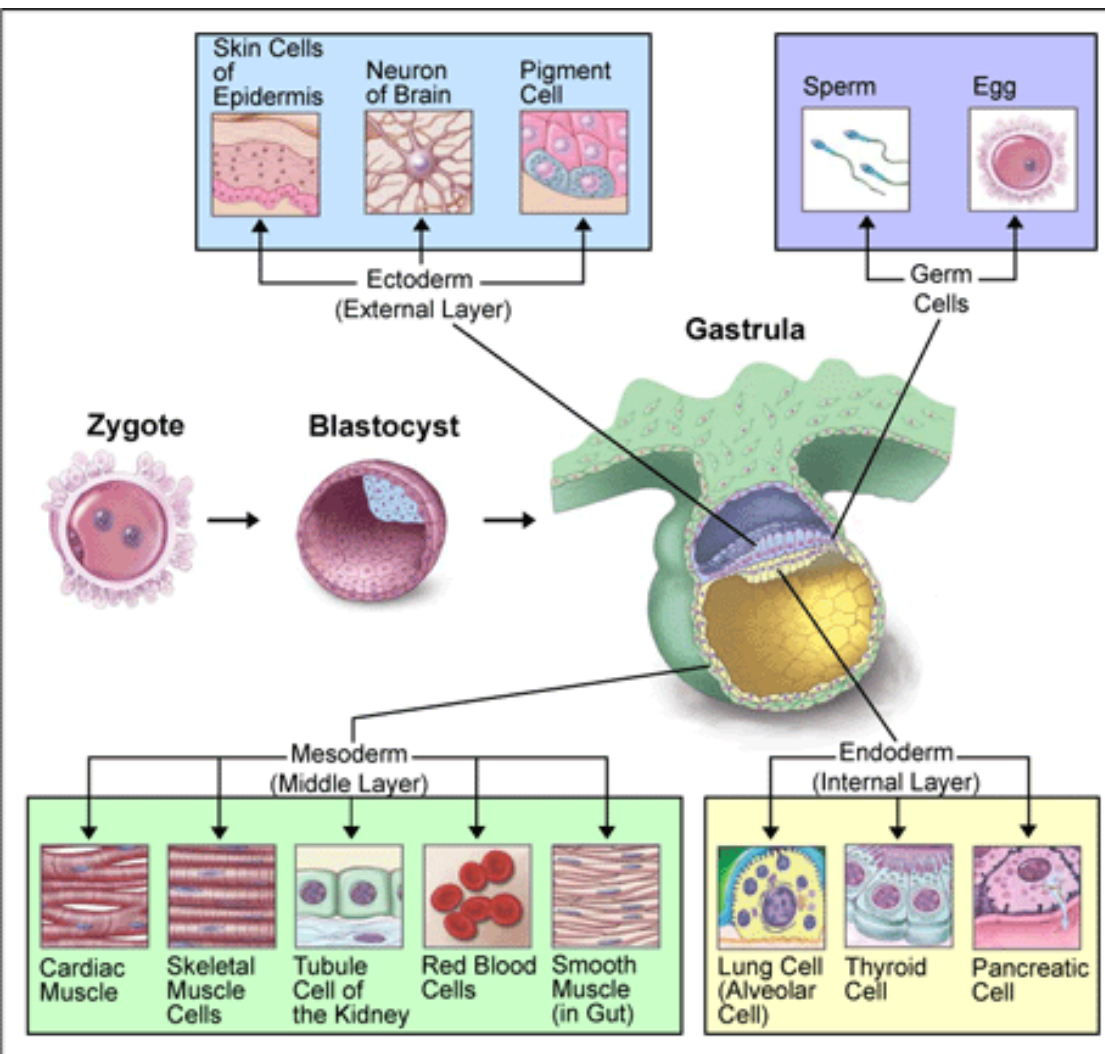


# Epithelial Tissue W3



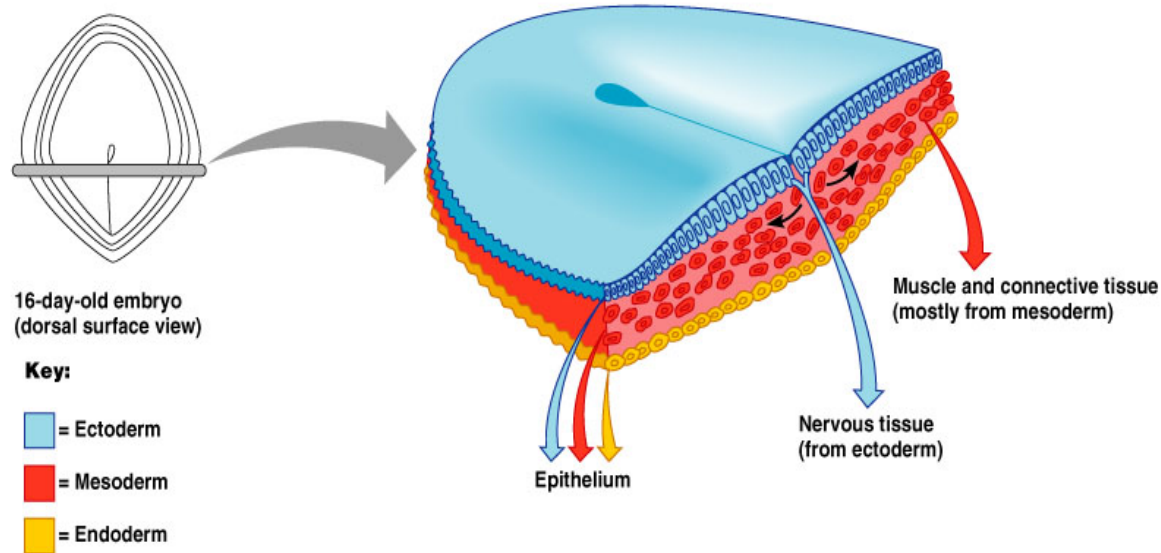
Dr. Deniz Balci  
[deniz.balci@neu.edu.tr](mailto:deniz.balci@neu.edu.tr)



## TISSUES

groups of cells with similar structure and function

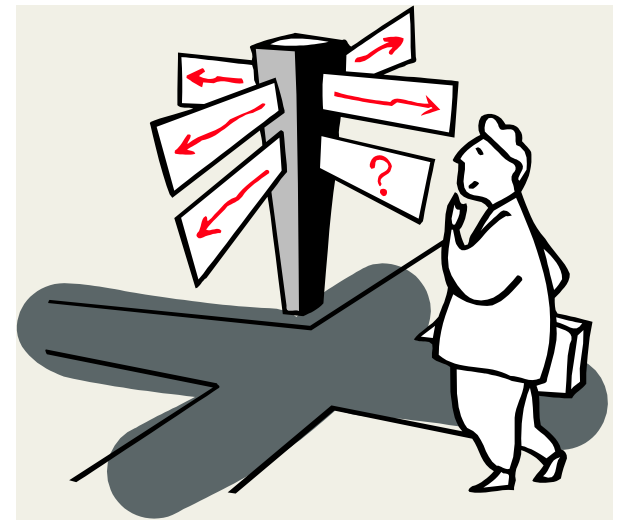
# Embryonic Tissue



- \* 3 major germ layers that form the trilaminar germ disc (source of multipotent *stem cells*)
  - \* **Endoderm:** Inner layer
    - \* Forms lining of respiratory, digestive tract and derivatives
  - \* **Mesoderm:** Middle layer
    - \* Forms tissues as such muscle, bone, blood vessels
  - \* **Ectoderm:** Outer layer
    - \* Forms epidermis of skin, oral and nasal mucosae, cornea, neuroectoderm

# Tissues and Histology

- Tissues - collections of **similar cells** and the **substances (ECM)** surrounding them
- Tissue classification based on
  - ✧ **structure and morphology** of the cells
  - ✧ composition of non cellular extracellular matrix (**ECM**) cell function
- \* Major types of adult tissues
  - \* **Epithelial**
  - \* **Connective**
  - \* **Muscle**
  - \* **Nervous**



# Epithelium Lecture Outline

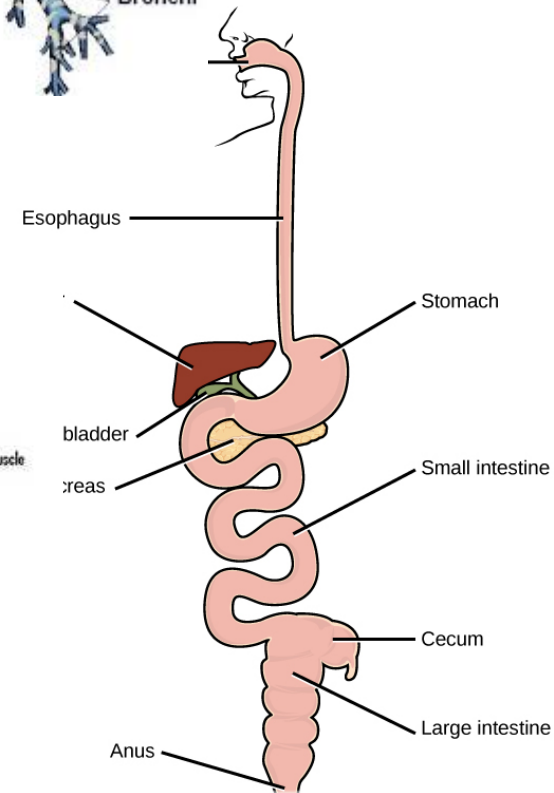
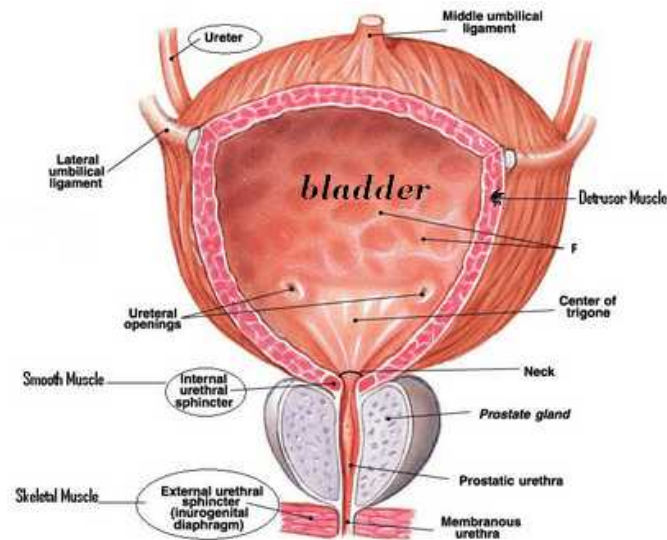
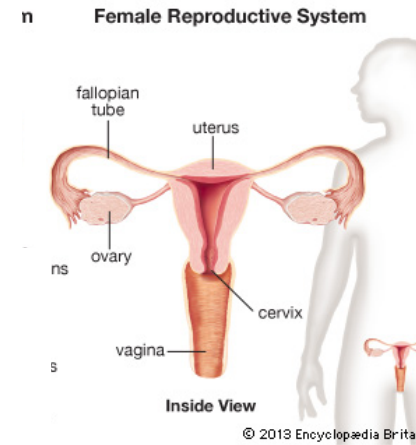
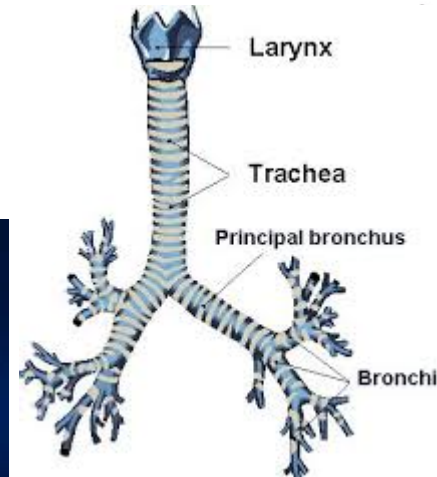
- **Function and types of epithelium**
- **Structure of epithelium**
- Types of covering/lining epithelium
- Types of glandular epithelium

# Functions of Epithelium

- Covering of external surfaces
- Lining of internal surfaces
- Protection
- Absorption
- Filtration
- Secretion
- Sensation

# Where is Epithelia Found?

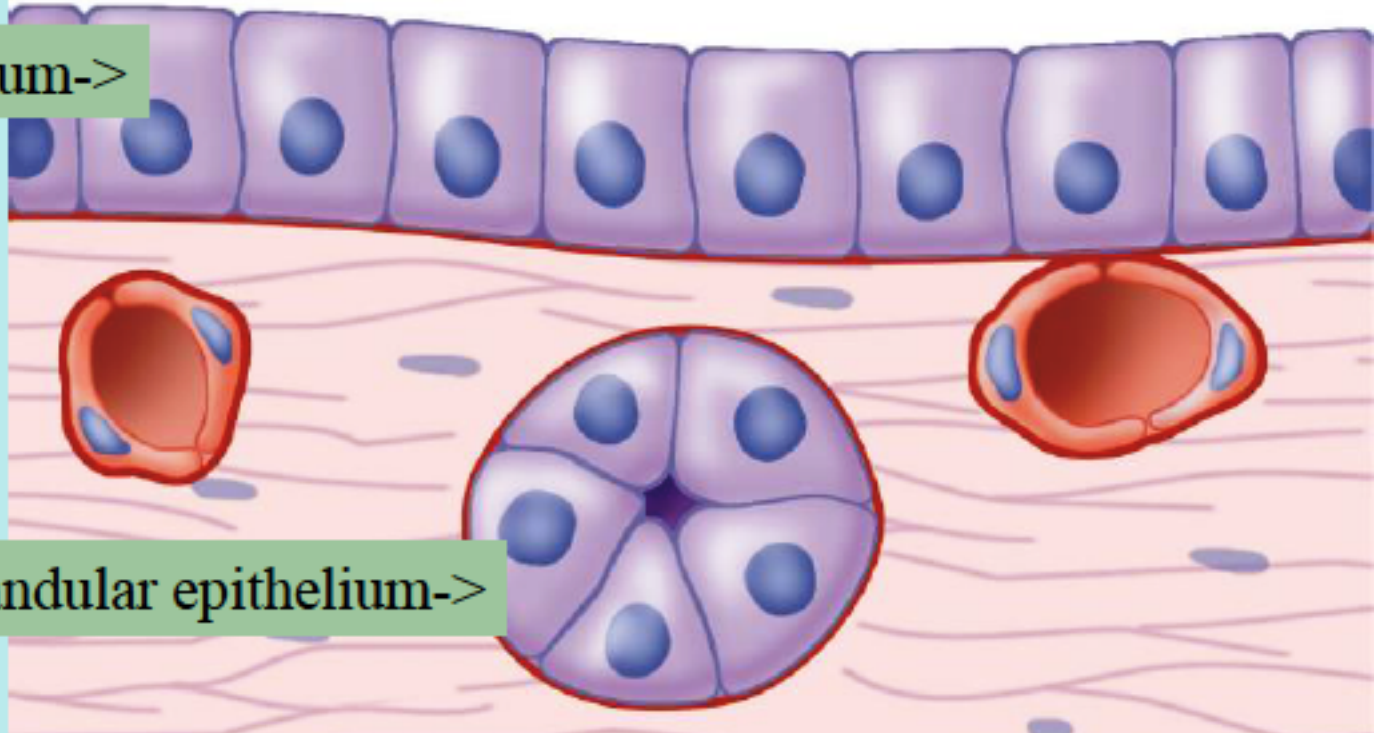
- ✓ Skin, digestive tube, reproductive tract, ureter, bladder, trachea, lungs



# Two Main Kinds of Epithelium

Lining epithelium->

Glandular epithelium->



## **Covering and lining epithelium**

Covers outer surfaces of body and lines internal body passages

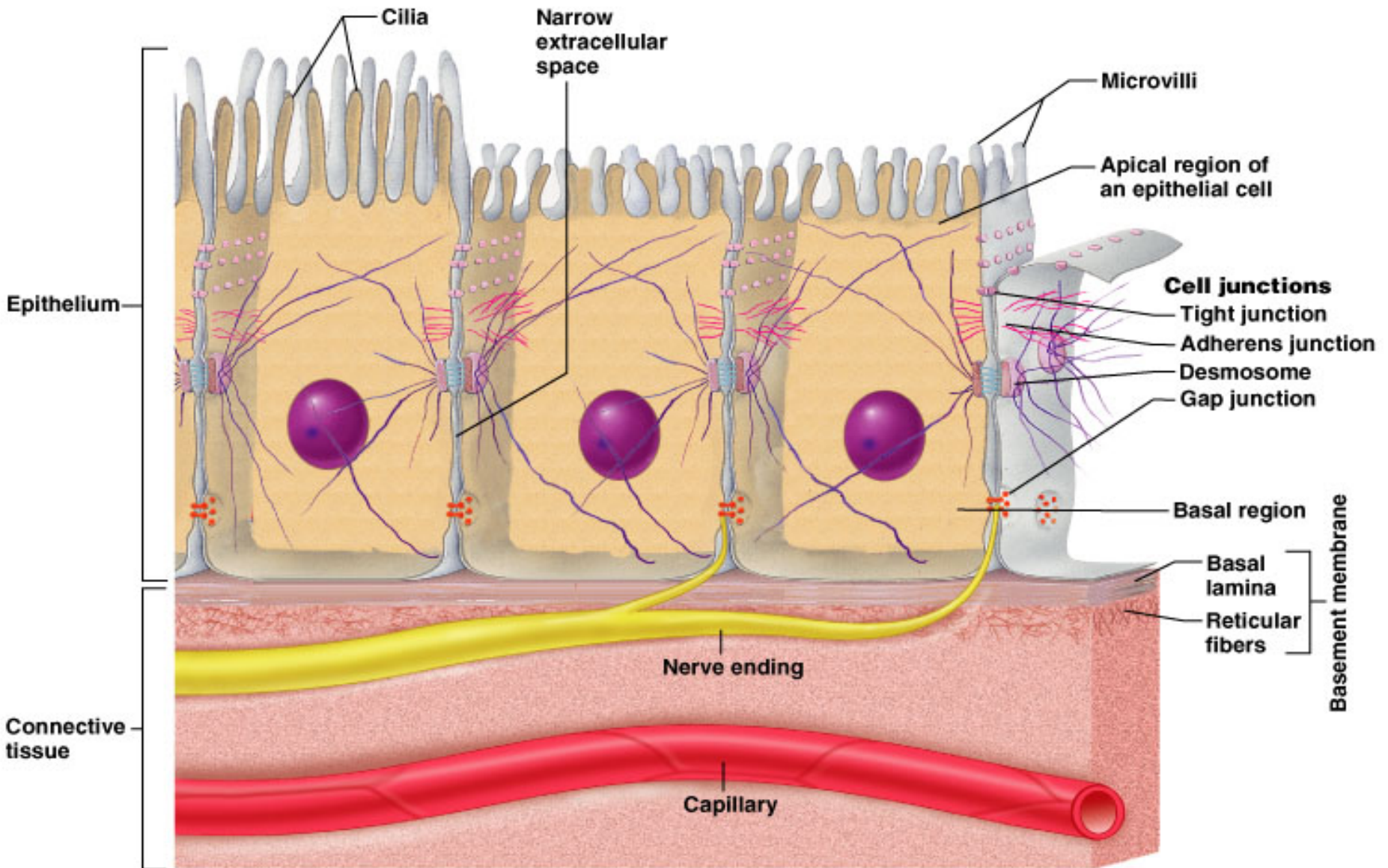
## **Glandular epithelium**

Contains cells specialized for secretion

# Unique Characteristics of Epithelium

- **Basal lamina** anchors epithelium to underlying connective tissue.
- Epithelial cells are very **cohesive** due to intercellular junctions.
- Epithelial cells **vary** in shape and size.
- Epithelial tissues are **avascular**.
- Epithelial cells demonstrate **polarity**.
- It has its own stem cells reserve so it can **regenerate**.

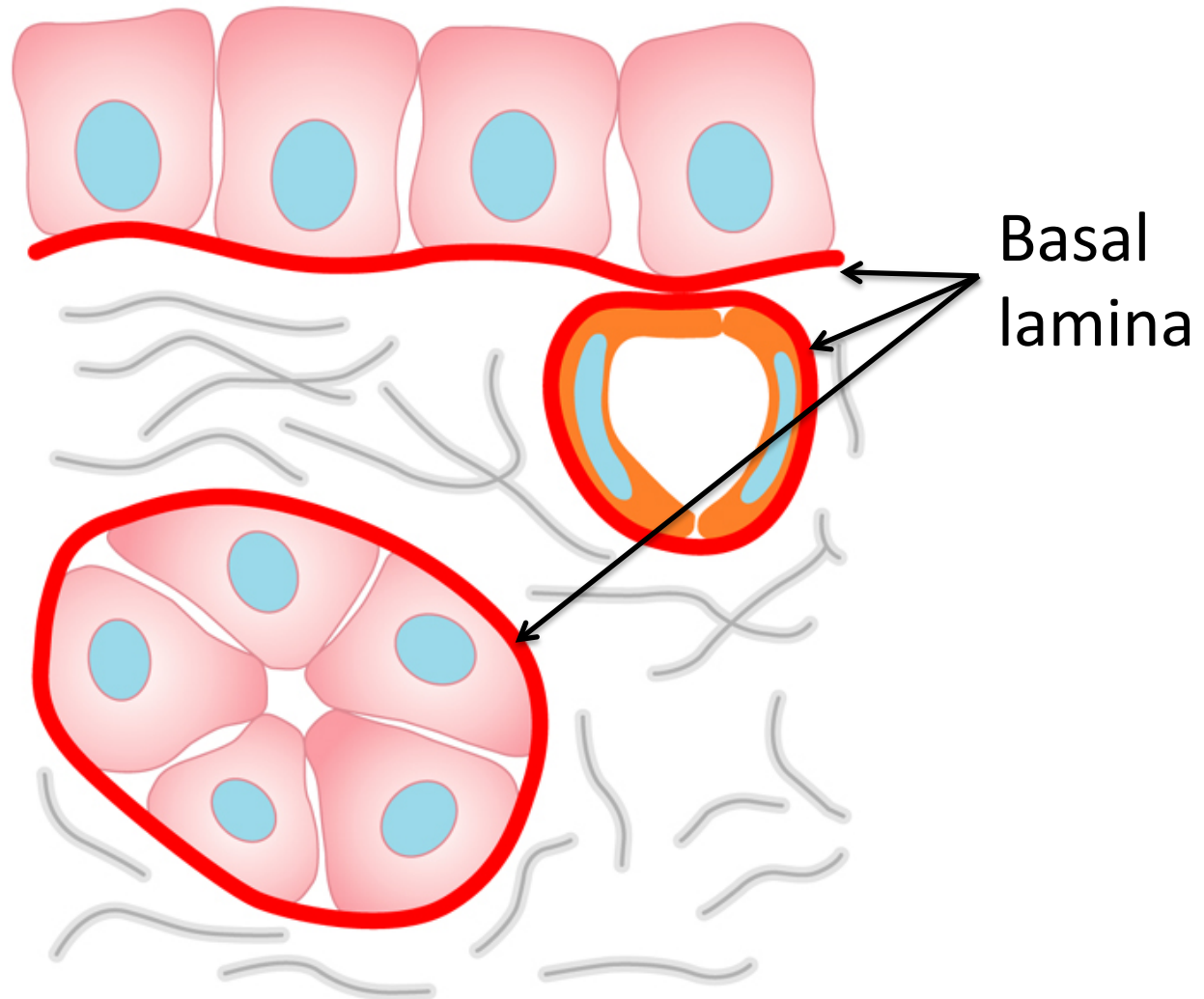
# Special Characteristics of Epithelia



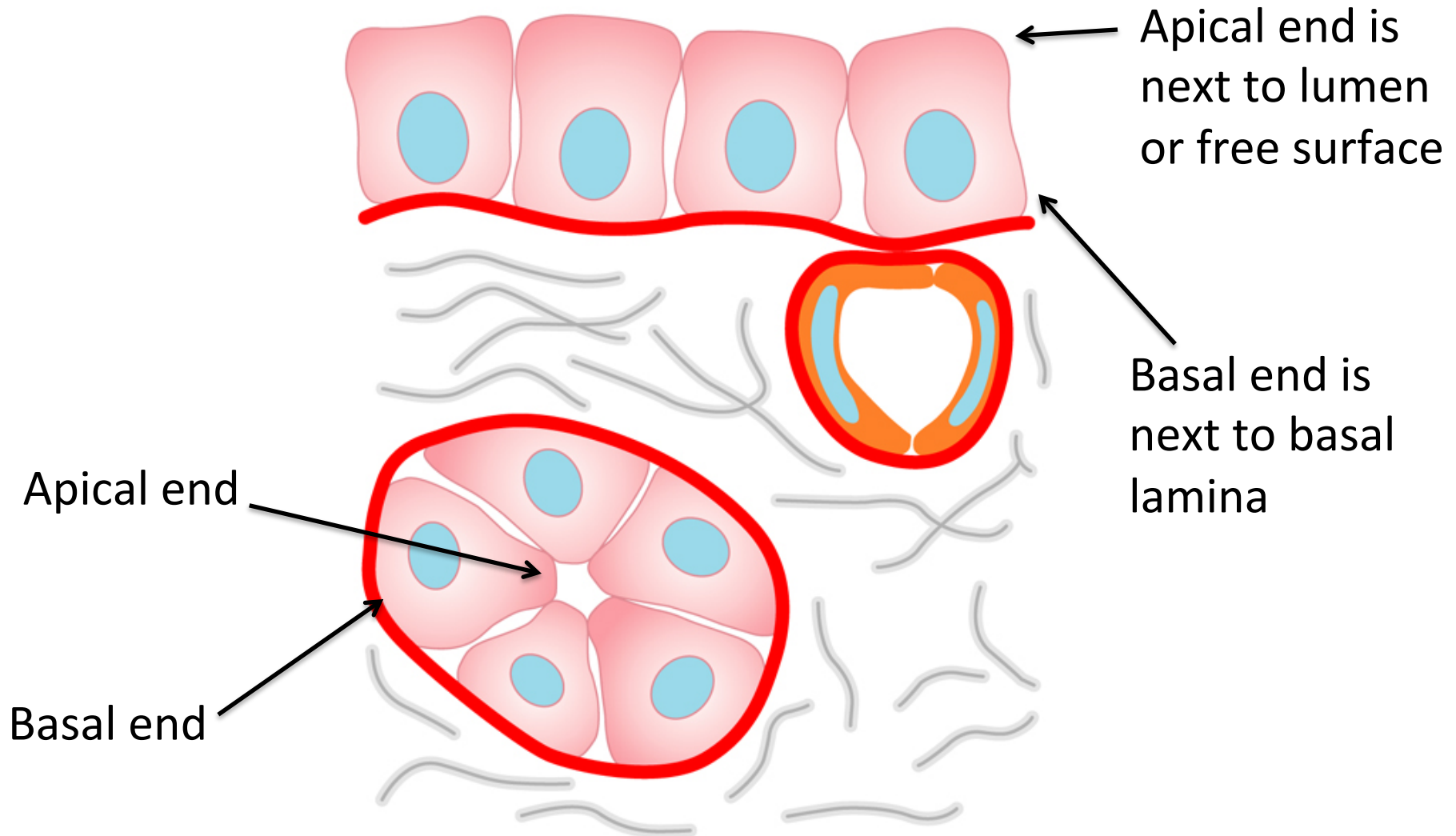
# Epithelium Lecture Outline

- Function and types of epithelium
- Structure of epithelium
  - Basement membrane
  - Connections between cells
  - Specialized apical structures

**Epithelial cells** make the basal lamina  
(a thin layer of matrix upon which they sit)



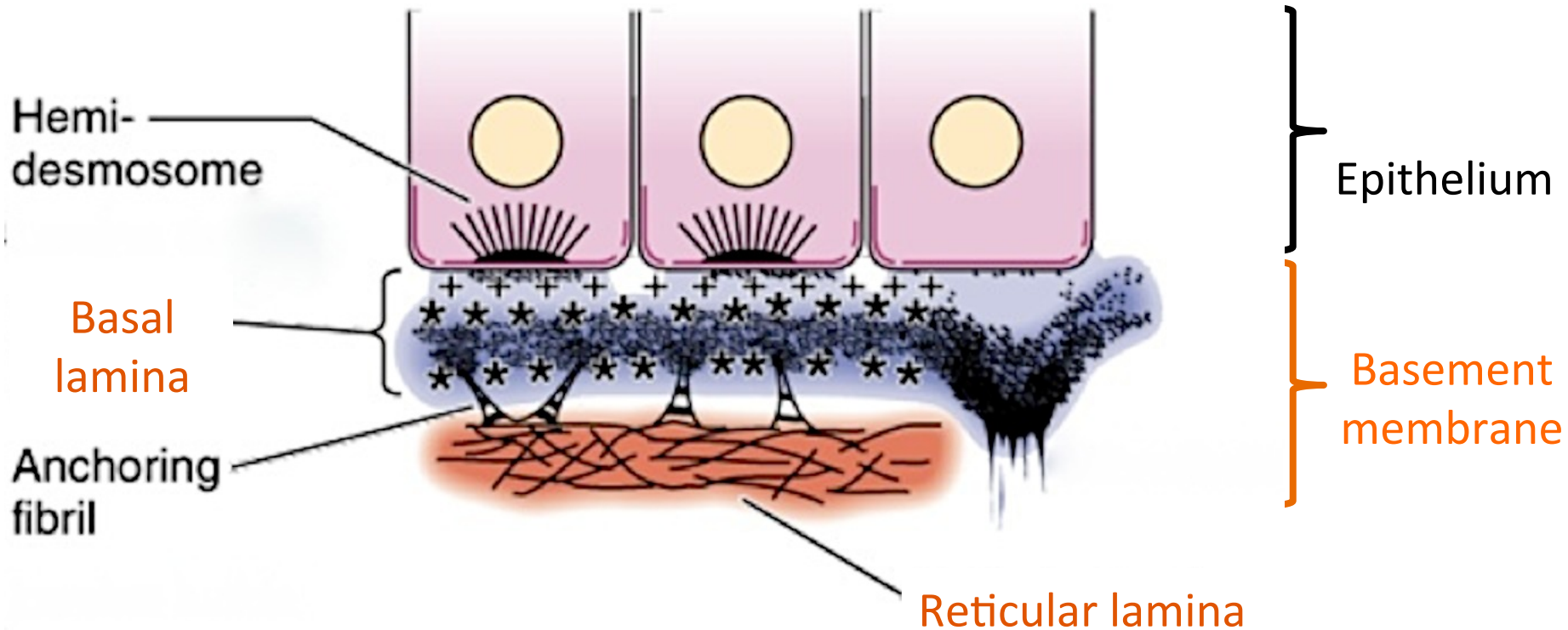
# Epithelial cells have polarity (a base and an apex)



# Functions of Basal Lamina

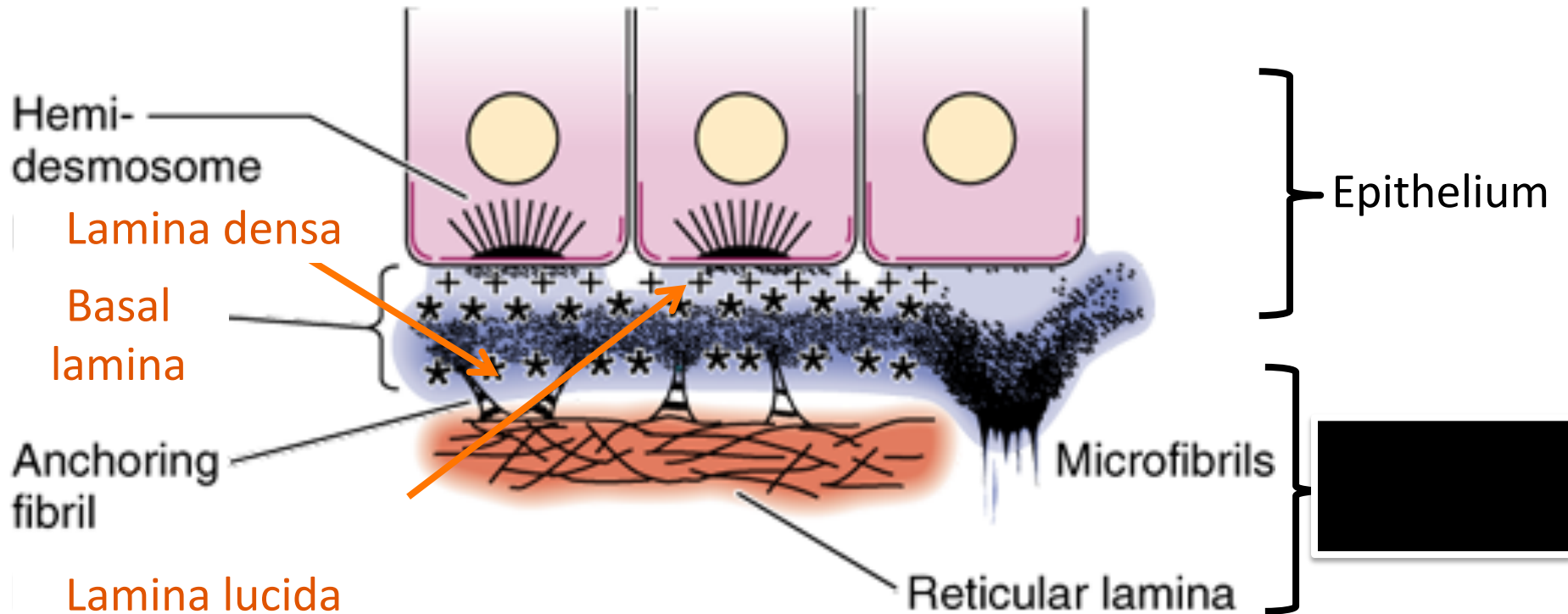
- **Structure:** attaches epithelium to connective tissue
- **Organization:** arranges plasma membrane proteins in the basal membrane
- **Filtration:** regulates movement of material between epithelium and connective tissue
- **Regulation:** binds growth factors that regulate cell proliferation, differentiation and metabolism
- **Migration:** orients movement of epithelial cells

# Basement membrane



**Basement membrane** is composed of basal lamina plus reticular lamina

# Basal Lamina



**Basal lamina** is composed of  
Lamina densa and lamina lucida

# Don't make this mistake!

“Basal lamina” and “basement membrane” are sometimes used interchangeably.

This is wrong, wrong, wrong!

The basal lamina is part of the basement membrane. They are not the same thing.

# Components of Basement Membrane

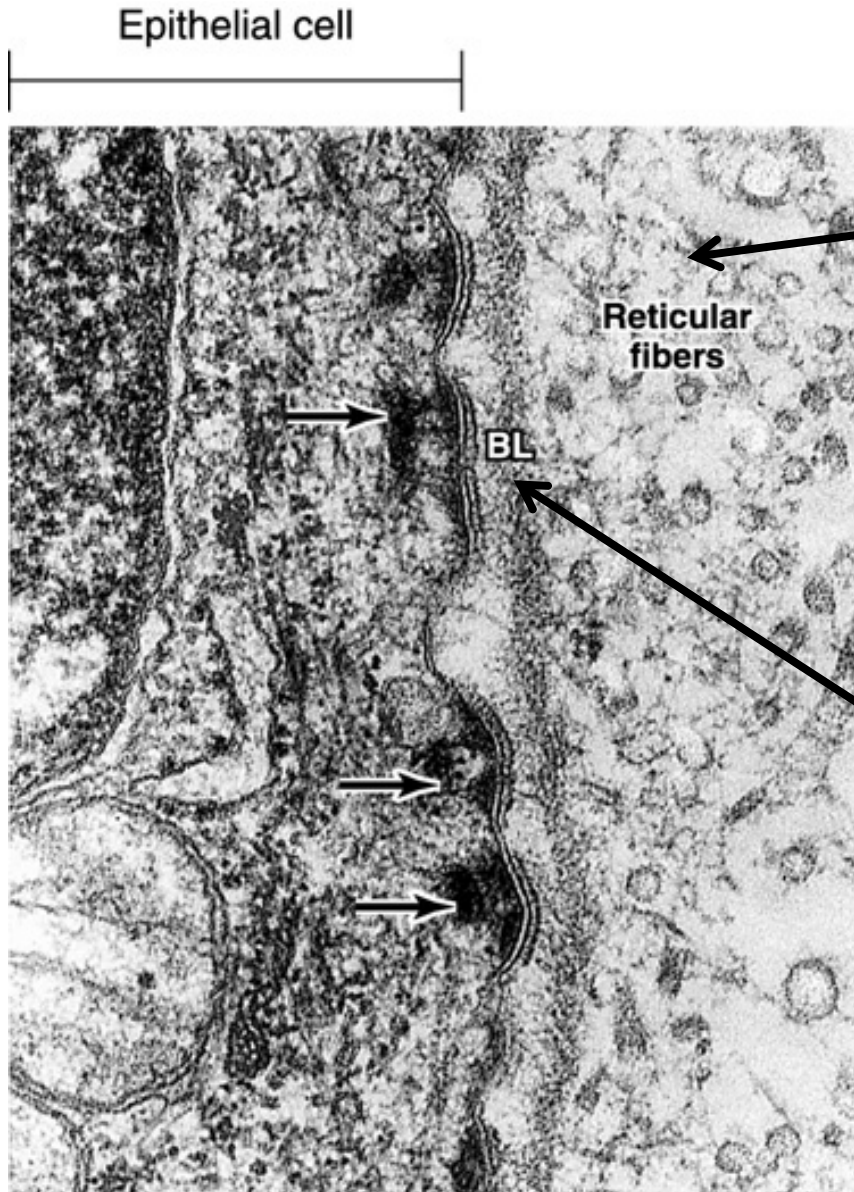
## **Basal lamina**

- Lamina lucida (laminin and entactin)
- Lamina densa (type IV collagen sandwiched between layers of perlecan, a proteoglycan)

## **Reticular lamina**

- Several collagen types

# Basement membrane = basal lamina + reticular lamina



## Reticular lamina

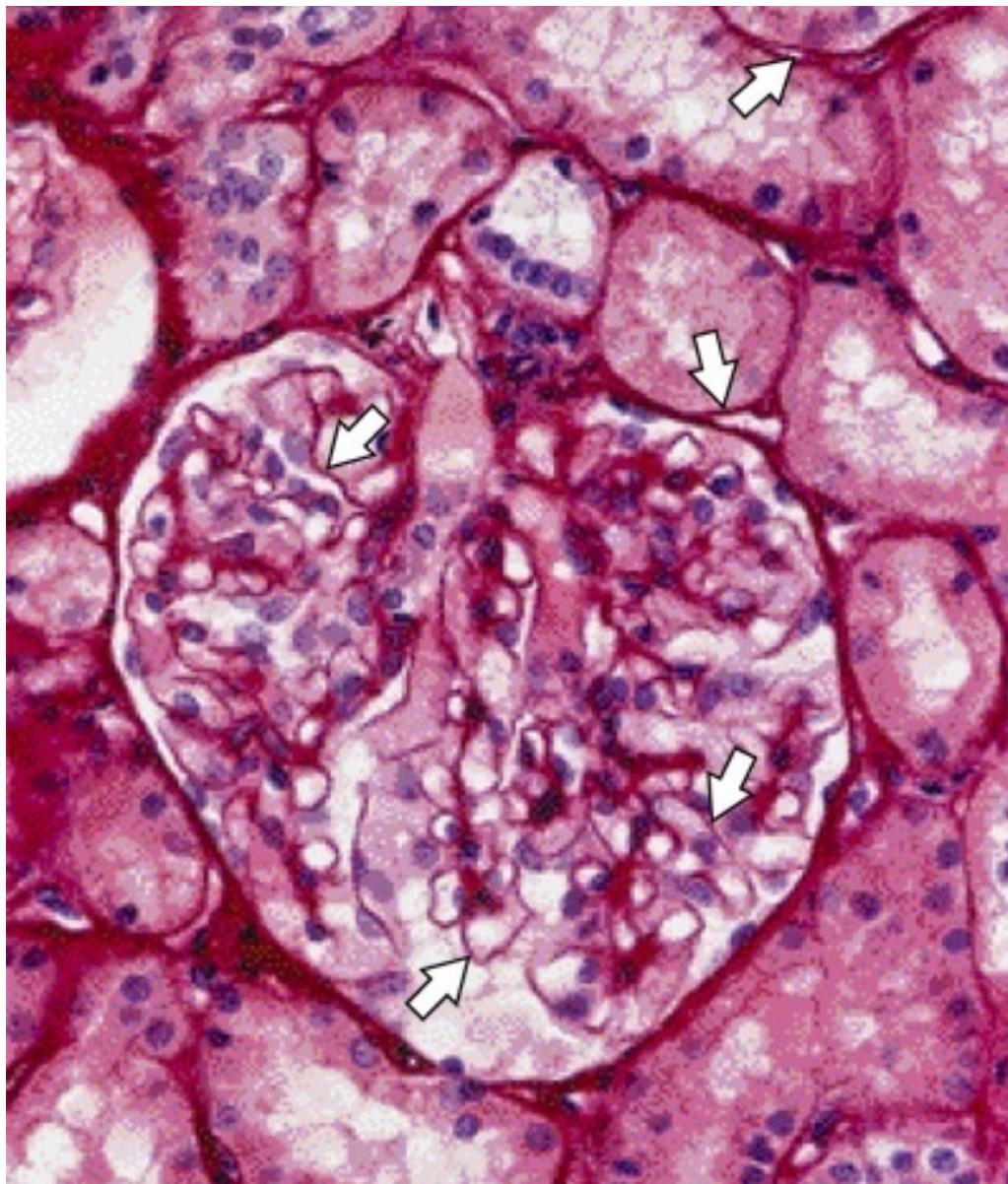
A bunch of different types of collagen.

Made by connective tissue.

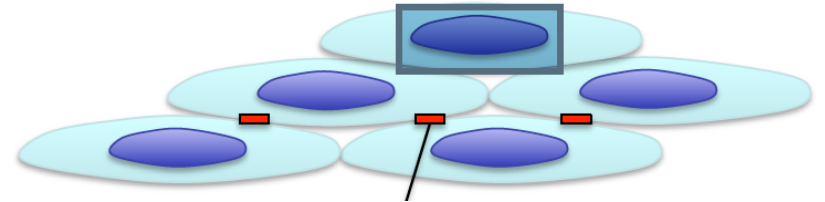
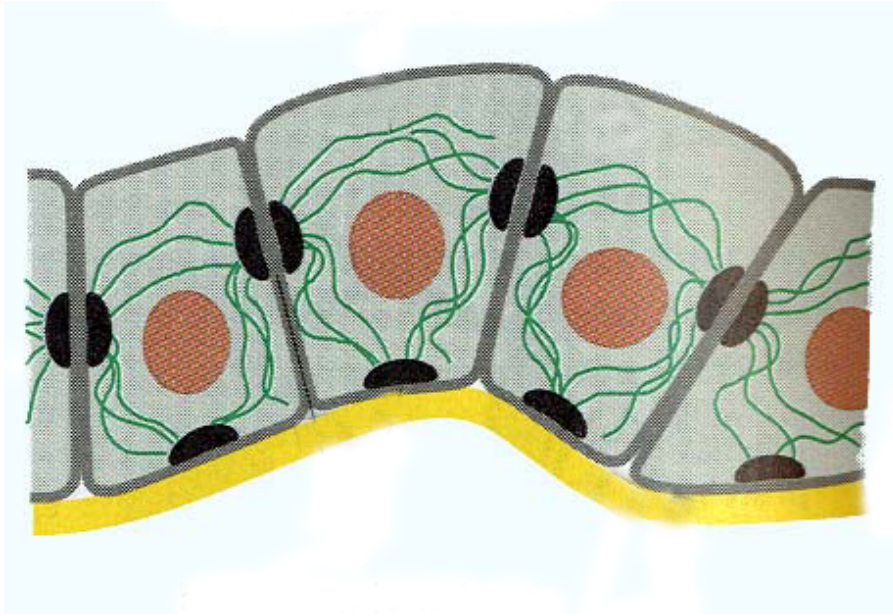
## Basal lamina

Type IV collagen sandwiched between layers of perlecan.

Made by epithelial cells.



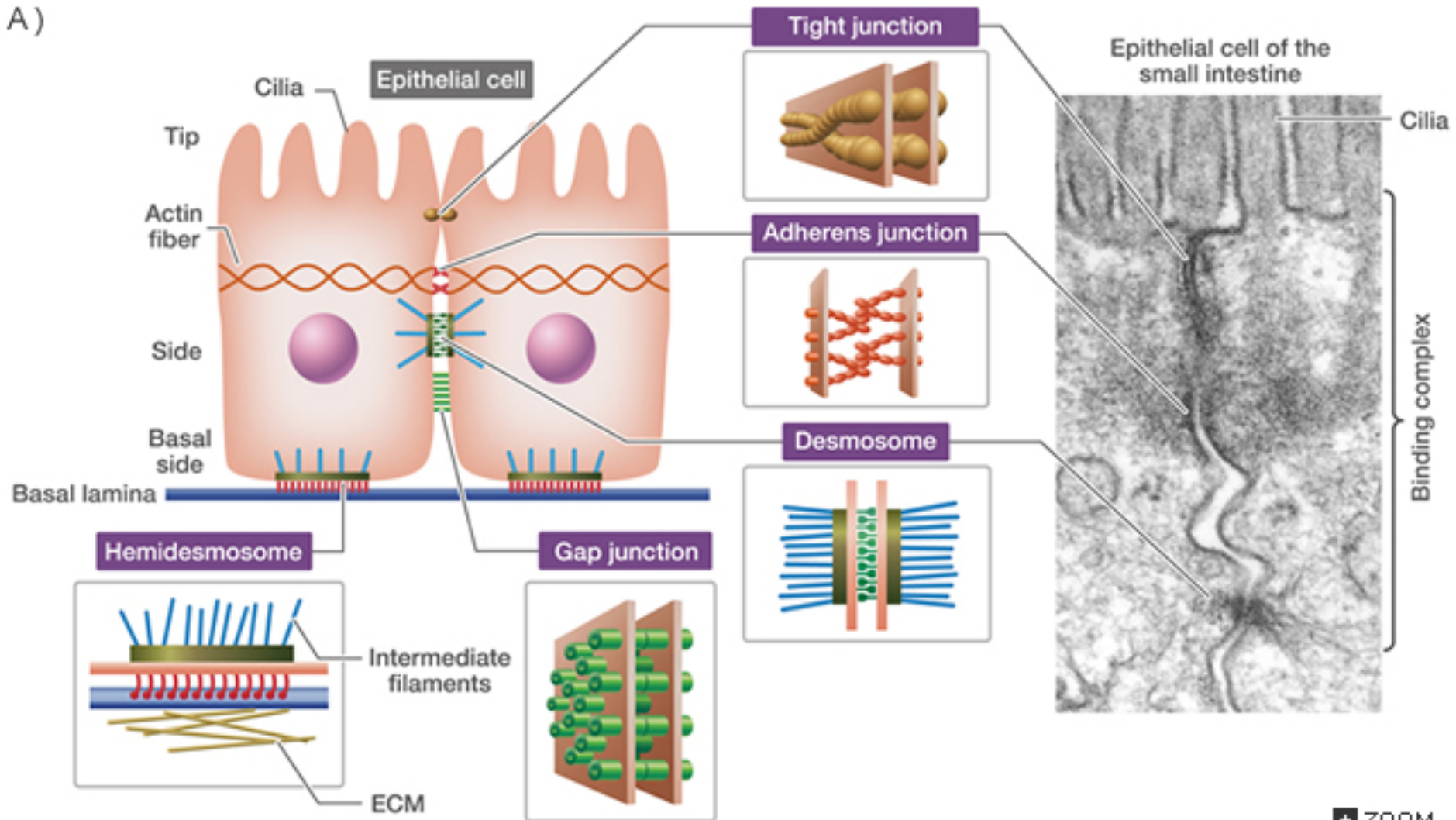
Special stains (like Periodic acid-Schiff) can make basement membrane more apparent.



- What are the factors keeps our cells together?
- How do they know each other?
- How do they decided to settle together?

# Cell-Cell & Cell-Matrix Interaction

A)



# Intercellular Junctions Connect Epithelial Cells

Intercellular junctions are present in most tissues but are especially numerous and prominent in epithelium.

- Zonula occludens (tight junction) stopper
- Zonula adherens (belt desmosome) holder
- Macula adherens (desmosome)
- Hemidesmosomes
- Gap junction (nexus) communication

# Intercellular Junctions

## Tight junctions

They define cell polarity and control the passage of substances between adjacent cells. Tight junctions have a **beltlike** distribution like a ribbon internally bracing the cells and are associated with **actin filaments**.

Note that gap junctions are not associated with cytoskeletal components.

## Zonula adherens or belt desmosome

This anchorage junction has a **beltlike** distribution and is associated with **actin filaments**.

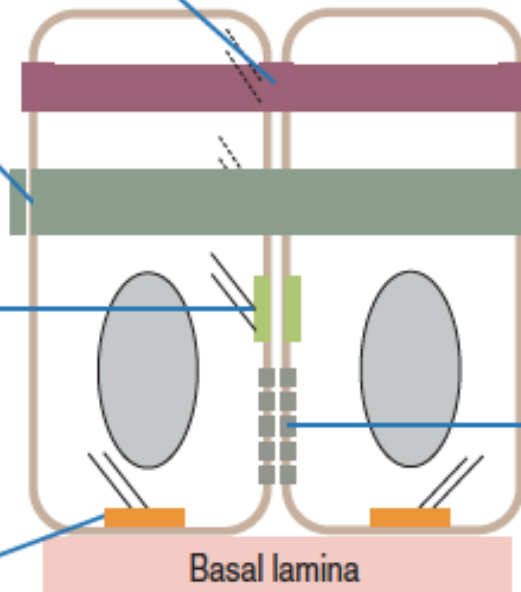
## Macula adherens or spot desmosome

This anchorage junction has a **spotlike** distribution and is associated with **intermediate filaments**.

## Hemidesmosome

Hemidesmosomes link the basal domain of an epithelial cell to the basal lamina.

**Intermediate filaments** are associated with a **plaque**.



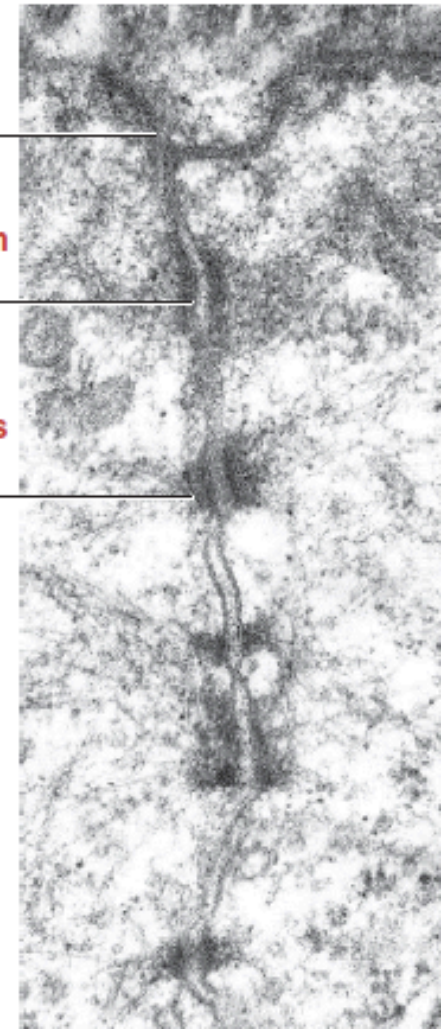
## Gap or communicating junctions

They connect functionally two adjacent cells. A gap junction is formed by **connexons**, channel-like structures that enable the passage of small molecules (~1.2 kd) between cells.

Tight junction

Zonula adherens

Macula adherens



# Cell Junctions Role

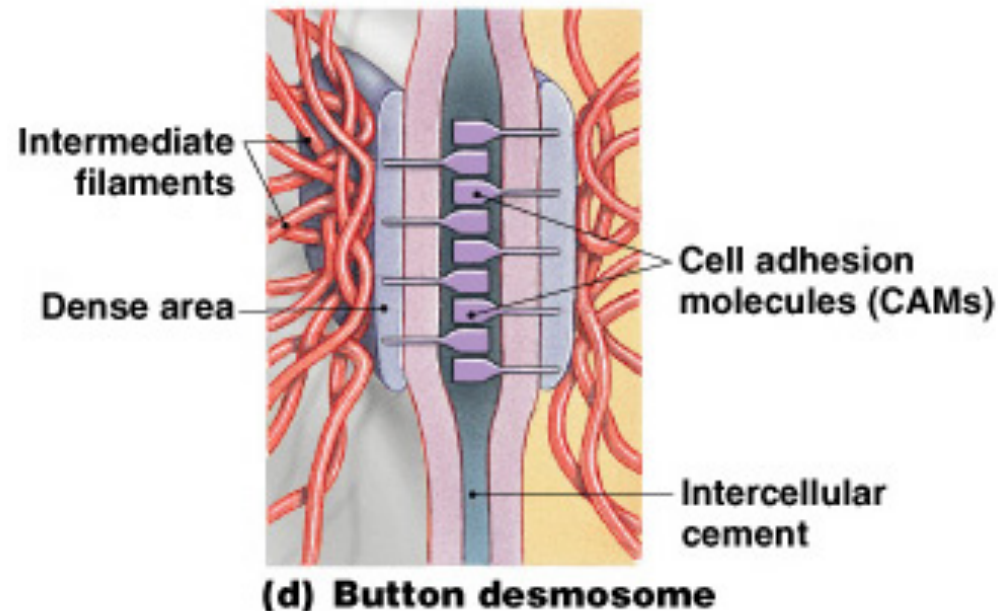


- **Tight Junctions** – surround cells, waterproof
  - Isolates wastes in the lumen
- **Desmosomes** – tie cells together with great strength (like rivets)
- **Belt Desmosomes**
- **Spot Desmosomes**
- **Hemidesmosomes attach** – tie cells with ECM with great strength (like rivets)
- **Gap junctions** – allow rapid communication

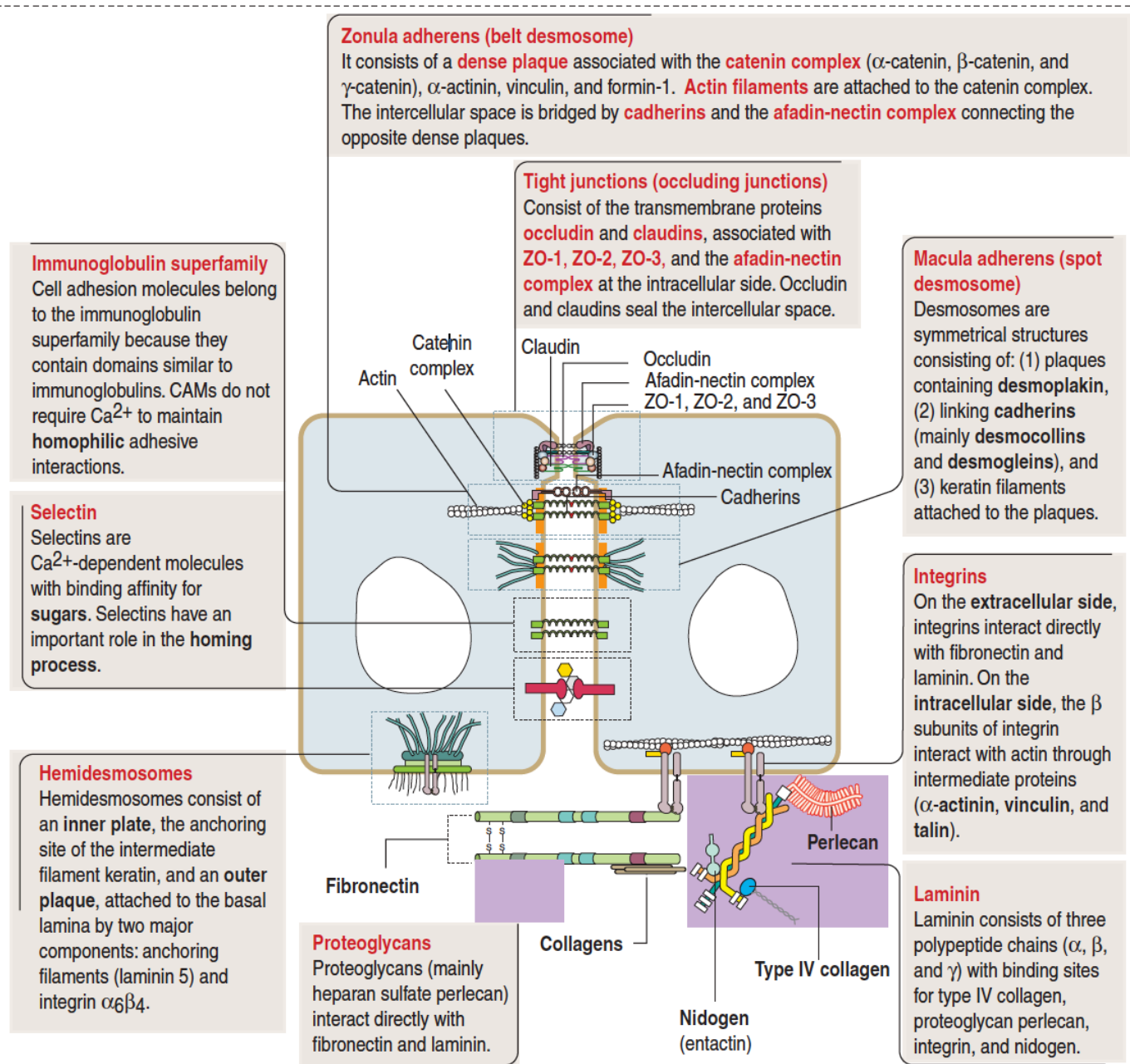
# Large Connections

- CAMs (cell adhesion molecules):
  - Transmembrane proteins: cell membrane-cell membrane connections
  - Ca<sup>2+</sup> dependent-Cadherin, selectin
  - Ca<sup>2+</sup> independent- Integrin, NCAM, ICAM-1/2, VCAM

- Intercellular cement:
  - Proteoglycans
    - Glycosaminoglycans
    - Hyaluronan



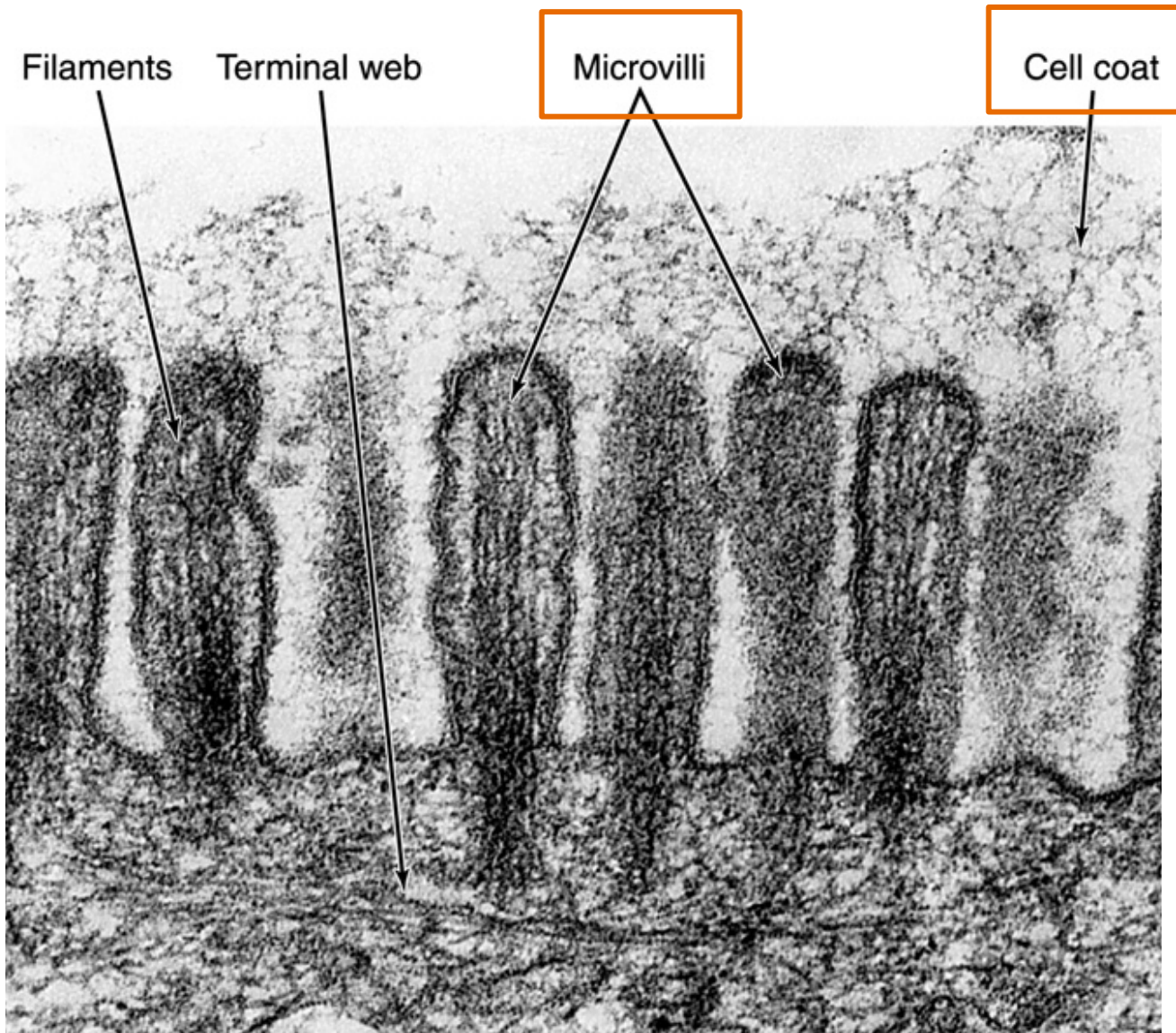
# Cell Adhesion Molecules



# Epithelium Lecture Outline

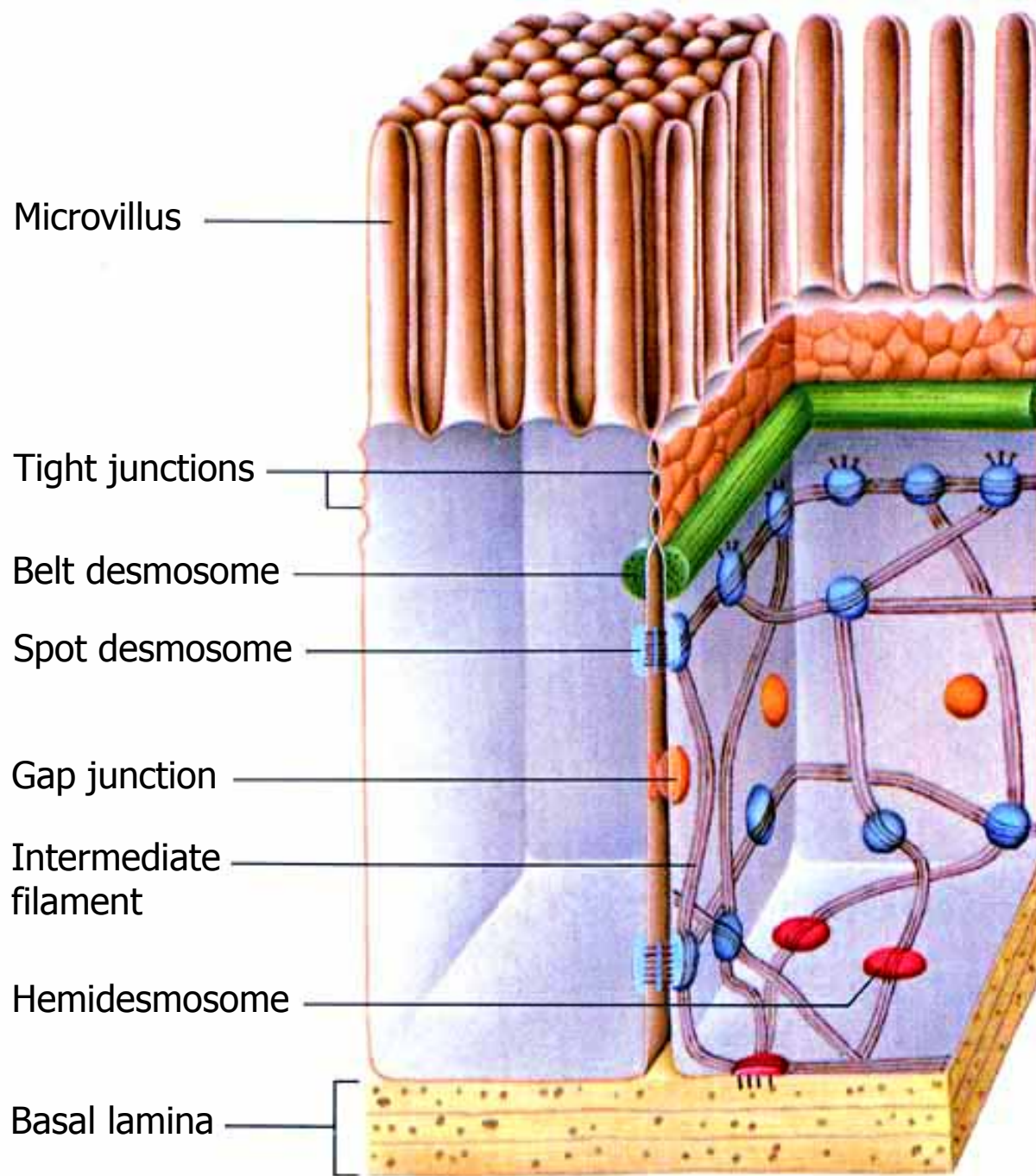
- Function and types of epithelium
- Structure of epithelium
  - Basement membrane
  - Intercellular junctions
  - Specialized apical structures

# Microvilli

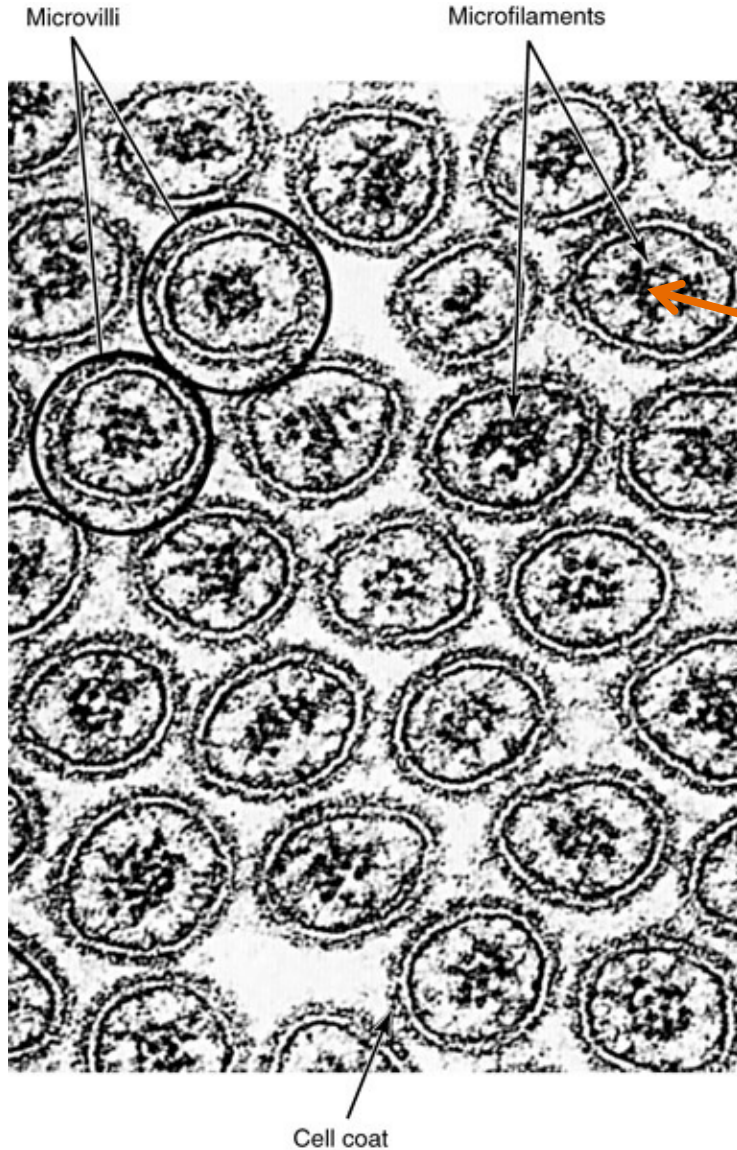


Microvilli + cell coat  
(or glycocalyx) =  
brush border or  
striated border

**Purpose of  
microvilli:** increase  
surface area for  
absorption or  
secretion



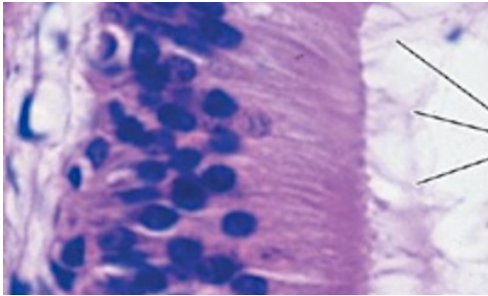
# Microvilli



Microvilli have a  
central core of  
**actin** microfilaments

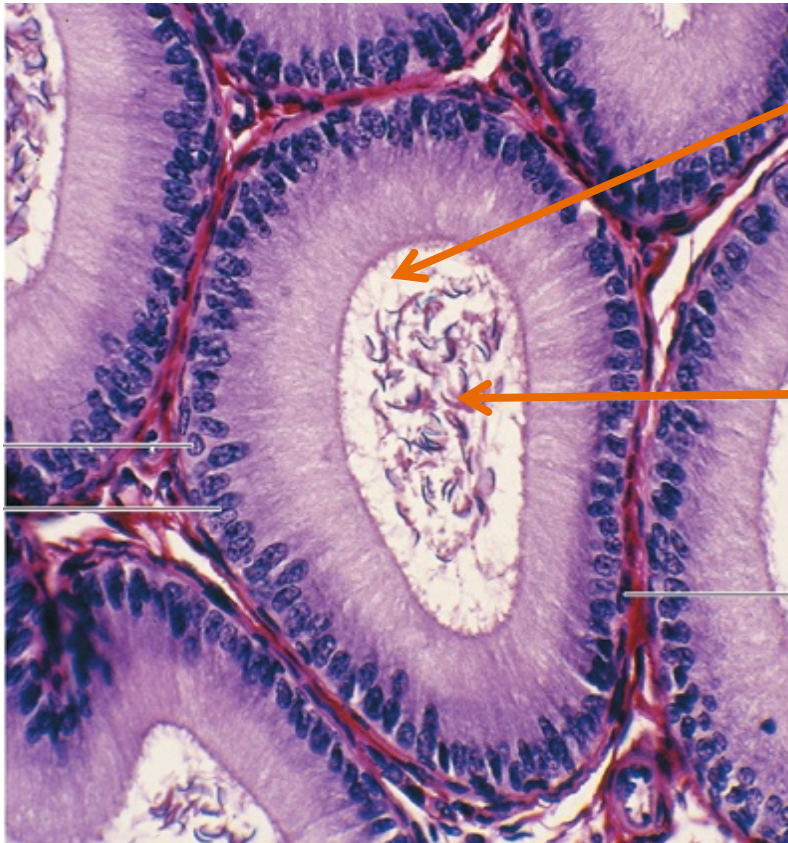
Microvilli don't wave  
back and forth like cilia.

# Stereocilia



Stereocilia

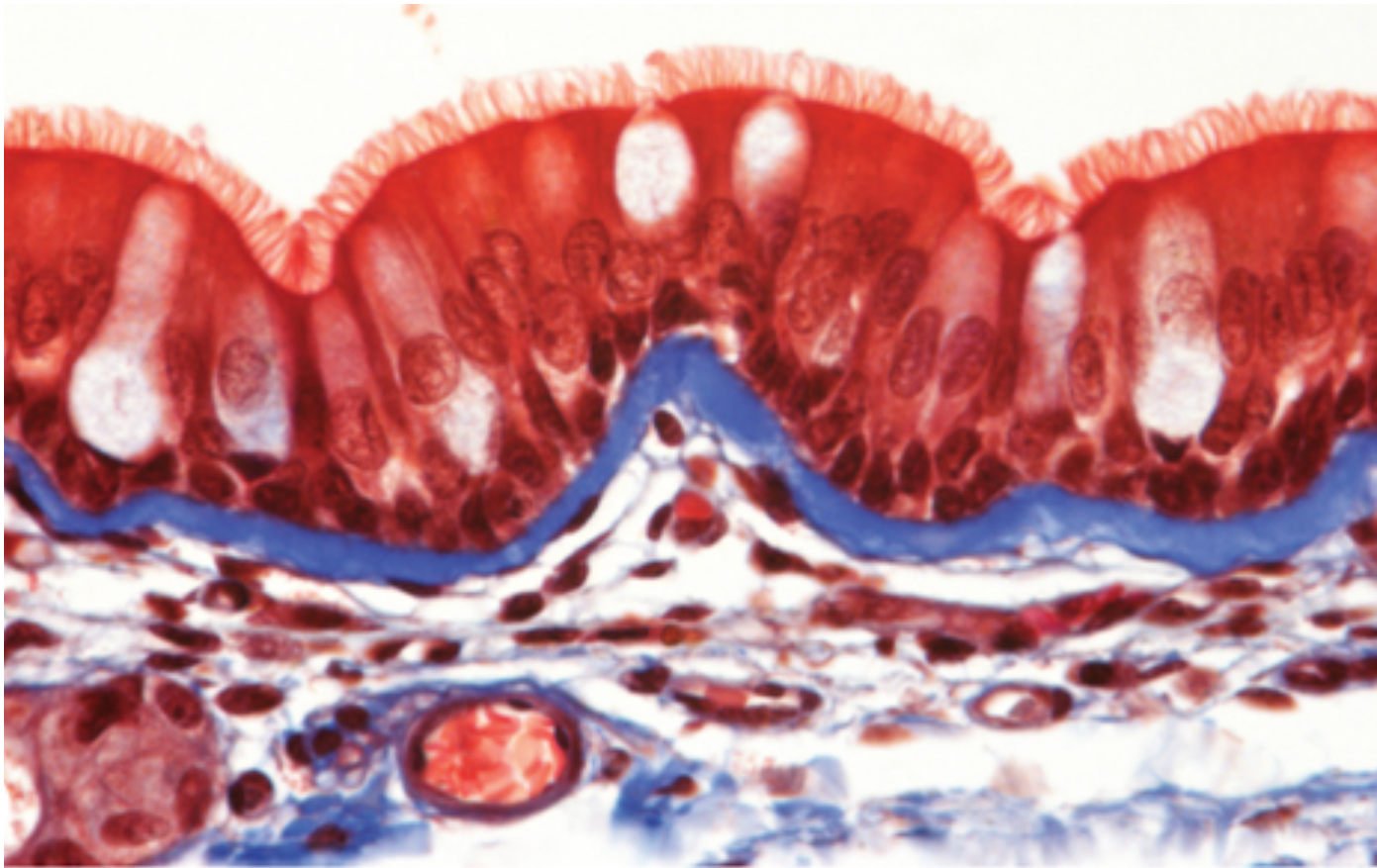
Stereocilia are long, non-motile microvilli found in parts of the male reproductive system



Spermatozoa

# Cilia

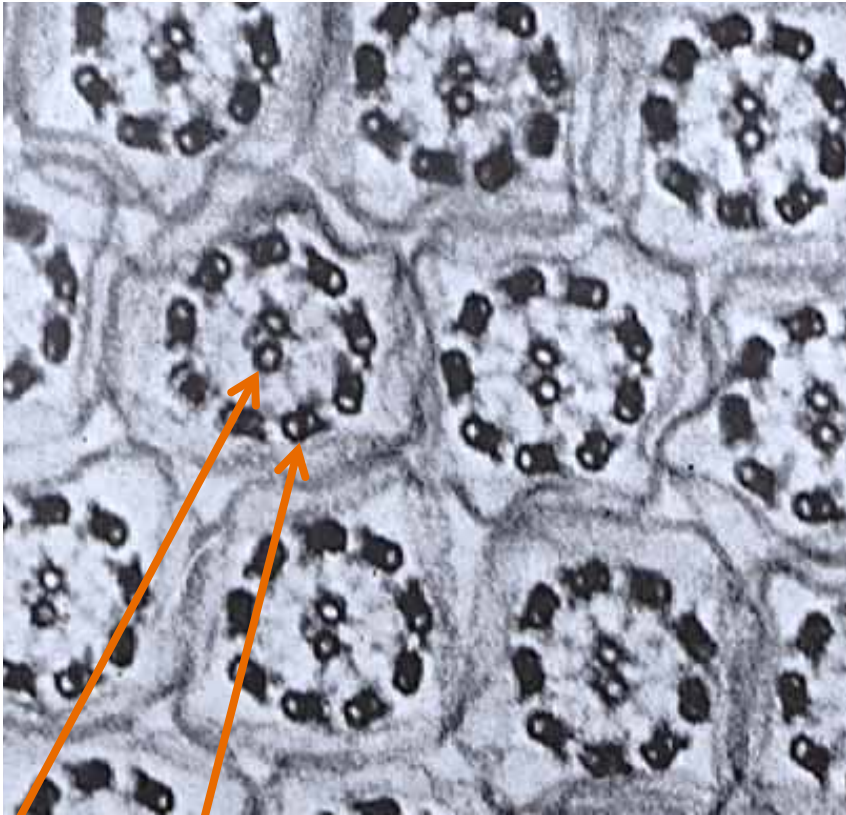
Cilia are much longer and wider than microvilli. They move back and forth to propel fluid along the epithelial surface.



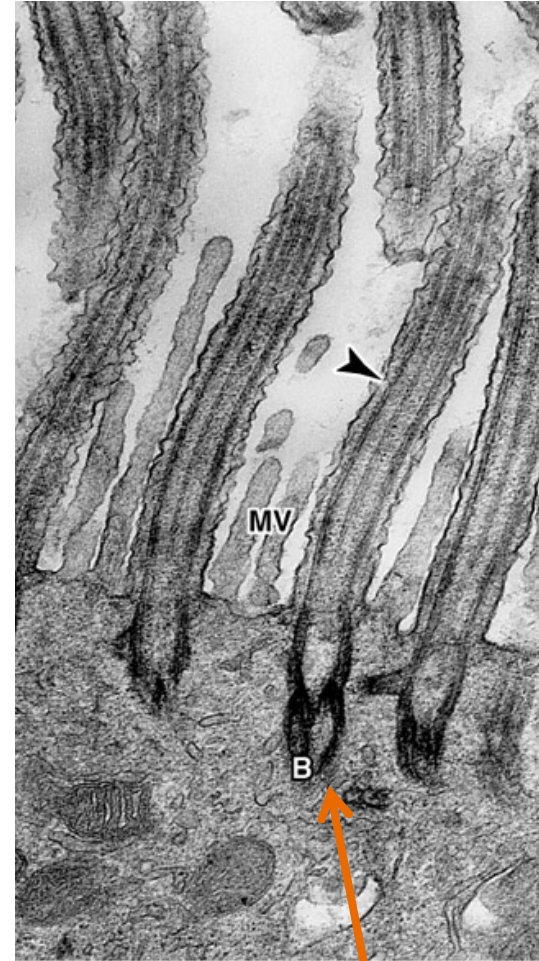
Cilia on respiratory epithelial cells

# Cilia

Cilia contain microtubules in a 9 + 2 configuration called an “axoneme”



2 central microtubules surrounded  
by 9 pairs of microtubules



Cilia insert into **basal bodies**  
with 9 triplets of microtubules

# THE END

