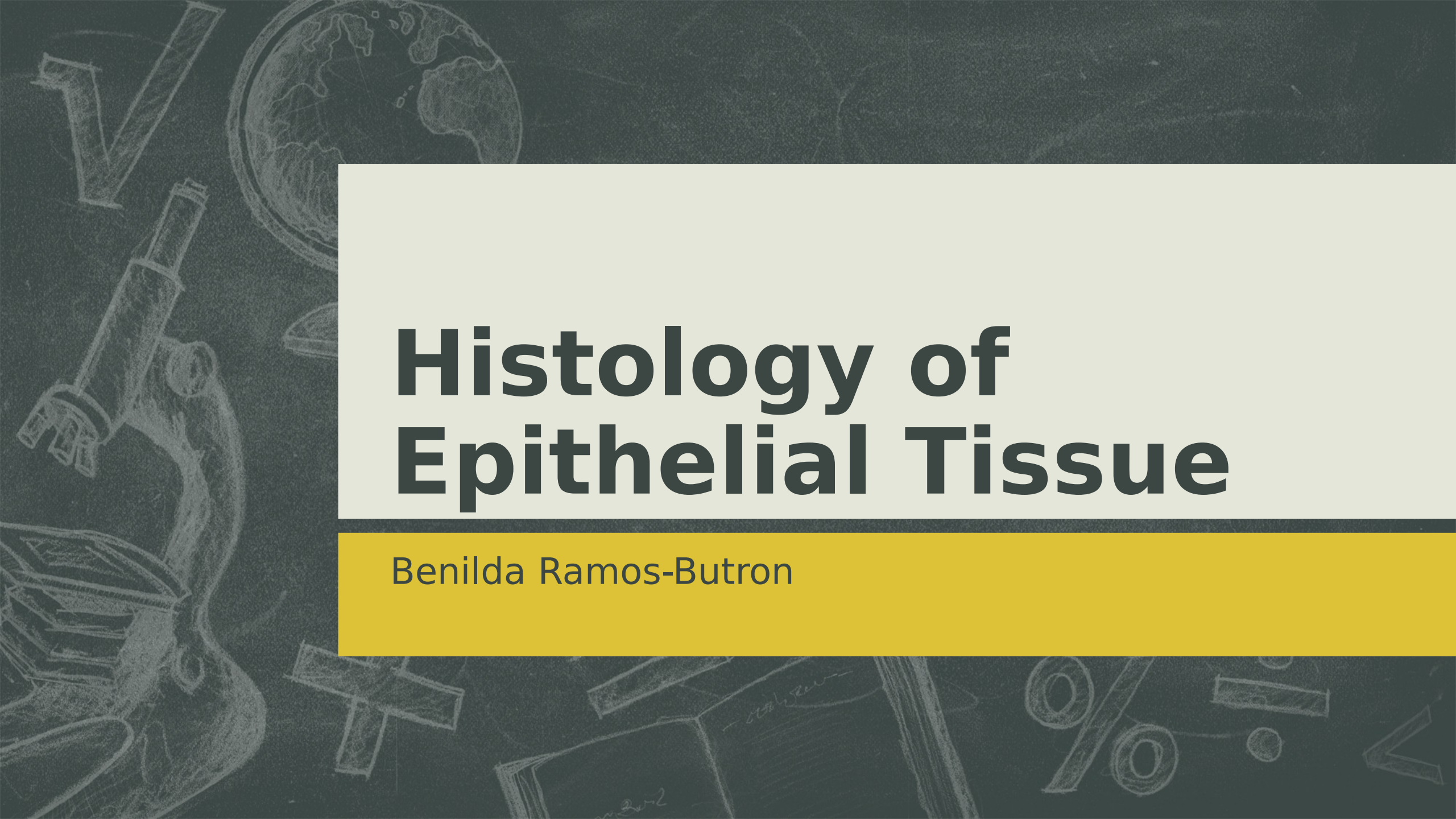


The background is a dark, textured surface with faint, light-colored sketches of various scientific and medical concepts. These include a globe in the upper left, a large letter 'V' in the top left, a microscope on the left side, a stack of books at the bottom left, a cross symbol, an open book with handwritten notes at the bottom center, and a large percentage sign and other symbols on the bottom right.

Histology of Epithelial Tissue

Benilda Ramos-Butron

Learning Outcomes

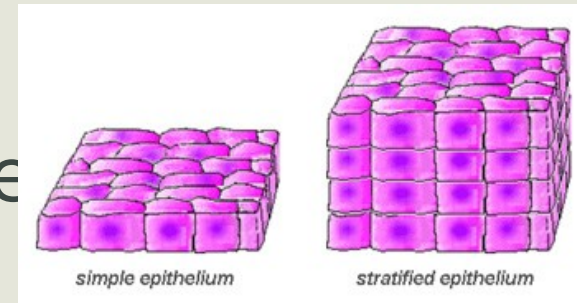
- Enumerate the characteristics of epithelial tissue
- Explain how epithelial cells are connected to one another
- Classify epithelial tissues according to shape, layers, and function
- Relate the design of each epithelial tissue to its function

What is a tissue?

- A tissue is an **aggregate** of cells and extracellular matrix organized to function in a collective manner
- **Four Basic Tissues**
 1. Epithelial Tissue
 2. Connective Tissue
 3. Muscle Tissue
 4. Nerve Tissue

What is Epithelial Tissue?

- A tissue made up of cells attached to each other by special junctions and a means of communication
- Very close together with very little substance between the cells
- May be in single or multiple layers
- Avascular
- Covers the surfaces of the body and lines body cavities



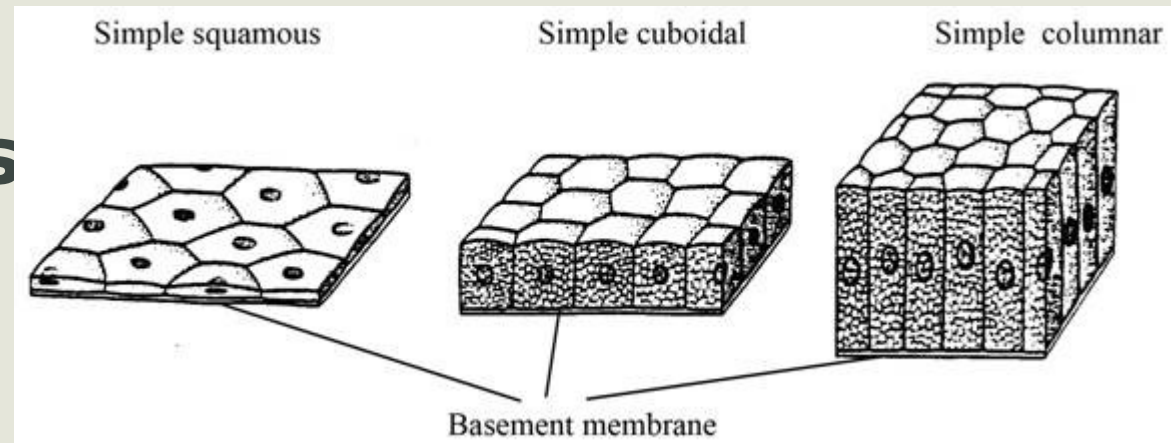
Epithelium Building Material

▪ Three Cell Types (According to Shape)

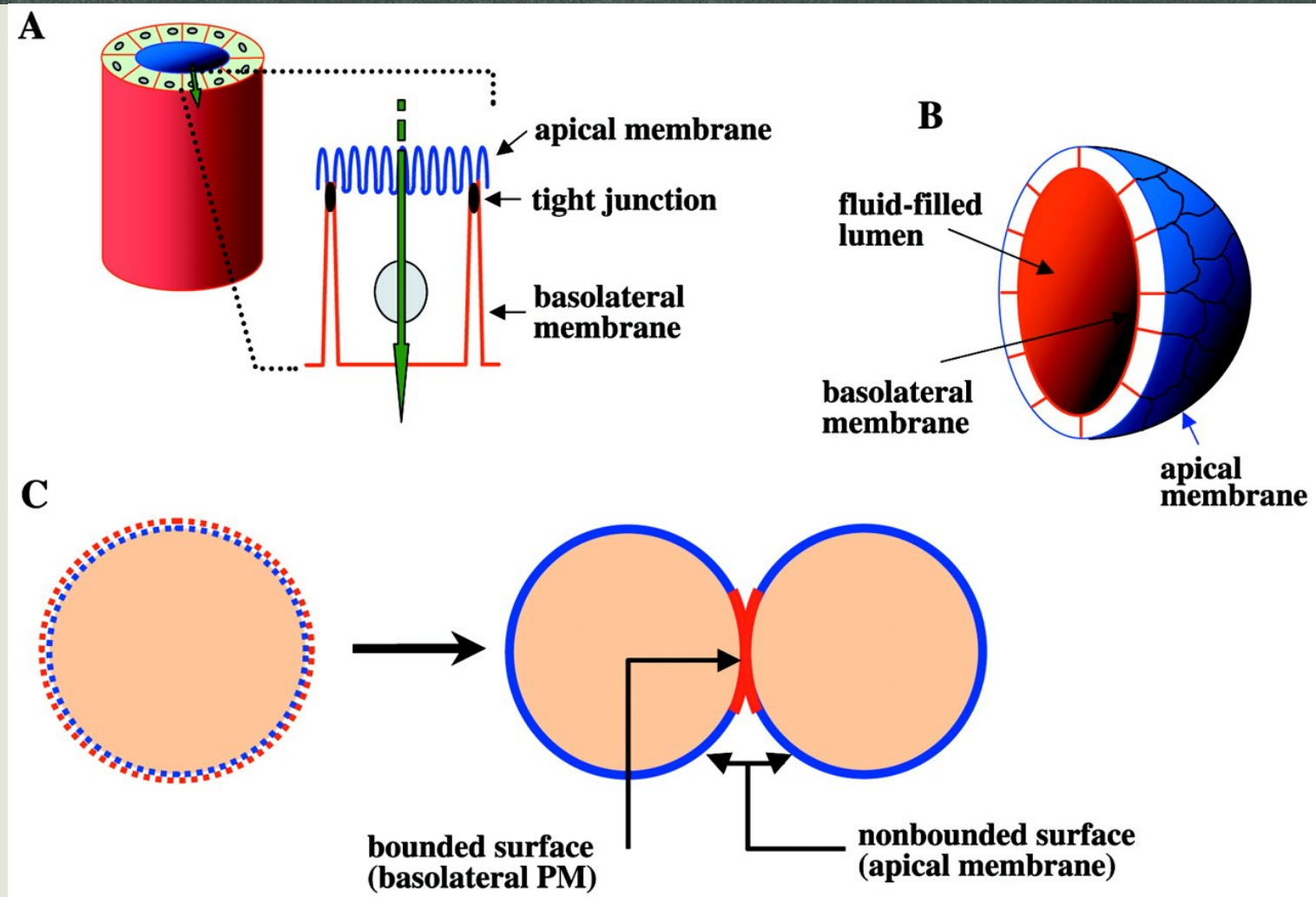
1. Columnar cells
2. Cuboidal cells
3. Squamous

▪ According to Layers

1. Simple
2. Squamous



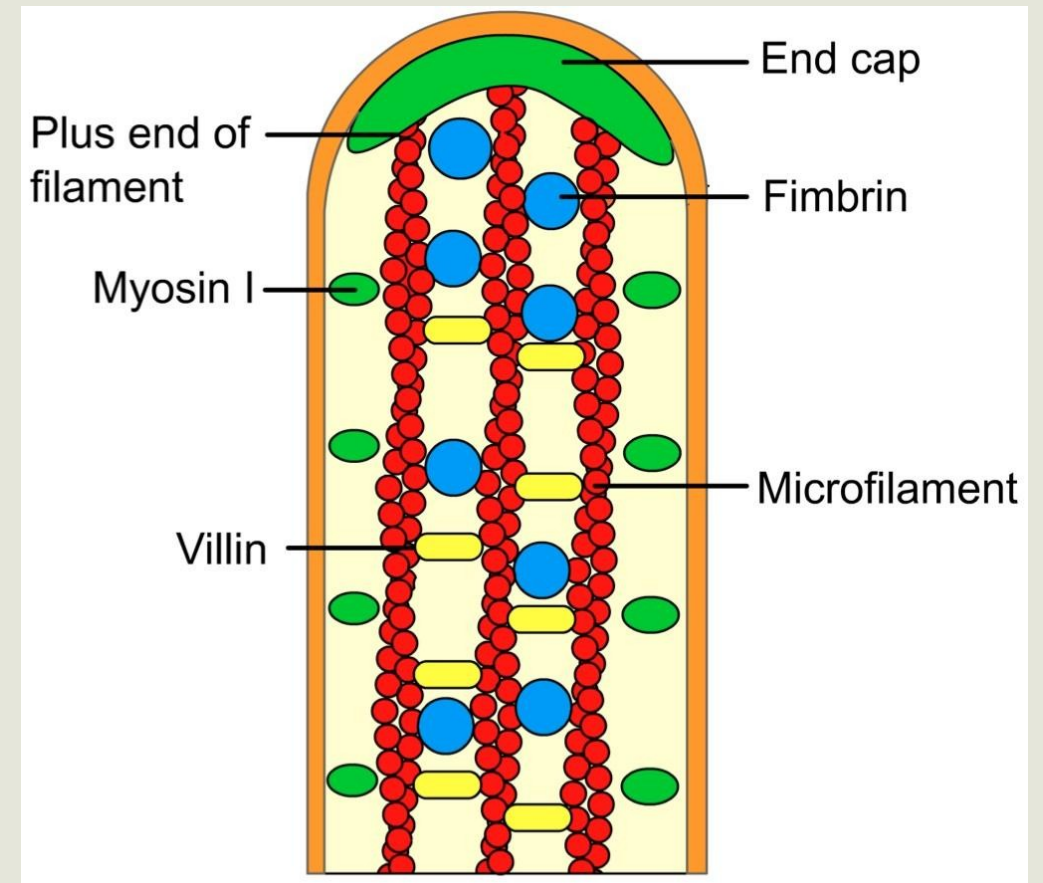
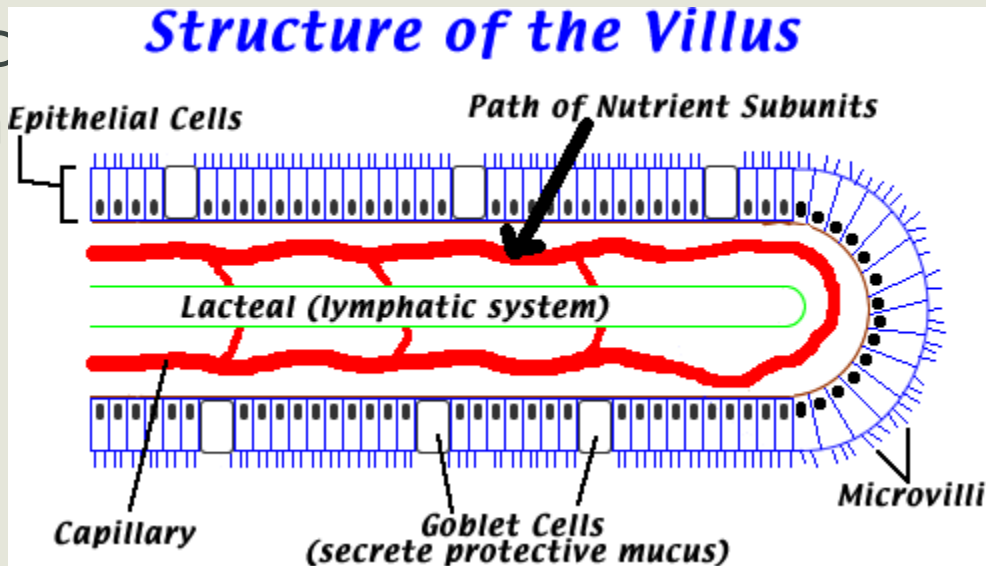
Polarity and Domains of Epithelial Cells



Cell Surface Projections: Microvilli

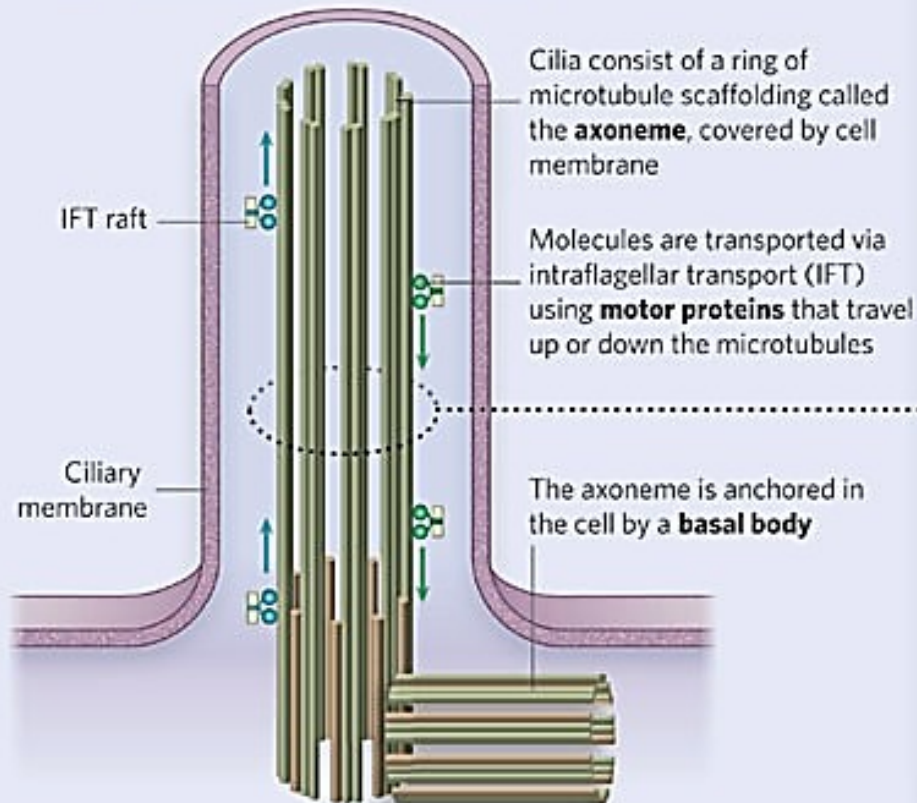
■ Microvilli

- 1-6 microns long and 0.1 microns wide
- Core: actin filaments with cross connections (binding)

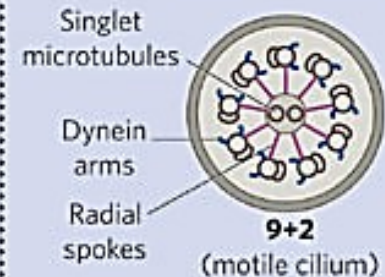
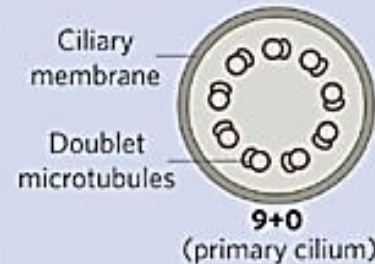


Cell Surface Projections: Cilia

THE CILIUM DISSECTED



A cross-section of an axoneme reveals either a **9+0** or a **9+2** arrangement of microtubules



In motile cilia, tubules work with the dynein arms and protein spokes that link them to produce movement

How are epithelial cells connected?

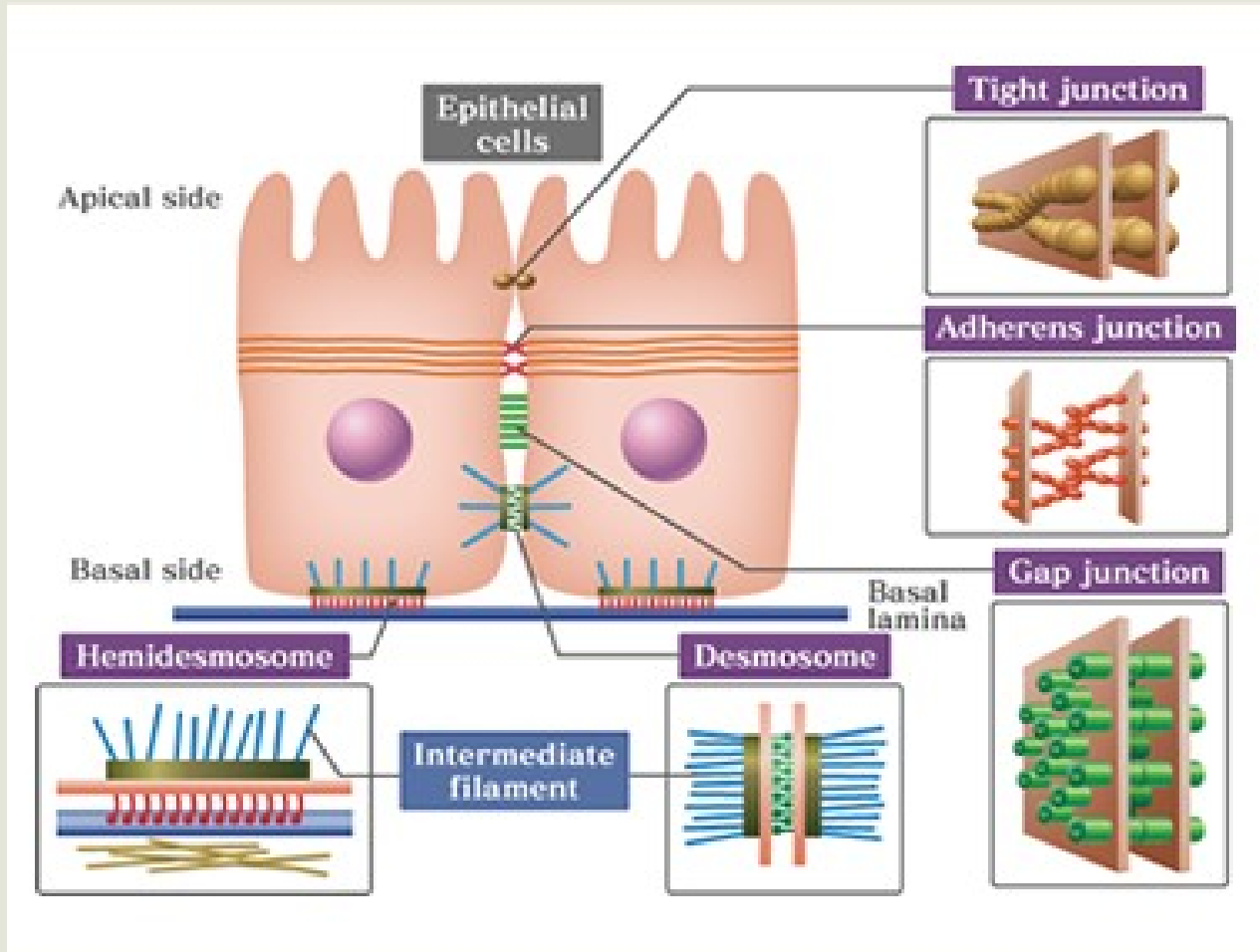
Four Junctions:

Zonula Occludens –
“tight junctions”

Zonula Adherens –
zones of sticking
together

Macula Adherens –
spots of sticking
together, “desmosomes”

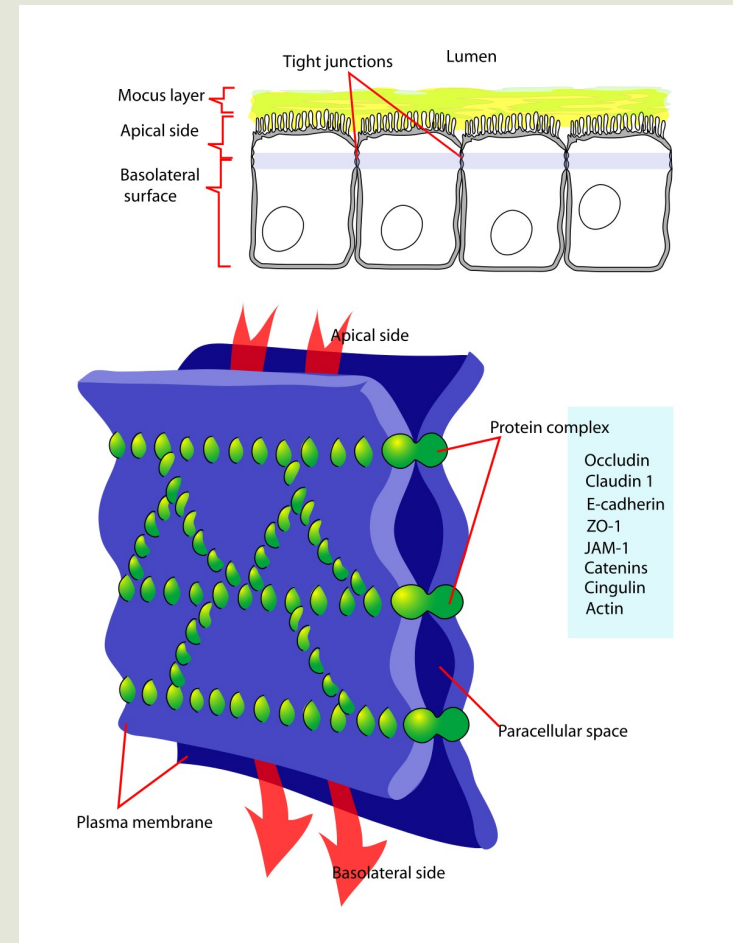
Gap Junctions (Nexus)
– cell to cell
communication



How are epithelial cells connected?

Tight Junctions

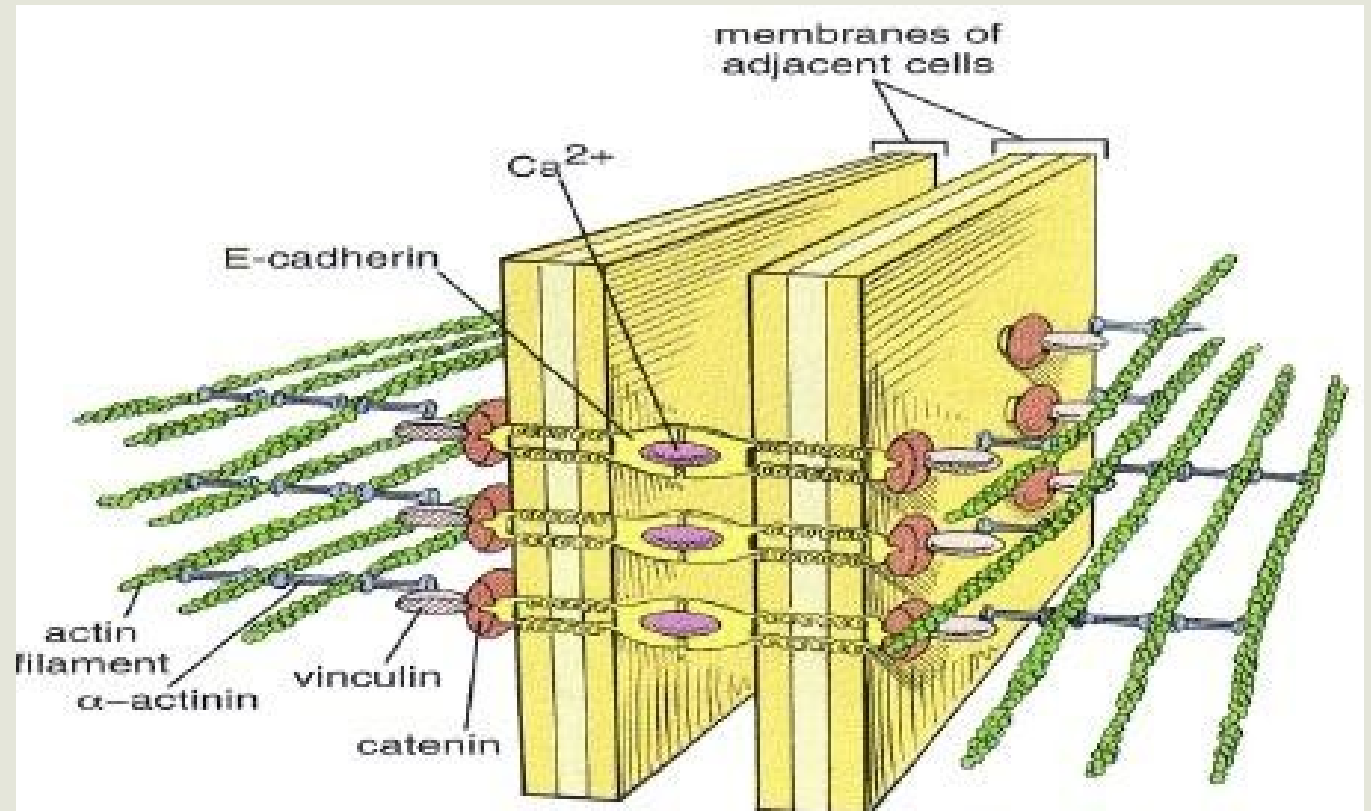
- Composed of beads of fusion of the outer leaflet of 2 adjacent cell membrane
- Prevents flow of ions, molecules and water between cells from surface to underlying connective tissue



How are epithelial cells connected?

Zonula Adherens

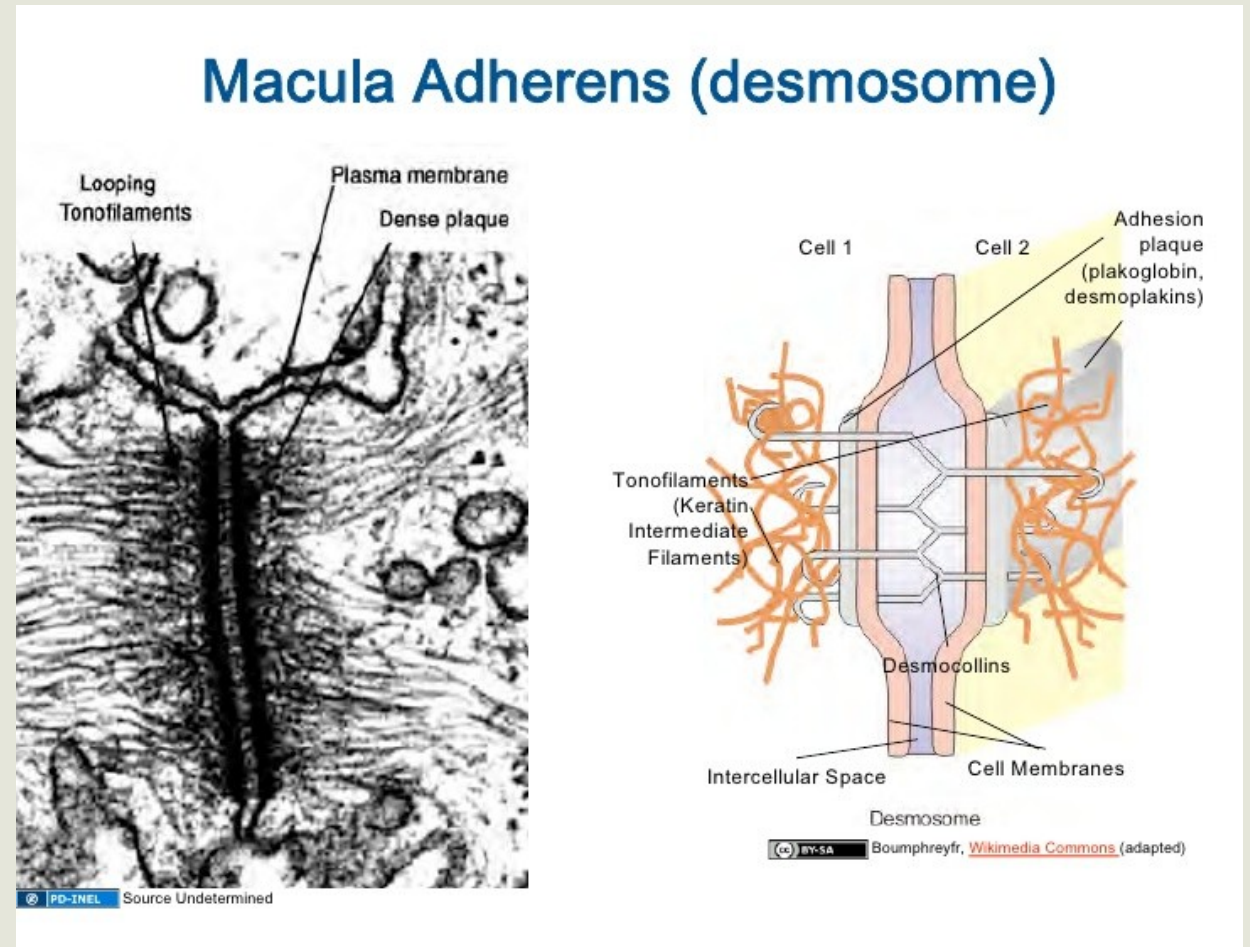
- Consists of cell adhesion molecules between cells gluing cells together and actin filaments anchoring into cell membrane inside cell to make junction robust



How are epithelial cells connected?

Macula Adherens/Desmosomes

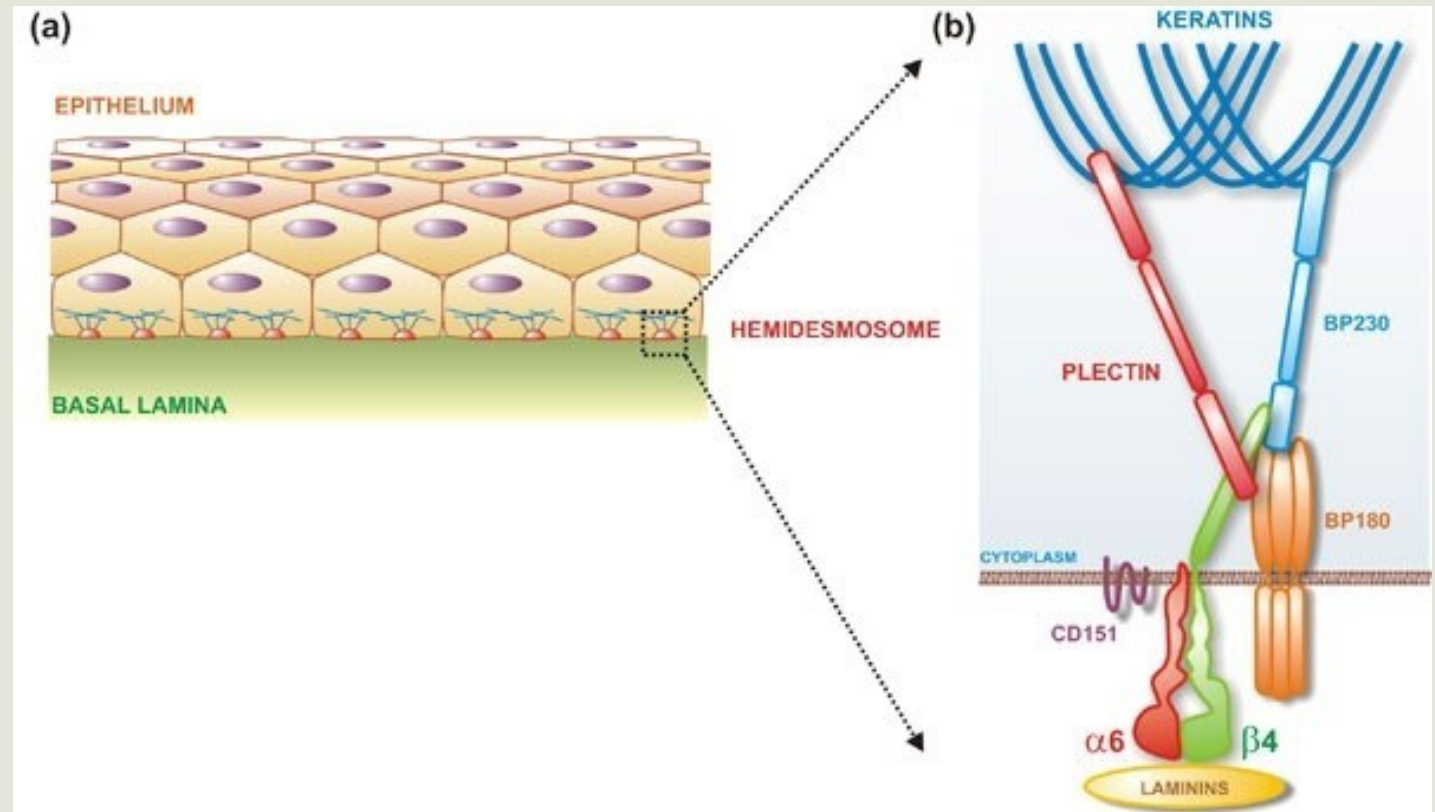
- Appear as plaques
- Between the cells proteins anchored in each cell membrane serve as glue
- Within the cells a protein forms a plaque into which intermediate filaments insert to provide robustness to the junction



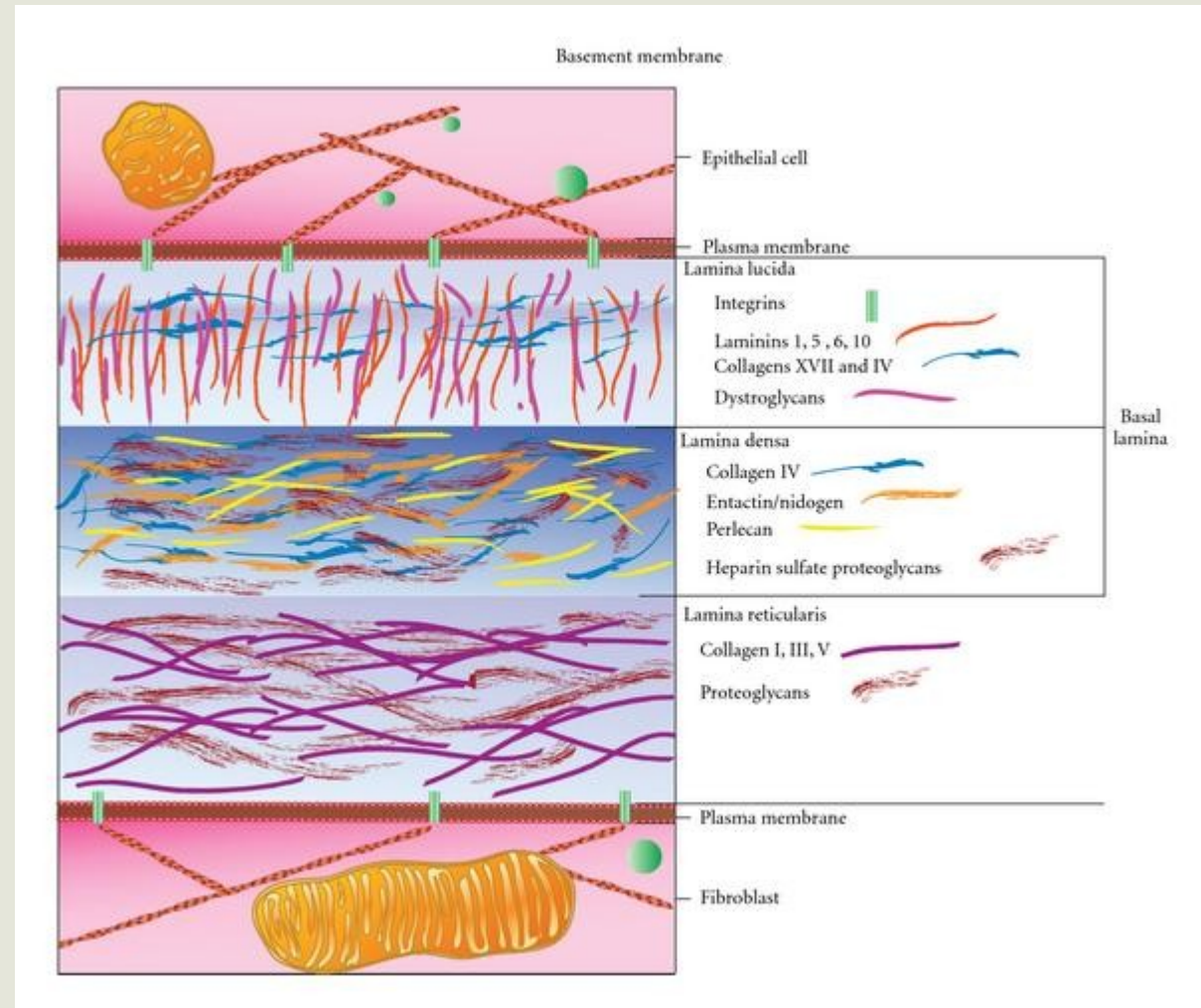
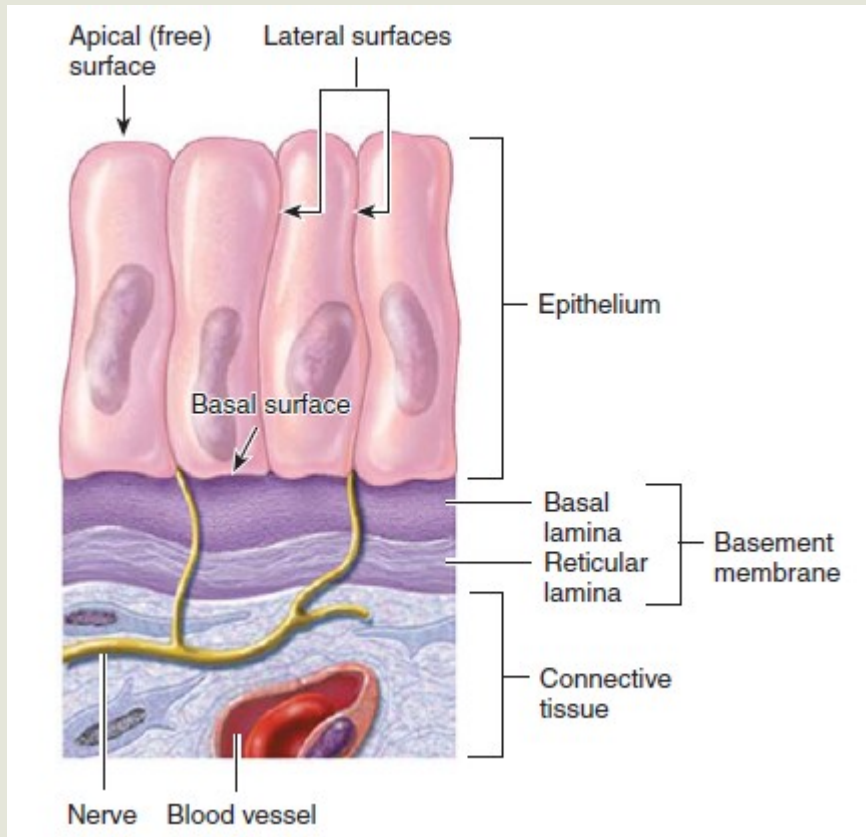
How are epithelial cells connected?

Macula Adherens: Modified

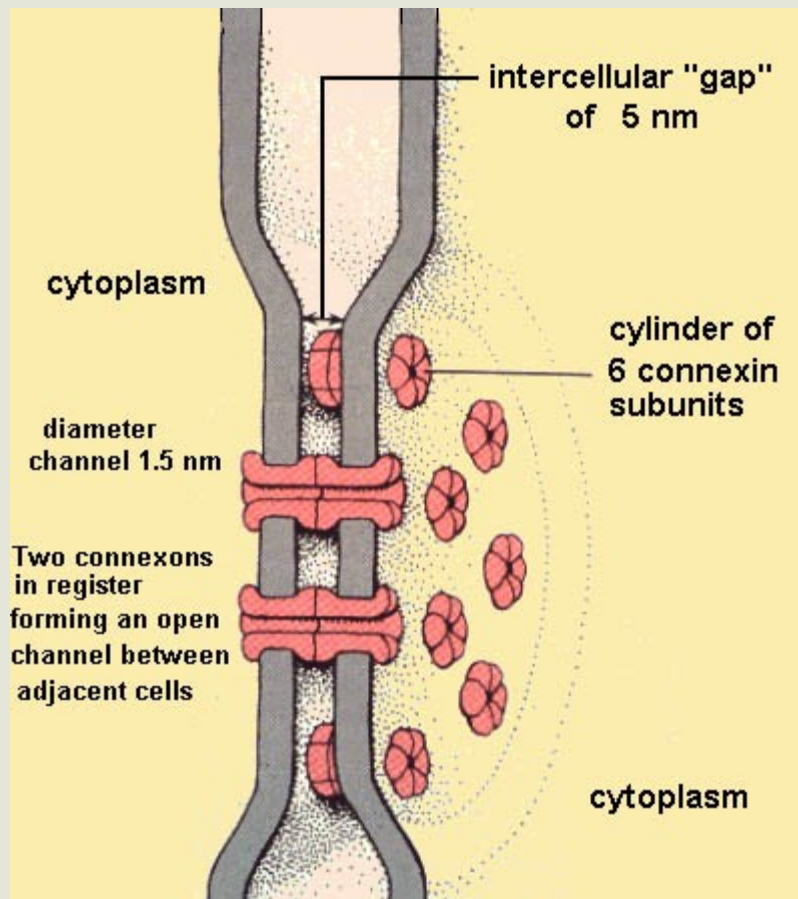
- Called *hemidesmosomes*



Basement Membrane and Basal Lamina



Gap Junction (Nexus)



- *Located between cells*
- *Arrangement of 6 connexin units to form a connexon*
- *Provides transmembrane channels for exchange of ions, regulatory molecules and small metabolites*

Classification of Epithelial Tissues

- **Covering/Lining Epithelium**

1. Simple squamous, cuboidal and columnar
2. Stratified squamous, cuboidal and columnar
3. Pseudostratified
4. Transitional

- **Glandular Epithelium**

1. Unicellular glands
2. Multicellular glands

Simple Epithelial Tissues

Simple Squamous Epithelium

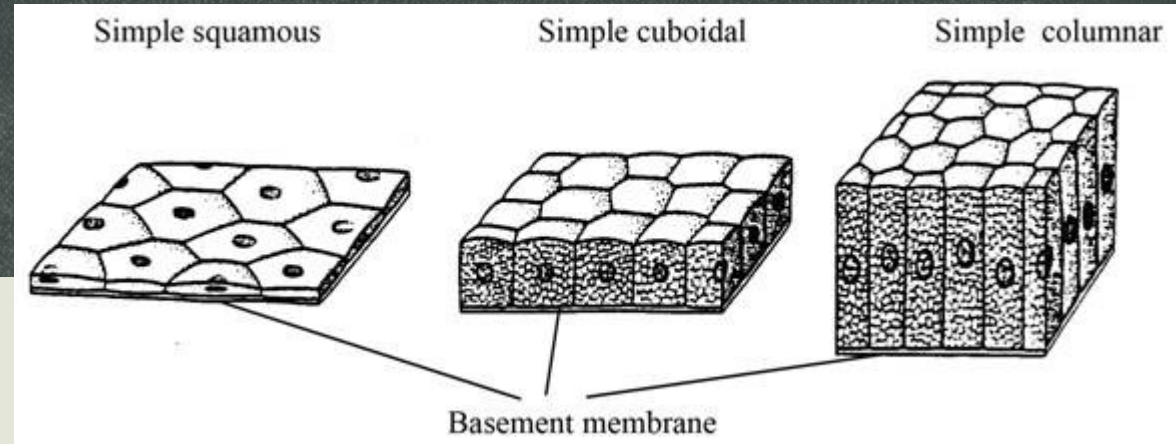
- Lines body cavities and blood vessels

Simple Cuboidal Epithelium

- Lines ducts and tubules (salivary glands and kidneys, functional cells in thyroid gland)

Simple Columnar Epithelium

- Lines ducts of glands, lines stomach and intestines, forms structure of tubules in the kidney



Stratified Epithelial Tissues

Stratified Squamous Non-keratinized

- Lines oral cavity, esophagus and vagina

Stratified Squamous Keratinized

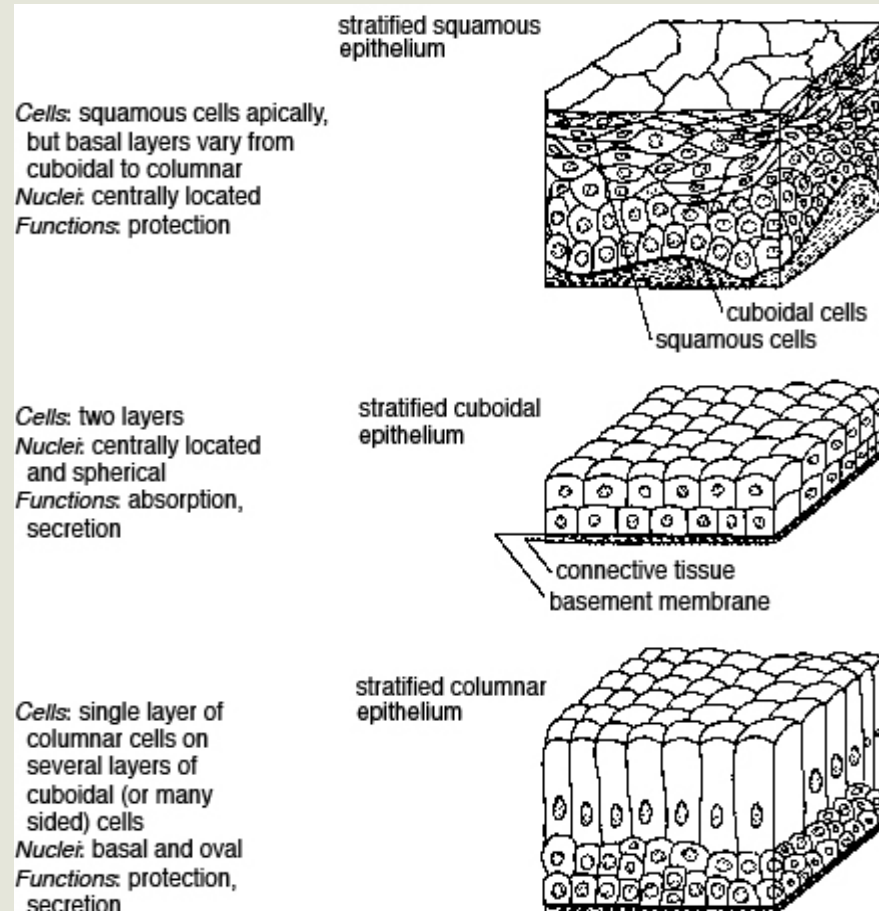
- Epidermis of skin

Stratified Cuboidal

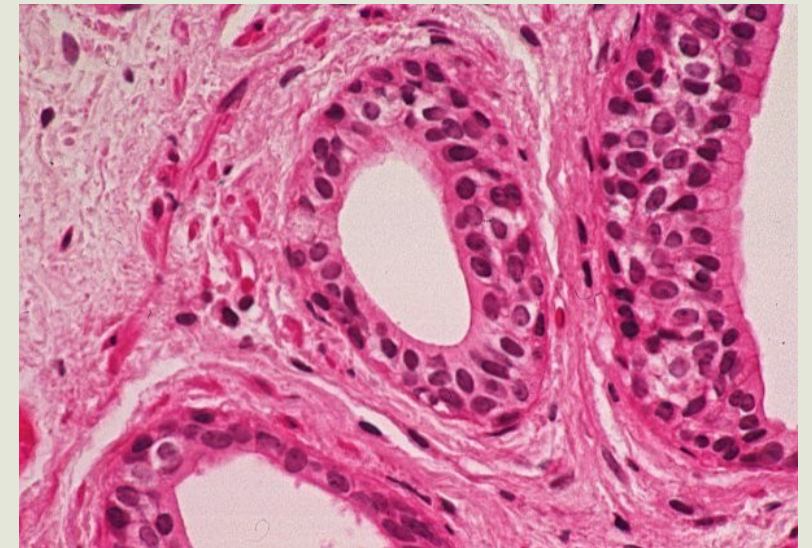
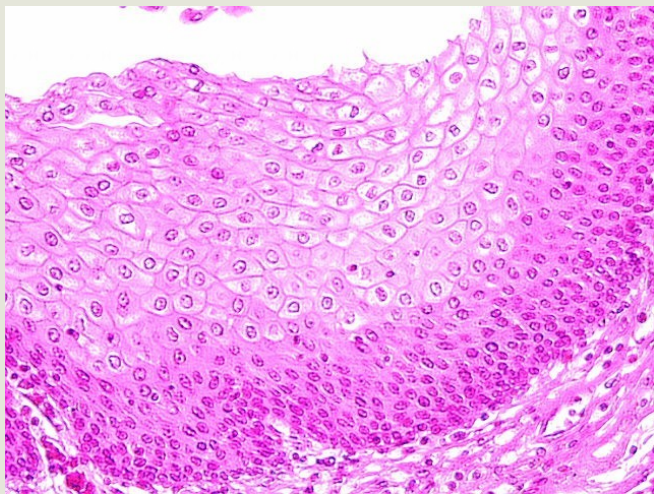
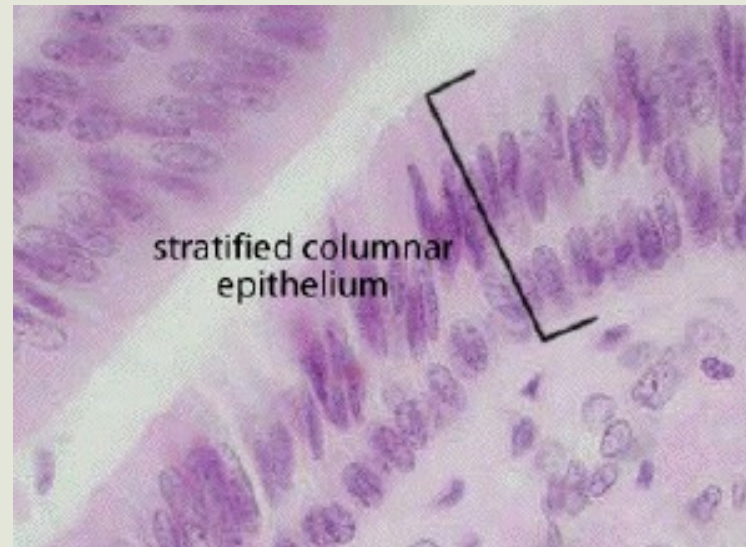
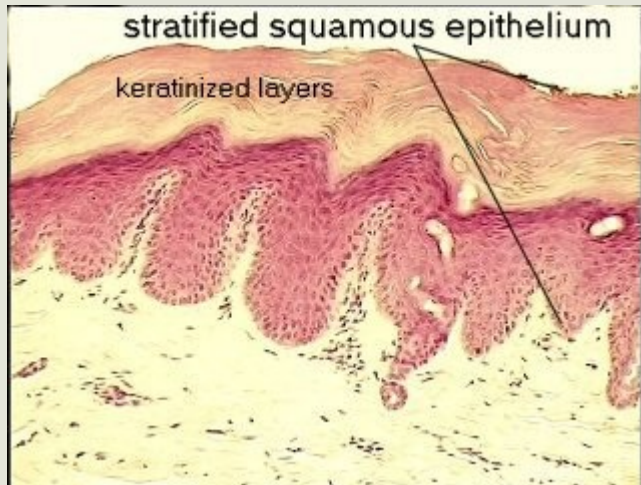
- Lines large ducts

Stratified Columnar

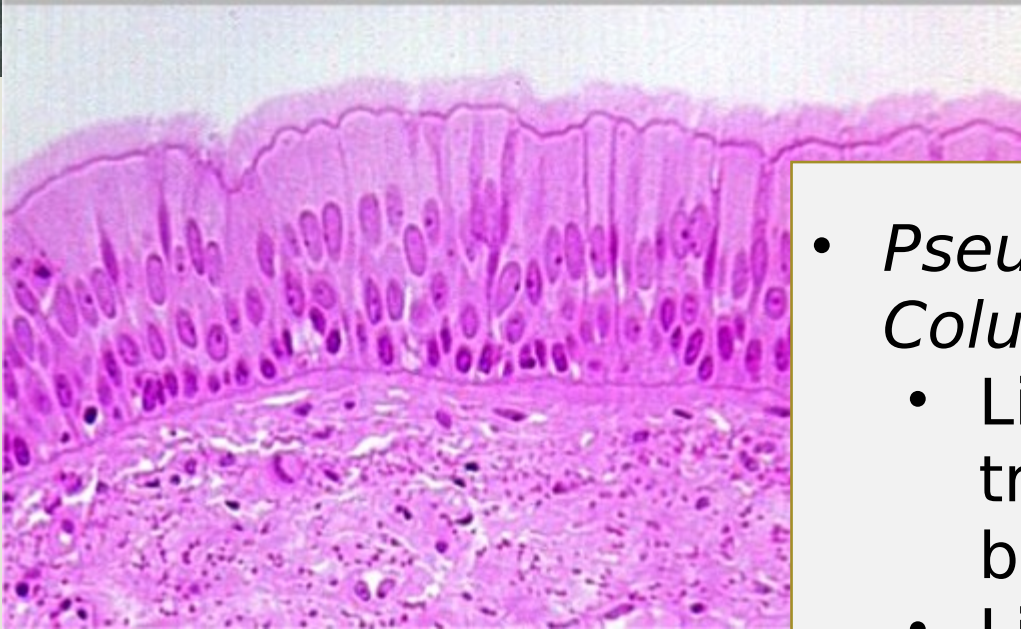
- Lines larger ducts



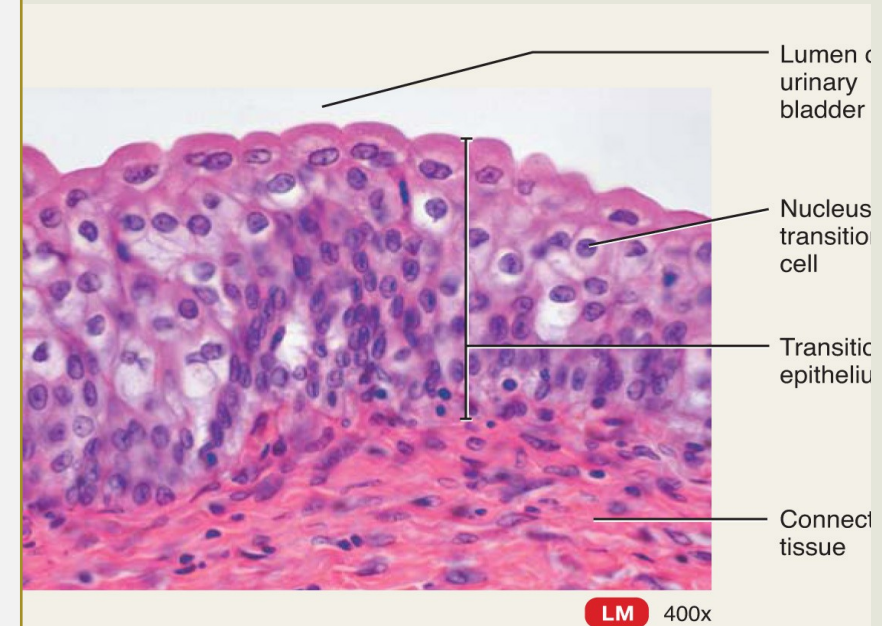
Stratified Epithelial Tissues



Special or Exceptional Epithelial Tissues

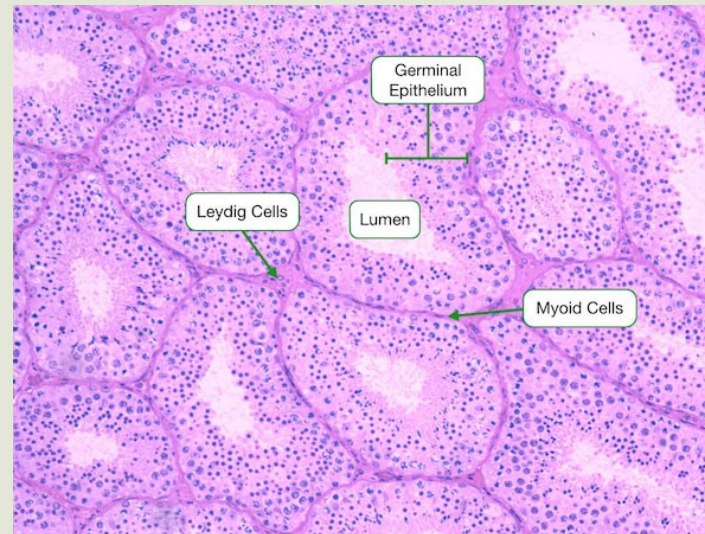
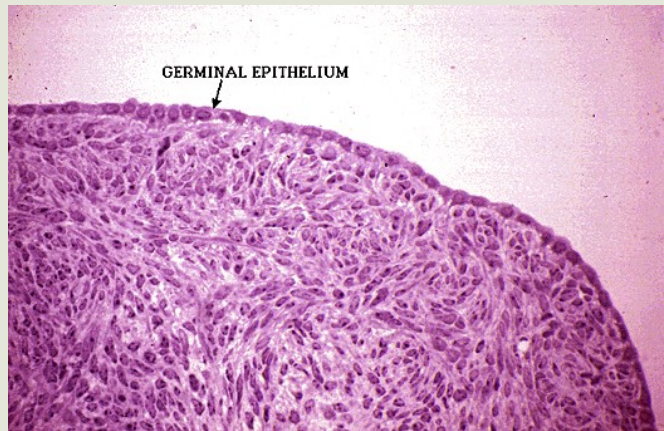
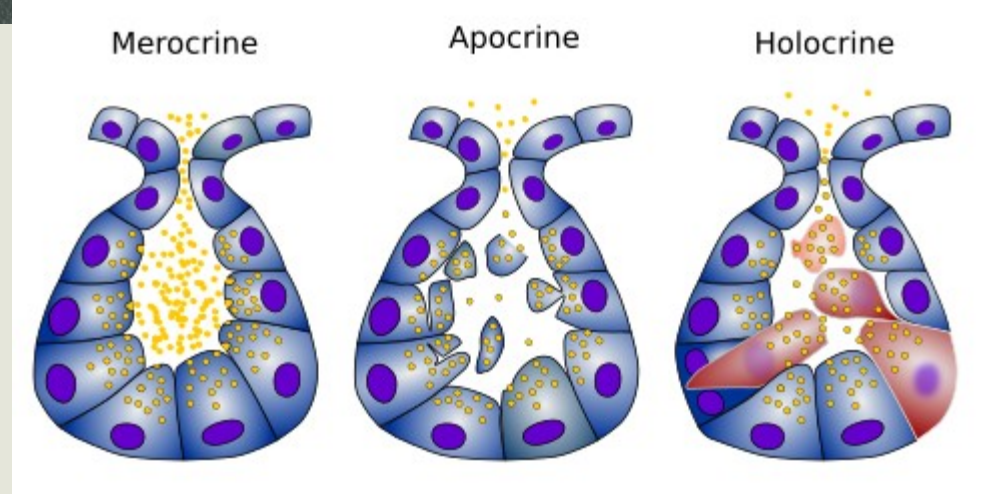
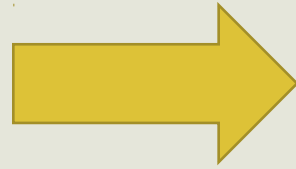
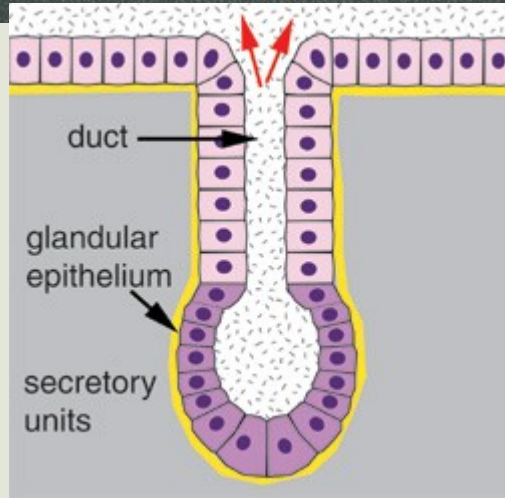


- *Pseudostratified Columnar Epithelium*
 - Lines nose, trachea, and bronchi with cilia
 - Line reproductive ducts
- *Transitional Epithelium*
 - lines ureter and urinary bladder



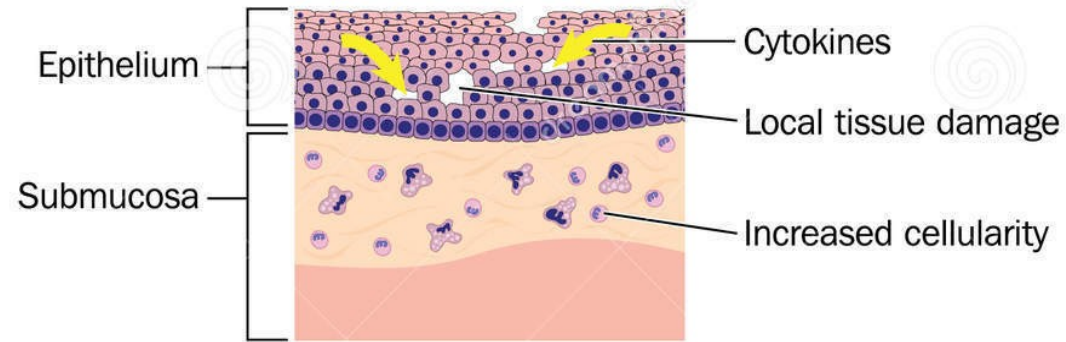
Low magnification view of transitional epithelium of urinary bladder in relaxed state

Special or Exceptional Epithelial Tissues

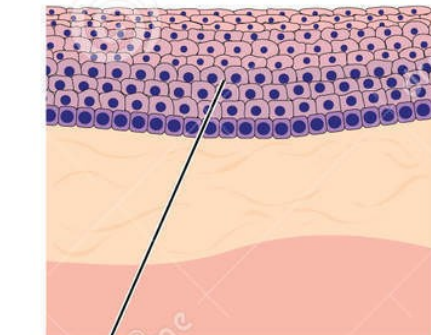


Epithelial Cell Type	Shape	Function	Example of Distribution
Simple	Squamous	Helps in the movement (contraction) of the organ (viscera) that it covers. Secretion of biologically active molecules that also help in lubrication.	Lining of vessels (blood and lymphatics) Serous lining of cavities, pericardium, pluera and peritoneum.
	Cuboidal	Covering and secreting.	Covers ovary and thyroid.
	Columnar	Protection, lubrication, absorption and secretion.	Lines the intestine and gallbladder.
Stratified	Squamous keratinized (dry)	Protection and prevents water loss.	Epidermis (skin).
	Squamous nonkeratinized (moist)	Protection, secretion and also prevents water loss.	Mouth, esophagus, larynx, vagina and anal canal.
	Cuboidal	Protection and secretion.	Sweat glands and developing ovarian follicles.
	Columnar	Protection.	Ocular Conjectiva and large ducts of salivary glands.
	Transitional	Protection and distensibility where the form changes based on the degree of distension.	Bladder, ureter and renal calyces.
Pseudostratified	Can be ciliated or non-ciliated.	Protection, secretion and cilia-mediated transport of particles trapped in mucus out of air passages.	Lining of trachea, bronchi and nasal cavity.

Phase 1

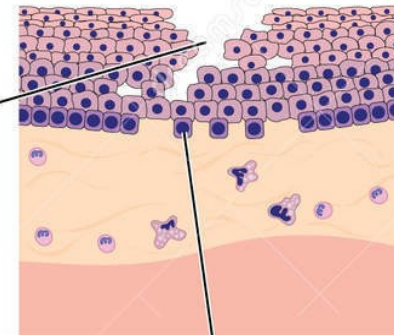


Phase 4



Phase 2

Atrophy and reduced epithelial renewal



Oral basal epithelium

Phase 3

Mucosal breakdown

Microbial colonization

