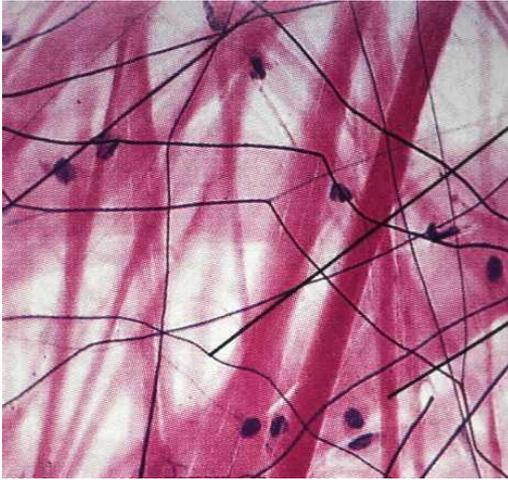


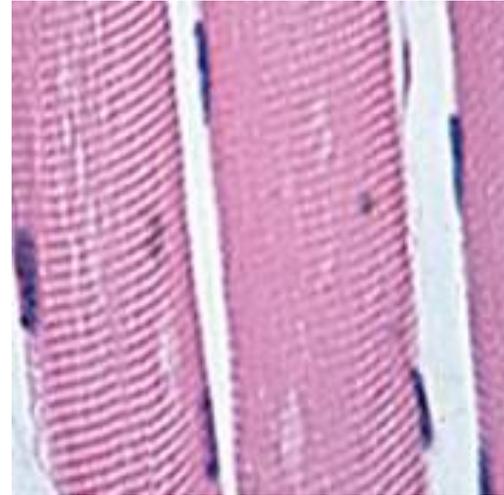
# Tissues are...

- ❑ Groups of similar cells and extracellular products that carry out a common function
  - providing protection
  - facilitating body movement
- ❑ Study of tissues is **histology**
- ❑ **4** primary types of tissues in the body
  1. Epithelial tissue
  2. Connective tissue
  3. Muscle tissue
  4. Nervous tissue

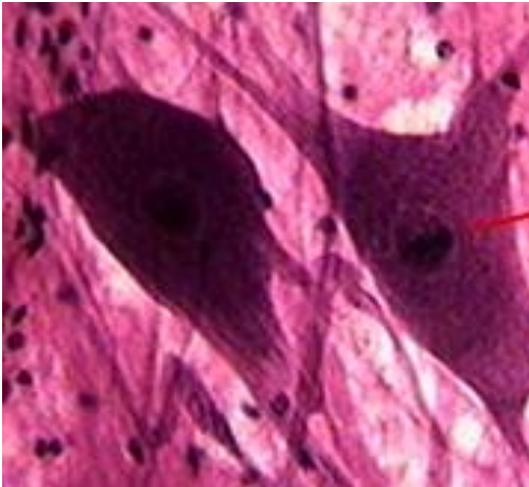
# 4 Basic Types of Tissues



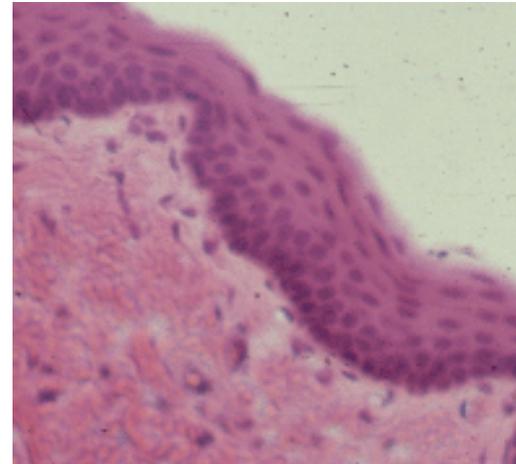
**Connective tissue**



**Muscular tissue**



**Nervous tissue**



**Epithelial tissue**

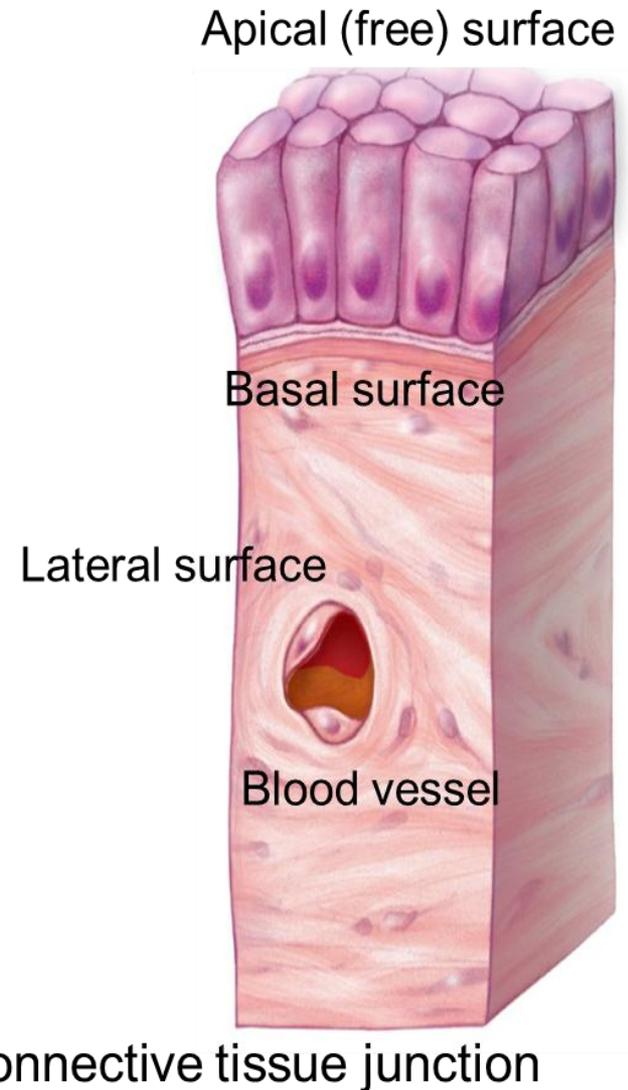
# Epithelial Tissue

- **Epithelial tissue** covers or lines every body surface and body cavity
- **Epithelium** is composed of one or more layers of closely packed cells between two compartments
  - Closely aggregated cells
  - Very little intercellular substances
  - Derived from **3** embryonic layers .
  - Regular shaped cells bind together by **junction coesmplex**
  - Resting on basal lamina (**basement membrane**)
  - Avascular
  - Rich in nerve supply
  - High renewal rate

# Characteristics of Epithelial Tissue

- 1. Cellularity:** composed almost entirely of cells (with some extracellular matrix and sometimes other structures)
  - Closely aggregated cells with very little intercellular substances
- 2. Polarity:** has specific top and bottom
  - **apical surface** exposed to external environment or internal body space, and
  - **basal surface** attached to underlying connective tissue, plus
  - **lateral surfaces** connected by intercellular junctions

4. **Attachment:** basal surface bound to basement membrane
5. **Avascularity:** no blood vessels; receive nutrients across apical surface or by diffusion
6. **Innervation:** lots of nerve endings
7. **High regeneration capacity:** epithelial cells are frequently damaged or lost to abrasion, so they are replaced quickly

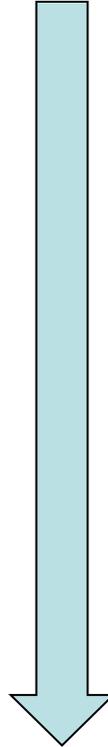
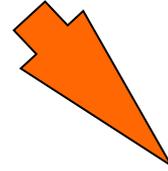


# Classification of epithelium

**Covering and lining  
epithelium**

**Special types**

**Glandular (secretory)  
epithelium**

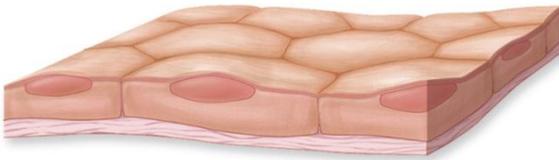


# Classification of covering epithelium

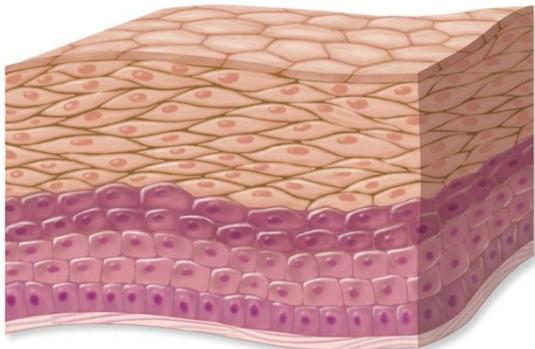
## Number of cell layers

- **simple** = one cell layer thick
- **stratified** = >2 cell layers thick

### •Simple



### •Stratified

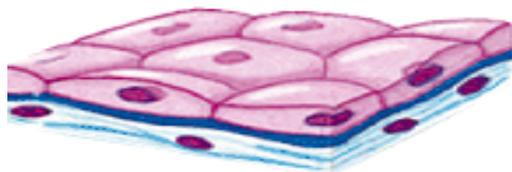
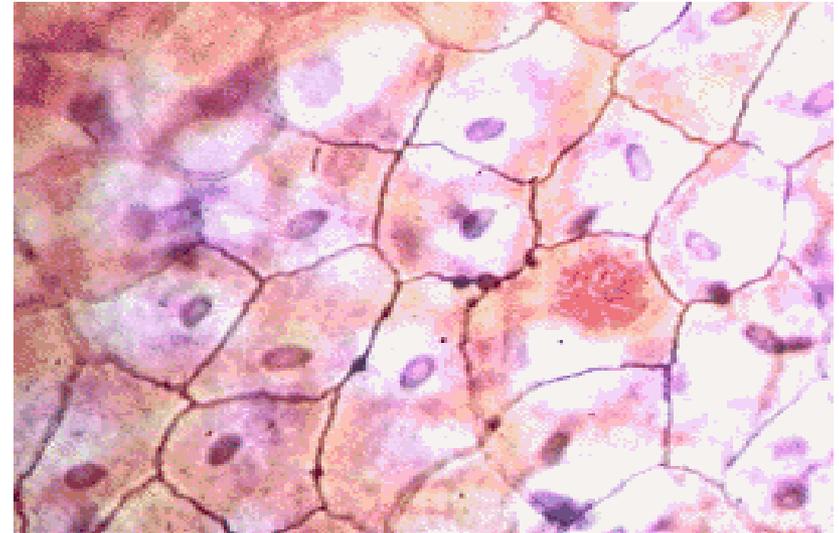
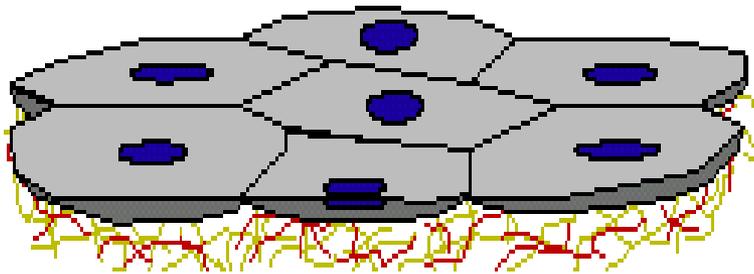


## Cell shape

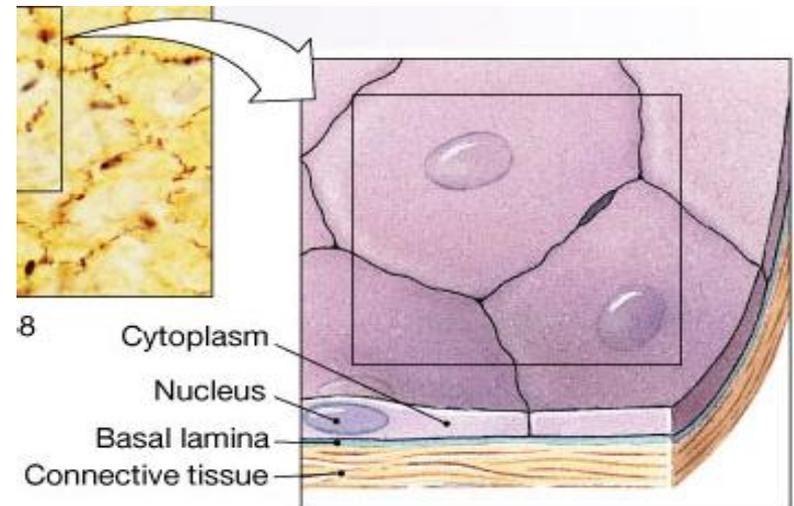
- squamous** = flattened
- cuboidal** = basically cube-shaped or roundish
- columnar** = long and thin (like a column)
- Pseudostratified**

# 1- Simple Squamous Epithelium

LM:

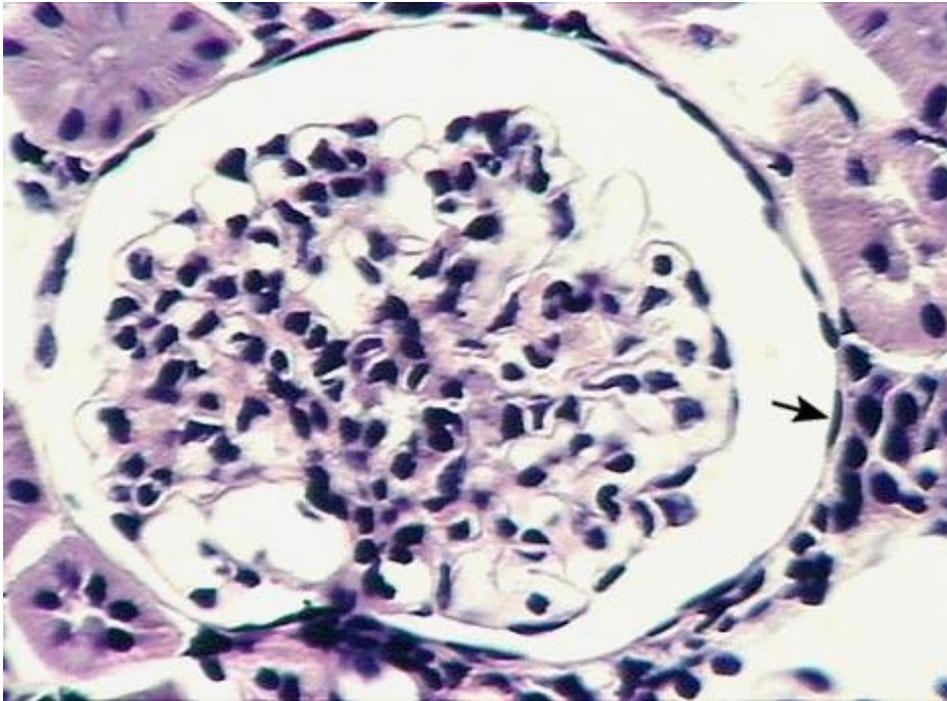


**Simple squamous**



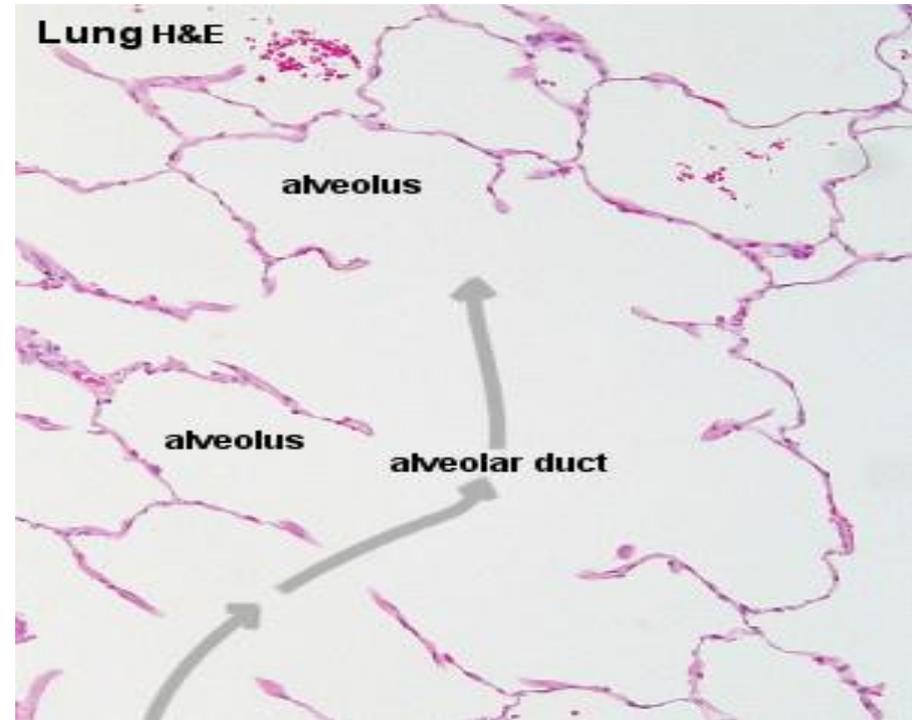
# 1- Simple Squamous Epithelium

(Bowman's capsule-  
kidney)



Function: Filtration of blood

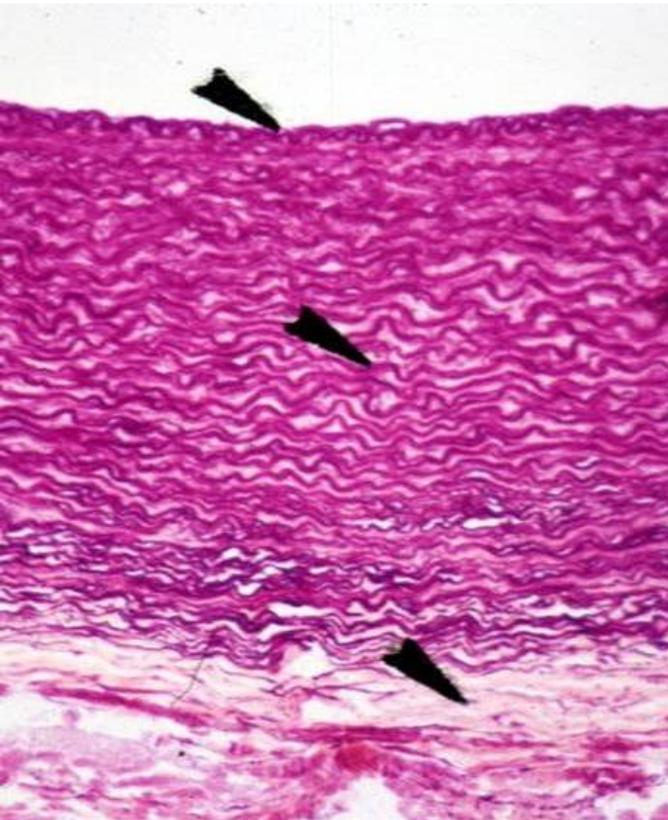
(Lung alveoli)



Function: gas exchange

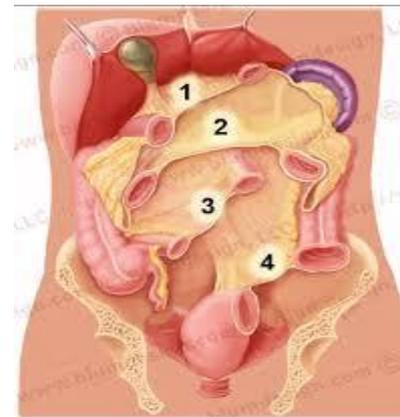
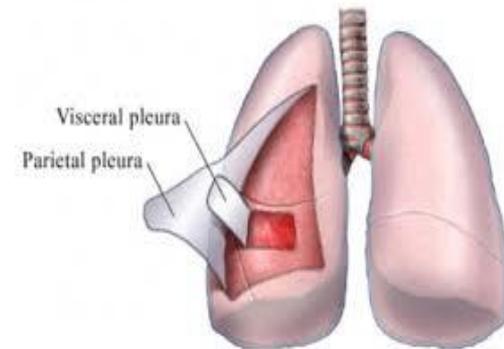
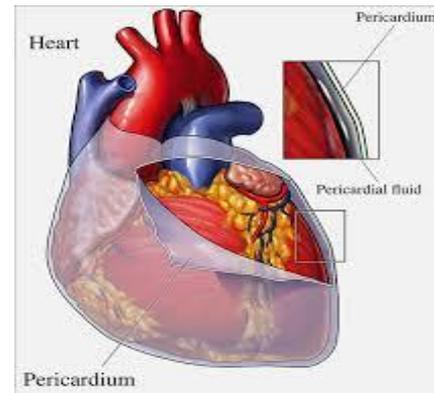
# Simple Squamous Epithelium

**Endothelium:**  
of the blood vess

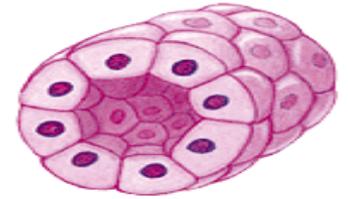


**Mesothelium :**

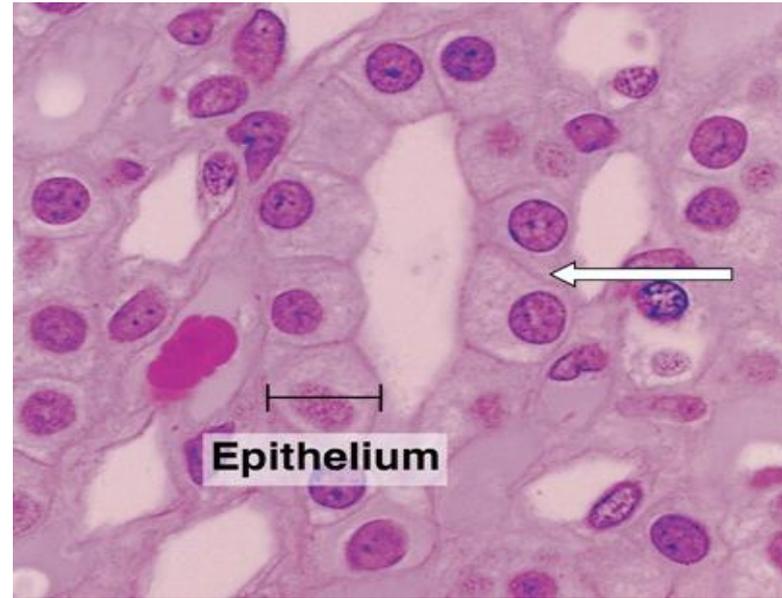
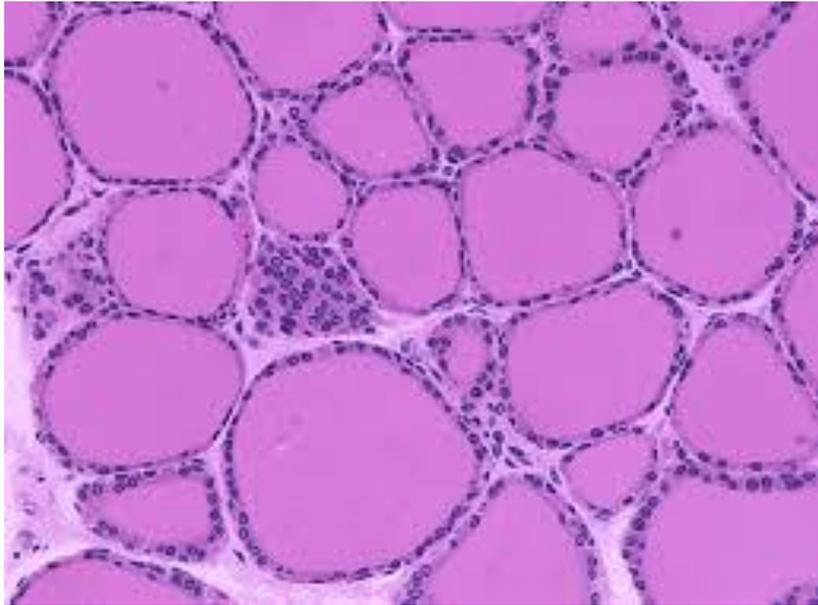
Pericardium, pleura, peritoneum  
Function : smooth surface



# 2- Simple cuboidal Epithelium

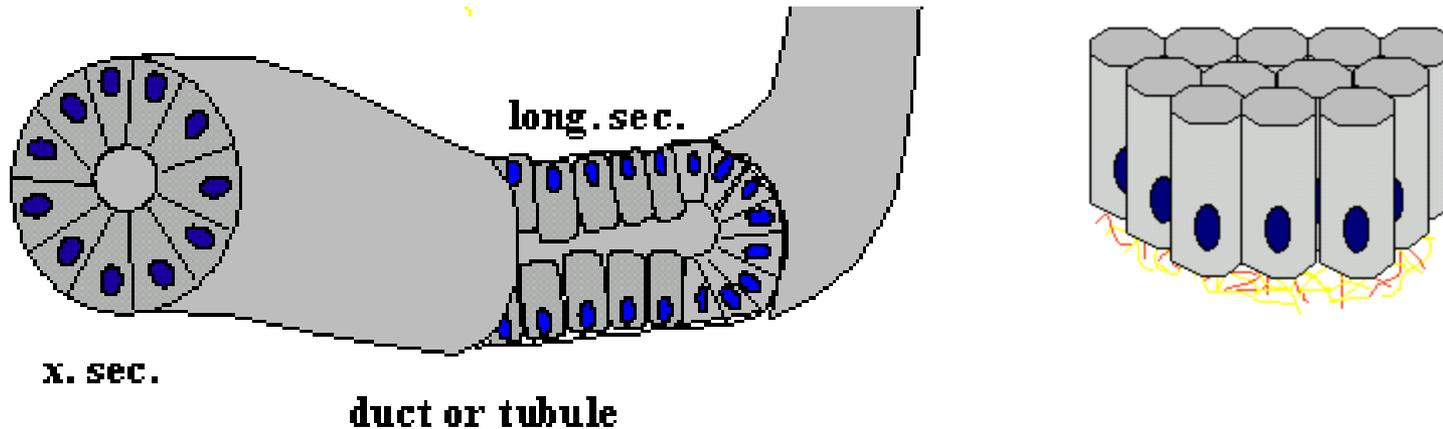


Simple cuboidal



**Site: Thyroid gland : secretion**  
**kidney tubules : ion exchange**

# 3- Simple Columnar Epithelium



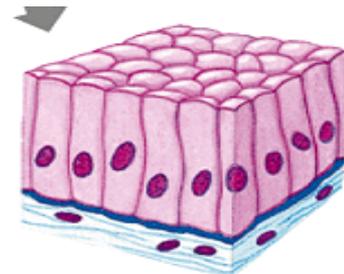
## Types:

a. Non ciliated

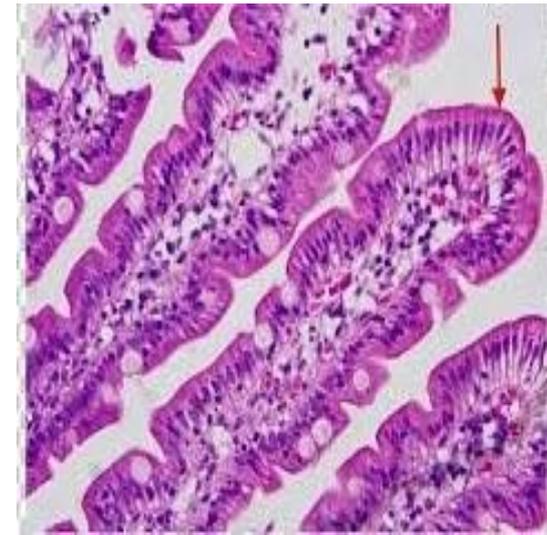
b. Ciliated

## a. Simple columnar epithelium (non ciliated)

LM



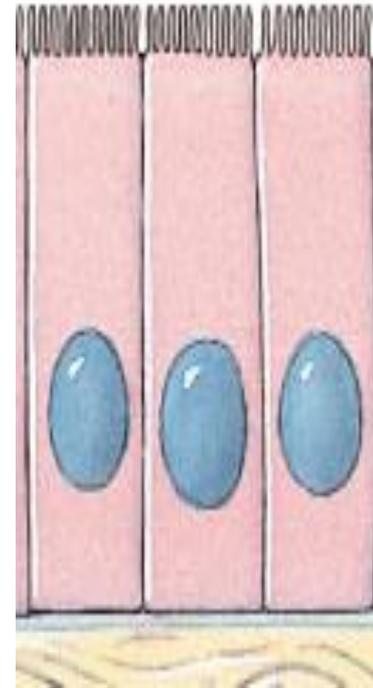
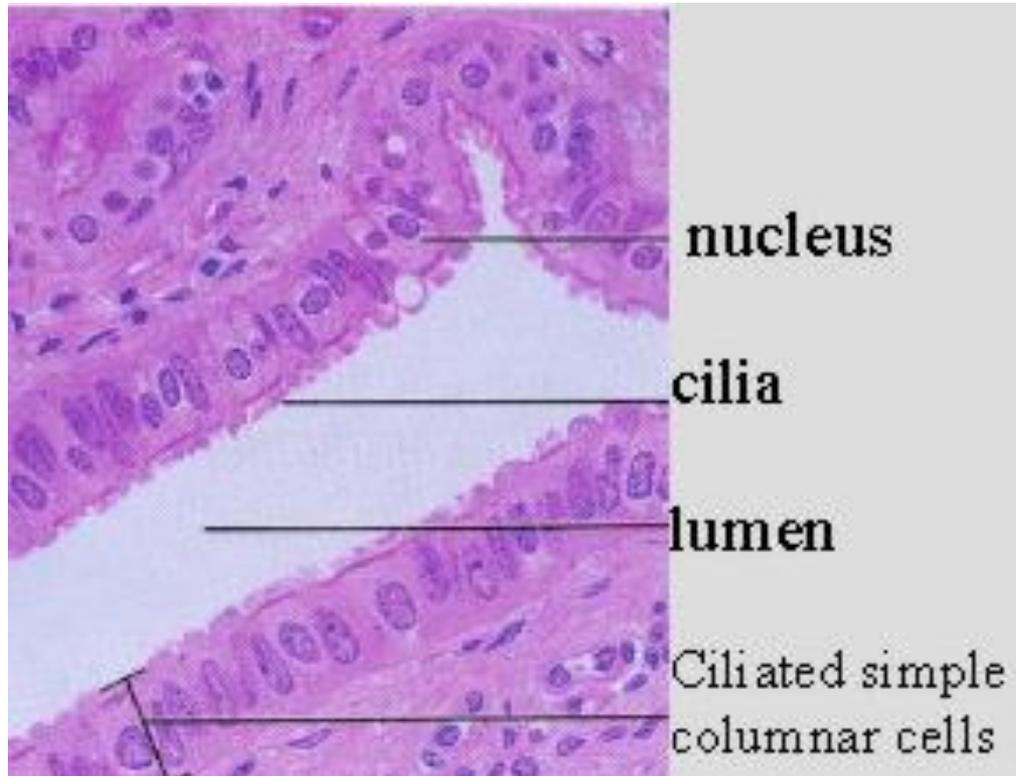
Simple columnar



**Sites: ducts of glands: secretion**  
**digestive tract : absorption**

(

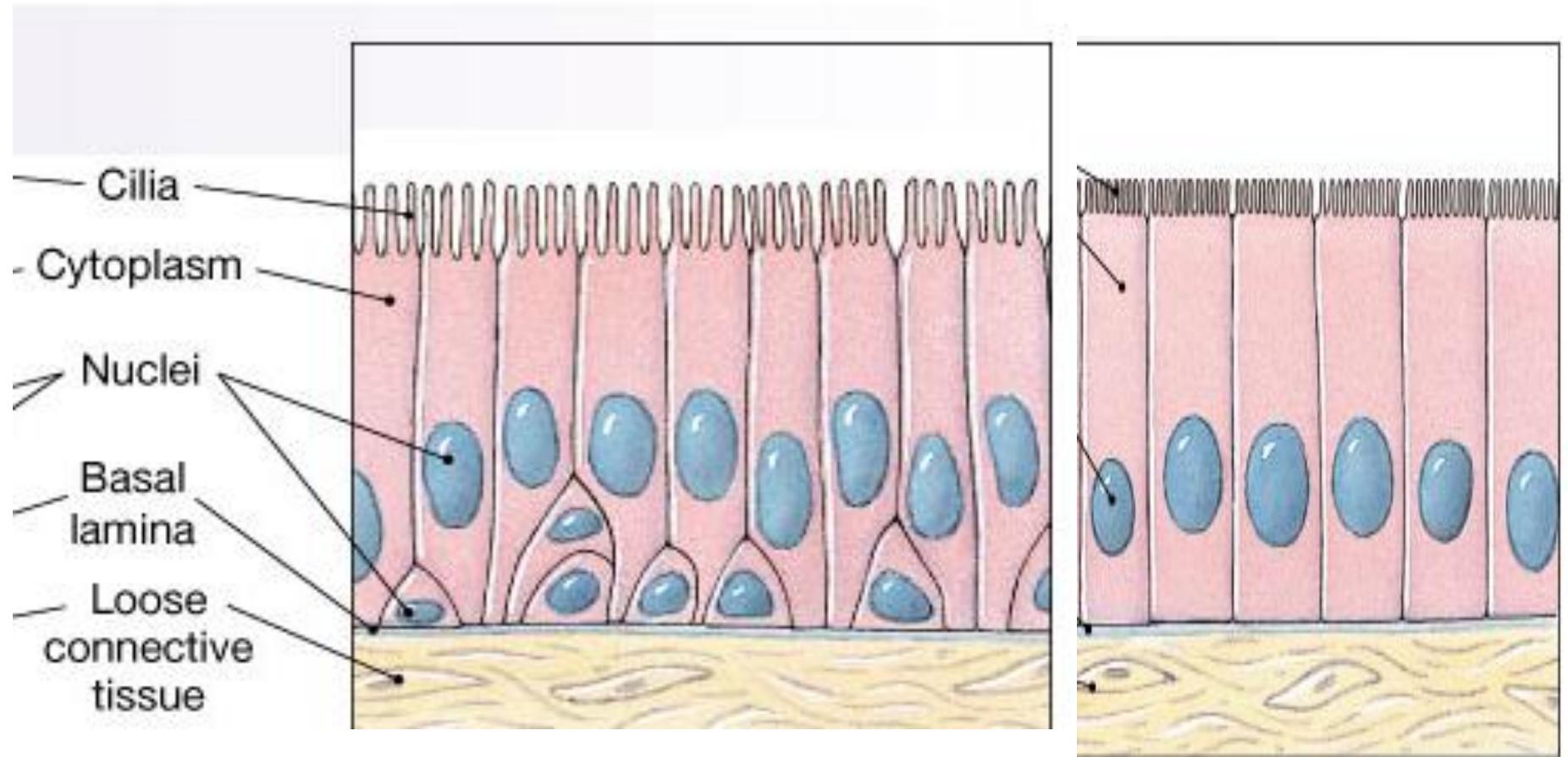
## **b. Simple columnar epithelium ciliated**



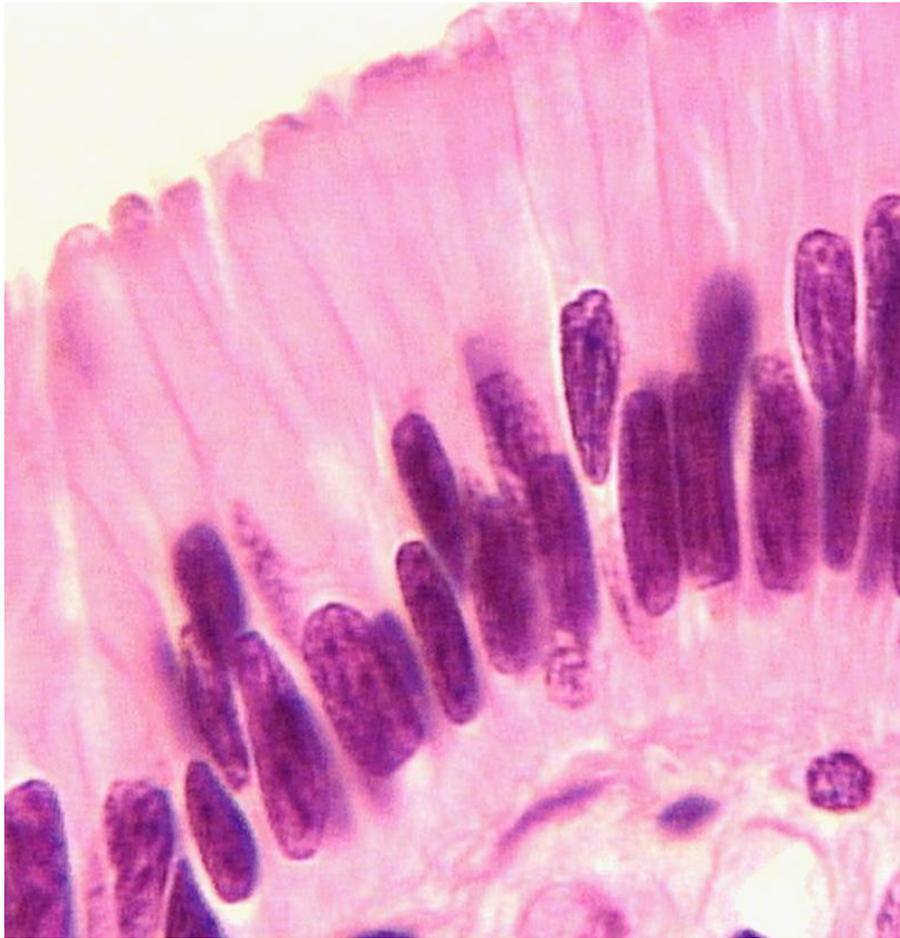
**Sites: uterus, oviduct & bronchiole of the lung**  
**(movement of luminal contents)**

# 4- Pseudostratified columnar epithelium

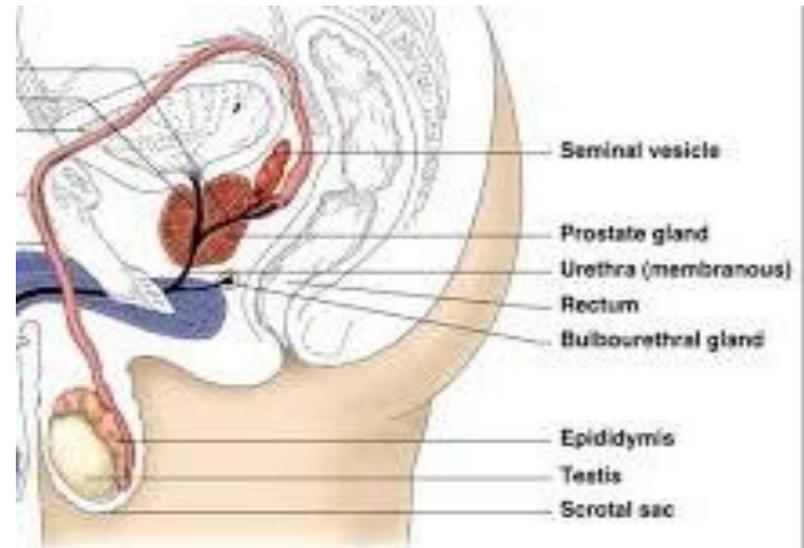
False



## **a- Pseudostratified columnar epithelium non ciliated**



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



# **b. Pseudostratified columnar epithelium ciliated**

**Sites:** Nose- Trachea



# Stratified Epithelium

**What cell is on the top layer?**

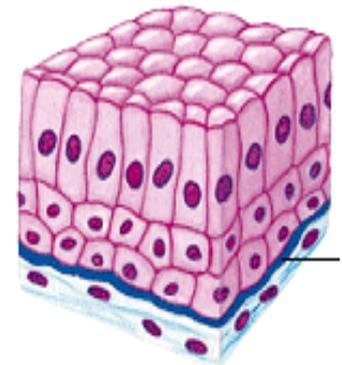
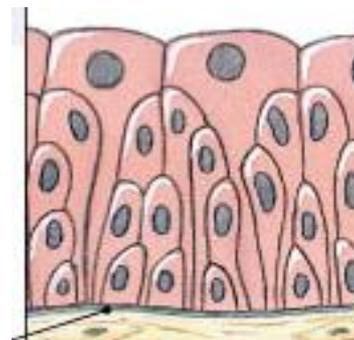
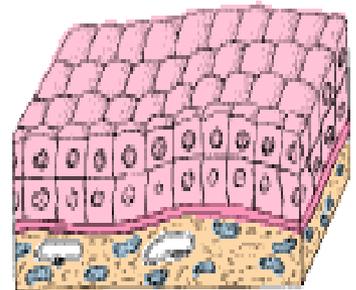
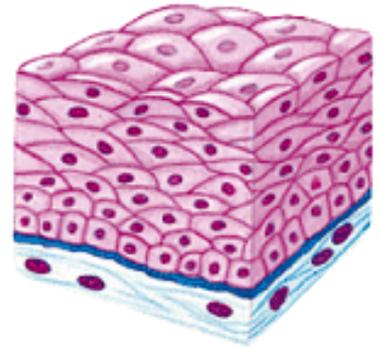
**Classification according to shape of most superficial layer**

Stratified sqamous epithelium

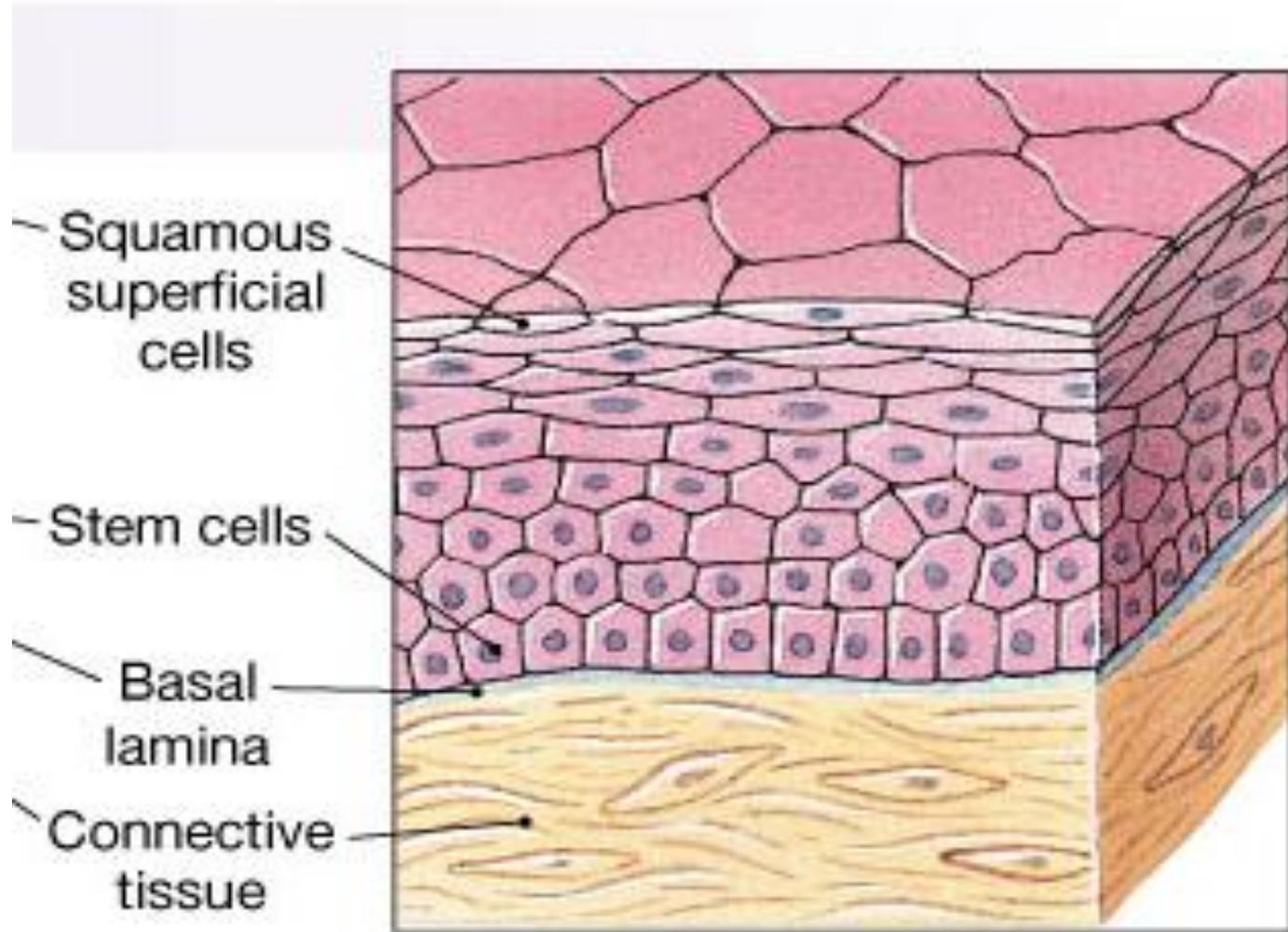
Stratified cuboidal epithelium

Stratified columnar epithelium

Transitional epithelium

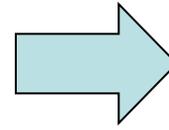
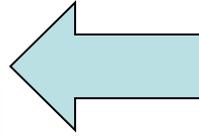


# Stratified Squamous Epithelium

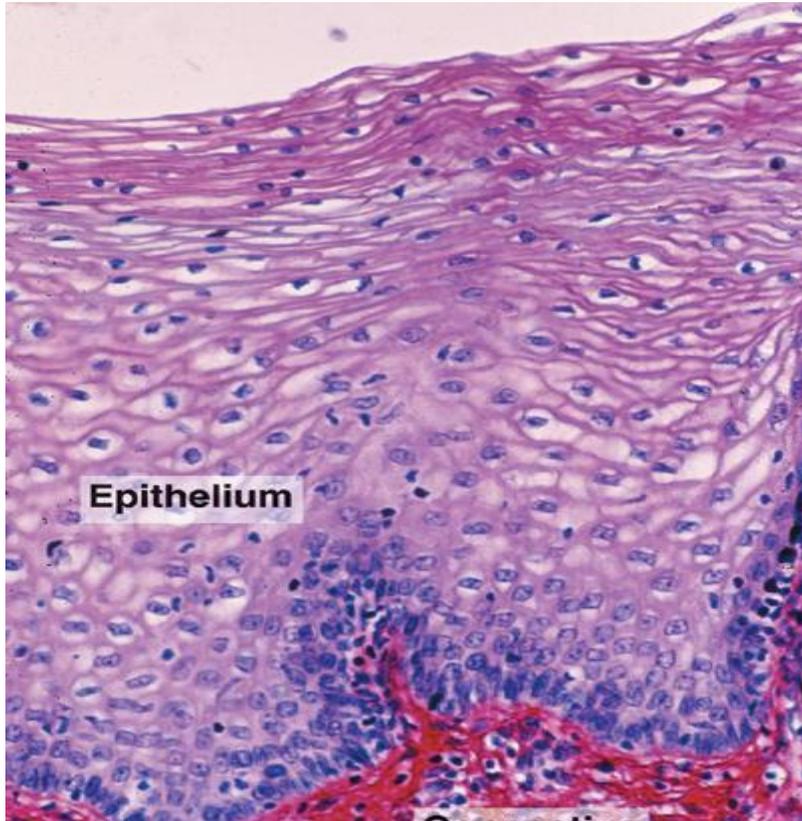


# Stratified squamous epithelium

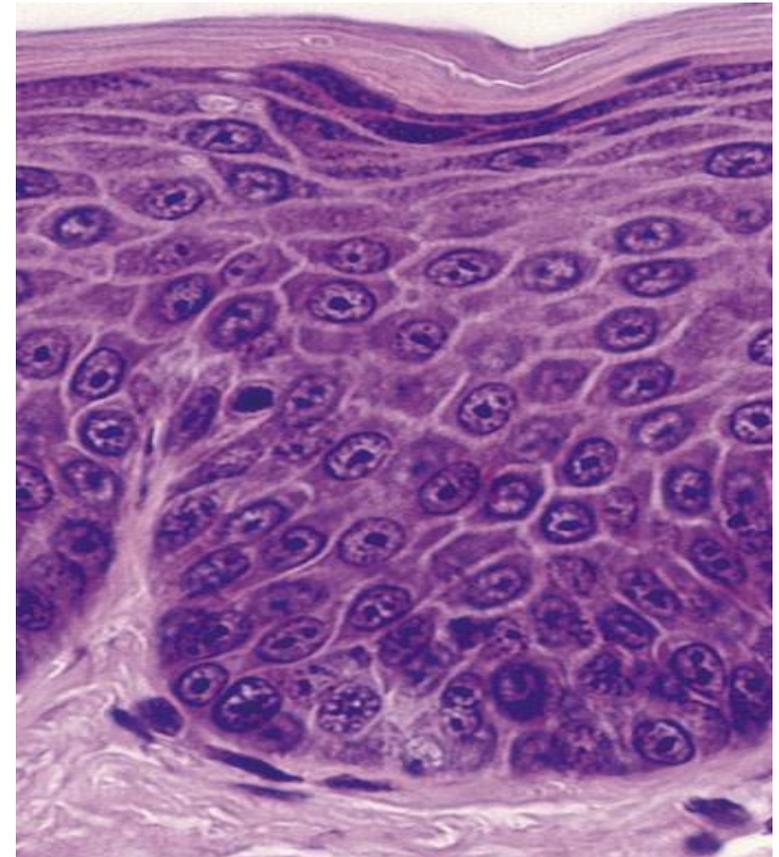
Non Keratinized



Keratinized



Oesophagus- vagina

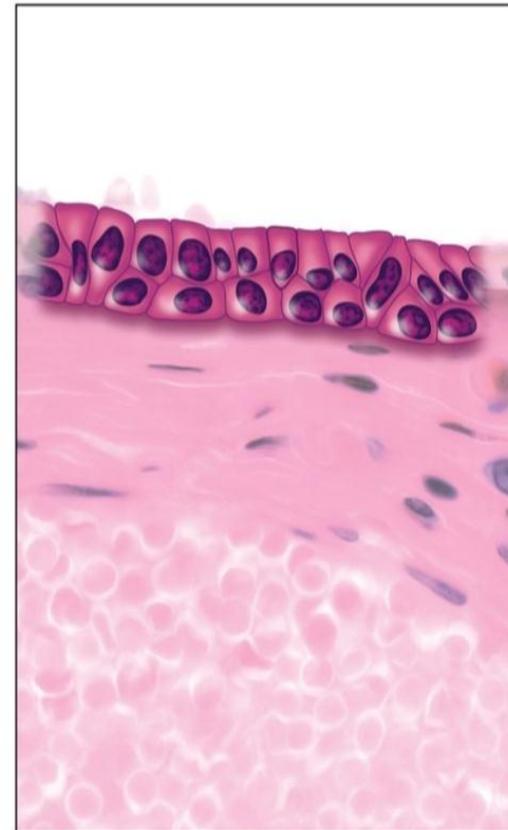


skin

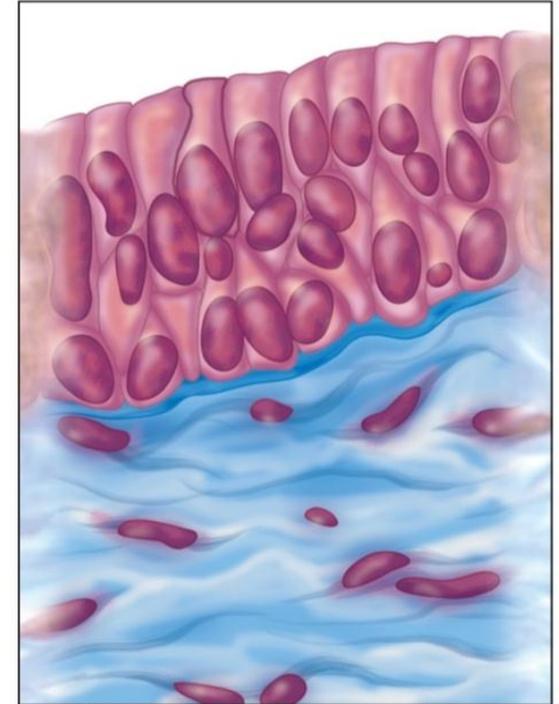
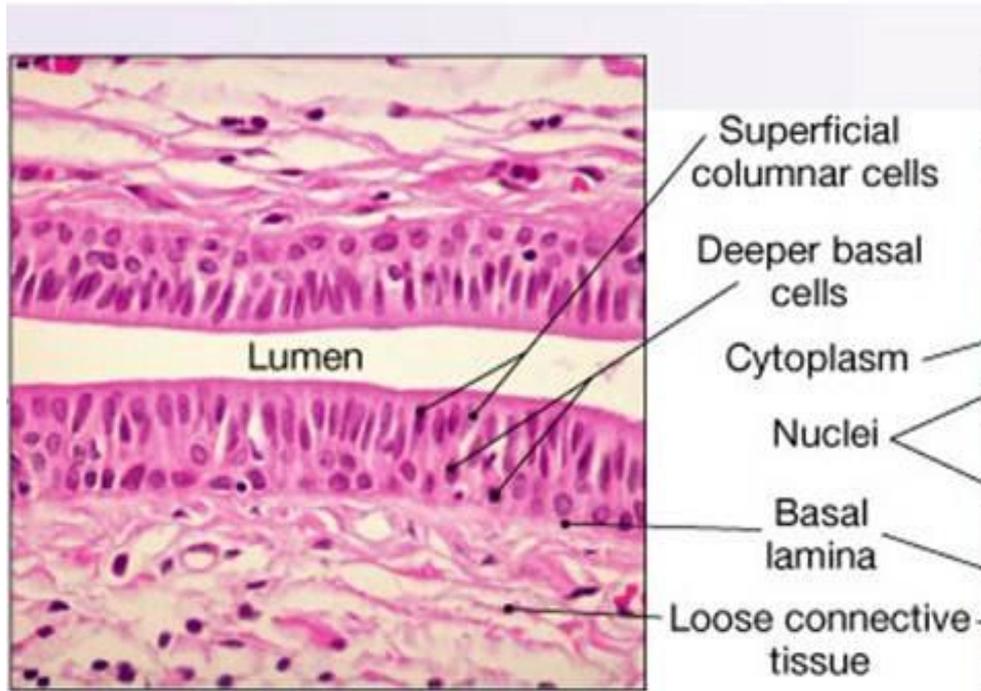
(Physical protection)

# Stratified Cuboidal Epithelium

(Ducts of sweat glands: secretion) (Rare)



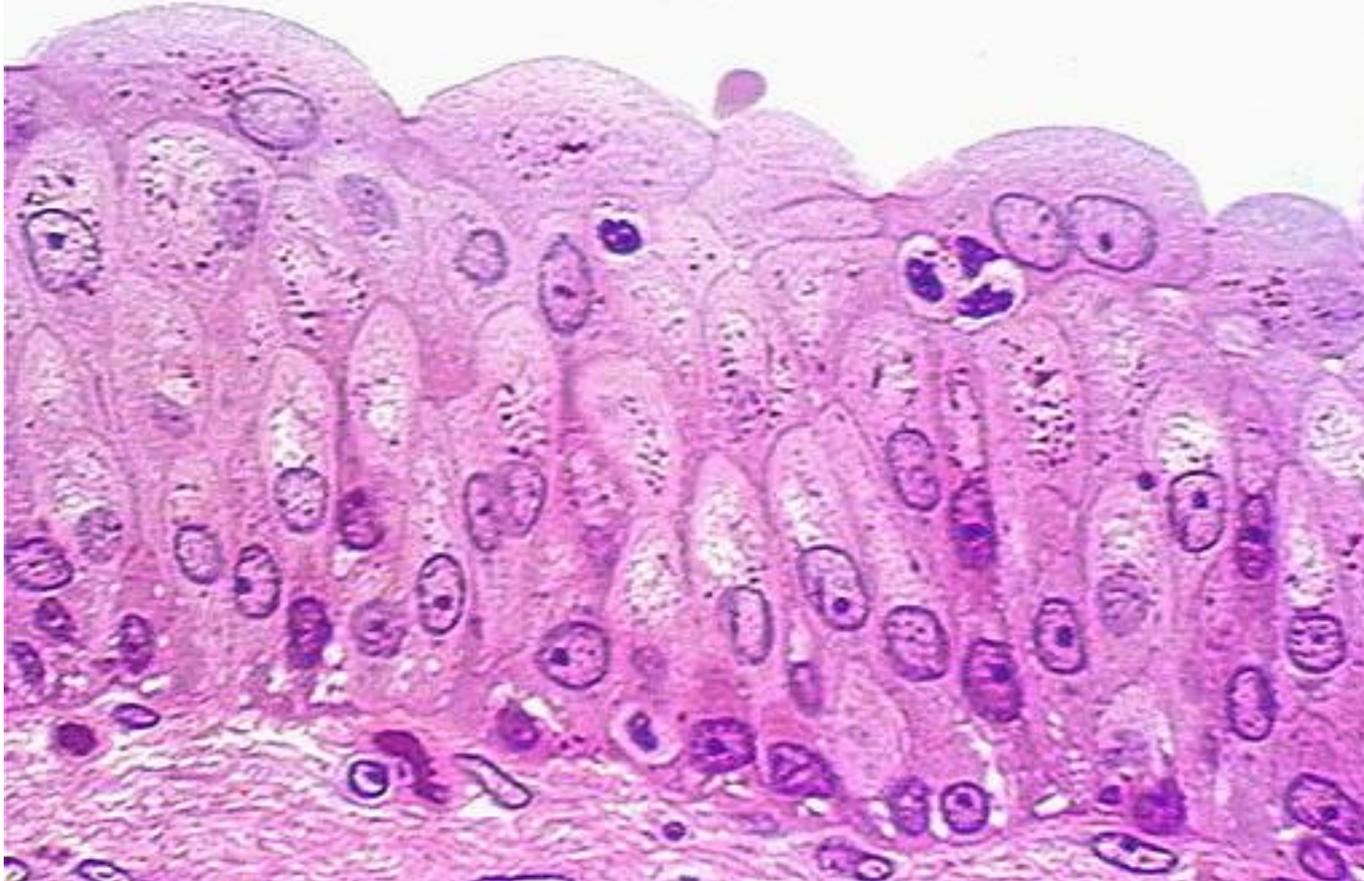
# Stratified Columnar Epithelium (Rare)



- ciliated: penile urethra
- Non ciliated: conjunctival fornix

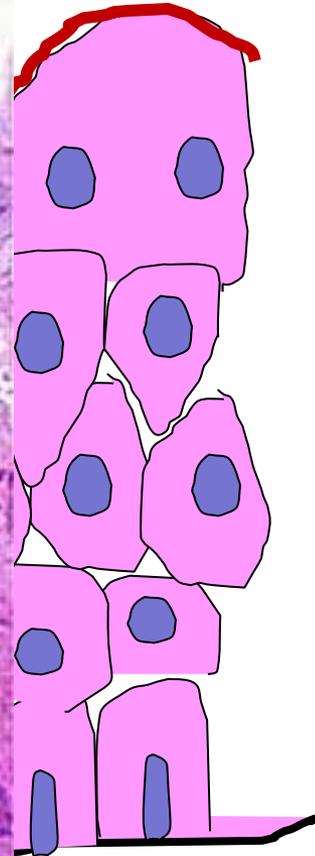
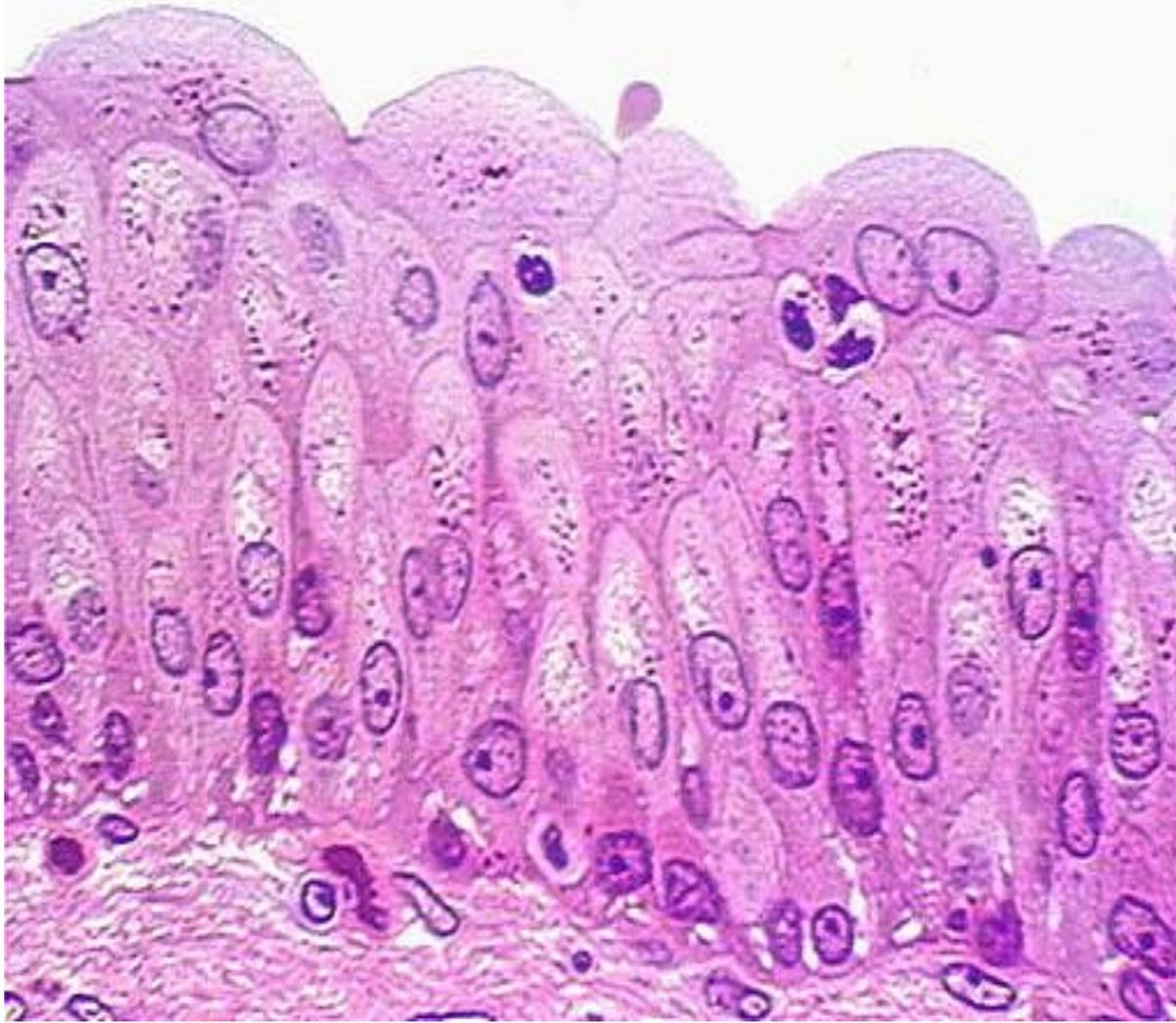
**(protection)**

# Transitional epithelium



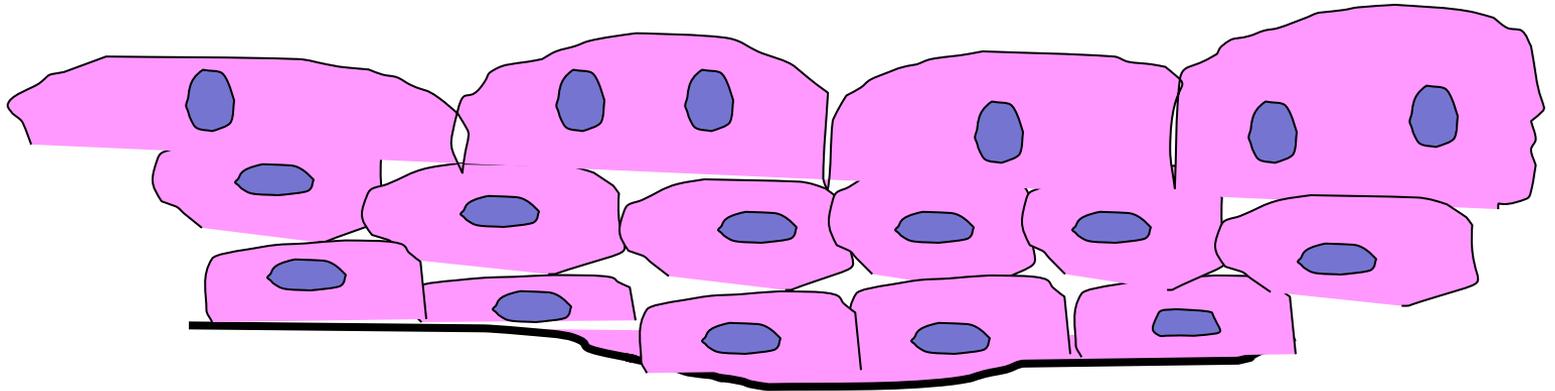
(urinary bladder - empty)

# Transitional Epithelium

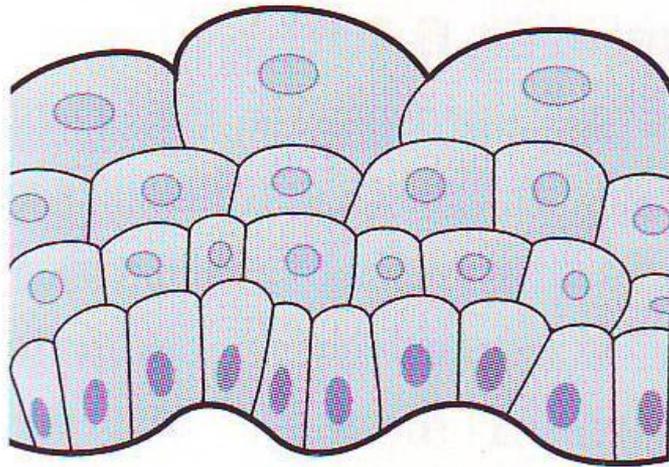


# Transitional Epithelium

**Full urinary bladder**

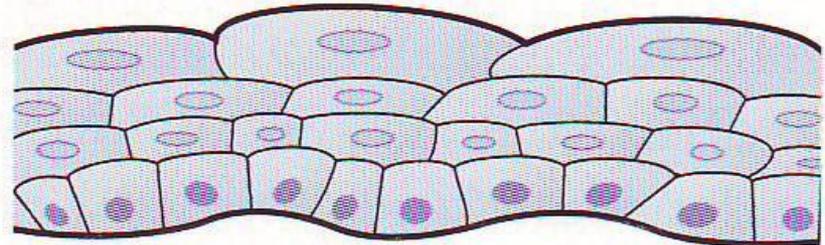


# Transitional epithelium



A

Relaxed



B

Stretched

**Transitional epithelium:** A. Relaxed. B. Stretched.

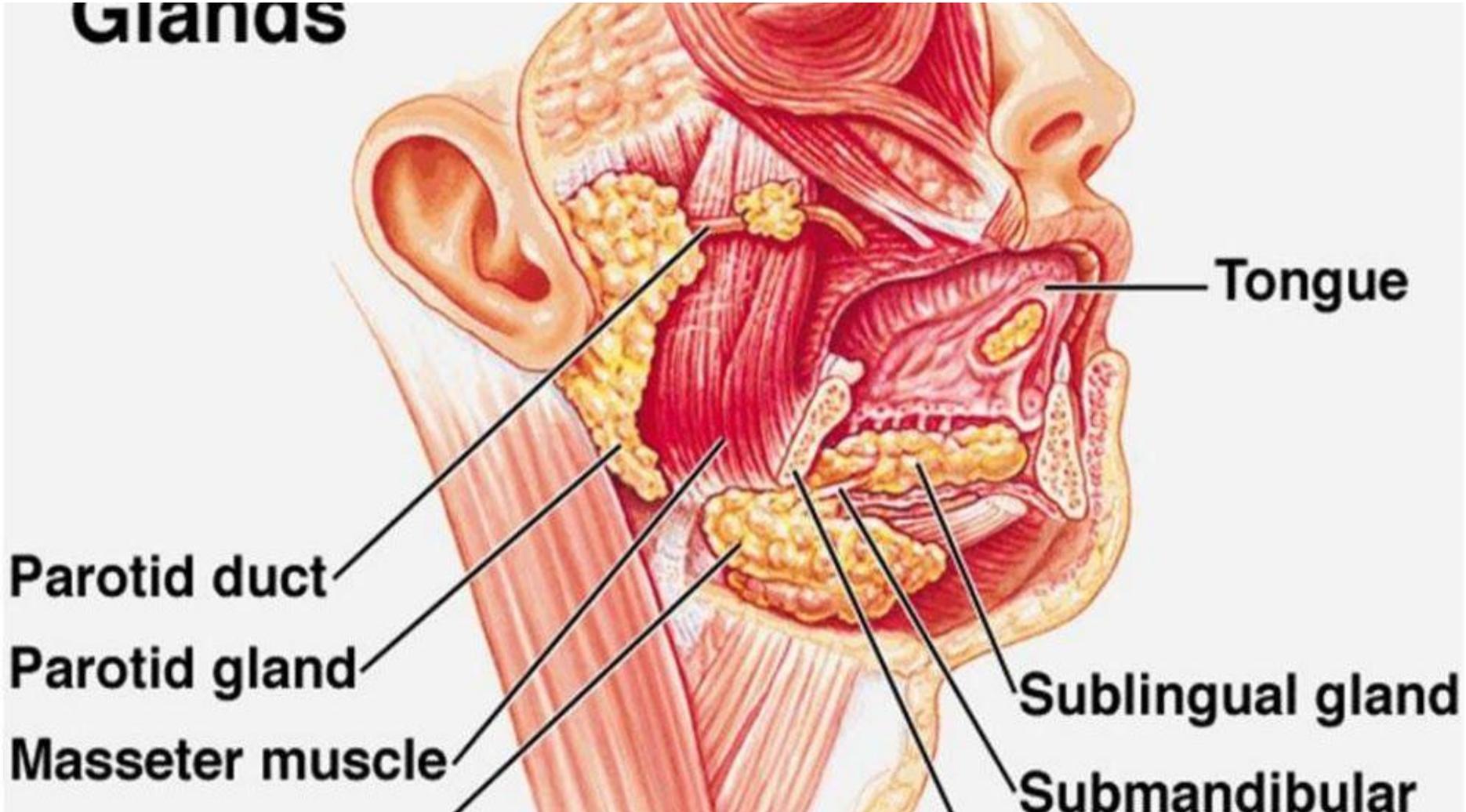
# **Transitional epithelium**

## **Adaptation of Transitional epithelium to its function:**

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

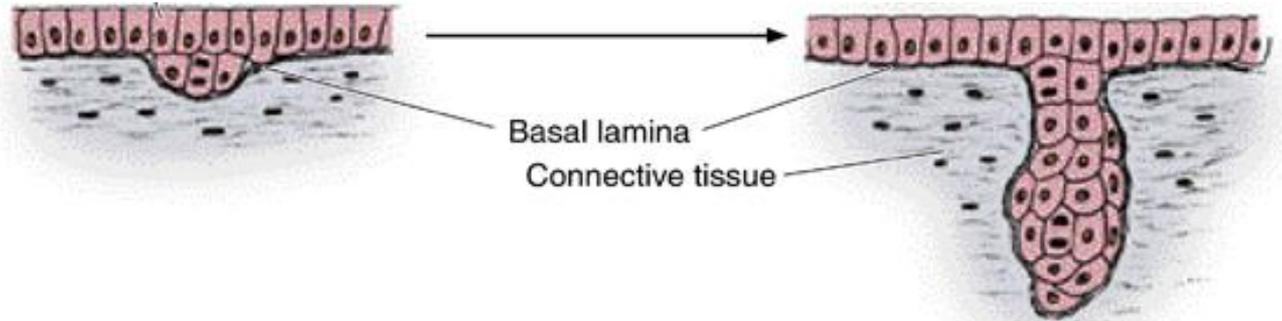
# Glandular Epithelium

## Glands

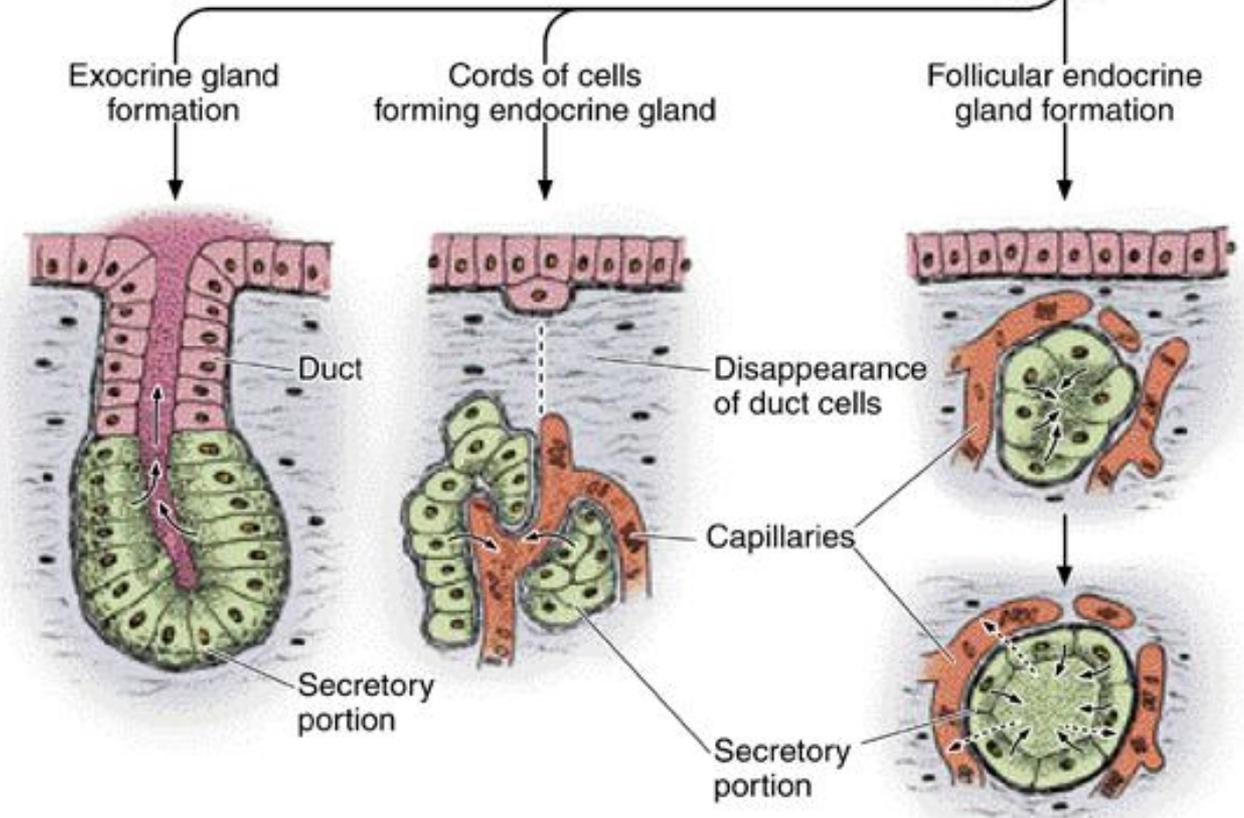


# Glandular Epithelium

Origin



differentiation



# **Types of glandular epithelium**

**It is classified according to:**

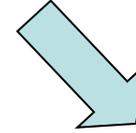
- 1- Number of cells**
- 2- Presence or absence of a duct system**
- 3- Mode of secretion (mechanism)**
- 4- Nature of secretion**
- 5- Shape of the secretory portion**
- 6- Branching of duct**

# Number of cells



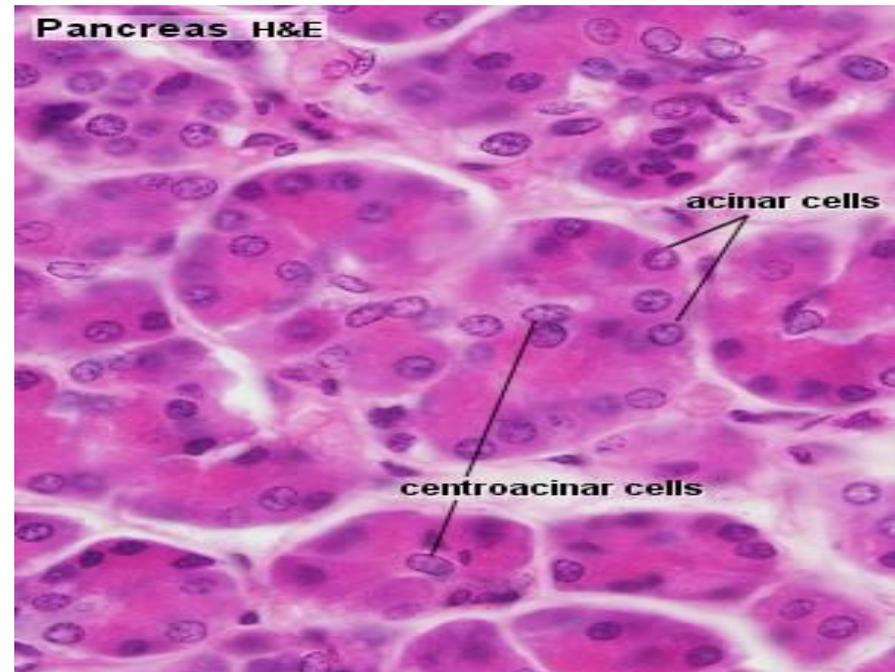
**Unicellular**

**(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**

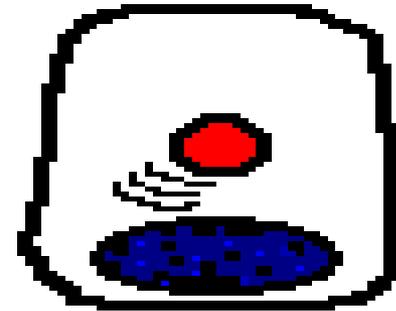
- **Apocrine glands**

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

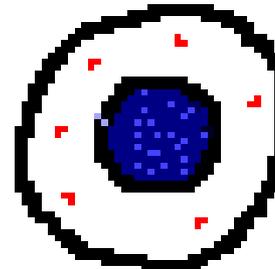
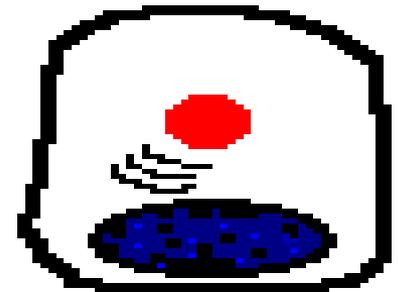
- **Holocrine gland**

- The secretion destroys the cell **Sebaceous glands**

merocrine



apocrine



# Presence of a duct system

**Exocrine**      **Endocrine**      **mixed**

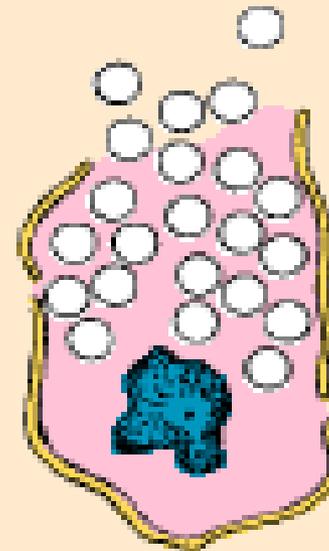
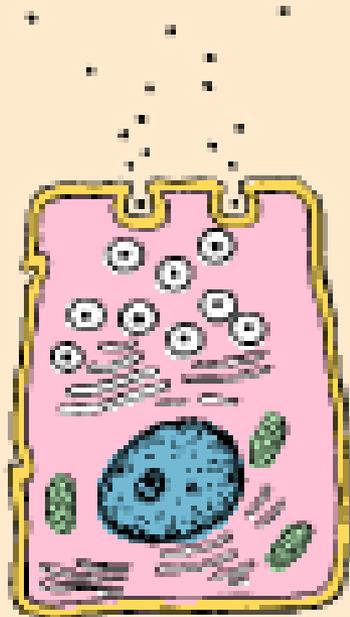
Exocrine Glands

Endocrine Glands

Merocrine

Apocrine

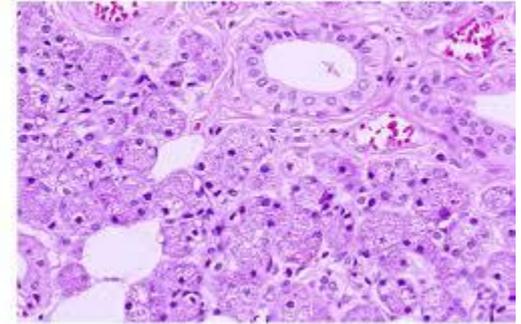
Holocrine



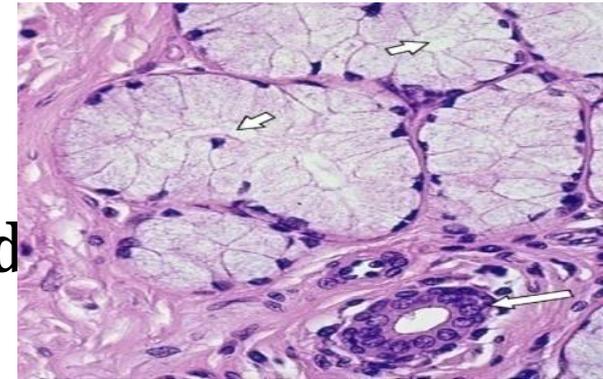
# Nature of Glandular secretions

❑ **Serous glands: parotid gland**

Parotid Gland

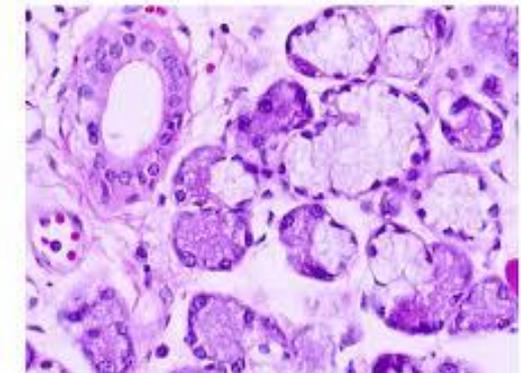


❑ **Mucous glands: sublingual gland**



❑ **Mixed glands: submandibular gland**

Submandibular Gland



❑ **Glands with special secretion:**

➤ **sebaceous gland (oily secretion)**

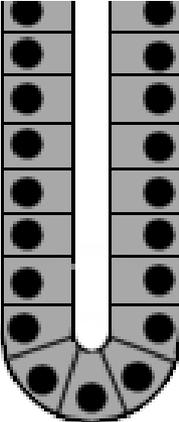
➤ **lacrimal gland watery secretion**

➤ **Mammary gland : Milk secretion**

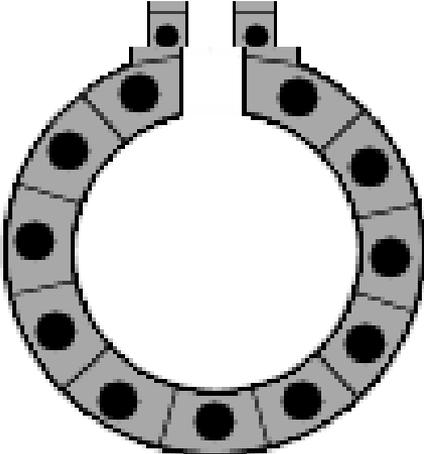
➤ **Glands in the ear : wax**

# Shape of secretory portion

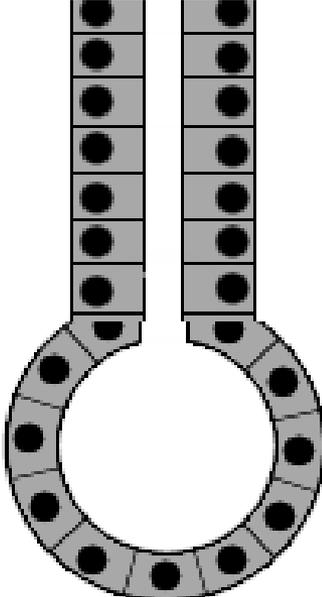
tubular



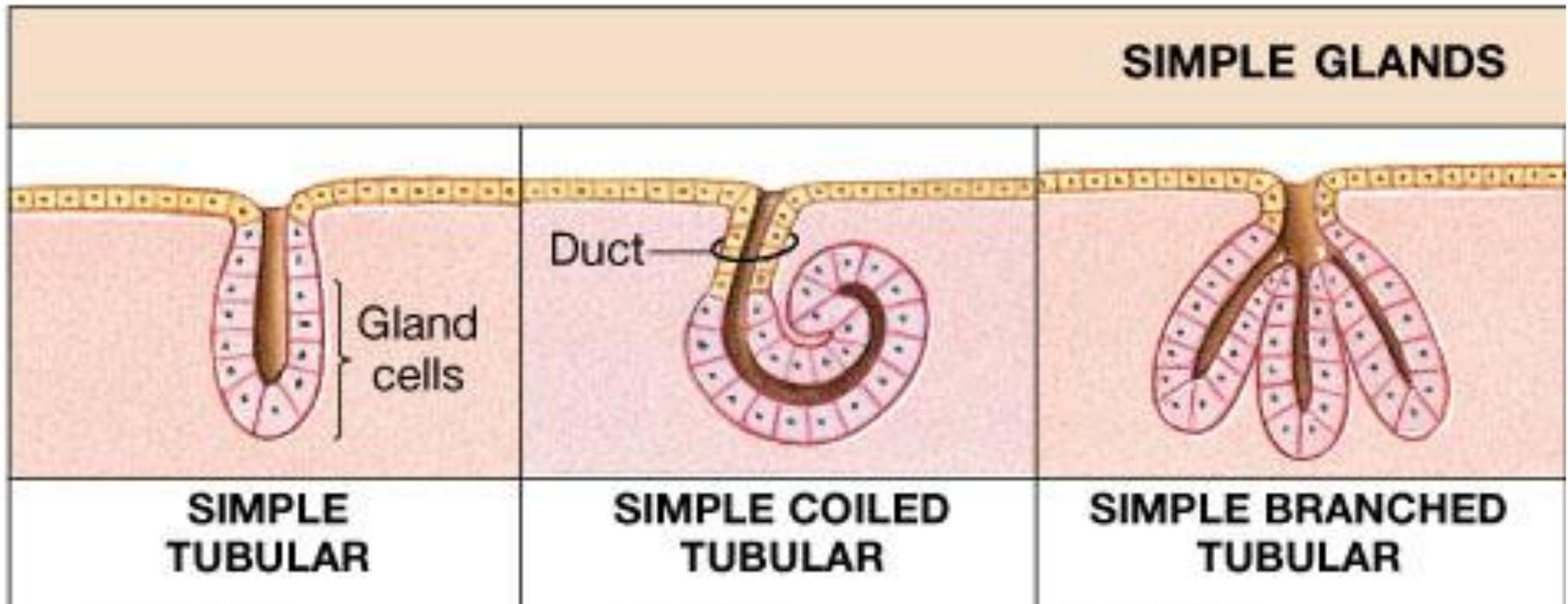
alveolar



tubulo-alveolar



# Classification of Tubular Glands

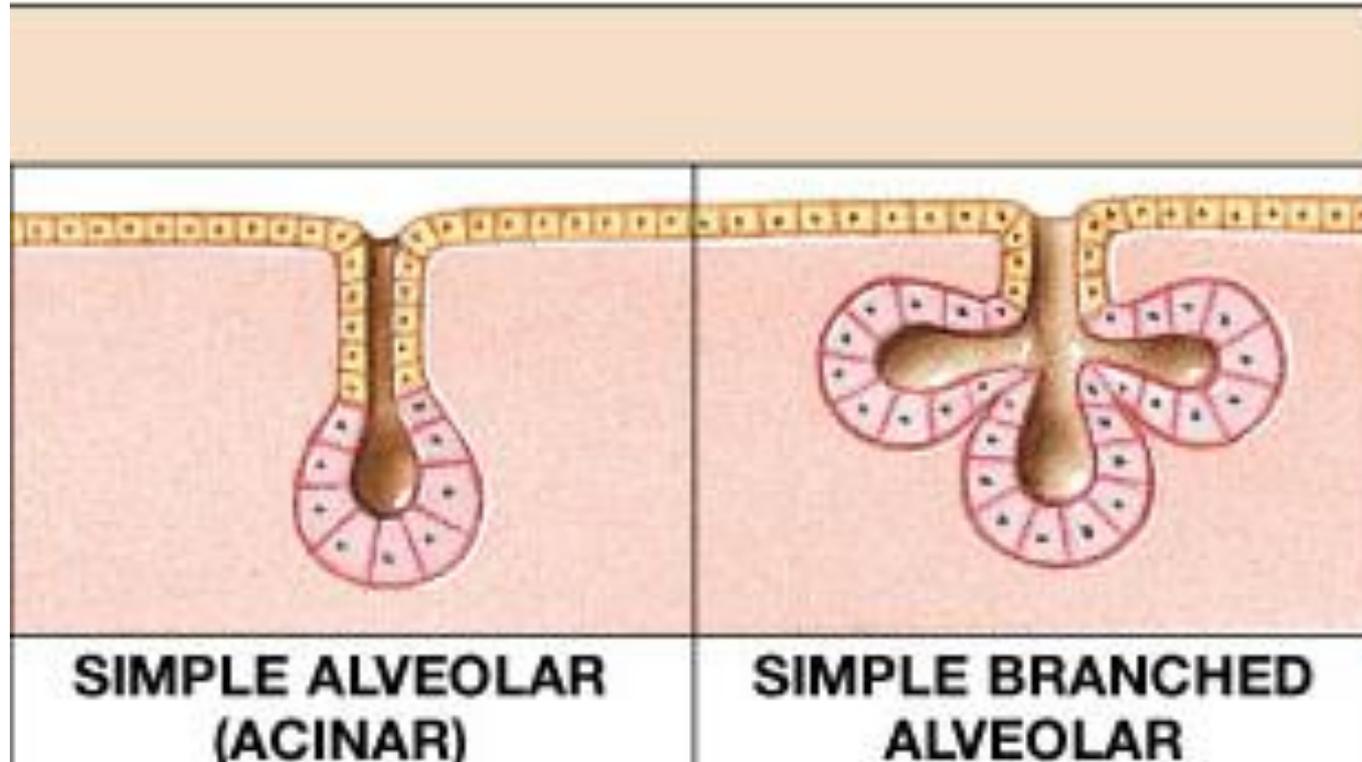


**Intestinal glands**

**Sweat glands**

**Fundic glands**

# Classification of Alveolar Glands

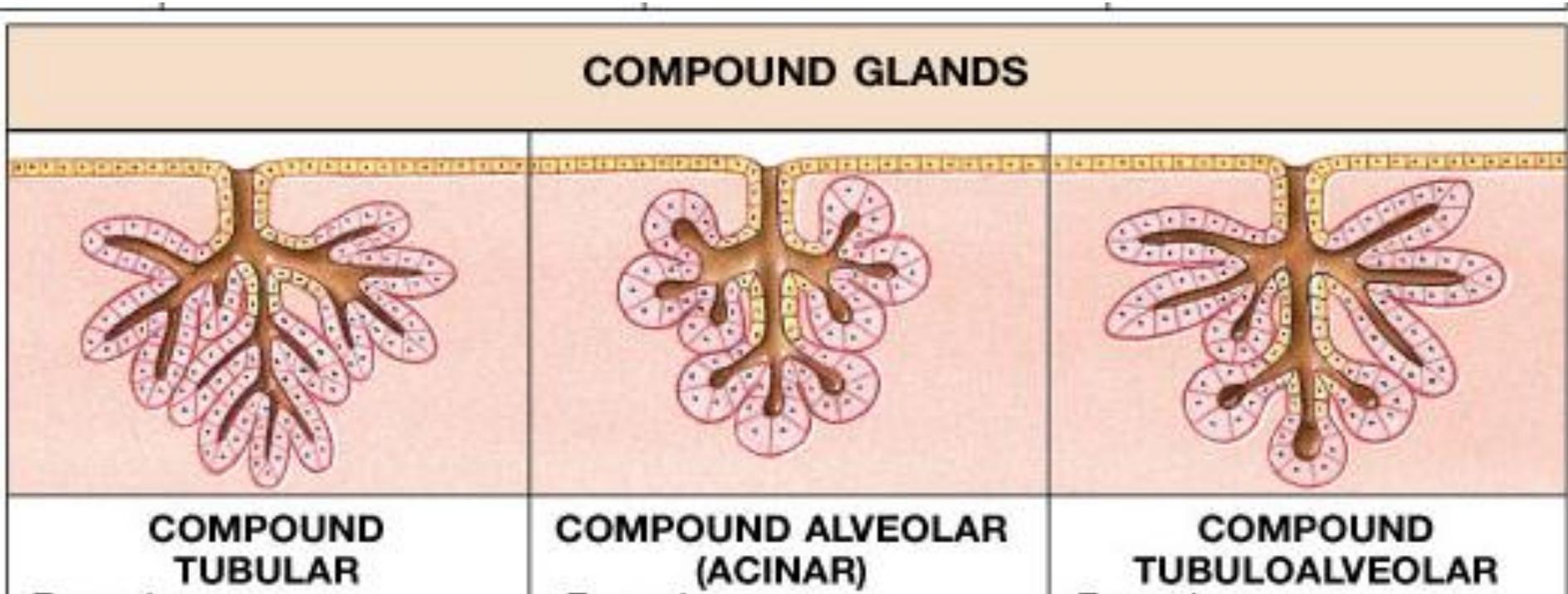


**Sebaceous glands**

**Tarsal glands**

# Classification of Compound Glands

**Compound: branched duct, branched secretory portion**



Liver

mammary glands

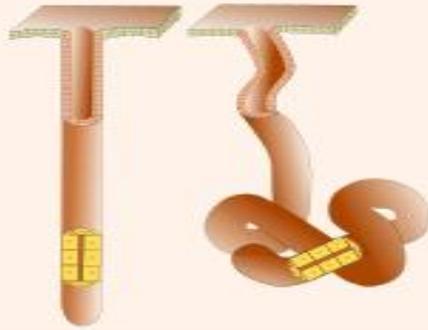
salivary glands

Tubular

Alveolar

Acinar

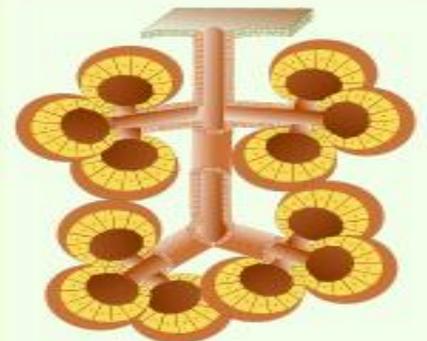
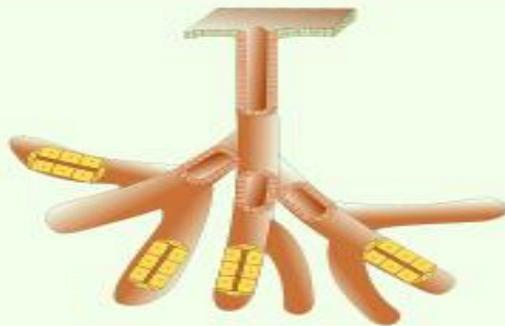
Simple types



Branched

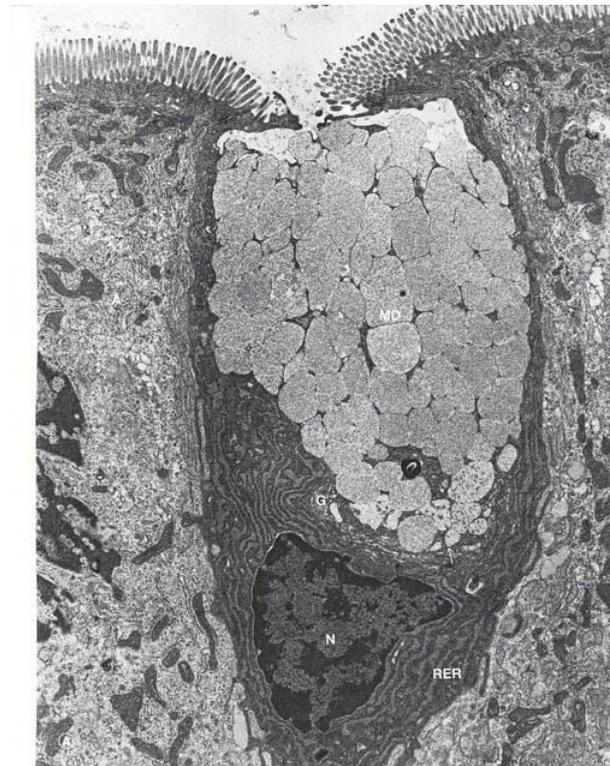
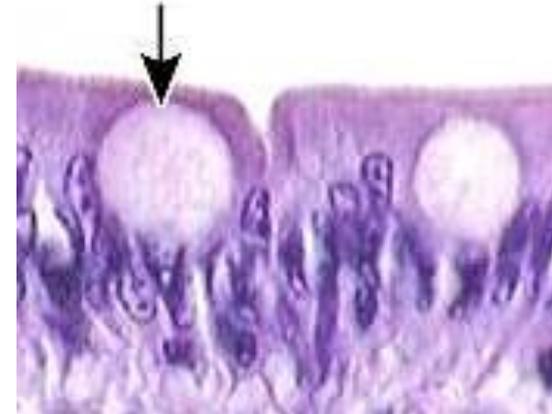


Compound



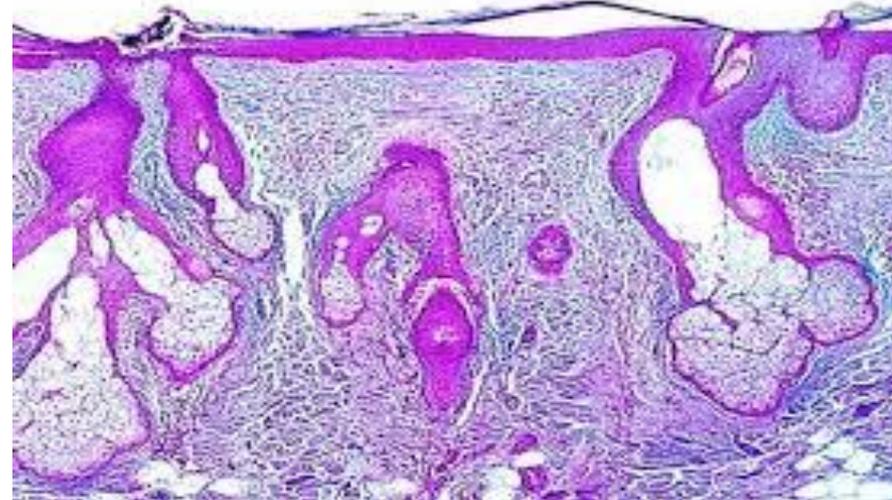
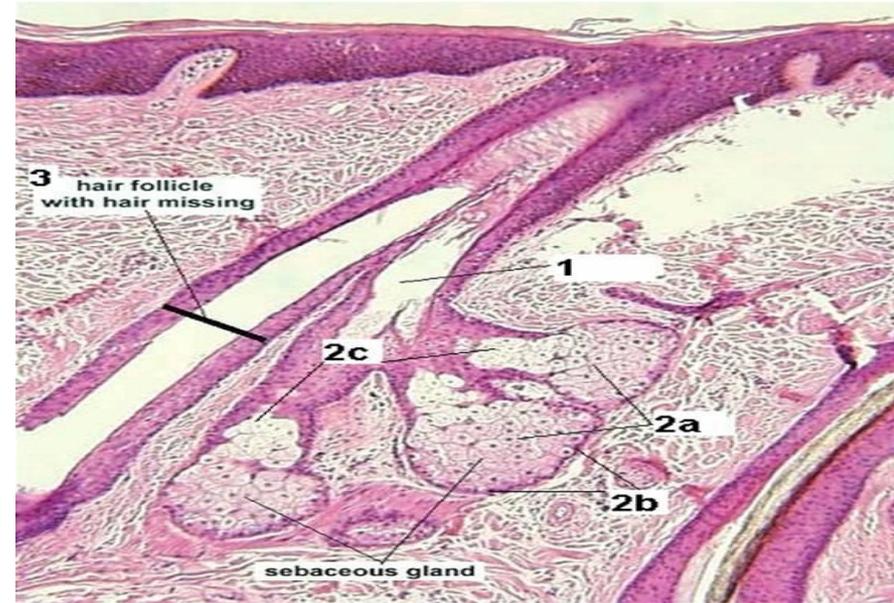
# Goblet cells

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



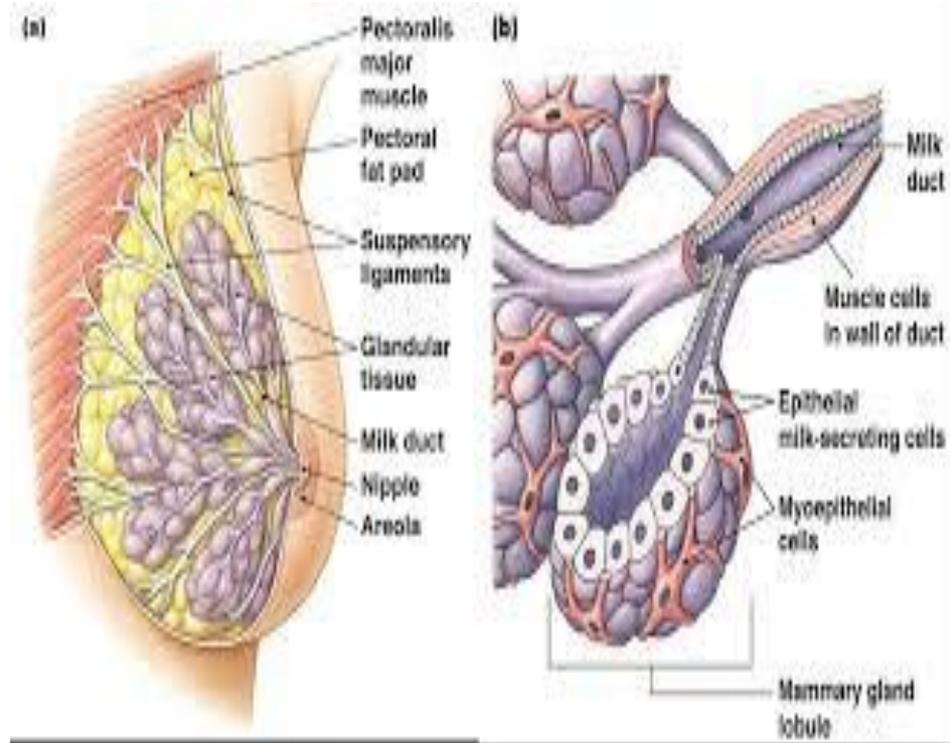
# Sebaceous gland

- 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



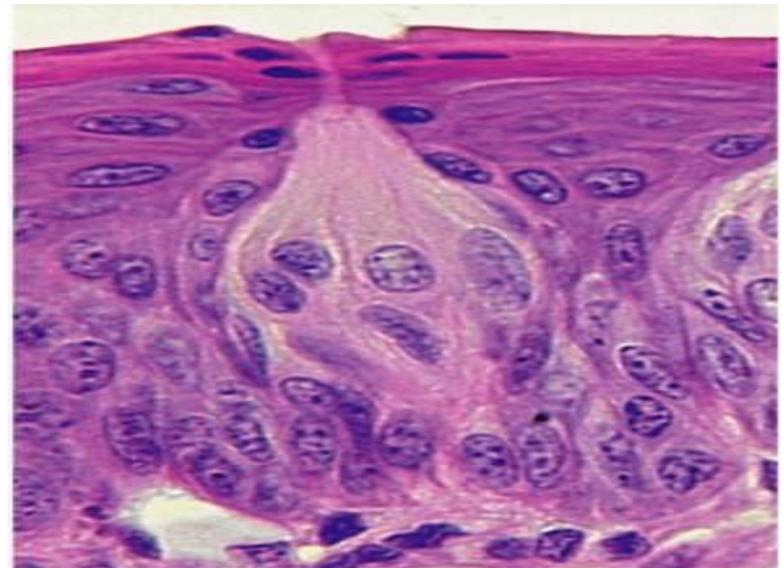
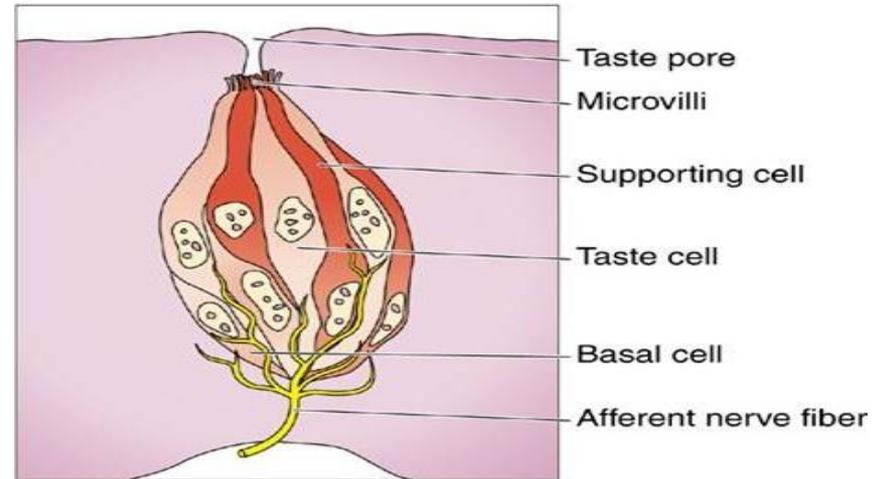
# Mammary gland

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



# Special types of epithelium

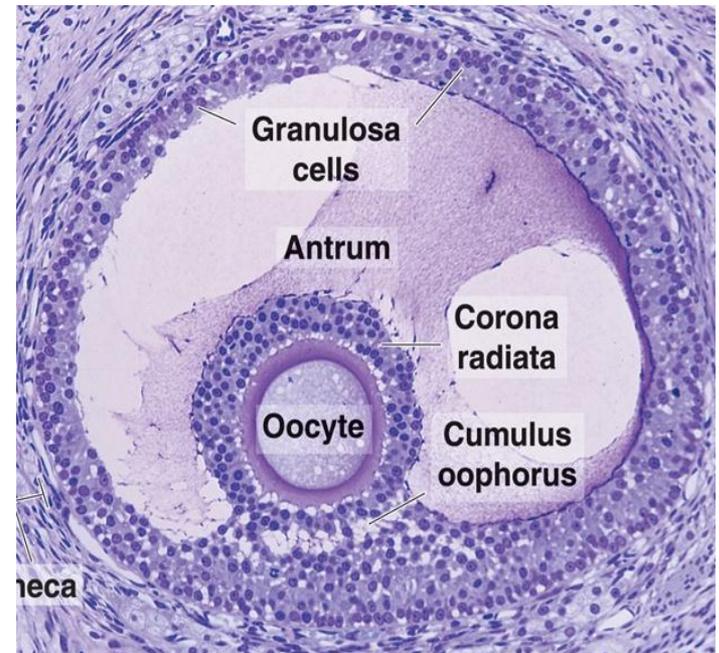
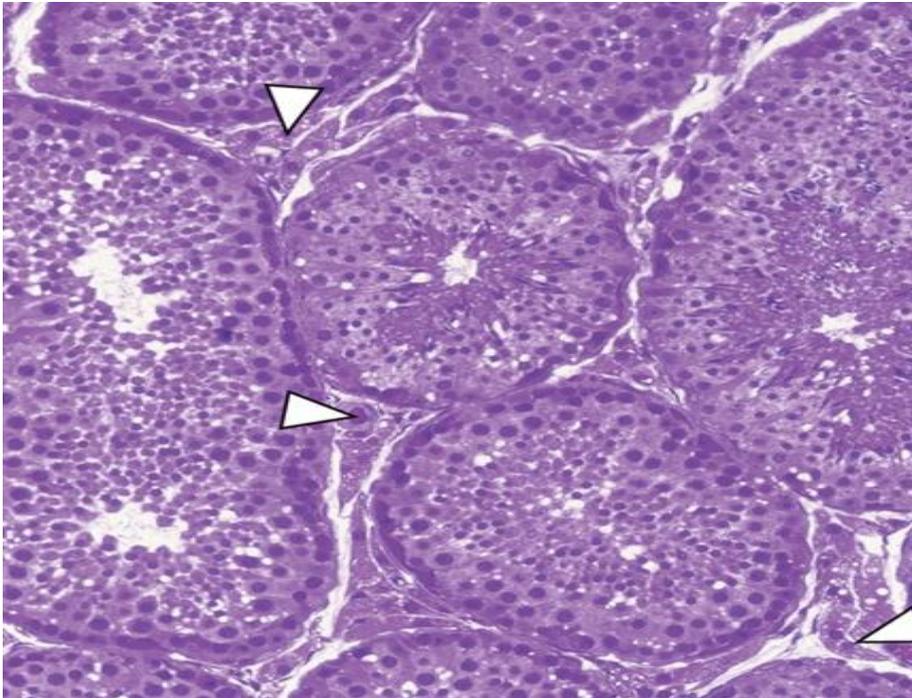
- **1-Neuroepithelium**
- E.g. Taste buds
- Site : dorsal surface of the tongue
- Function : sensation



# Special types of epithelium

## 2. Germinal epithelium

**Testis:** sperm



**Ovary:** ovum

**Function:** :  
Reproduction

### 3- Myoepithelium

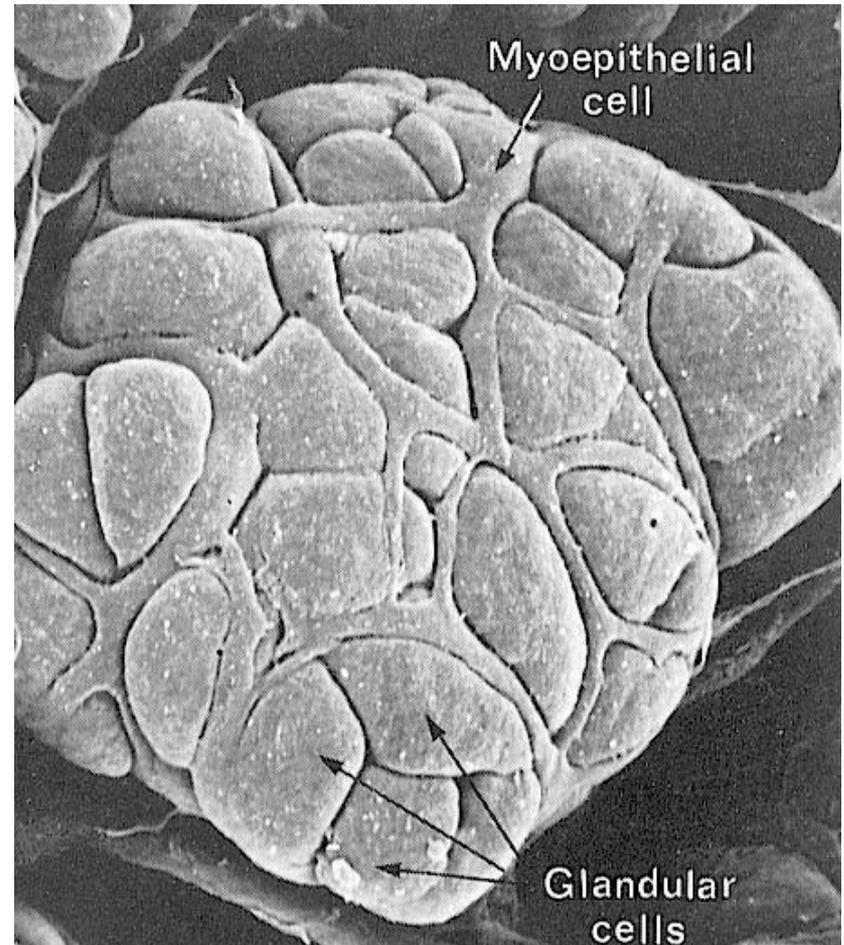
**Shape :** Irregular with many processes

Contain actin & myosin in the cytoplasm

**Site :** Acini & ducts of the gland

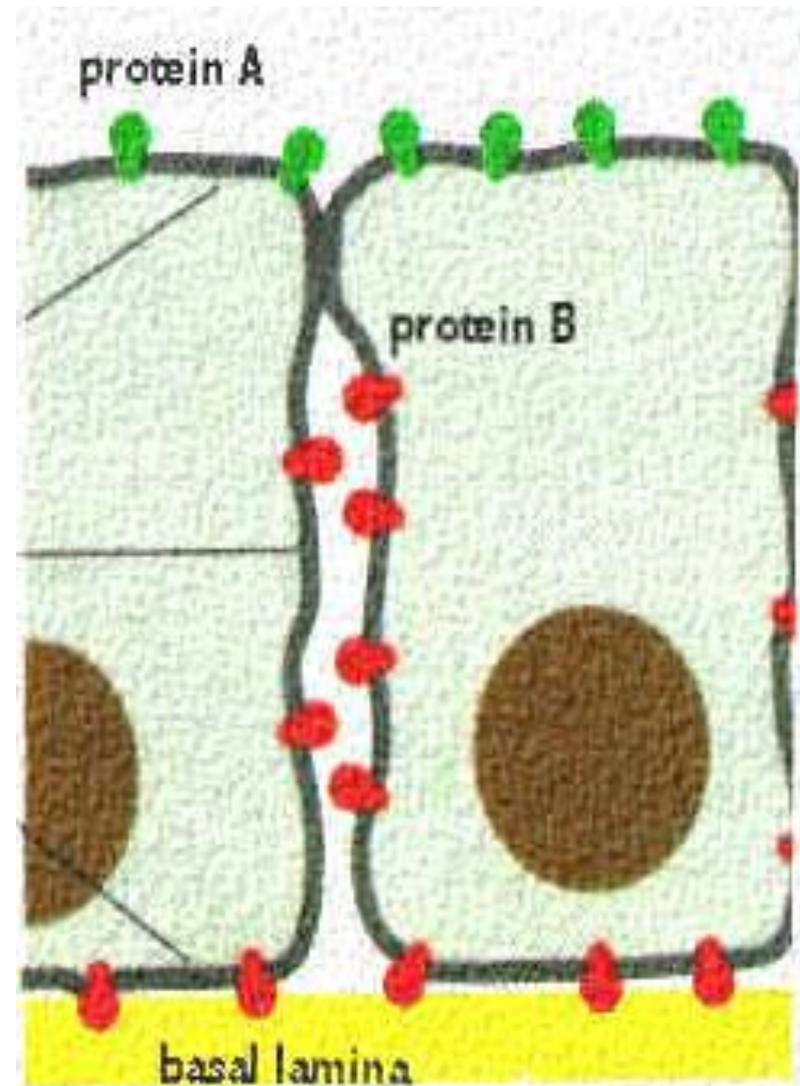
**Function :**

Contraction for squeezing the secretion



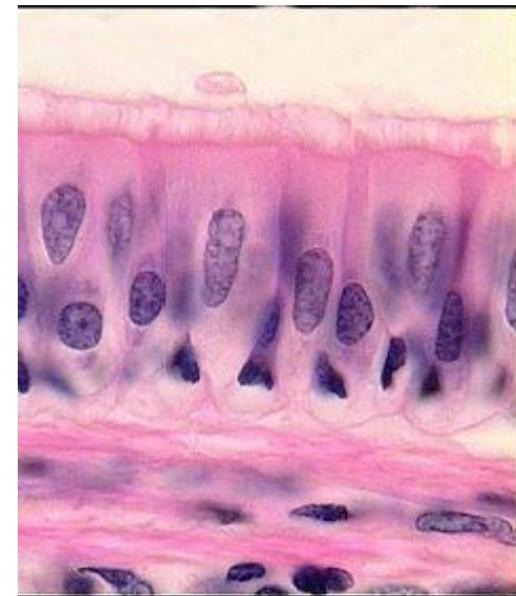
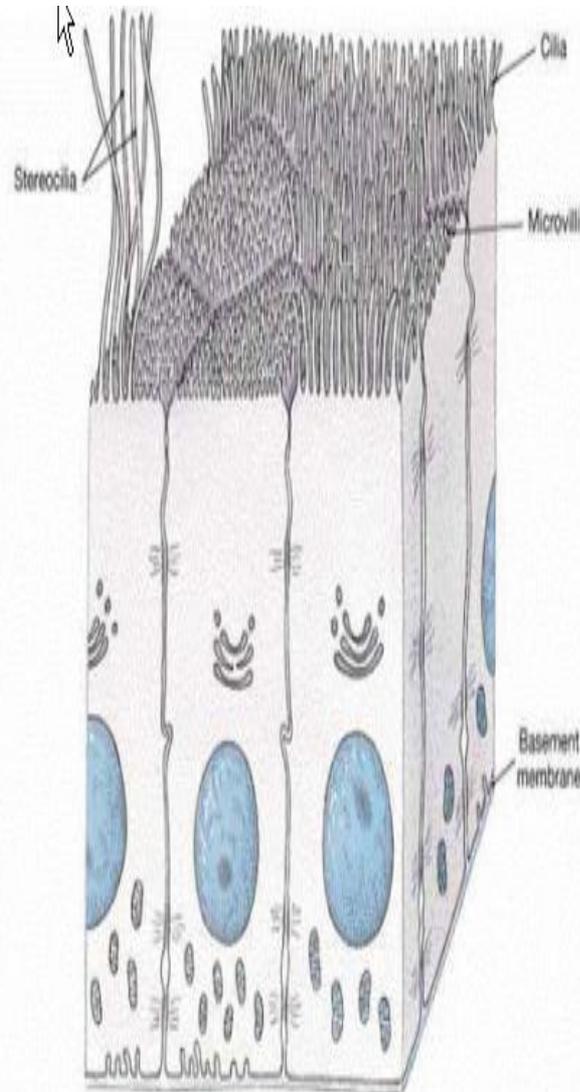
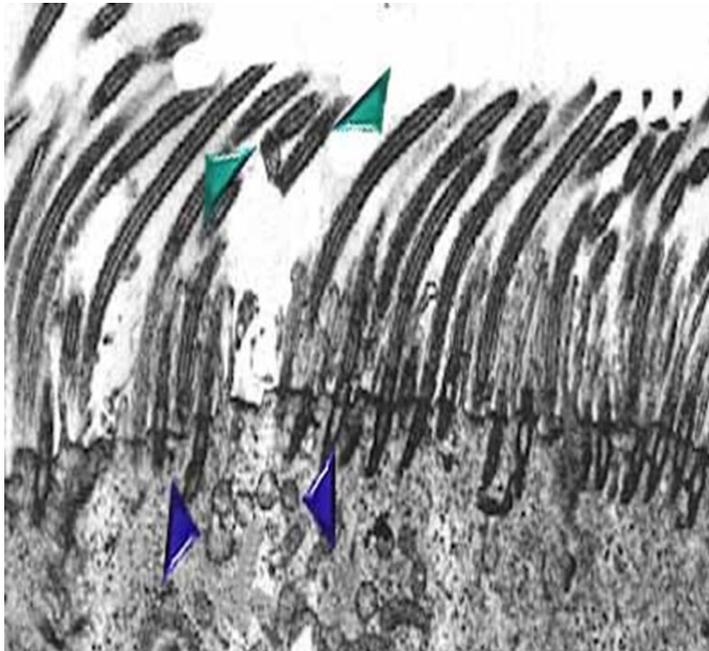
# Epithelial polarity

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

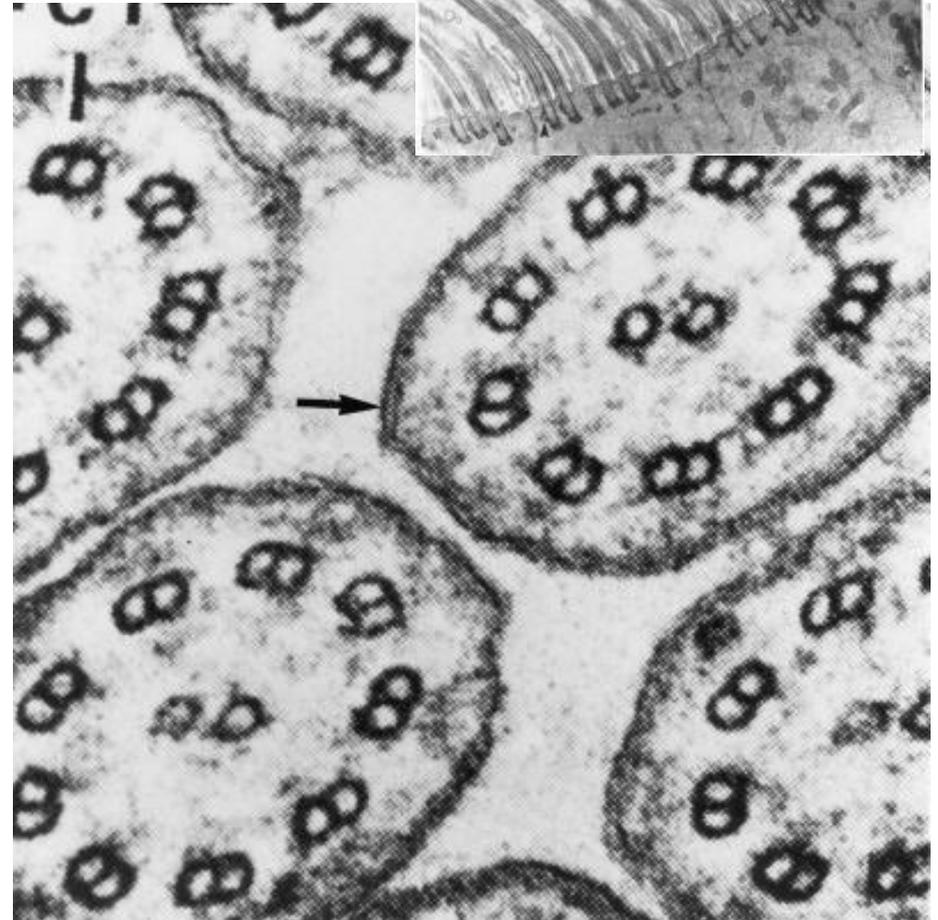
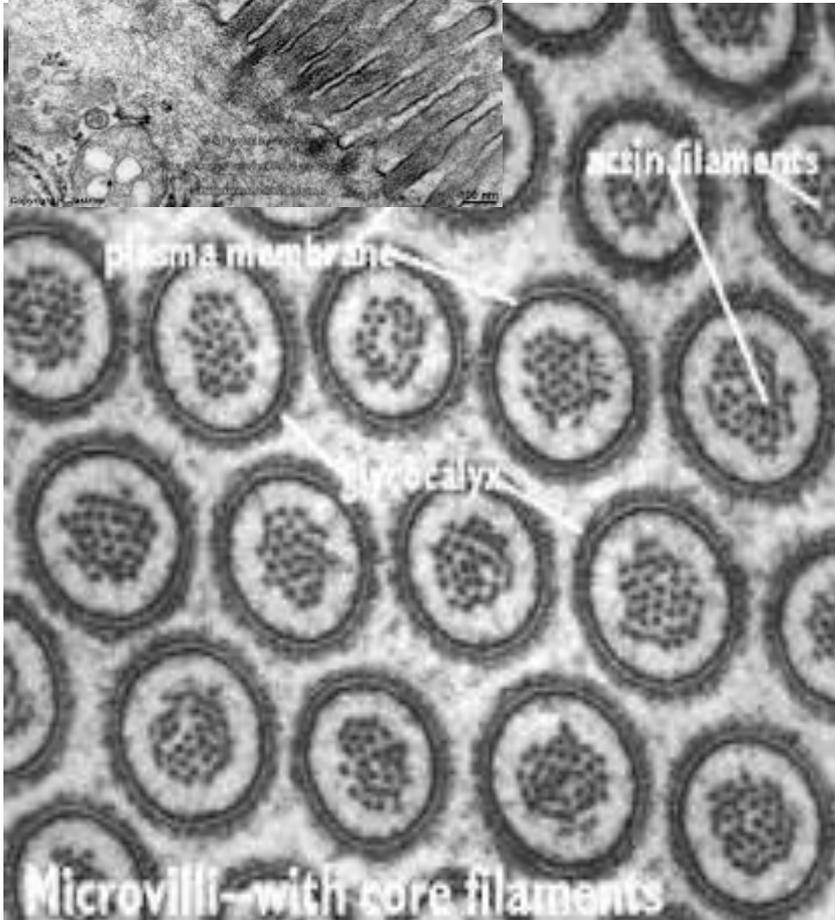
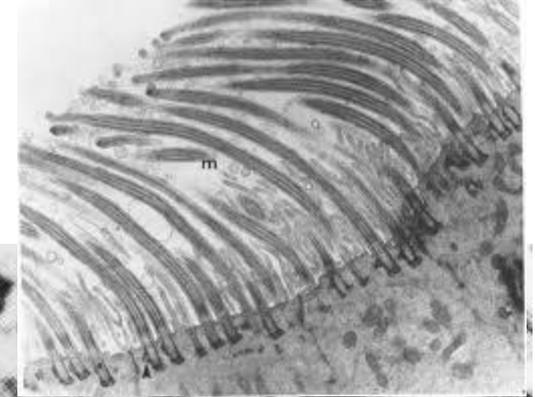


# Apical modifications

- Cilia
- Microvilli
- Stereocilia



# Apical modifications



| <b>Microvilli</b> |   | <b>Stereocilia</b>   | <b>Cilia (kinocilia)</b>  |
|-------------------|---|--|---|
| 1.                | Superficial evaginations of cells                               | Superficial evaginations of cells                                  | Cell surface prolongations which develop from inside the cell       |
| 2.                | Glycocalyx present  | Glycocalyx present   | Glycocalyx inconspicuous  |
| 3.                | Length 0.6-2.0 $\mu\text{m}$ ;<br>thickness - 0.1 $\mu\text{m}$ | Length - 2-15 $\mu\text{m}$ ;<br>thickness-upto 0.25 $\mu\text{m}$ | Length 2-150 $\mu\text{m}$ ;<br>thickness - about 0.5 $\mu\text{m}$ |
| 4.                | Cylindrical in outline  | Elongated, wavy and tapering structures                            | Thread-like structures with tapering ends                           |
| 5.                | Supported internally by actin filaments                         | Supported internally by actin filaments                            | Supported internally by microtubules                                |
| 6.                | Basal granule absent  | Basal granule absent   | Basal granule present   |
| 7.                | Interconnections absent   | Adjacent stereocilia often develop interconnections                | Interconnections rare   |
| 8.                | Not vibratile   | Not vibratile  | Vibratile   |
| 9.                | Take part in absorption of materials                            | Sensory transducers absorptive in function                         | Take part in material movement                                      |

# 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**)

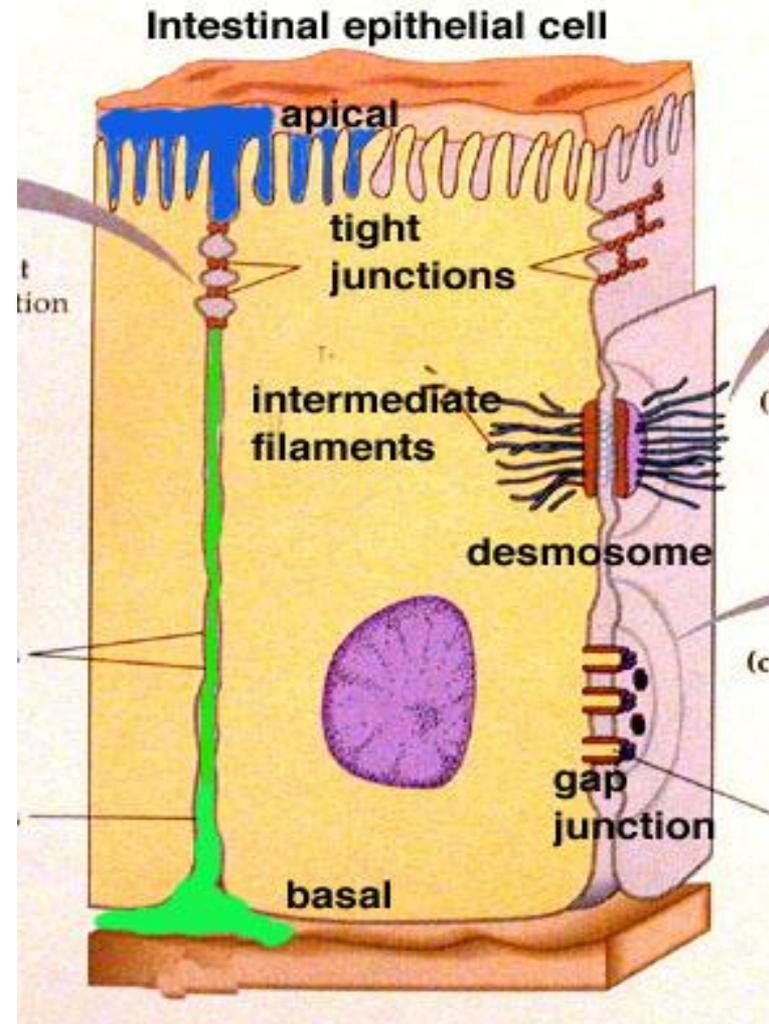
- provide mechanical stability to the epithelial cells.

- **Zonula adherens:**

- **Macula adherens = desmosomes:**

## 3- Communicating junctions: (**Gap**) allow movement of molecules between cells

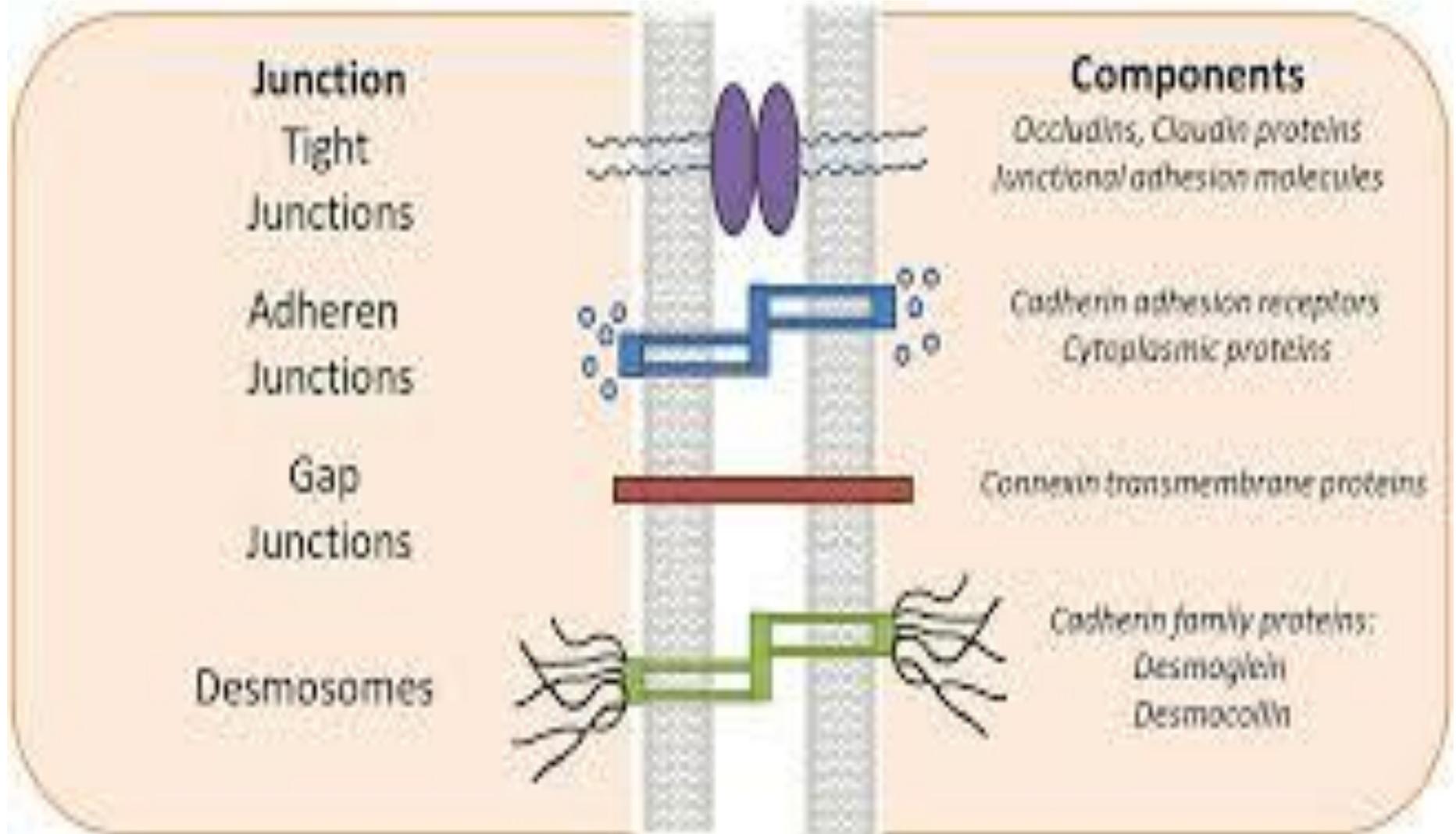
**It permits the exchange of molecules e.g. ions, amino acids allowing integration, communication and coordination between .It is found mainly in cardiac and smooth muscle cells**



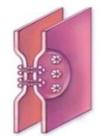
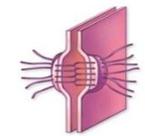
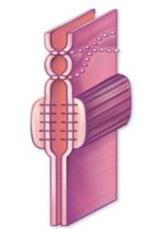
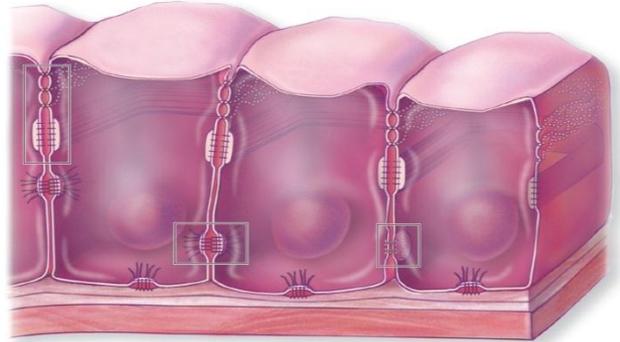
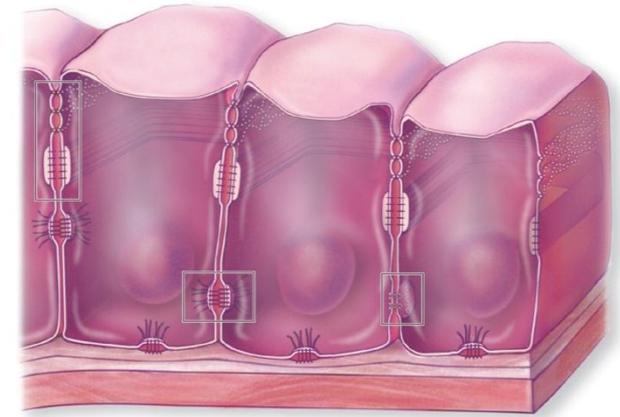
## Cell Junctions Types

- ❑ **Tight Junctions** (Occluding Junctions)
  - ❑ Seal adjacent epithelial cells together
  - ❑ Prevent passage of most dissolved molecules, membrane-bound lipids and proteins between apical and basolateral surfaces
- ❑ **Gap Junctions** (Communicating Junctions)
  - ❑ Allow adjacent cell communication; pass ions & small molecules between cytoplasms
- ❑ **Focal Adhesions & Hemidesmosomes**  
(Anchoring Junctions, Actin & Intermediate Filament Attachment Sites)
  - ❑ Form around integrin-mediated cell–ECM contacts
  - ❑ Focal adhesions connect integrins to actin filaments
  - ❑ Hemidesmosomes connect integrins to intermediate filaments
- ❑ **Adherens Junctions & Desmosomes**  
(Anchoring Junctions, Actin & Intermediate Filament Attachment Sites)
  - ❑ Form around cadherin-mediated cell–cell contacts
  - ❑ Adherens junctions connect cadherins to actin filaments
  - ❑ Desmosomes connect cadherins to intermediate filaments

# Intercellular junctions

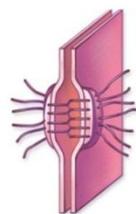
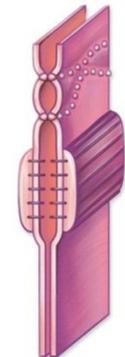
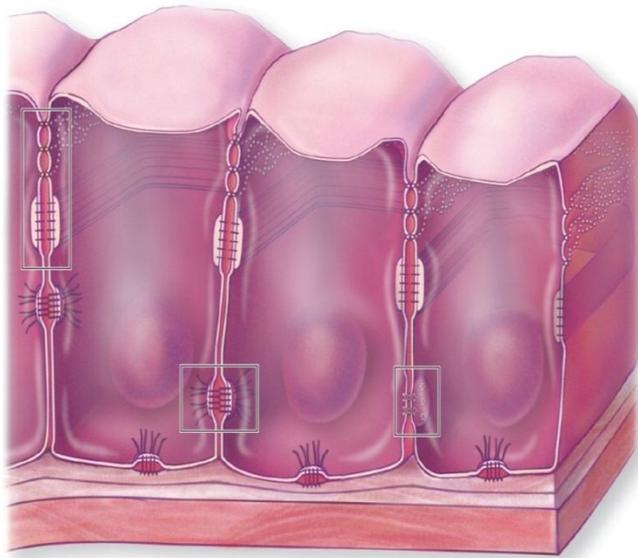


## Hemidesmosome



**Desmosomes** attach cells to each other

- Bind epithelium together
- Bind muscle cells
- Resist shear forces

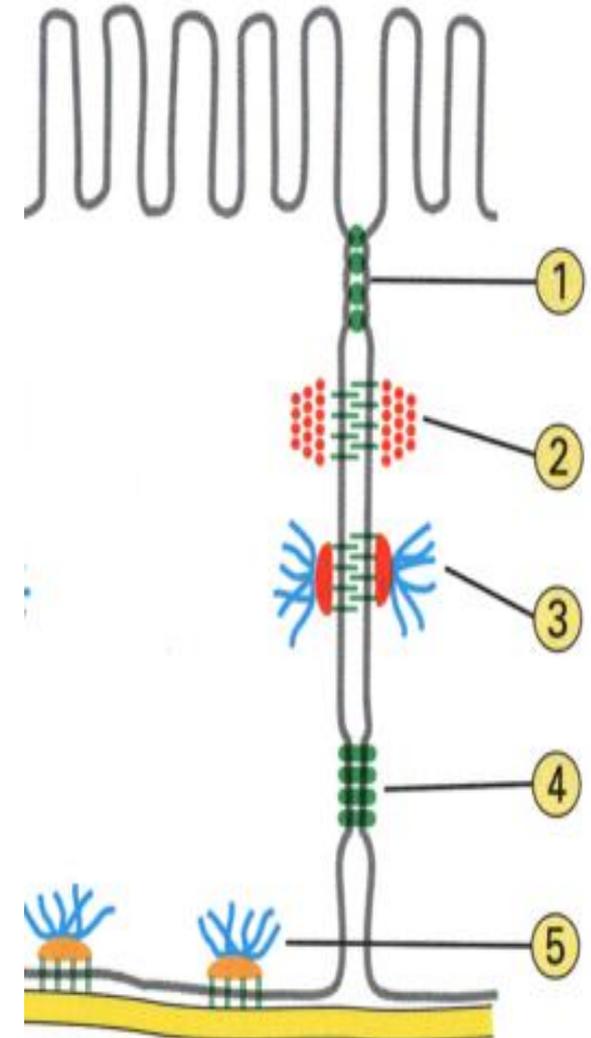
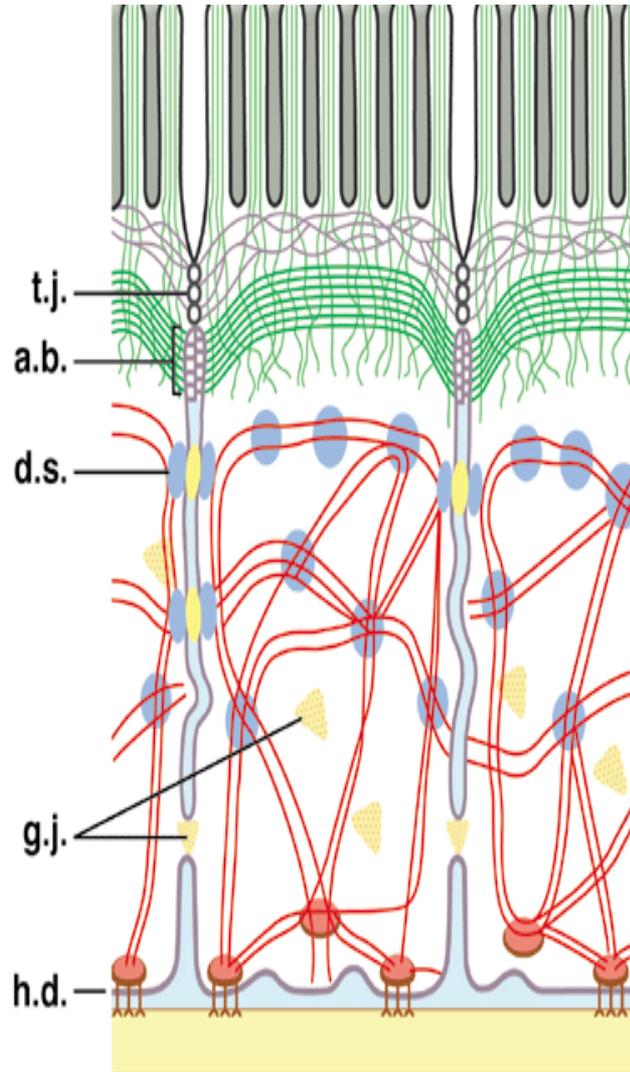
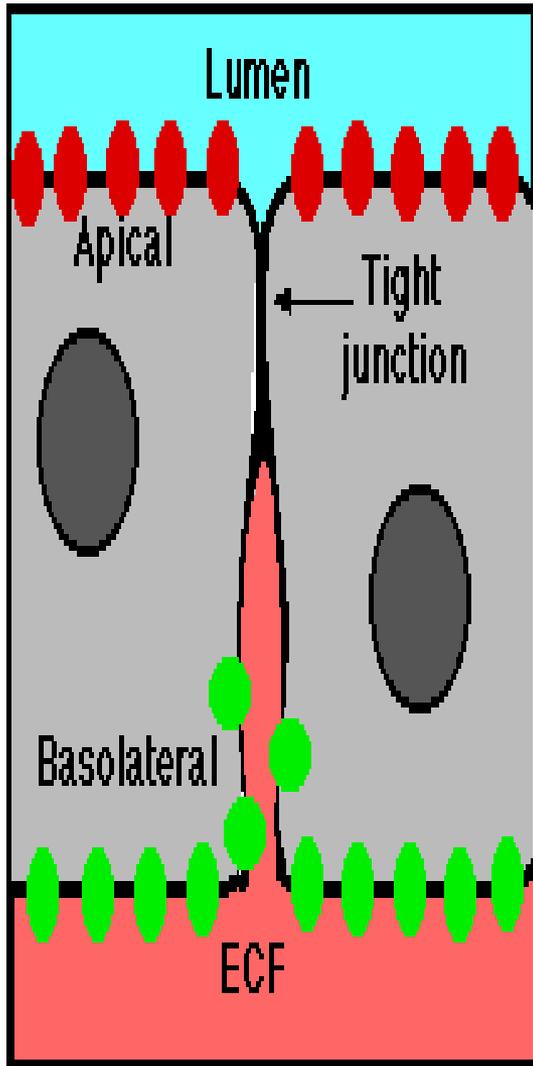


## Tight junction

anchor cells to each other

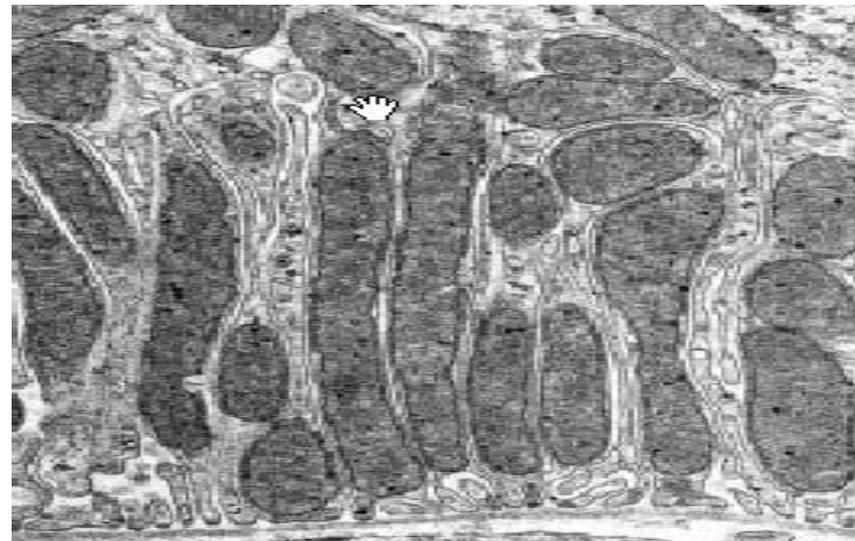
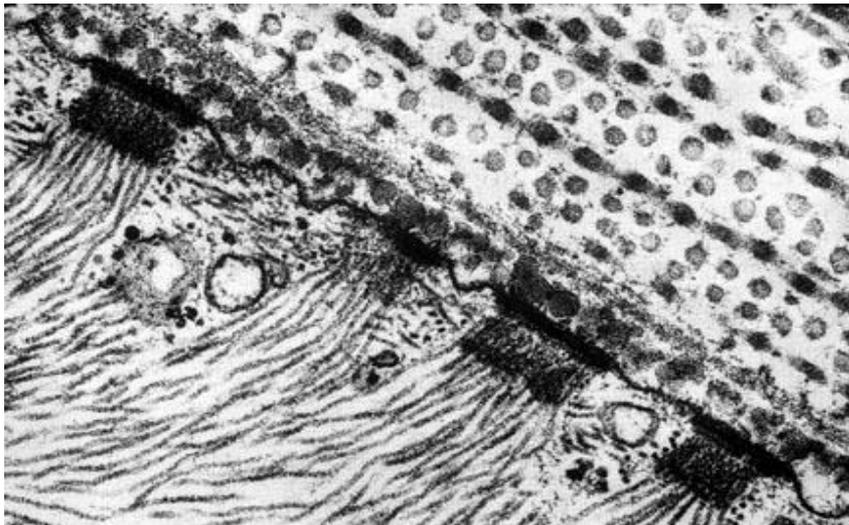
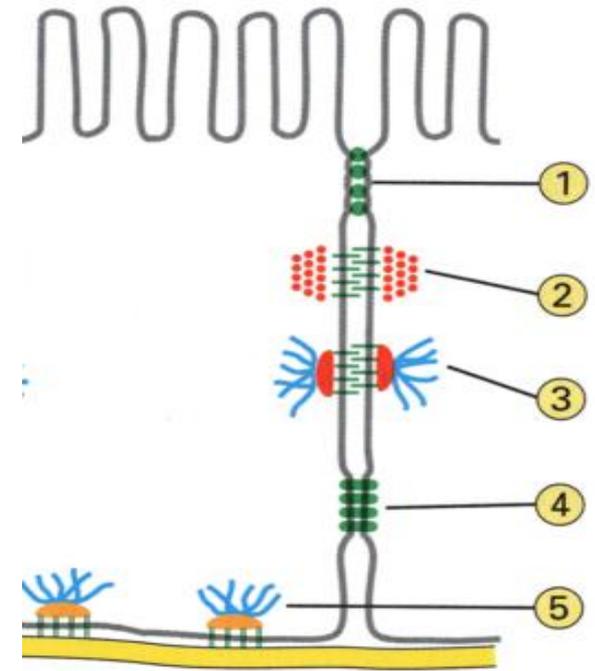
- prevents substances from passing between cells
- materials must move through cells, or are blocked from moving past cells
- found in intestinal lining

# Intercellular junctions



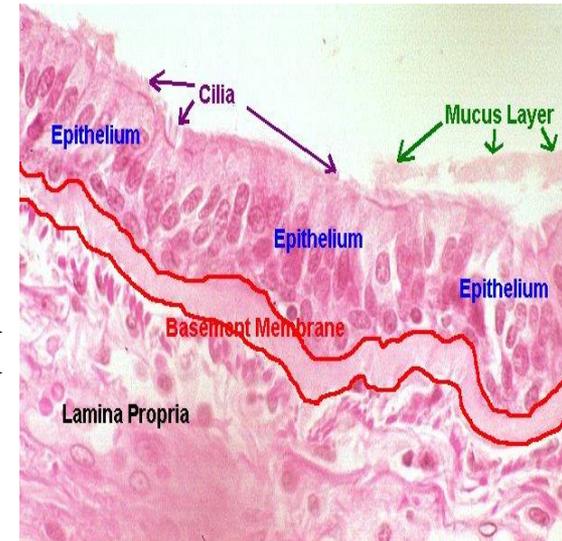
# Basal modifications

- **Basement membrane**
- **Basal infolding**
- **Hemidesmosome**
- In some epithelial tissue, basal cells anchored to basement membrane with junctions called **hemidesmosomes**



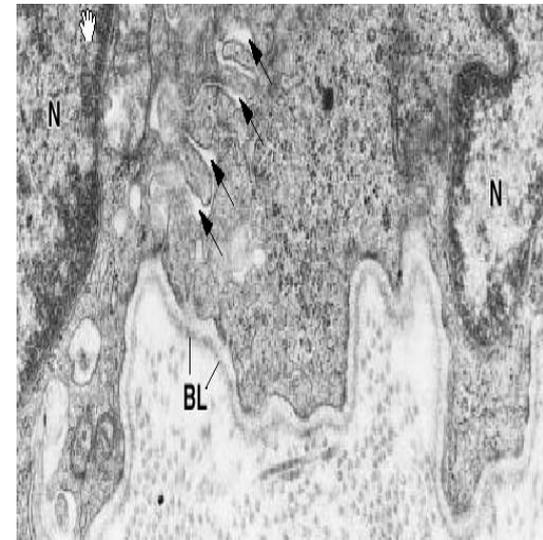
# Basement membrane

- is extracellular layer between epithelium and connective tissue often visible with microscope
- 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



Thank  
You

