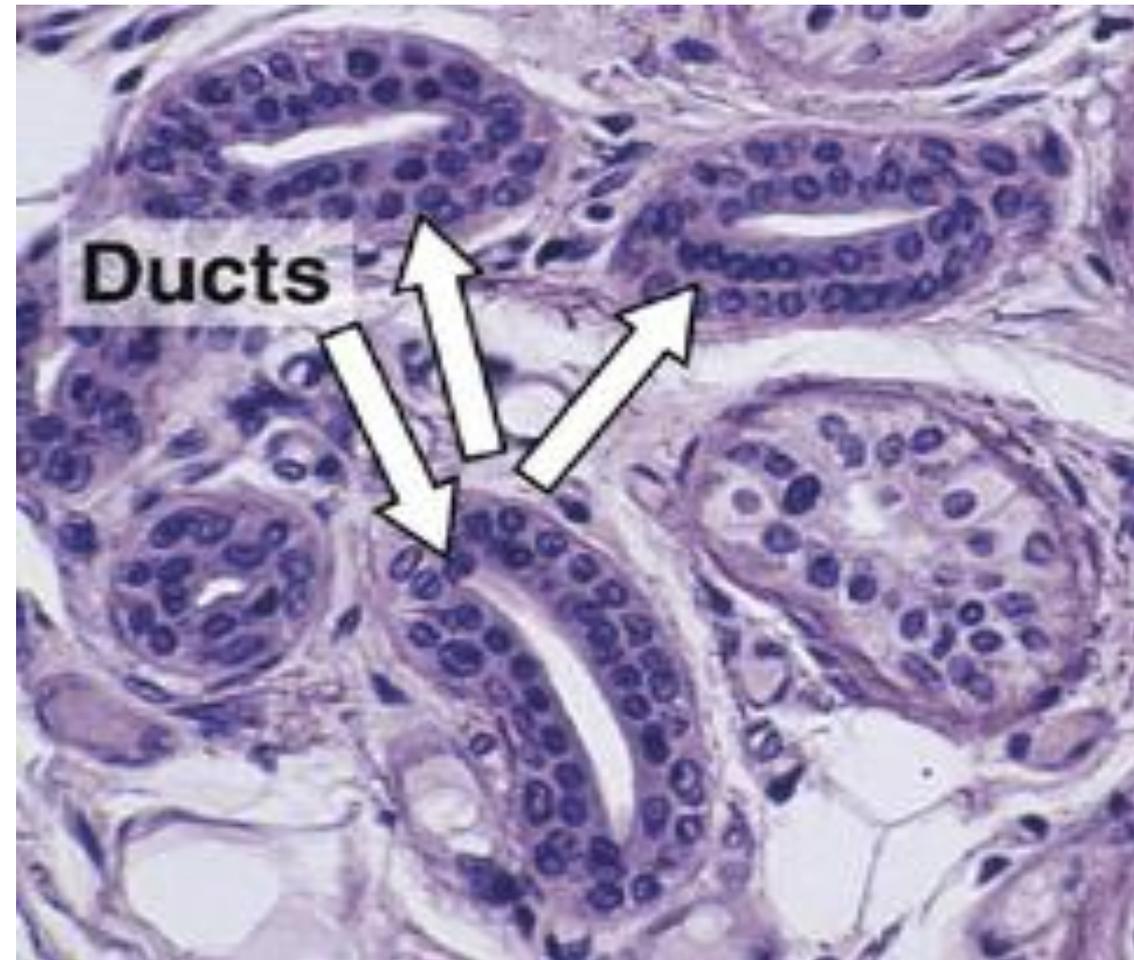


Oesophagus- vagina
(Physical protection)

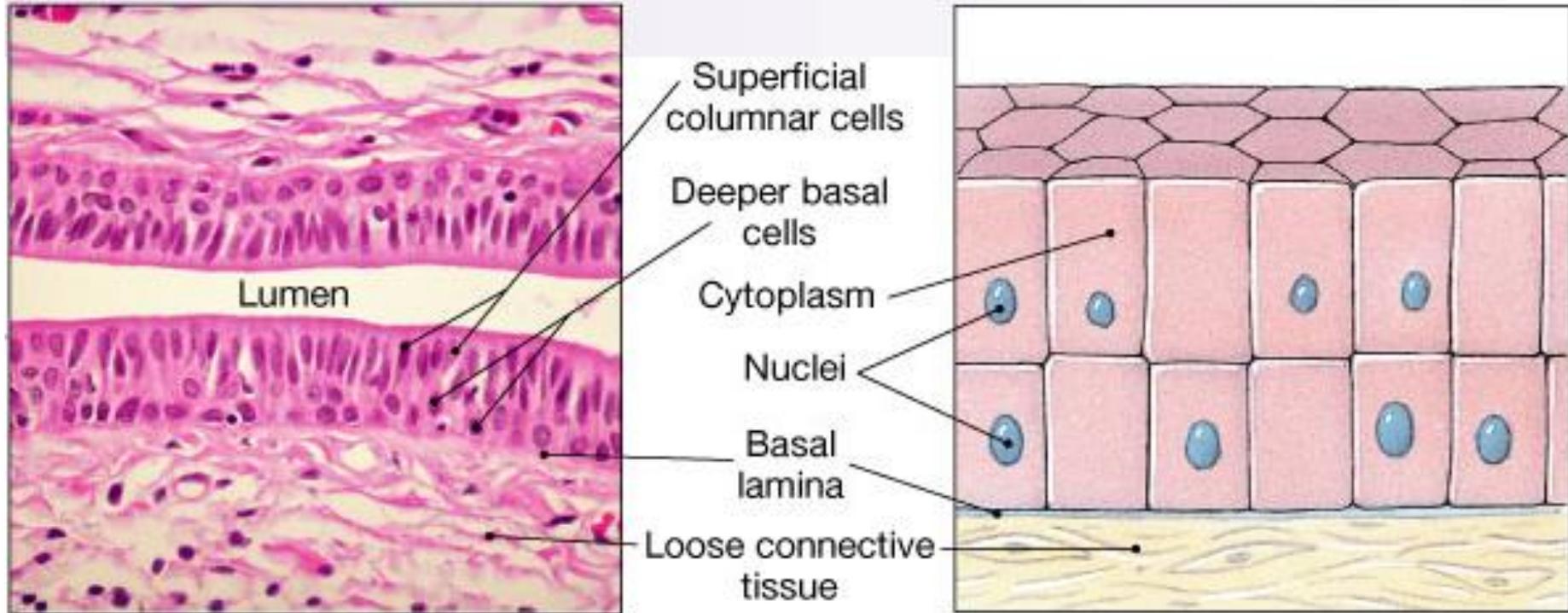
skin

Stratified Cuboidal Epithelium

(Ducts of sweat glands: secretion) (Rare)



Stratified Columnar Epithelium (Rare)

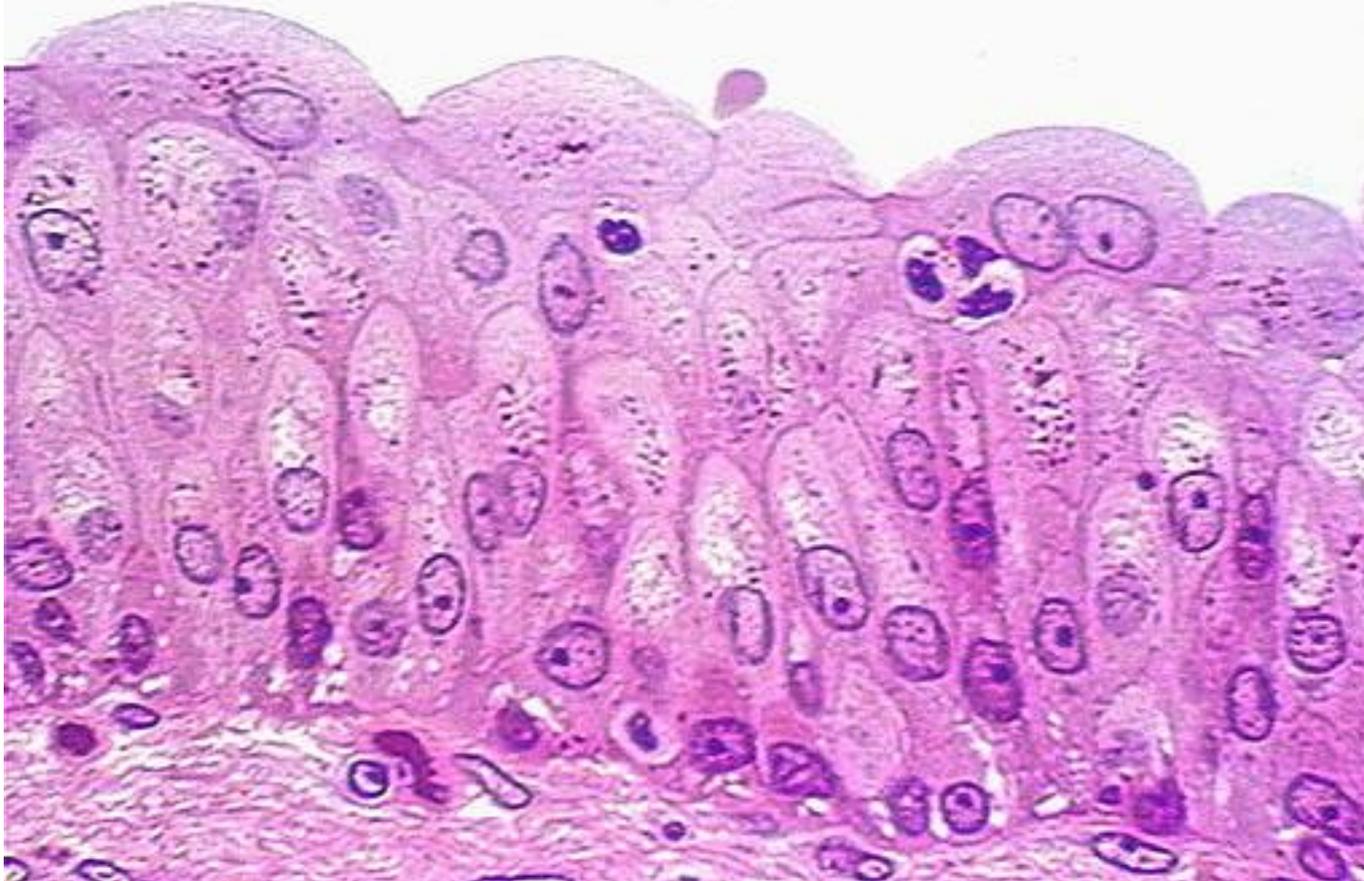


- ciliated: penile urethra

- Non ciliated: conjunctival fornix

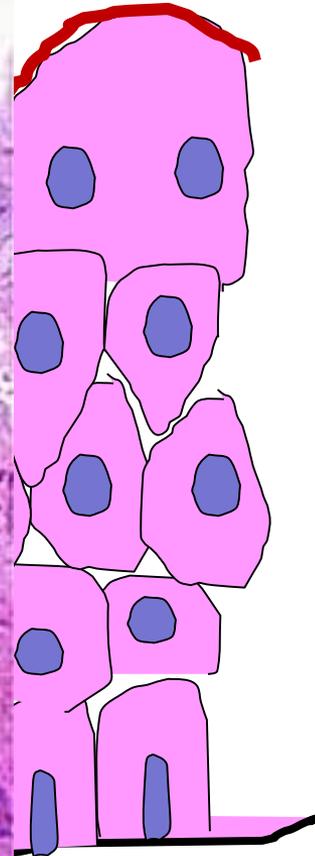
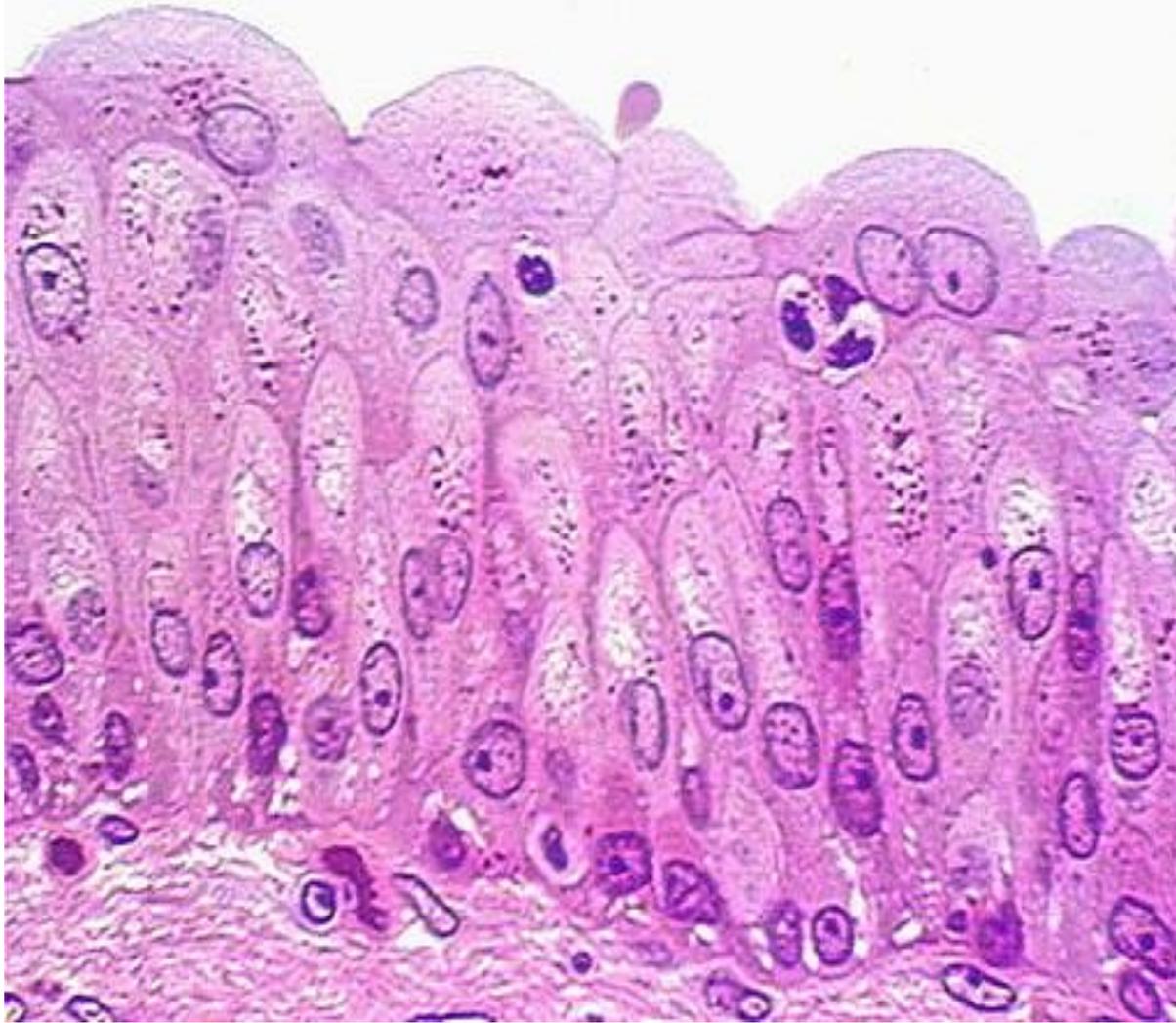
(protection)

Transitional epithelium



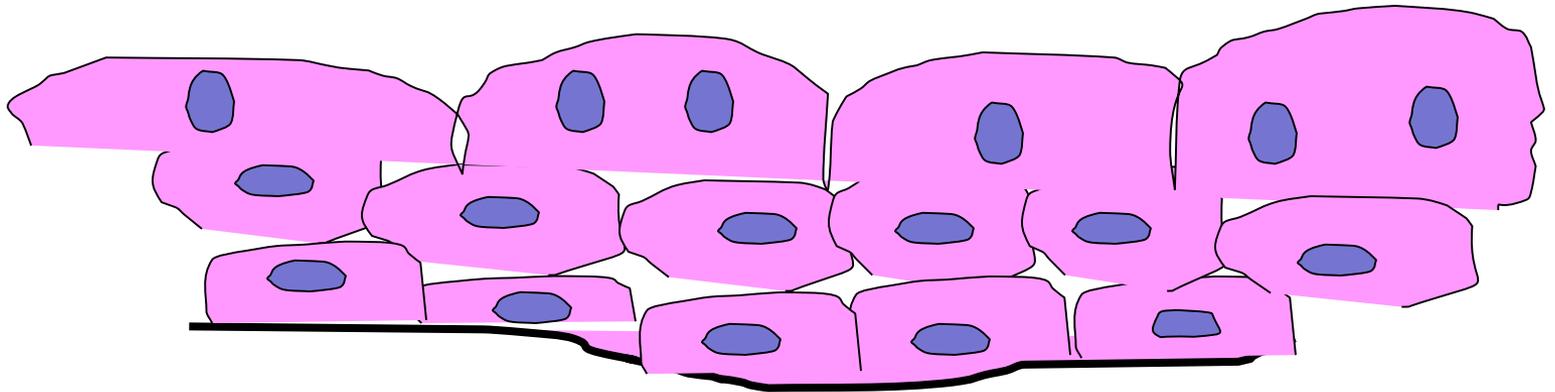
(urinary bladder - empty)

Transitional Epithelium

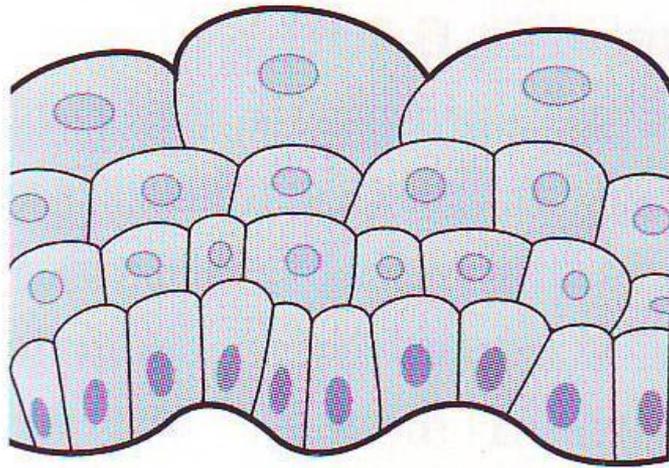


Transitional Epithelium

Full urinary bladder

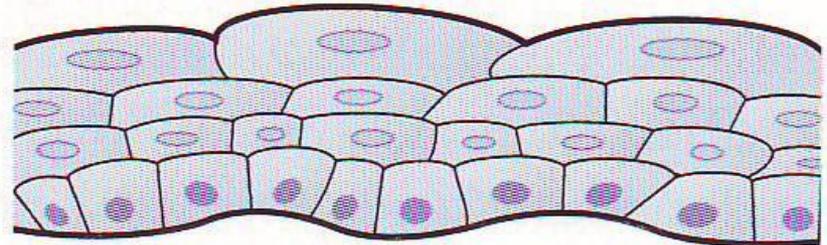


Transitional epithelium



A

Relaxed



B

Stretched

Transitional epithelium: A. Relaxed. B. Stretched.

Transitional epithelium

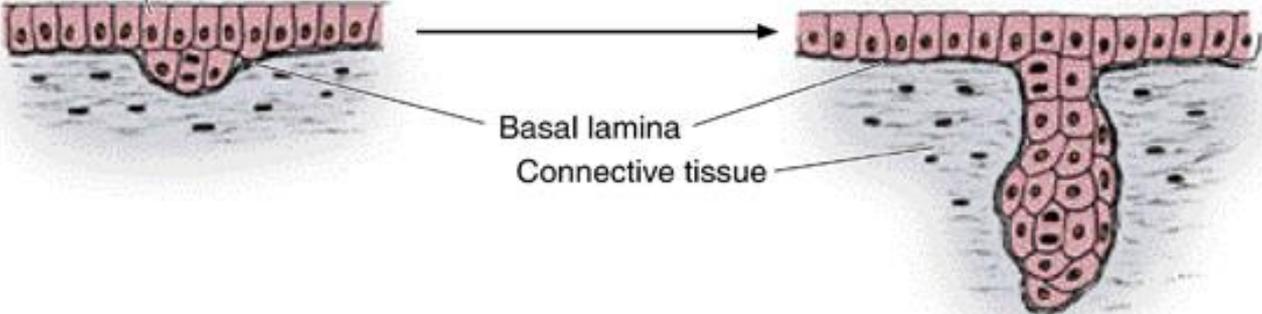
Adaptation of Transitional epithelium to its function:

- **Thin corrugated basement membrane**
- **Abundant mucoïd intercellular substance to allow gliding of cells on each other.**
- **Cuticular border at the free surface.**

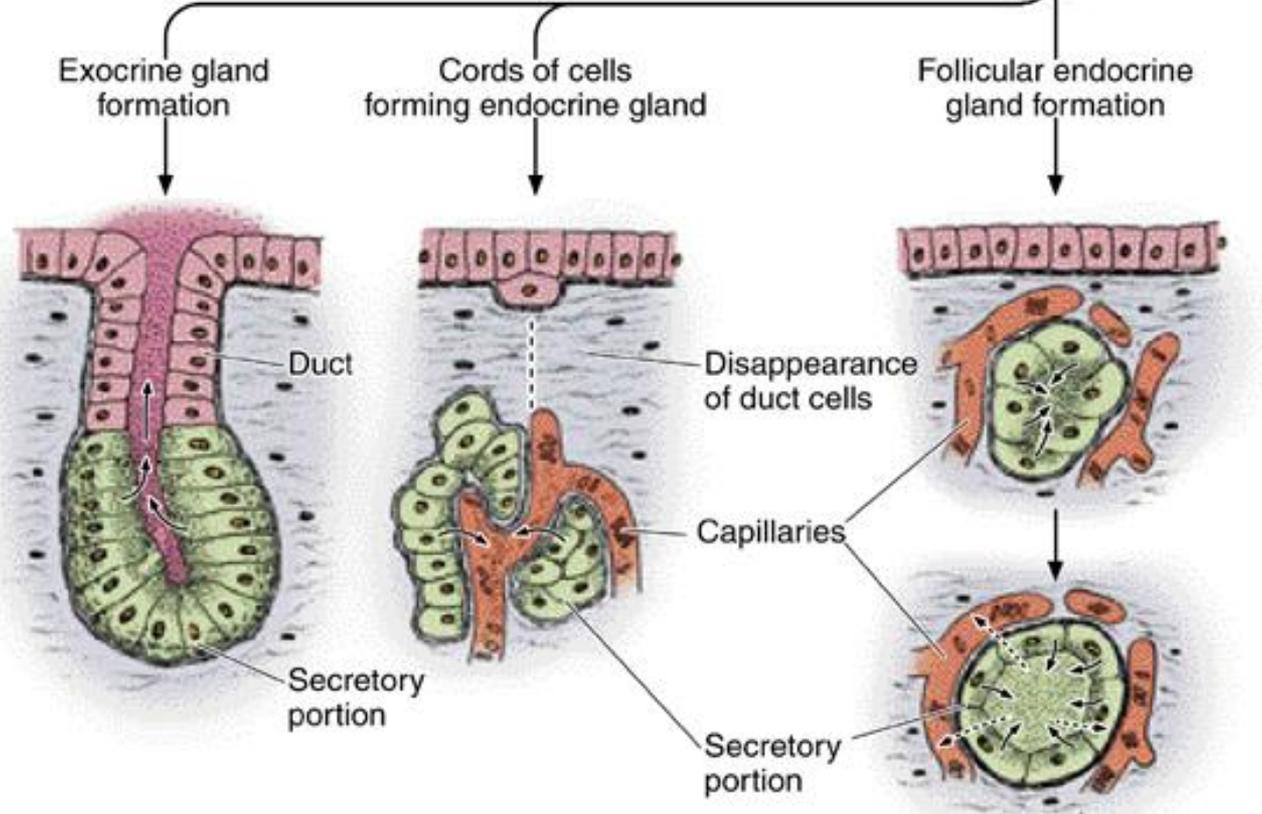
Type of epithelium	Site	Function
Stratified squamous Non Keratinized	<input type="checkbox"/> Oesophagus- vagina	Physical protection
Stratified squamous Keratinized	<input type="checkbox"/> skin	Physical protection
Stratified cuboidal	<input type="checkbox"/> Ducts of sweat glands	secretion (rare)
Stratified Columnar	<input type="checkbox"/> - ciliated: penile urethra <input type="checkbox"/> - Non ciliated: conjunctival fornix	Protection (rare)
Transitional	<input type="checkbox"/> urinary bladder	protection

Glandular Epithelium

Origin



differentiation

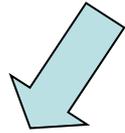


Types of glandular epithelium

It is classified according to:

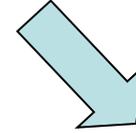
- 1- Number of cells**
- 2- Presence or absence of a duct system**
- 3- Mode of secretion (mechanism)**
- 4- Nature of secretion**
- 5- Shape of the secretory portion**
- 6- Branching of duct**

Number of cells



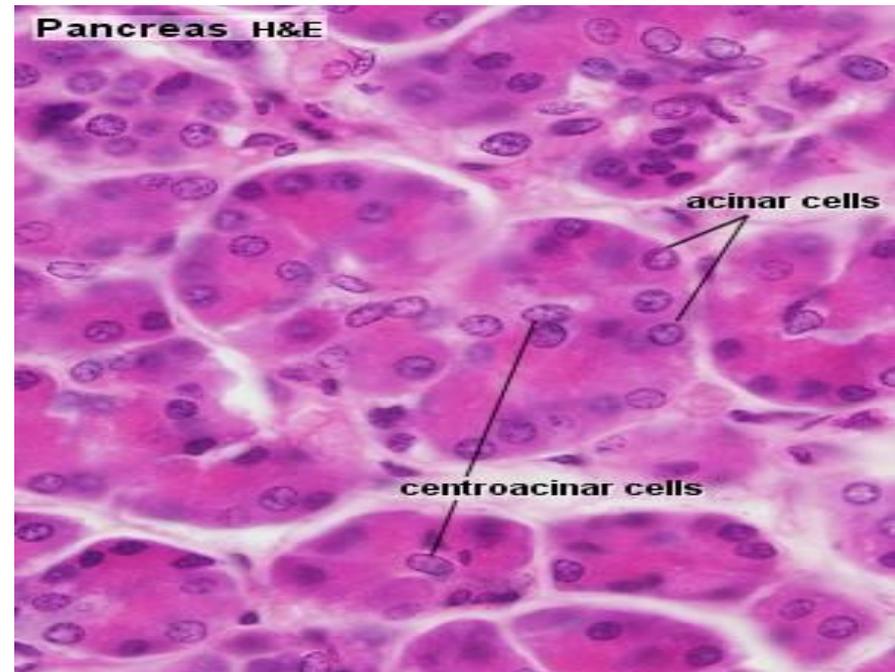
Unicellular

(goblet cell)



Multicellular

**(Most of the glands
e.g. Salivary glands)**

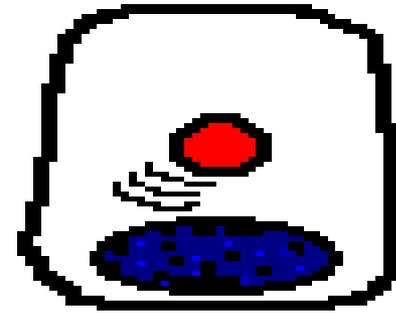


Mechanism (Mode) of Glandular secretions

☐ Merocrine glands

The secretion released through exocytosis e.g. **Pancreas**

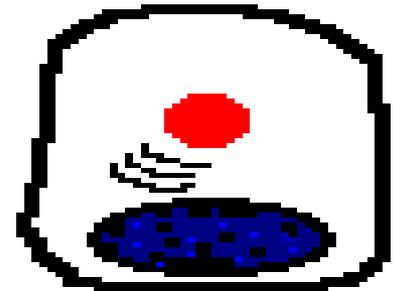
merocrine



☐ Apocrine glands

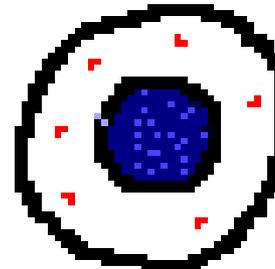
The secretion involves the loss of both product and apical cytoplasm e. g. **Mammary glands**

apocrine



☐ . Holocrine gland

The secretion destroys the cell e.g. **Sebaceous glands**



Presence of a duct system

Exocrine **Endocrine** **mixed**

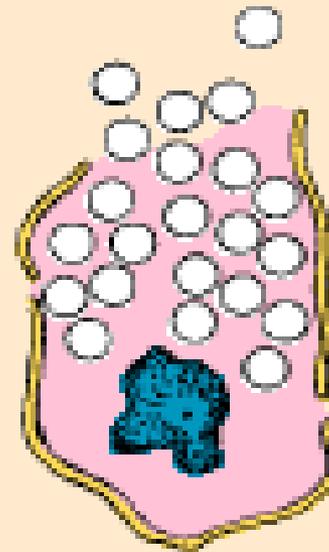
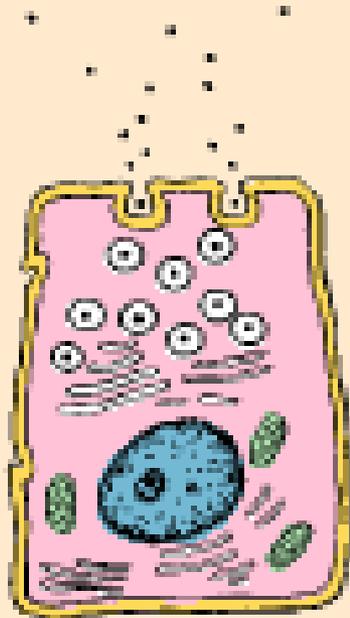
Exocrine Glands

Endocrine Glands

Merocrine

Apocrine

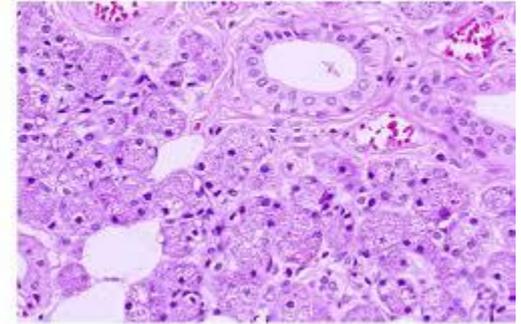
Holocrine



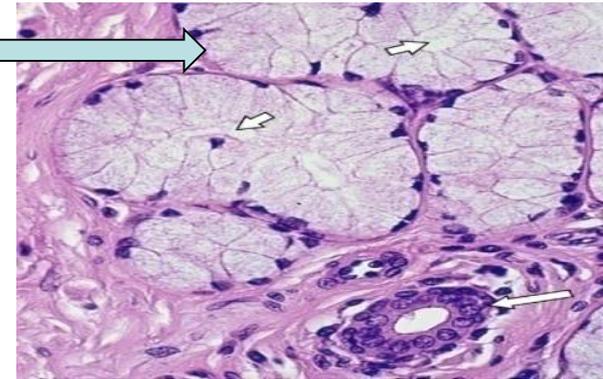
Nature of Glandular secretions

- **Serous glands:** parotid gland

Parotid Gland



- **Mucous glands:** sublingual gland

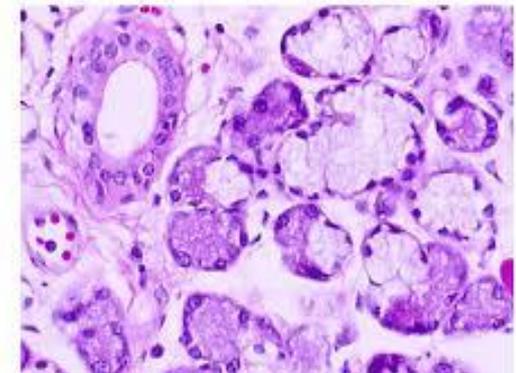


- **Mixed glands:** submandibular gland

- **Glands with special secretion:**

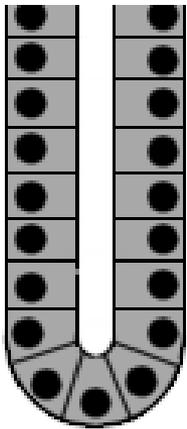
- **sebaceous gland (oily secretion)**
- **lacrimal gland watery secretion**
- **Mammary gland : Milk secretion**
- **Glands in the ear : wax**

Submandibular Gland

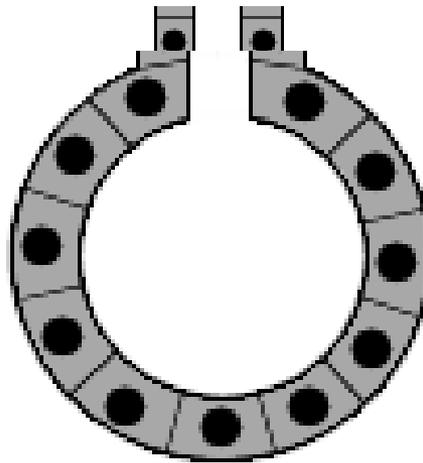


shape of secretory portion

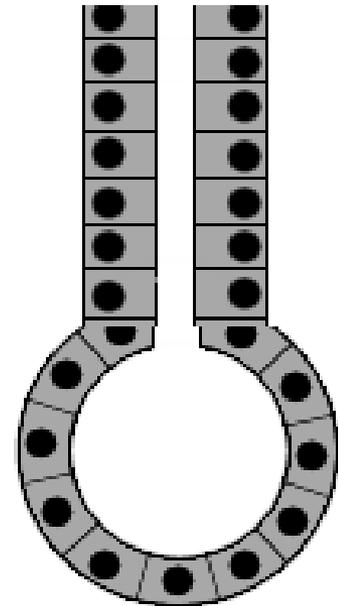
tubular



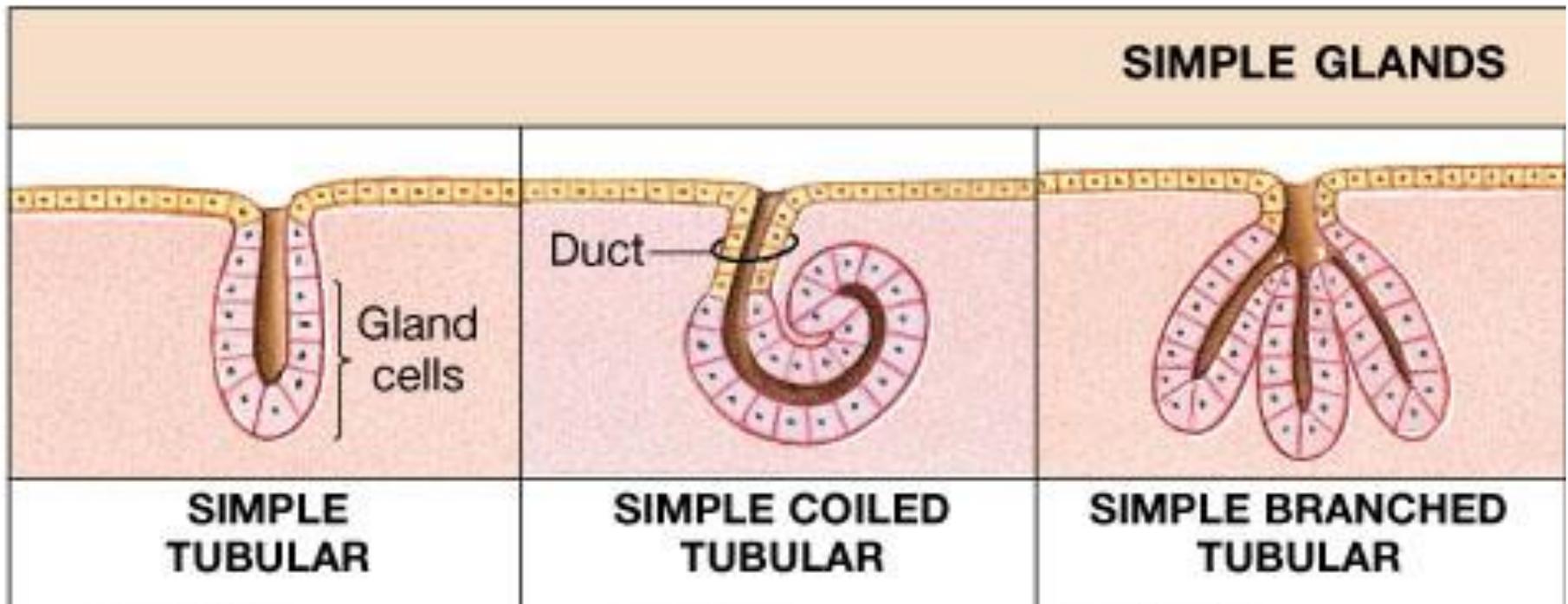
alveolar



tubuloalveolar



Classification of Tubular Glands

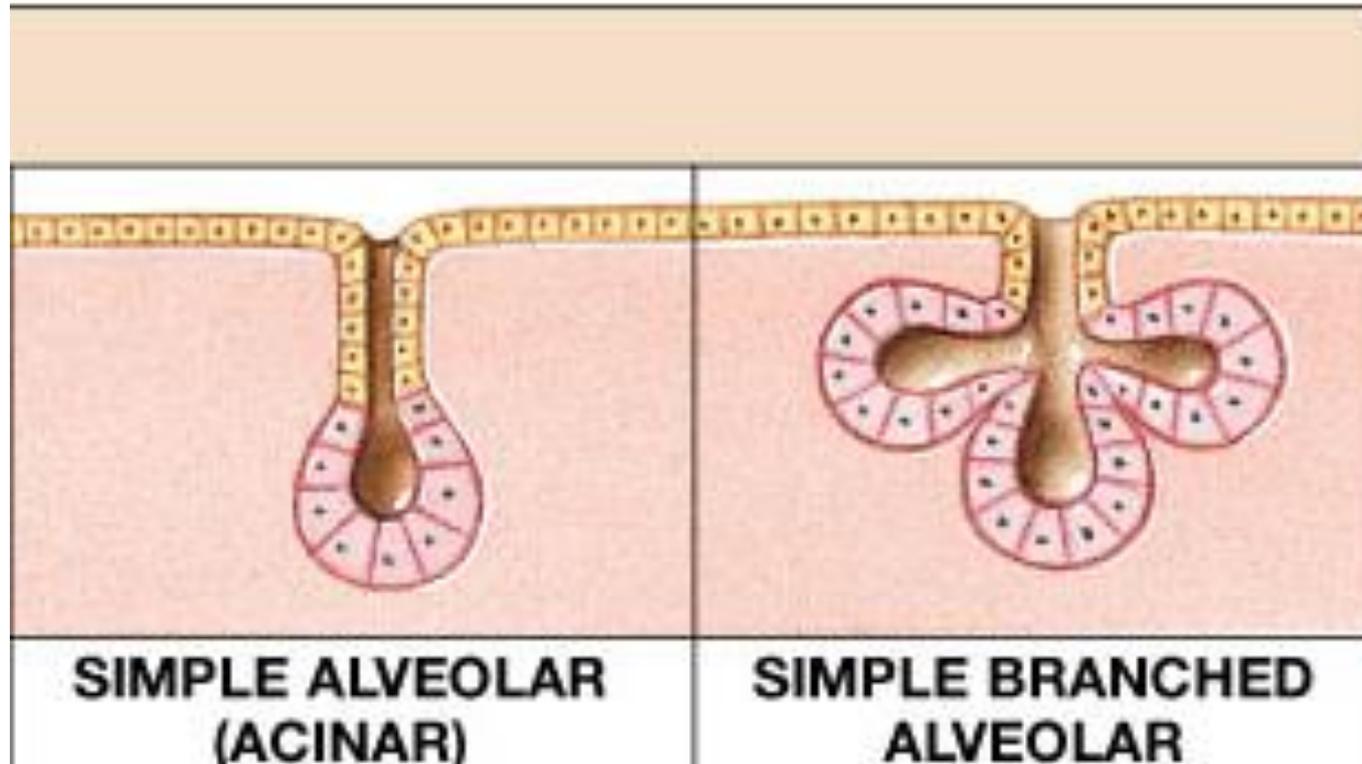


Intestinal glands

Sweat glands

Fundic glands

Classification of Alveolar Glands

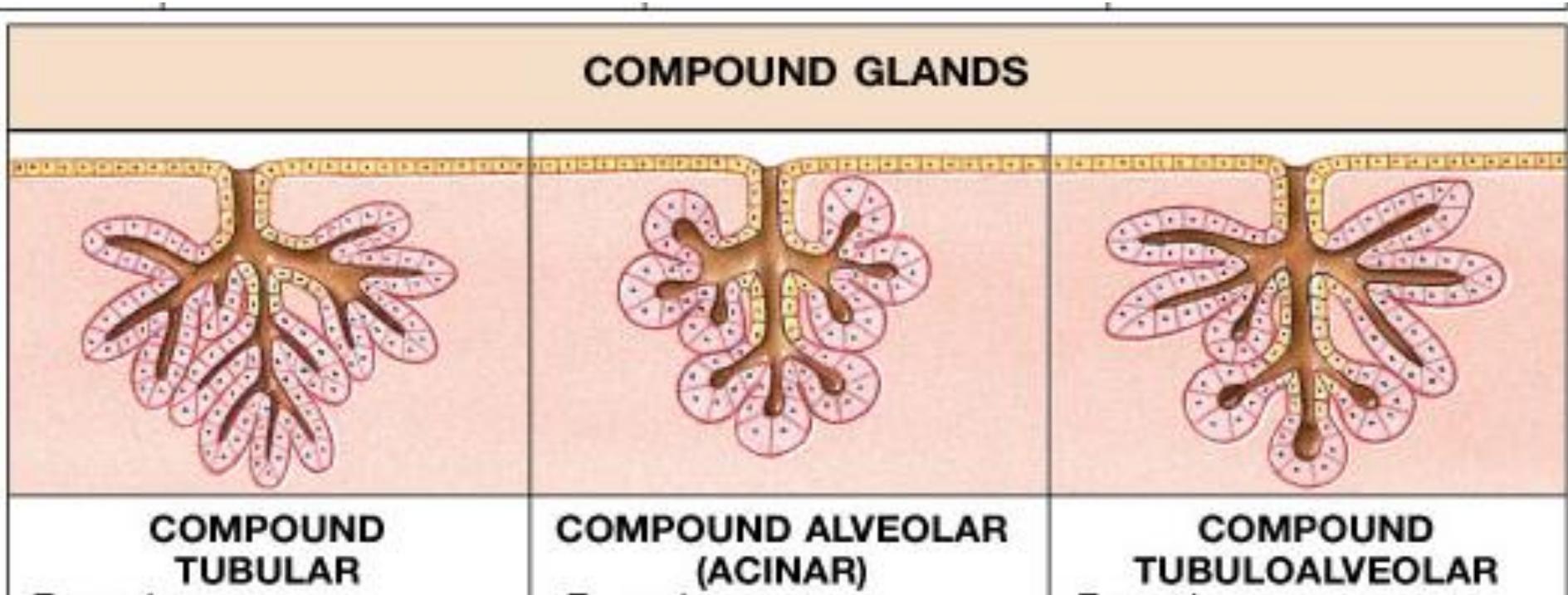


Sebaceous glands

Tarsal glands

Classification of Compound Glands

Compound: branched duct, branched secretory portion



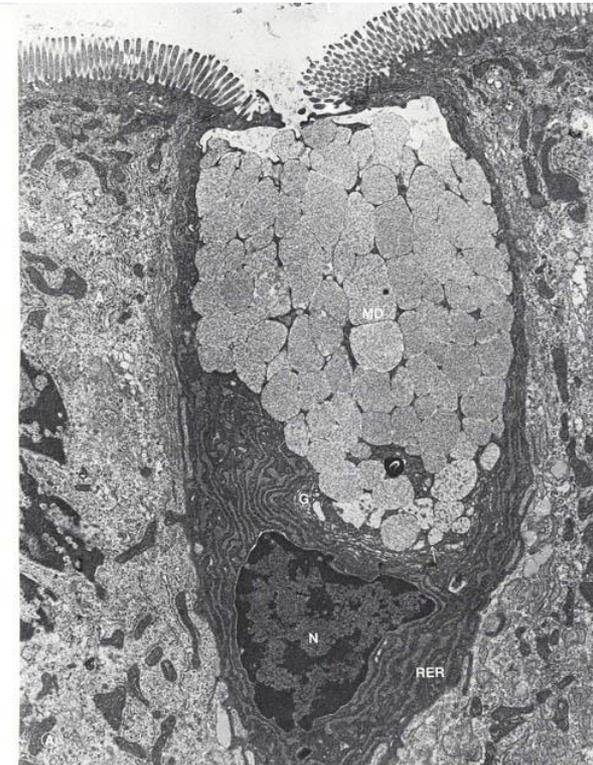
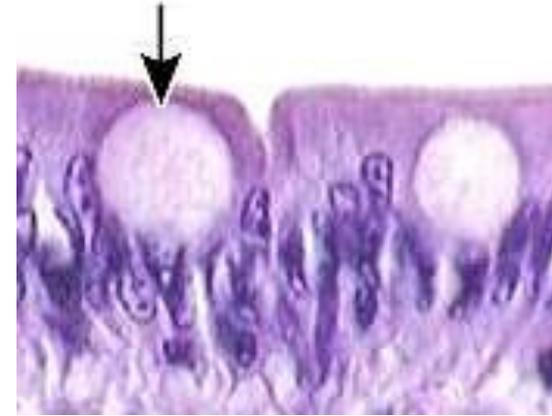
Liver

mammary glands

salivary glands

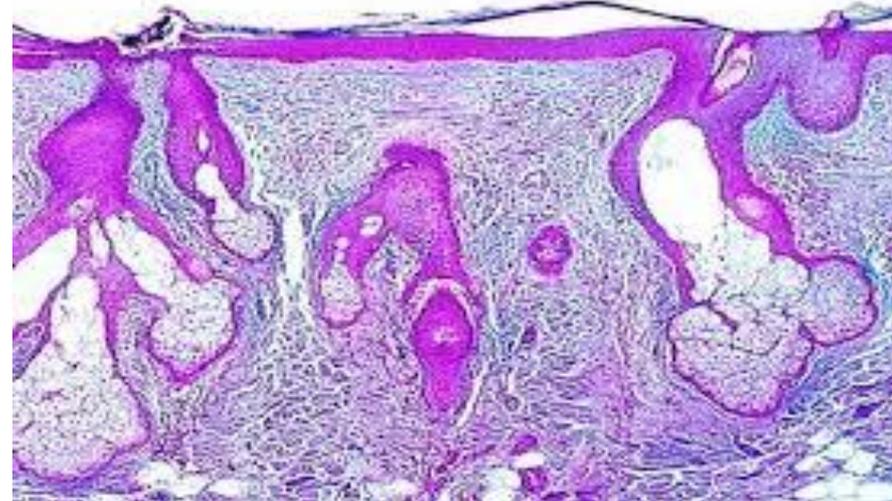
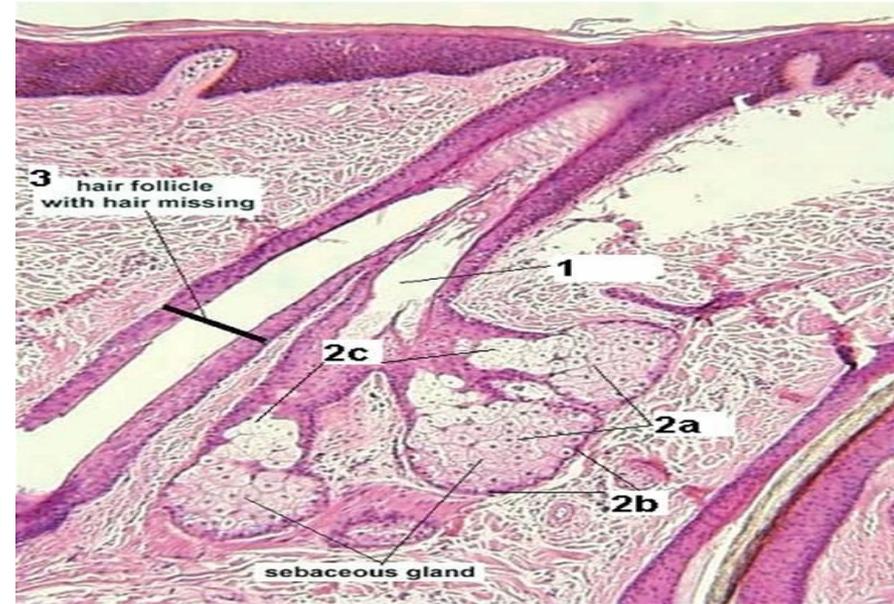
Goblet cells

- Unicellular
- Exocrine
- Shape of the cell : flask shape with basal nuclei
- **Mode** of secretion: Merocrine
- **Nature** of secretion : Mucus
- **Site** : Respiratory system , GIT



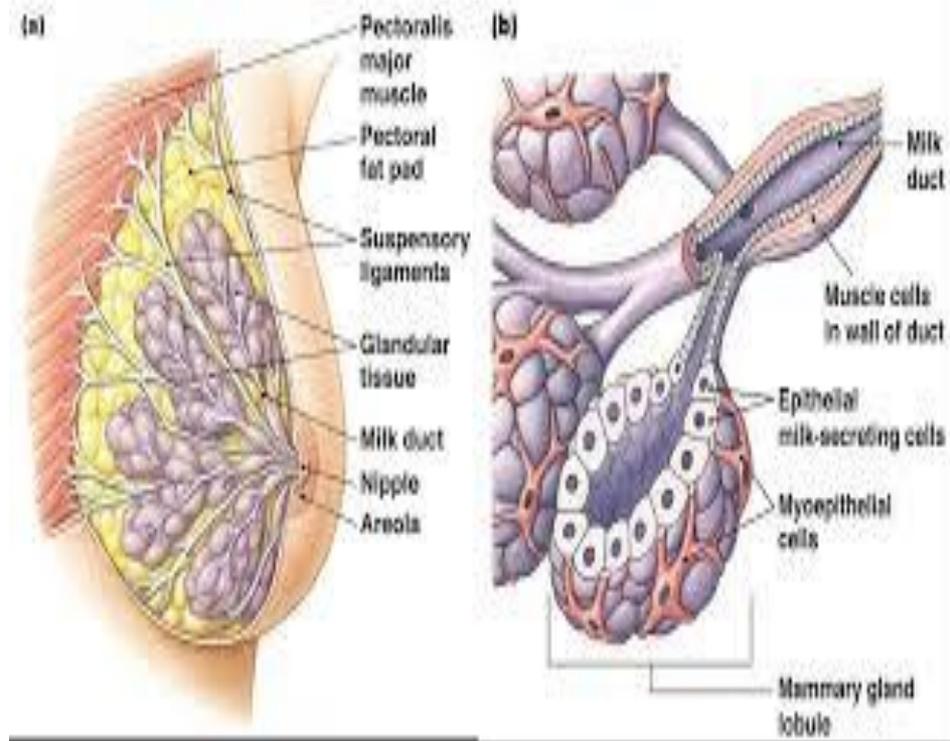
Sebaceous gland

- Exocrine
- Mode : Holocrine
- **Nature : (oily secretion)**
- **Shape of secretory units :
Branched alveolar**
- **Site : Related to hair follicles**
- Activity of the gland increase at the age of puberty
- **Obstruction of the duct by thick secretion & keratin**  **Acne**



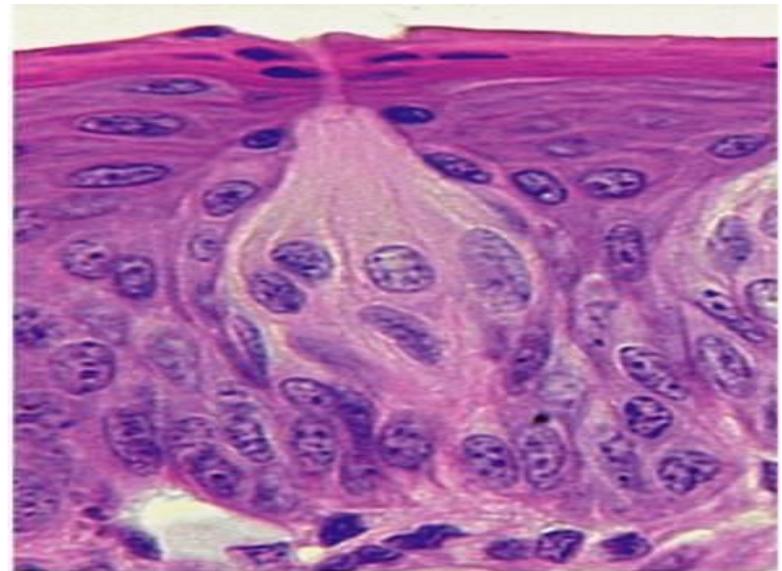
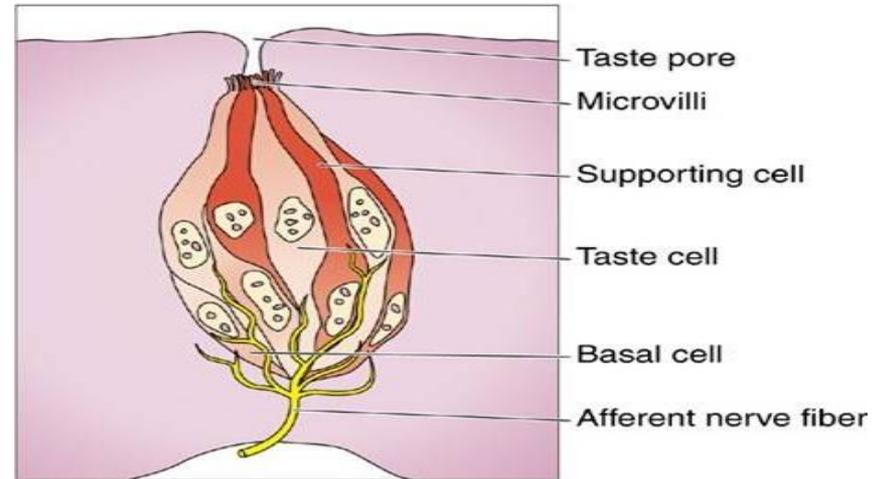
Mammary gland

- Exocrine
- Mode : Apocrine
- **Nature : (milk secretion)**
- **Shape of secretory units : Compound alveolar**
- **Site : Related to skin**



Special types of epithelium

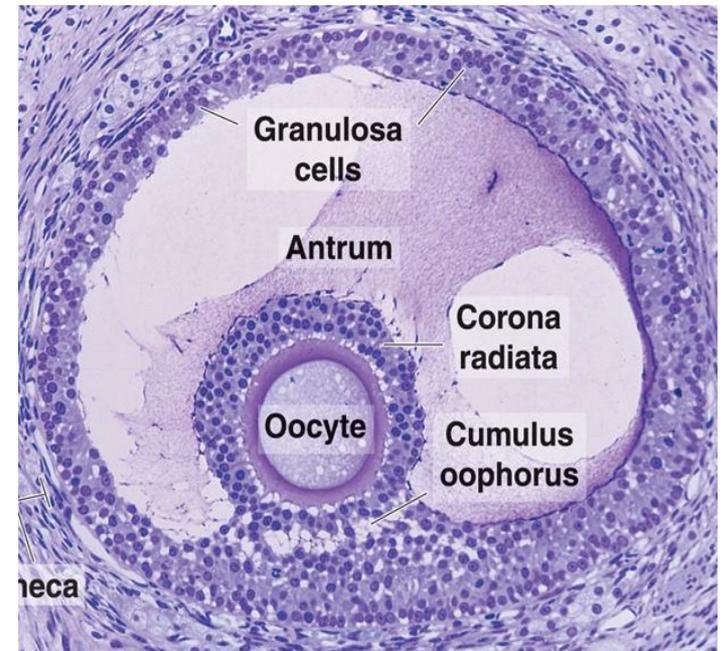
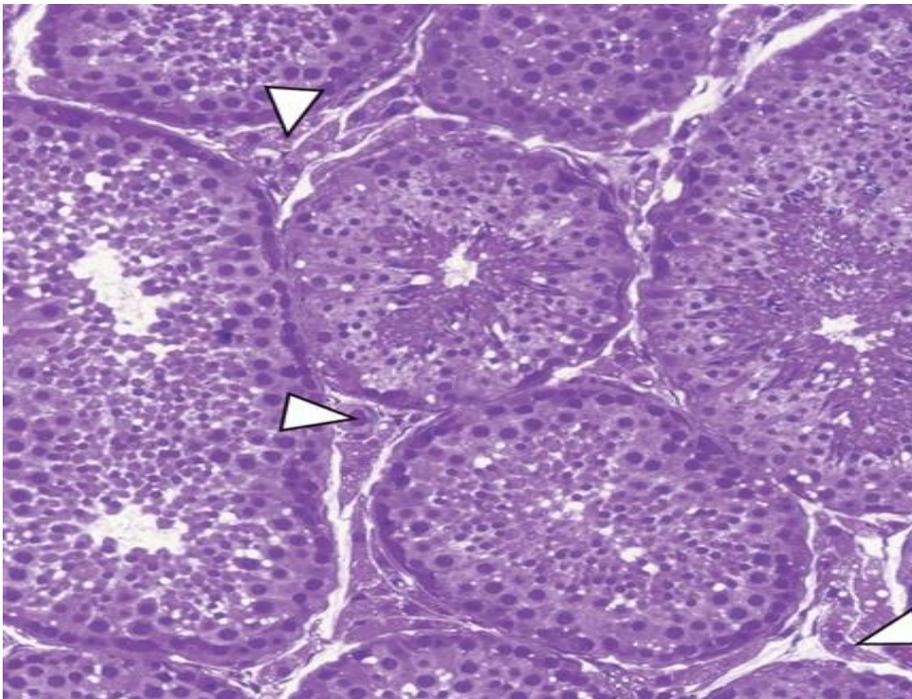
- **1-Neuroepithelium**
- E.g. Taste buds
- Site : dorsal surface of the tongue
- Function : sensation



Special types of epithelium

2. Germinal epithelium

Testis: sperm



Ovary: ovum

Function: :
Reproduction

3- Myoepithelium

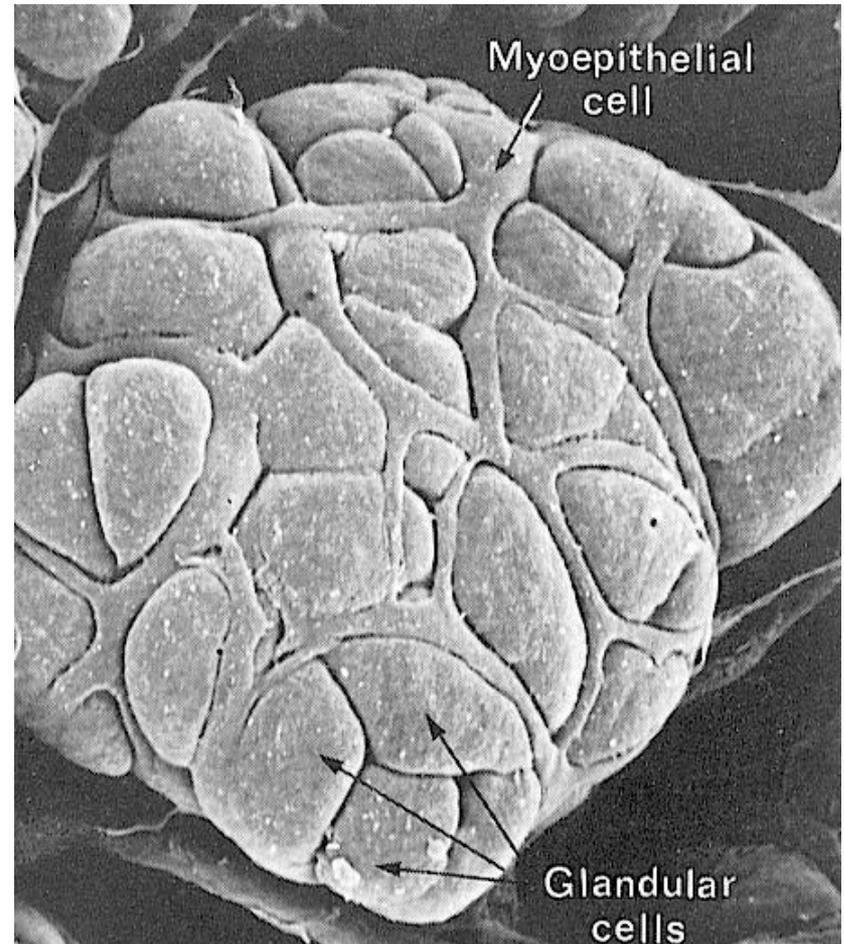
Shape : Irregular with many processes

Contain actin & myosin in the cytoplasm

Site : Acini & ducts of the gland

Function :

Contraction for squeezing the secretion

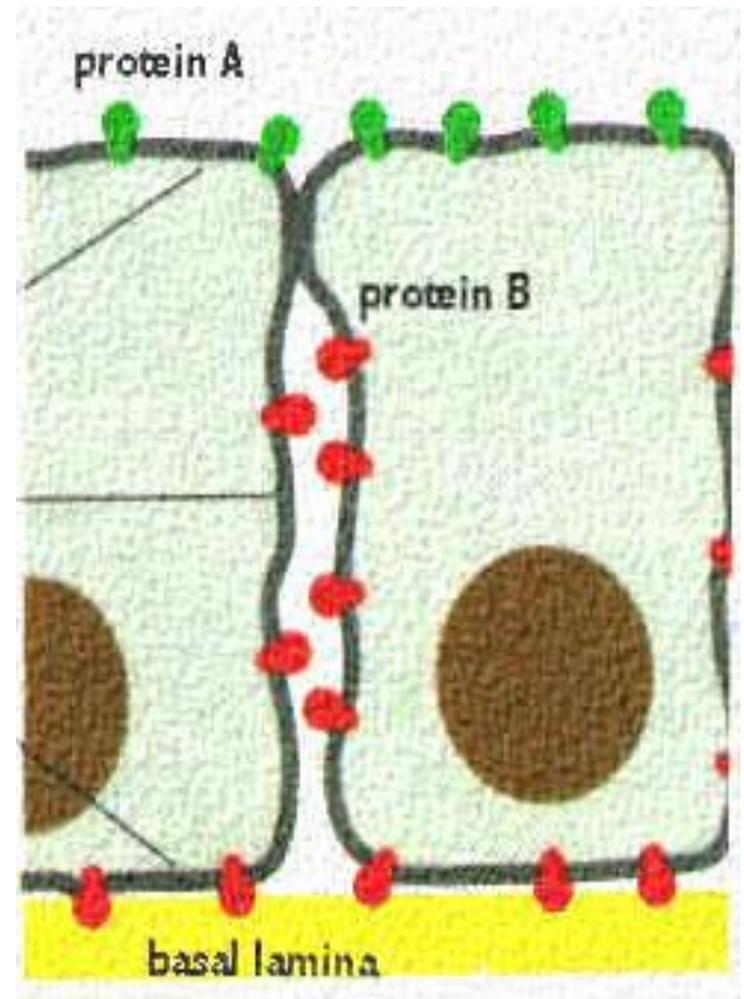


Functions of epithelium

- **Protection**, protect underlying tissues from mechanical injury, harmful chemicals, invading bacteria and from excessive loss of water.
- **Absorption**: certain epithelial cells lining the intestine absorb nutrients from the digestion of food.
- **Secretion**, in glands, epithelial tissue is specialised to secrete specific chemical substances such as enzymes, hormones and lubricating fluids.
- **Excretion**, epithelial tissues in the kidney excrete waste products from the body and reabsorb needed materials from the urine. Sweat is also excreted from the body by epithelial cells in the sweat glands.
- **Sensation**: sensory stimuli are detected by specialized epithelial cells; specialized epithelial tissue containing sensory nerve endings is found in the skin, eyes, ears and nose and on the tongue.
- **Diffusion**, simple epithelium promotes the diffusion of gases, liquids and nutrients; because they form such a thin lining, they are ideal for the diffusion of gases (e.g. walls of capillaries and lungs).
- **Contraction** e.g., myoepithelial cells have ability to contract.
- **Cleaning**: ciliated epithelium assists in removing dust particles and foreign bodies which have entered the air passages.

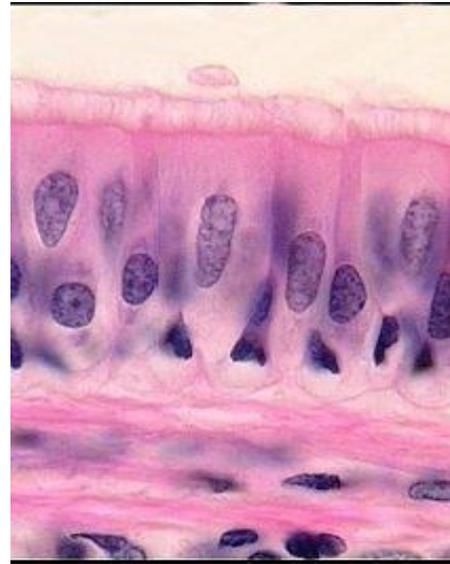
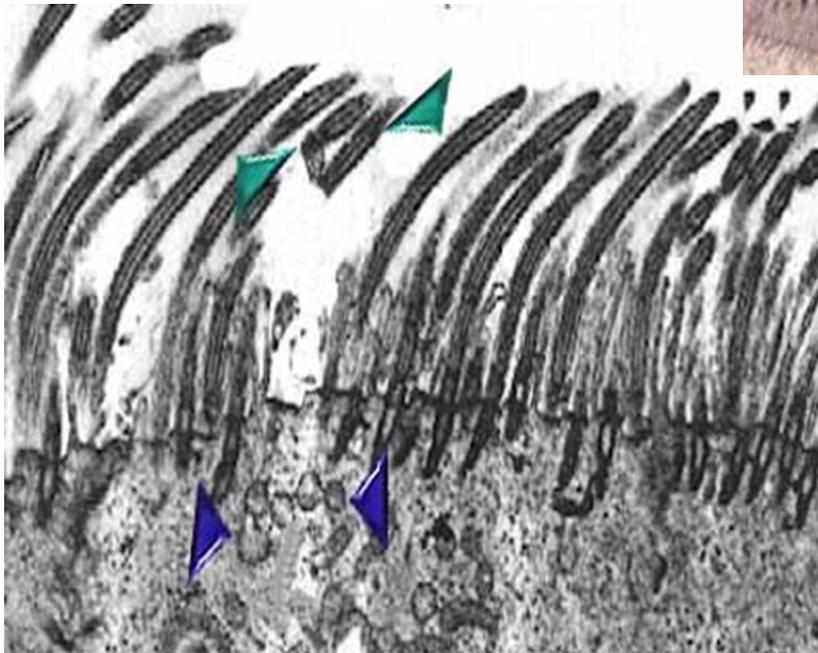
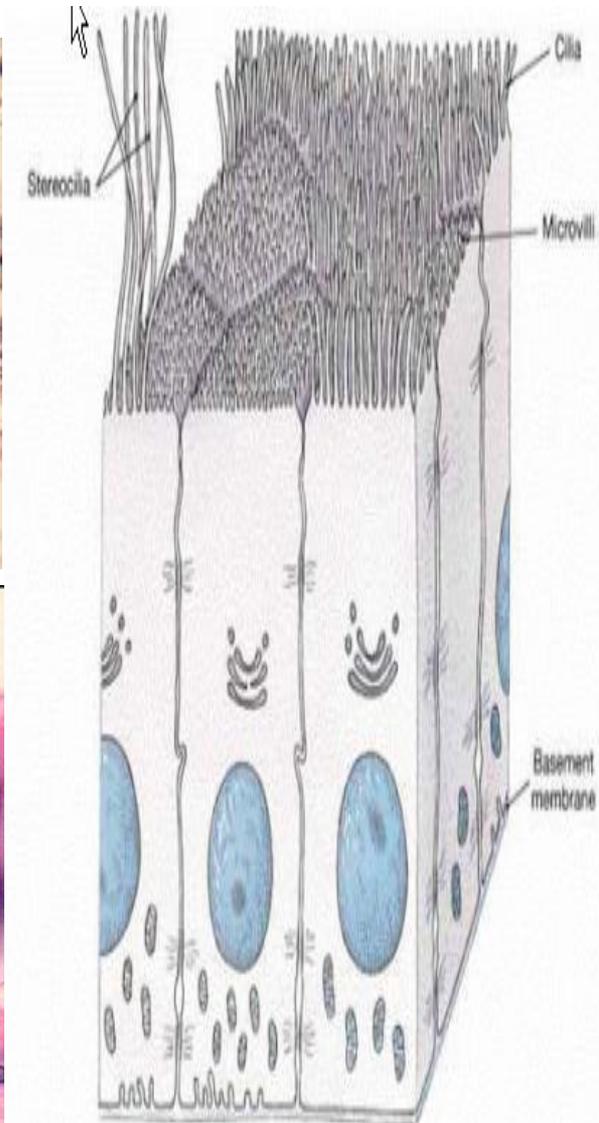
Epithelial polarity

- Cells have a top , lateral side and a bottom
- So different activities take place at different places
- **Apical modifications**
- **Basal modifications**
- **Lateral modifications**

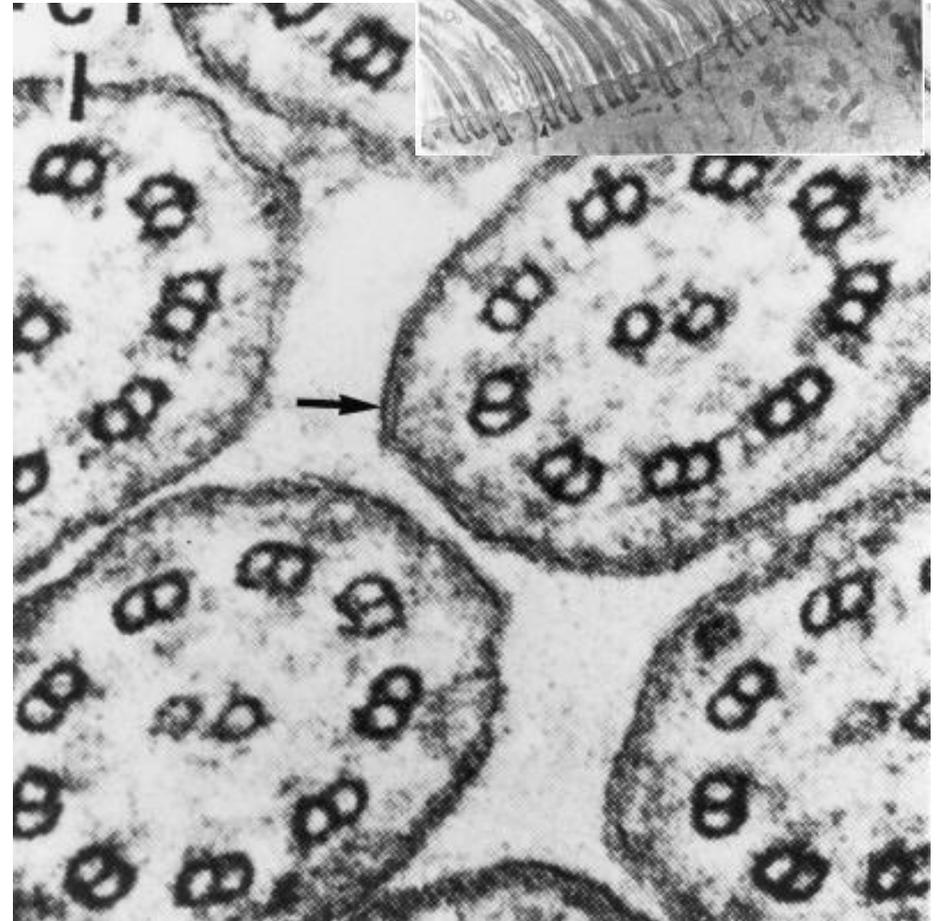
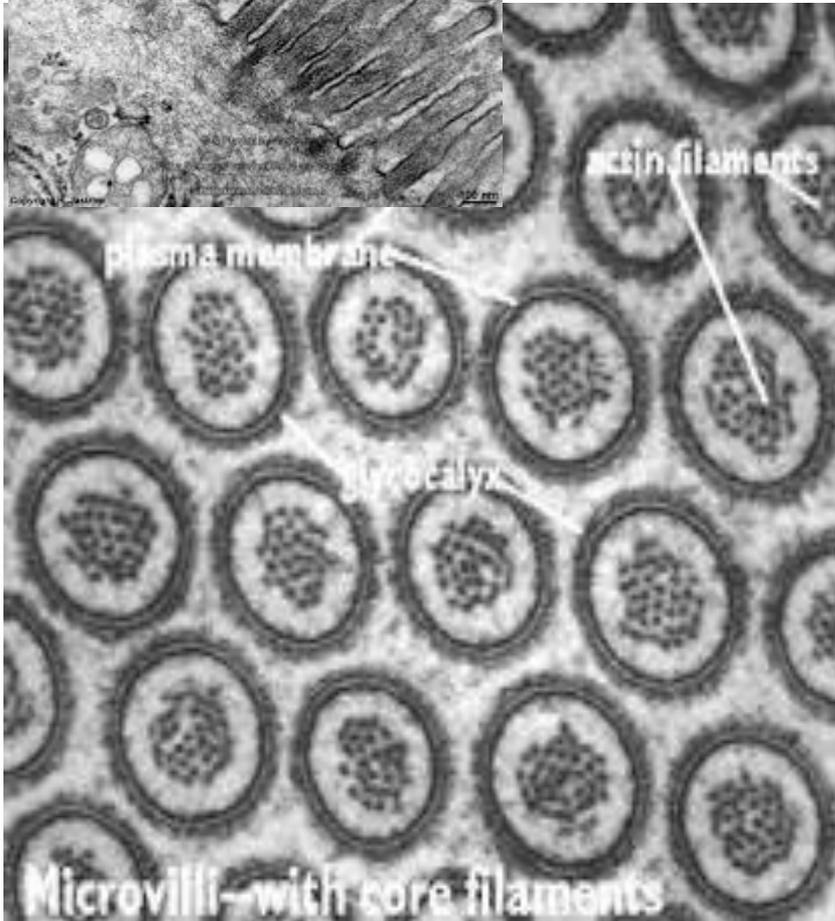
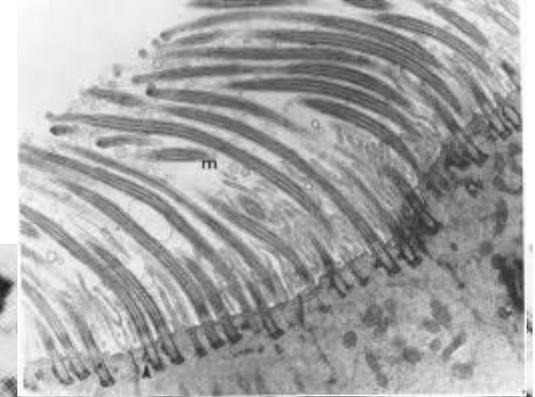
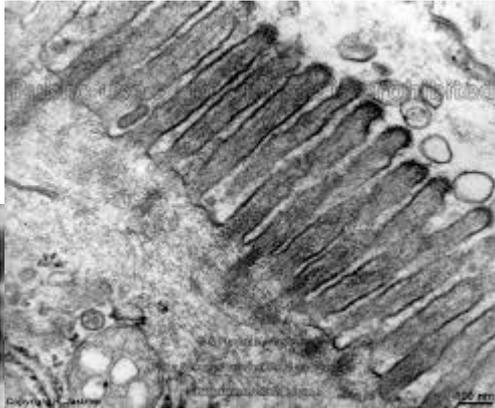


Apical modifications

- **Cilia**
- **Microvilli**
- **Stereocilia**



Apical modifications



Intercellular junctions (cell to cell adhesion)

- The intercellular junctions are more **numerous between the epithelial cells.**

They are three types

1- Occluding junctions: (Tight)

link cells to form an impermeable barrier.

2- Anchoring junctions: (Adhering)

- provide mechanical stability to the epithelial cells.

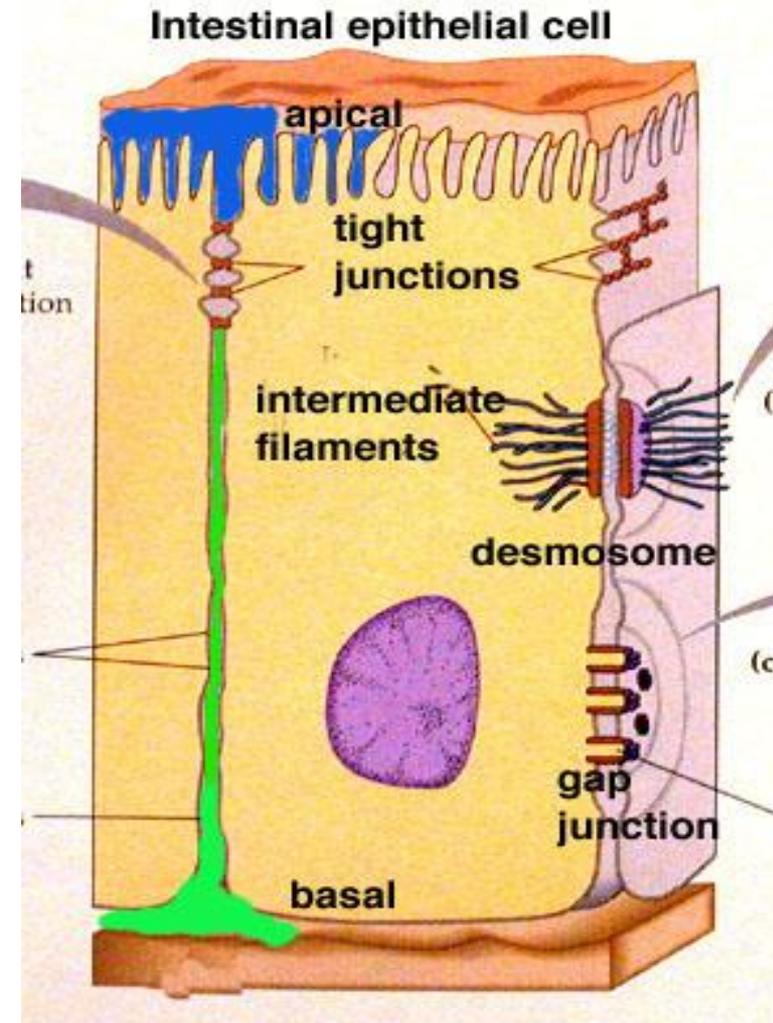
- **Zonula adherens:**

- **Macula adherens = desmosomes:**

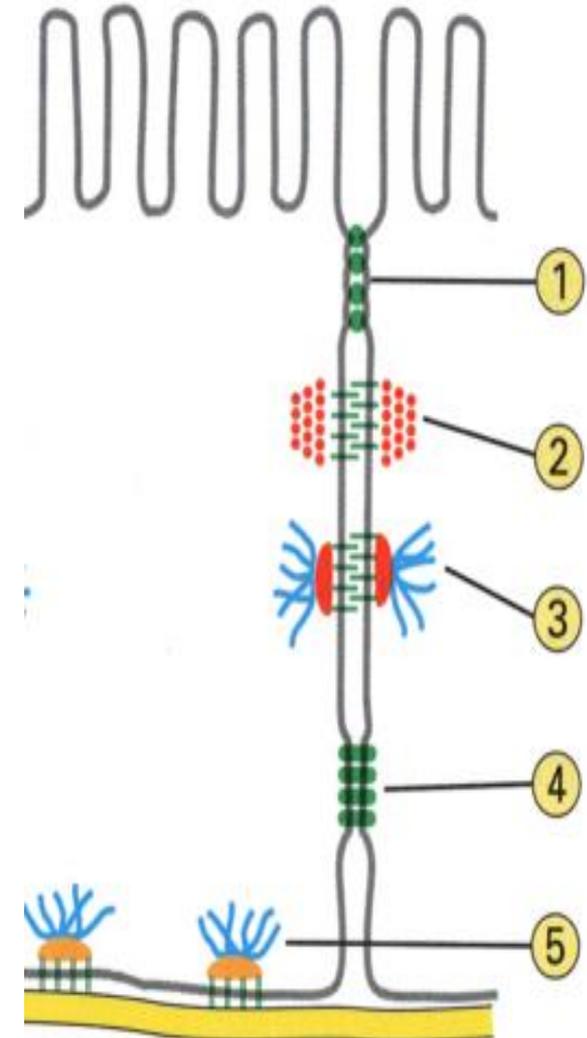
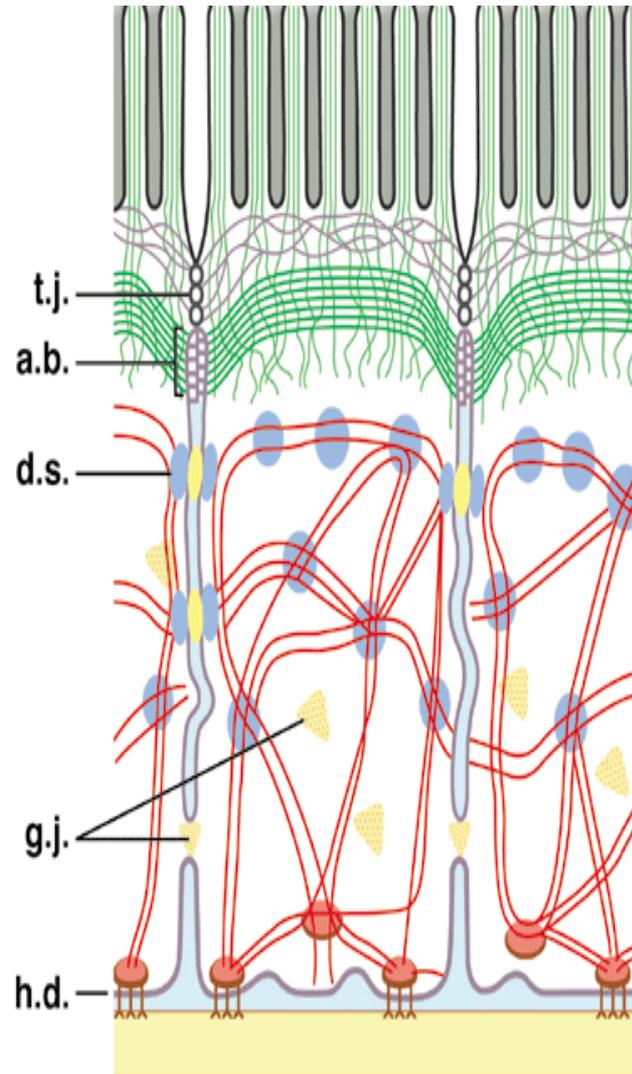
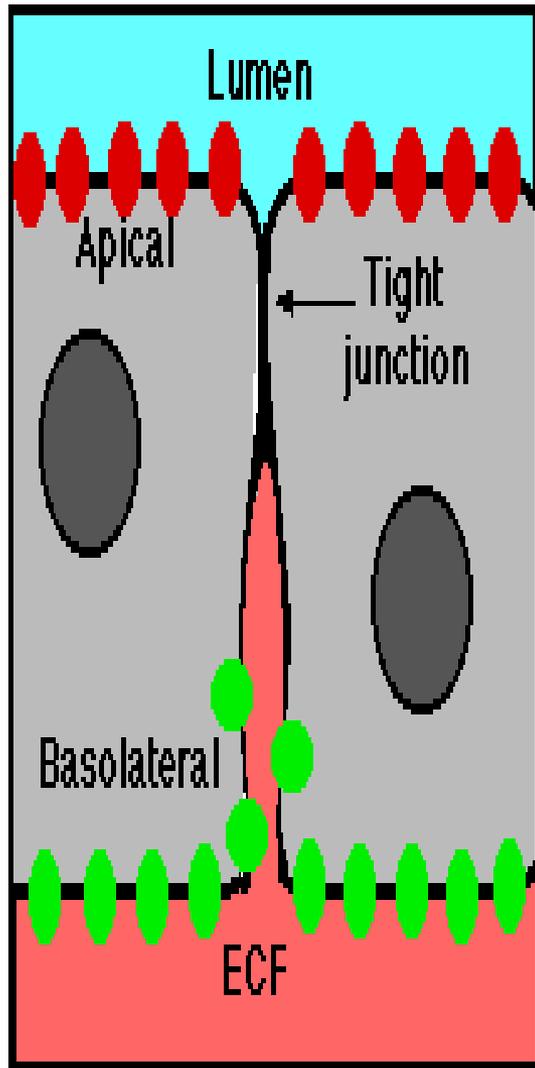
3- Communicating junctions: (Gap)

allow movement of molecules between cells
It permits the exchange of molecules e.g. ions, amino acids allowing integration, communication and coordination between cells

It is found mainly in cardiac and smooth muscle cells

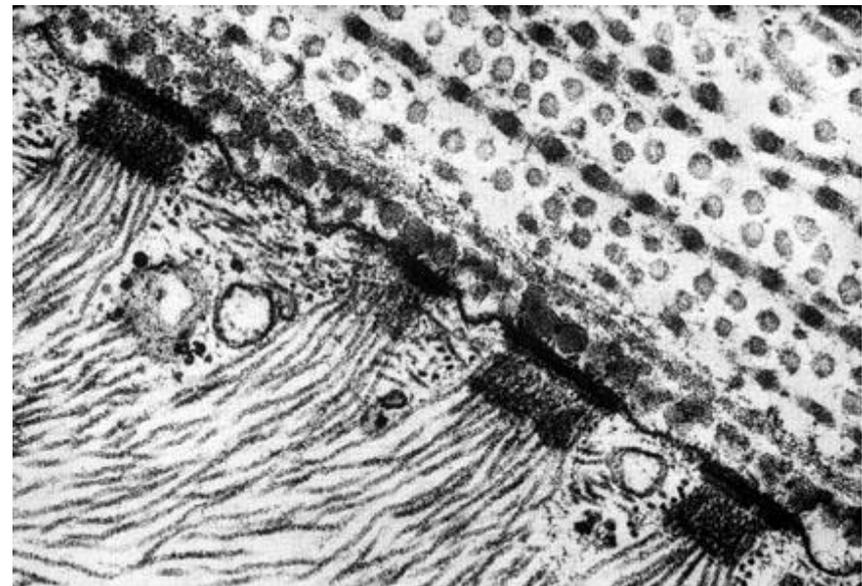
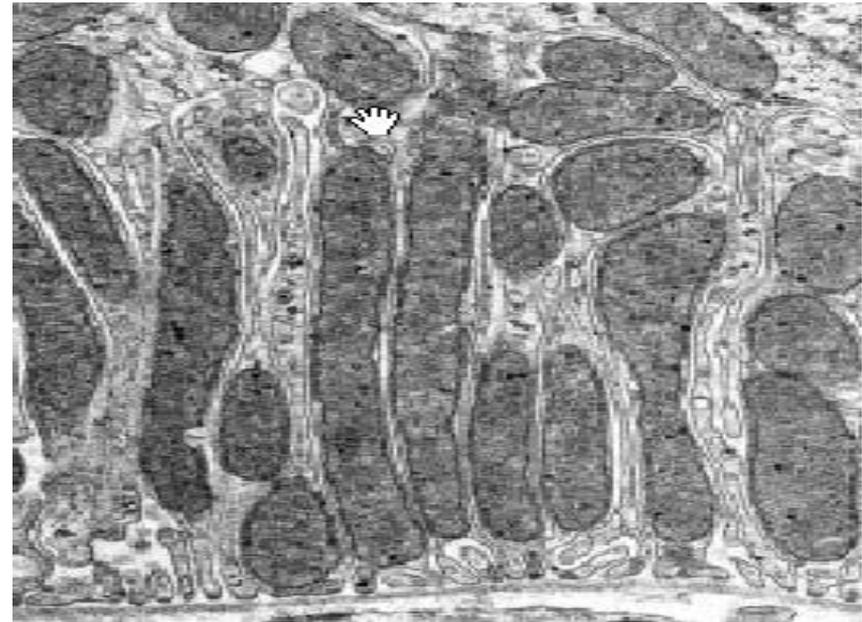
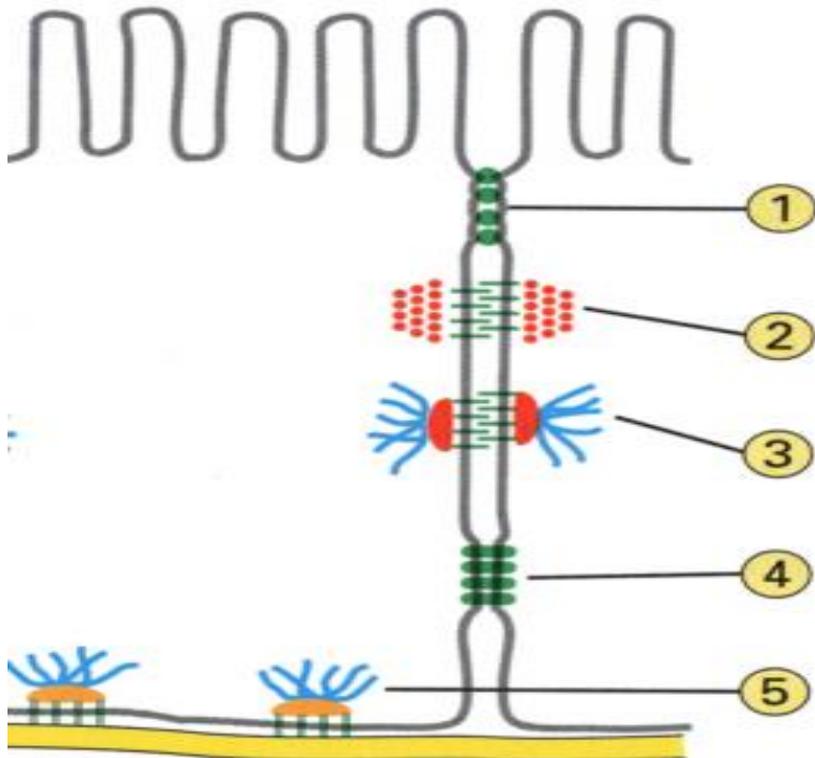


Intercellular junctions



Basal modifications

- Basement membrane
- Basal infolding
- Hemidesmosome

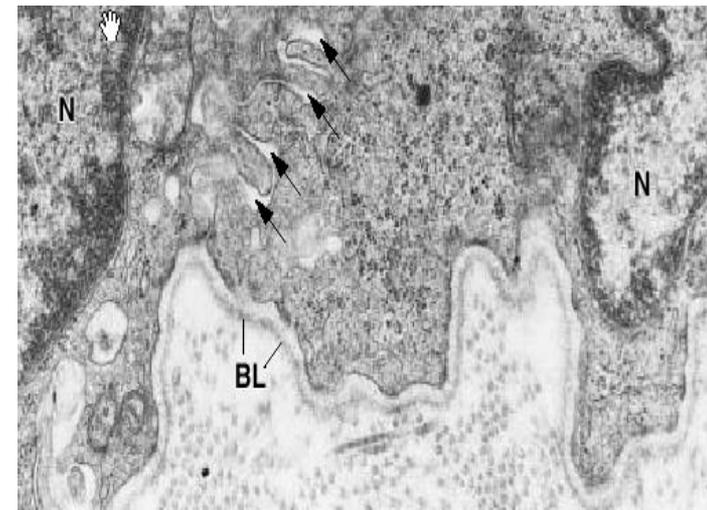
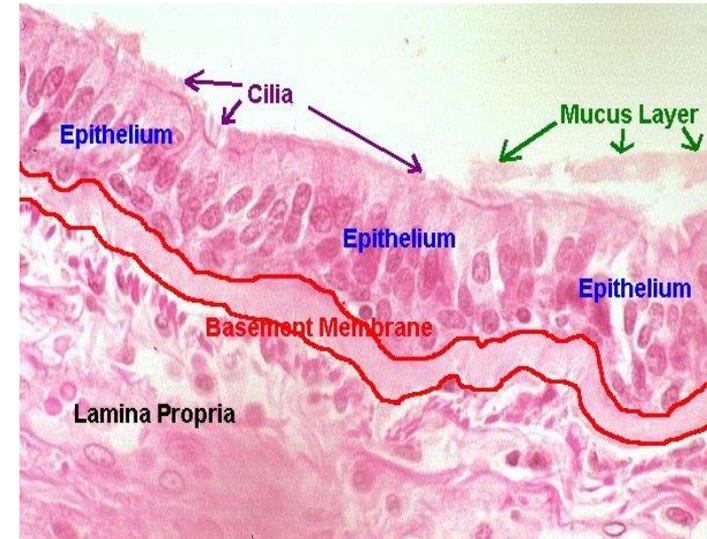


Basement membrane

- Thin extracellular layer having two parts:
- **Basal lamina** : type IV collagen + laminin
- Produced by epithelial cell
- **Reticular lamina** : Type VII collagen + type III collagen (reticular F)
- Secreted by C.T. cells

Function :

1. Attach epithelium to C.T.
2. Separate epithelium from other tissue
3. Regulate (filter) substances passing from C.T. to epithelium
4. Guide during tissue regeneration



Basal lamina. Basement membrane

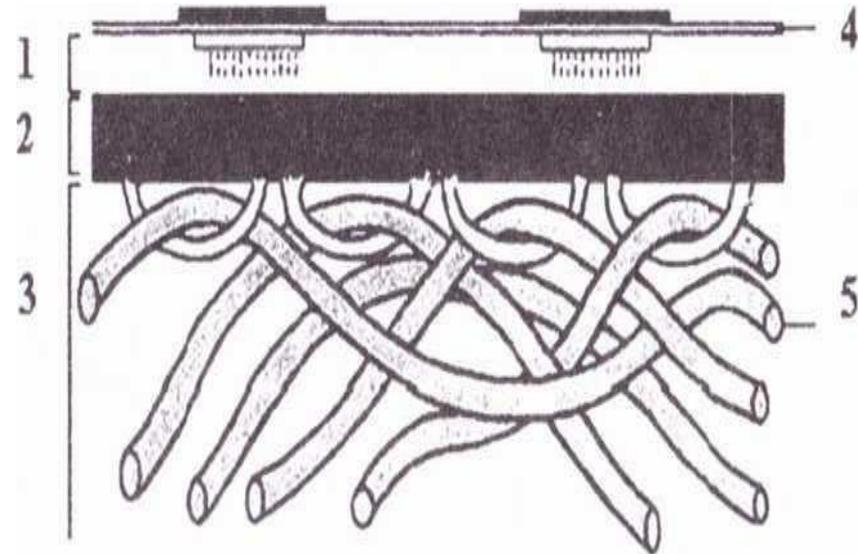
The **basal lamina** connects the epithelium and subjacent connective tissue.

With electron microscope the basal lamina consists of **2 layers**: inner **lamina lucida** (thin amorphous layer of glycoprotein) and Outer **lamina densa** (thick network of collagen fibrils).

Outside the basal lamina is associated with the **reticular lamina**; it consists of delicate reticular fibres.

Schematic diagram of the basement membrane.

- 1 - lamina lucida,
- 2- lamina densa,
- 3 - reticular lamina,
- 4 - plasmolemma of the basal surface of the epitheliocytes,
- 5 — collagen fibers



CLINICAL APPLICATION

Basement Membranes and Diabetes

In untreated cases of diabetes mellitus (type 1 or type 2 diabetes), the basement membranes of the epithelial lining of capillaries thicken over time. This thickening is caused by increased amounts of glucose, present in high concentrations in diabetics, binding to the proteins of the basement membrane. This process is referred to as increased glycosylation of the basement membrane. Thickening is especially evident in the capillaries in the kidneys and retina of the eye, which can become nonfunctional. For this reason, kidney failure and blindness are major symptoms of advanced diabetes

Basement Membranes and cancer

When cancer cells penetrate the basement the cells spread and metastasis

Thank
You

