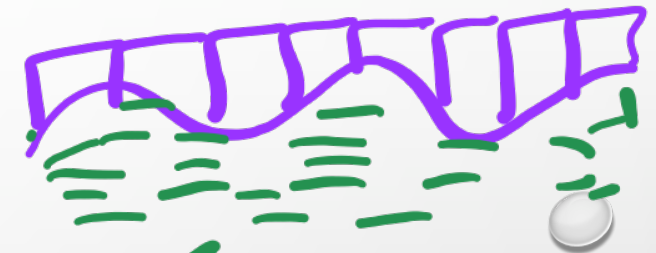


EPITHELIUM

Lamina propria:

A thin layer of loose connective tissue that forms part of the most linings known as mucous membranes.



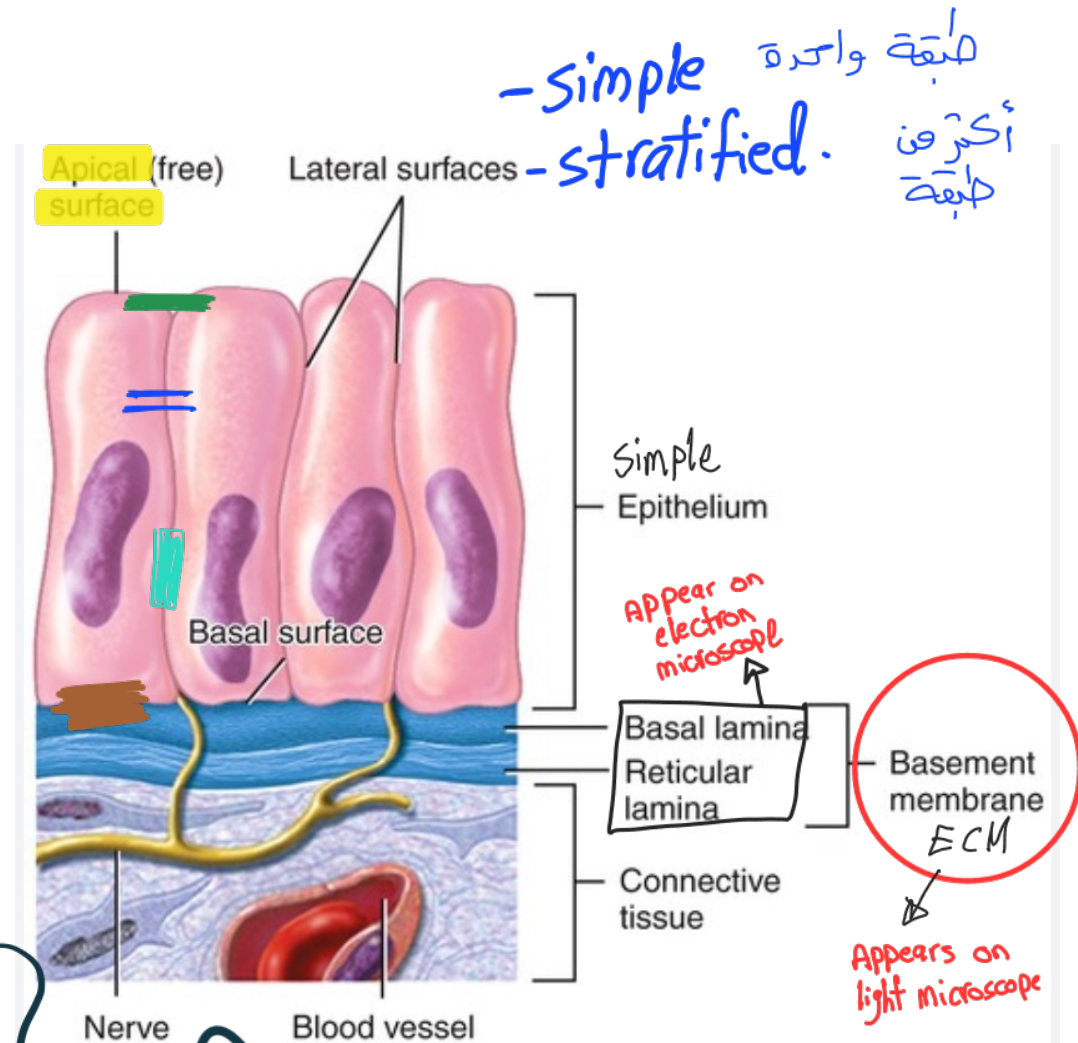
Lamina Propria

* Epithelial cells are polarized.

Epithelium

- Continuous sheets of cells adhering strongly to one another and to the underlying ECM. They line internal surfaces and cover the external surfaces
- It is a selective barrier that cover, lines, and protects tissues and is often involved in absorption or secretion.
- Separated from the adjacent connective tissue by a basement membrane

usually



gap junctions
tight junctions
desmosomes.
hemidesmosomes

* نصف النسيج بناءً على نوع الطبقة العليا فيه.

- * Connective tissue can be divided into 2 types :-
- Loose (more common)
 - Dense (has more cells)

Characteristics of epithelium

- **Supported** by the underlying connective tissue.
- **Innervated** (has nerves).
- **Avascular** (no blood vessels) ; blood supply is in supporting connective tissue.
- Has a **good regeneration capacity** but varies widely; **GIT every week—or quite slow as in large glands.**

Functions of epithelium

- **Protection**/covering—lining—ⁱⁿepidermis + Oral mucosa (Same as skin, but skin is keratinized while the oral mucosa is not)
- **Secretion**—glandular tissue e.g. cells that secrete enzymes and HCl in stomach
- **Absorption**—intestines. for balance
- **Detection of sensations**—inner ear, taste buds. special senses
- **Contraction**---specialized cells--myoepithelial cells ⁱⁿ(glands) (Epithelial cells containing muscle fibers)

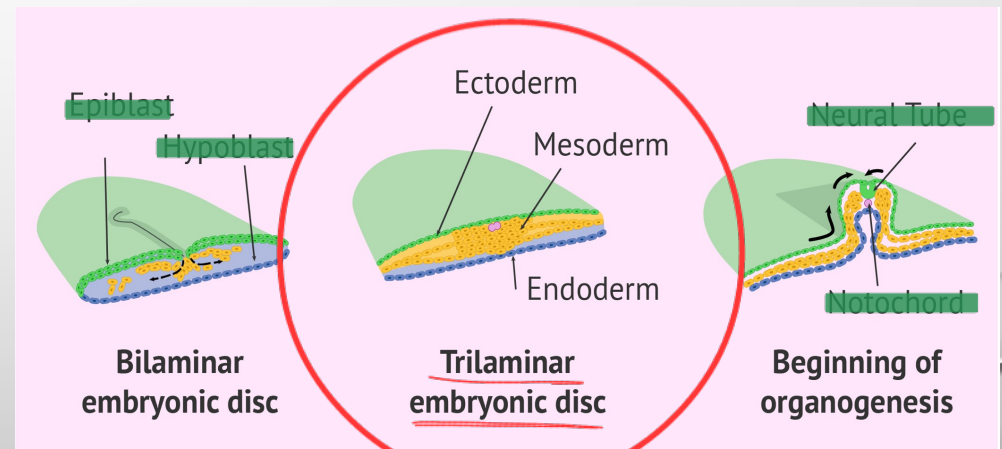
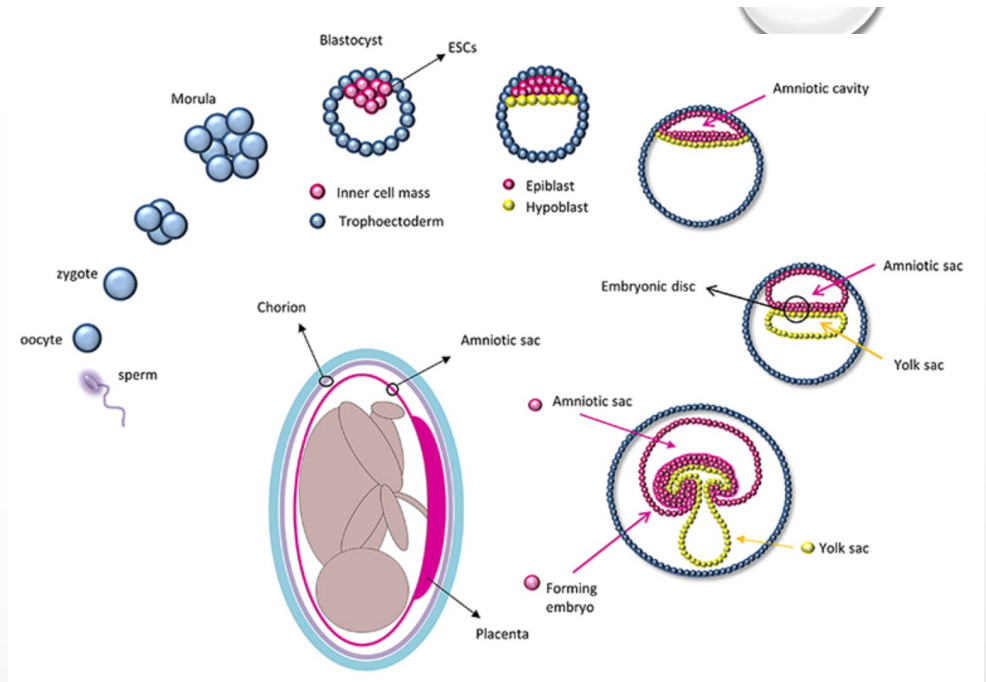
Embryogenesis of epithelium



Epithelium arises from all germinal layers:

mesoderm, endoderm, ectoderm

1. **Ectoderm**: **epidermis** (stratified squamous keratinized).
2. **Mesoderm**: **endothelium**.
3. **Endoderm**: **GIT tract** (not all), **lungs**.



Features

Epithelial cells are highly polarized:

- **Apical surface** - **faces the lumen or the external environment**

increasing the surface area • Microvilli, cilia, stereocilia

Movement

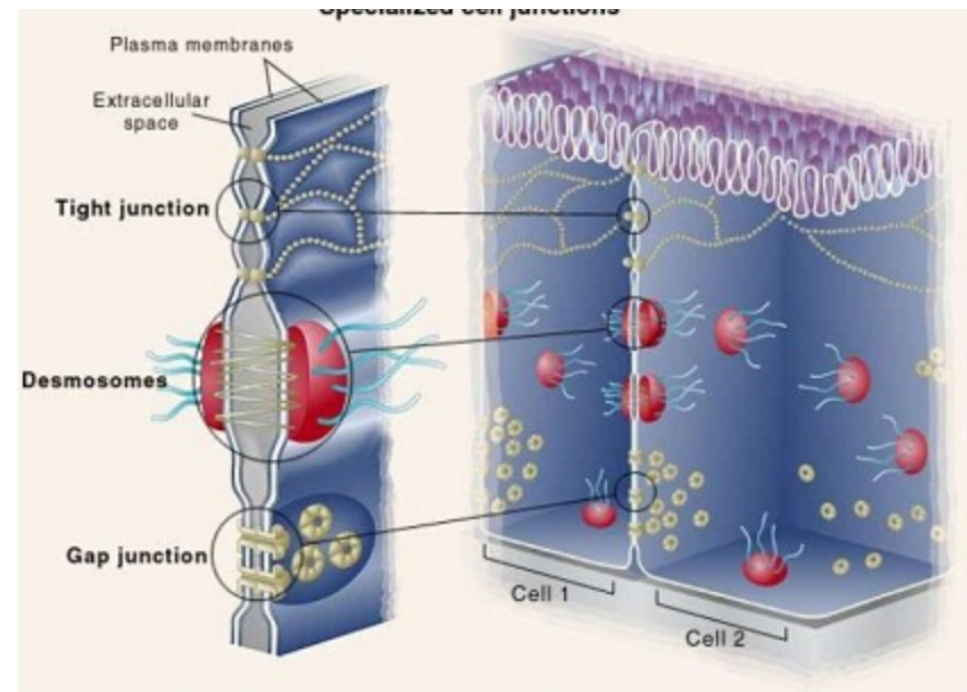
*Detection of motion
Absorption
Sensory function*

- **Lateral surface** - **faces the sides of adjacent cells**

- Tight junctions, desmosomes, gap junctions (intercellular junction)

- **Basal surface** - attaches to the basement membrane

- Basement membrane, hemidesmosomes





Columnar
-Oval-



Cuboidal
-spherical-

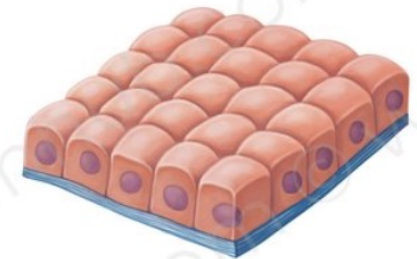
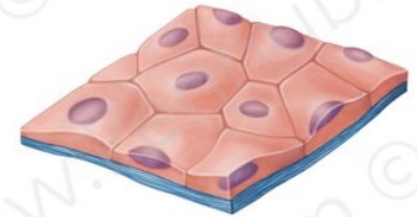


squamous
-flattened-

Features

- Cells' shape: **columnar**, **cuboidal** and **squamous** --- fits the function.
- Nucleus shape: elliptic (oval), spherical, or flattened --- cell shape.
- Most epithelia are adjacent to connective tissue ----- receive nutrients and O₂. - **lamina propria** (digestive, respiratory, urinary).

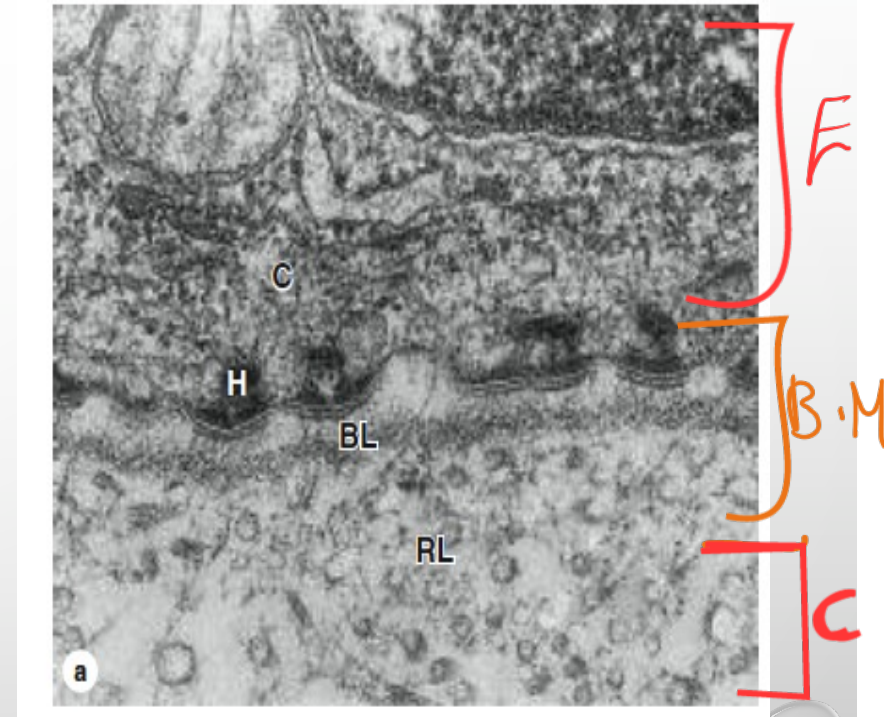
وظيفة تخریب ال epithelial عن طريق ال diffusion tissue



تمرير المواد بين ال
epithelial and connective tissues
يسهل حفا فرتي هذرا ال membrane

Basement membrane

- **Thin extracellular**, felt-like sheet of **macromolecules**.
- A **semipermeable** filter for substances reaching epithelial cells from below
- Electron microscope: basal lamina (epithelium), reticular lamina(CT).



⑦

+ 4
3

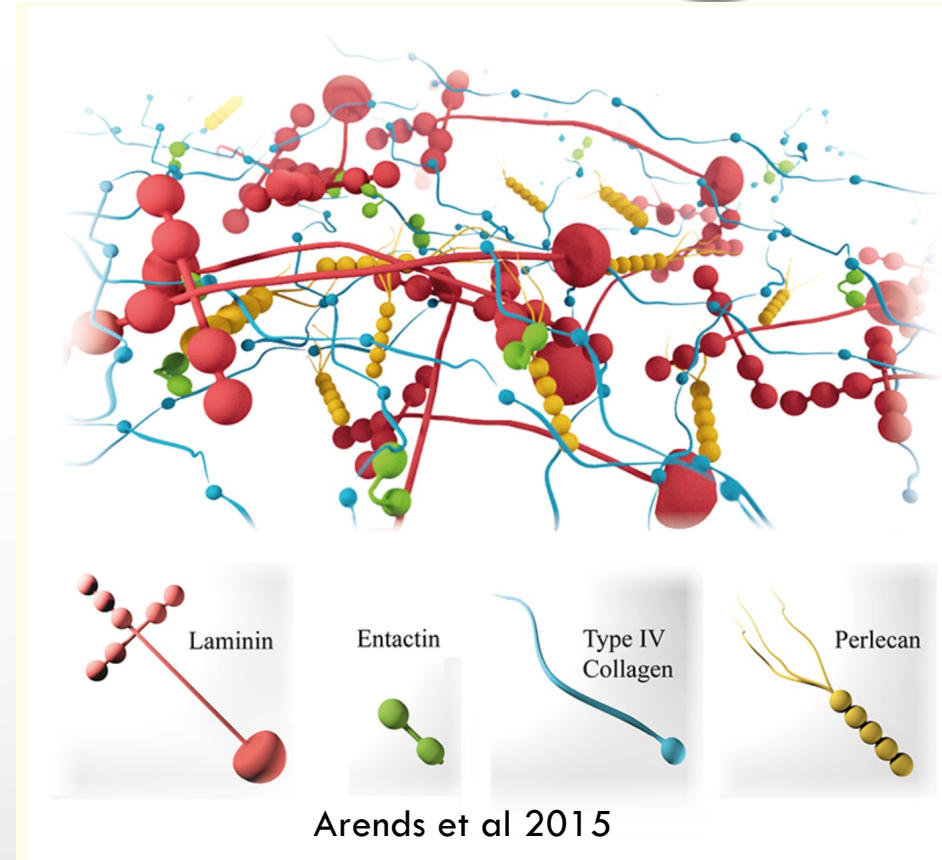


hemidesmosomes (Integrin)

Basal Lamina

• Molecules of basal lamina:

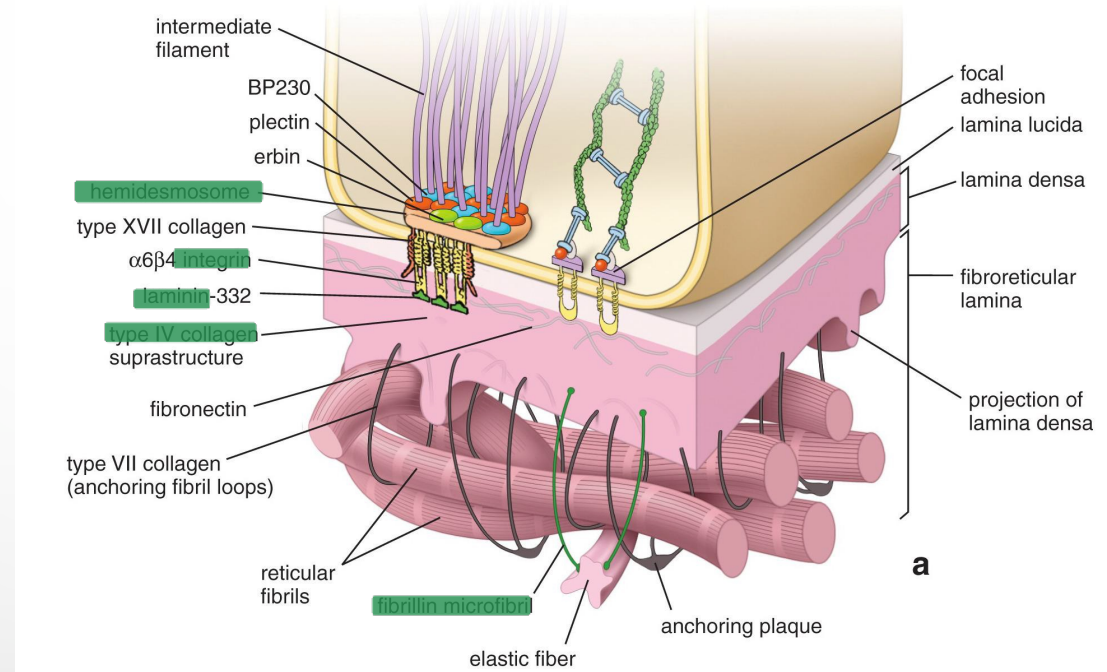
1. **Type IV collagen**: a two-dimensional network of evenly spaced subunits.
2. **Laminin** large glycoproteins that attach to integrins, and project through the network of collagen IV.



3. **Nidogen (entactin)** and **perlecan** protein and a proteoglycan, cross-link laminin to the collagen network and help determine the porosity of the basal lamina and the size of molecules able to filter through it.

Basal lamina contains collagen type III which is bound to basal lamina by collagen type VII.

Reticular lamina



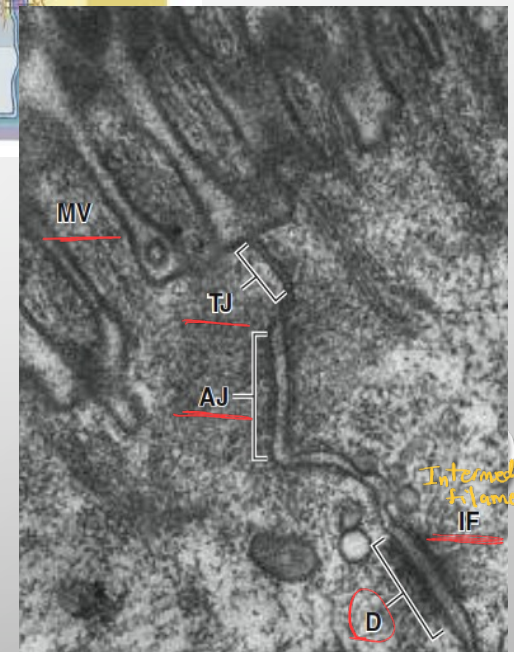
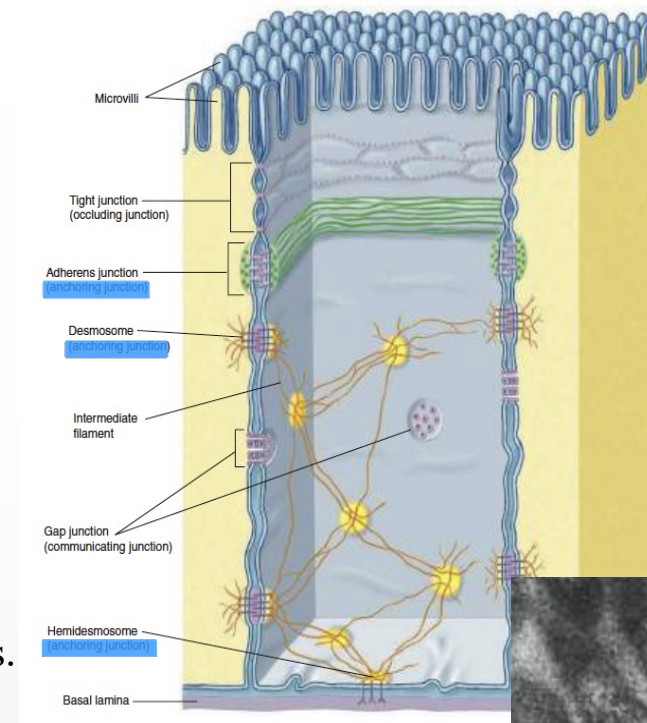
- Contain reticular fibers (collagen type III)
- Anchoring fibrils of type VII collagen link the basal lamina with the reticular fibers of the reticular lamina
- Product of the connective tissue.

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The title 'Junctional Complexes' is centered in a black serif font.

Junctional Complexes

Junctional Complexes

- Membrane-associated structures provide adhesion and communication between cells
- Epithelial cells adhere strongly to neighboring cells and basal laminae
prevent the paracellular movement
- **Tight or occluding** junctions **form a seal** between adjacent cells.
تعاوط سبب مانع الجريان الجانبي
- **Adherent** or anchoring junctions are sites of strong cell **adhesion**.
- **Gap** junctions are channels for **communication** between adjacent cells.
- **Desmosome** or **macula adherens** are **disc-shaped** structures at the surface of **one cell** that are matched with identical structures at an adjacent cell surface.

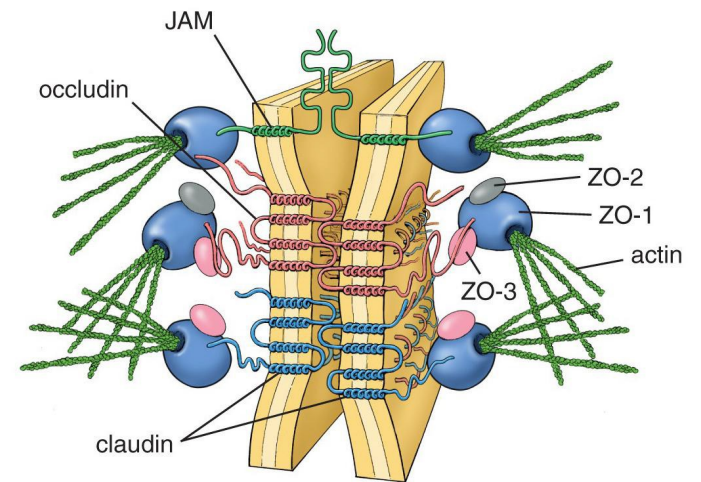
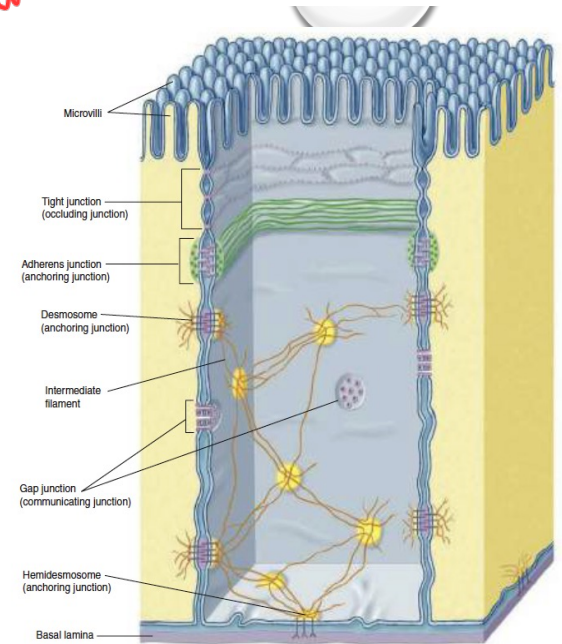
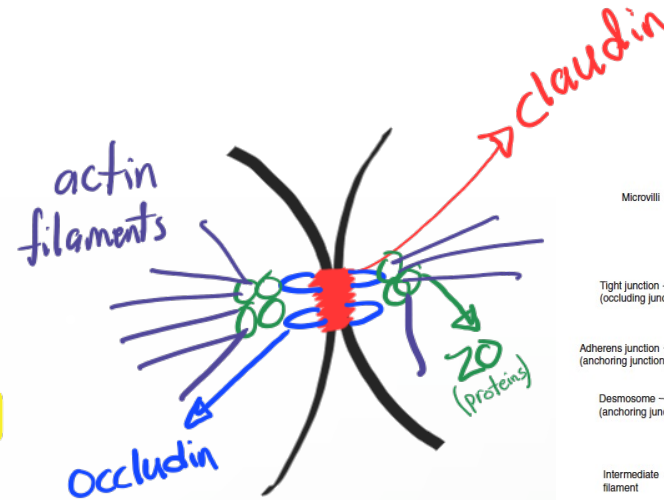


Their function is to prevent the paracellular movement

Tight Junction

Zonula occludens

- Tight or occluding junctions form a seal between adjacent cells.
- They are the most apical
- The seal between the two cell membranes is due to tight interactions between the transmembrane proteins claudin and occludin
- The intercellular seal of tight junctions ensures that molecules crossing an epithelium in either direction do so through transcellular route not the paracellular one.

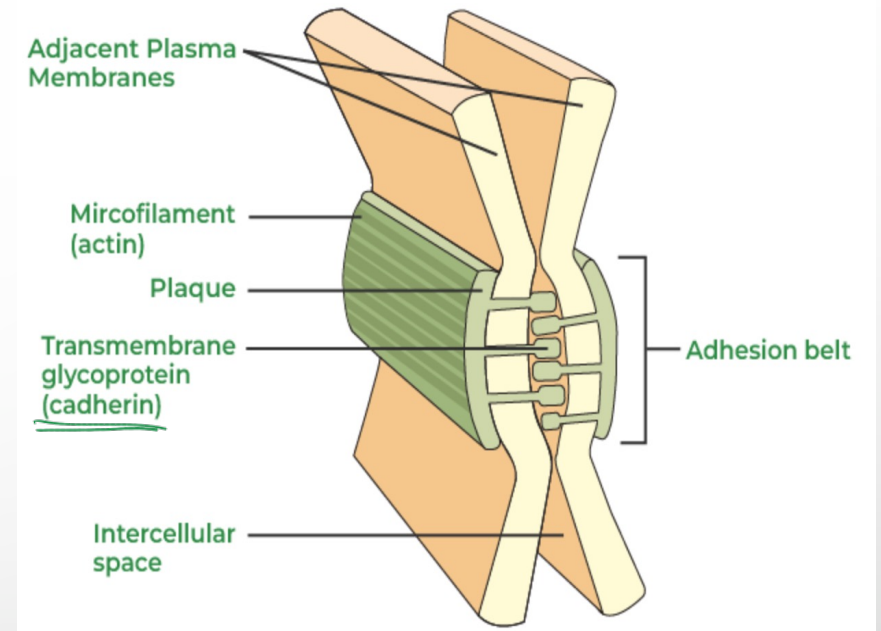


→ It also separates apical and basolateral surfaces.

Adherent Junctions

Zonula Adherens

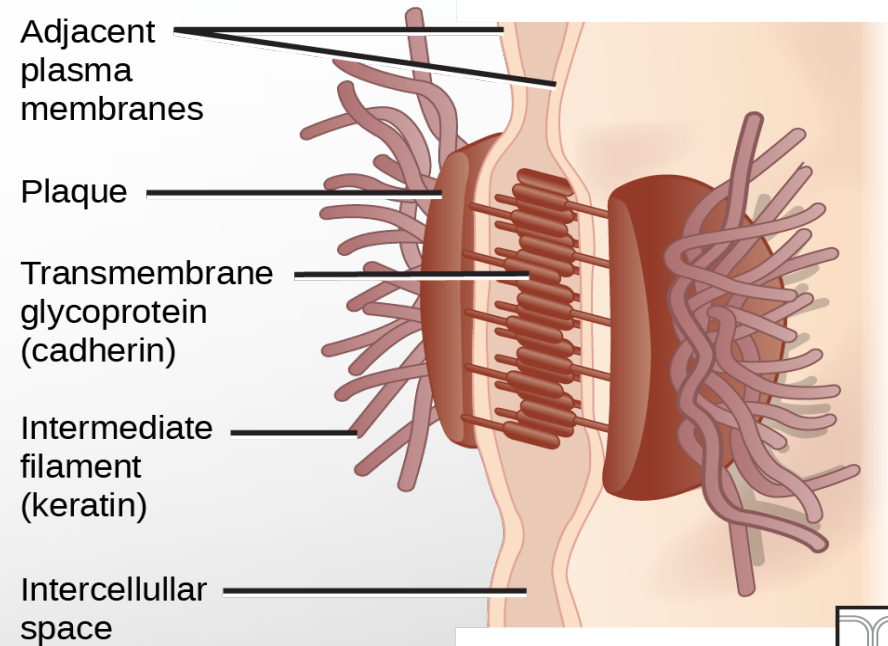
- Encircle the epithelial cell, usually below the tight junction.
- Firmly anchors cells to neighboring ones.
- Cell adhesion is mediated by **e-cadherin** (transmembrane glycoproteins) of each cell that bind each other in the presence of Ca^{2+} .
- At their cytoplasmic ends, cadherins bind **catenins** that link to actin filaments with actin-binding proteins.
- The actin filaments linked to the adherens junctions form part of the "terminal web," a cytoskeletal feature at the apical pole in many epithelial cells.



Desmosomes

- Disc-shaped structures that are matched with identical structures at an adjacent cell surface
- Desmosomes contain larger members of the cadherin family called **desmogleins and desmocollins**.
- The cytoplasmic ends of these transmembrane proteins bind **a catenin-like protein** which bind intermediate filament proteins rather than actins.

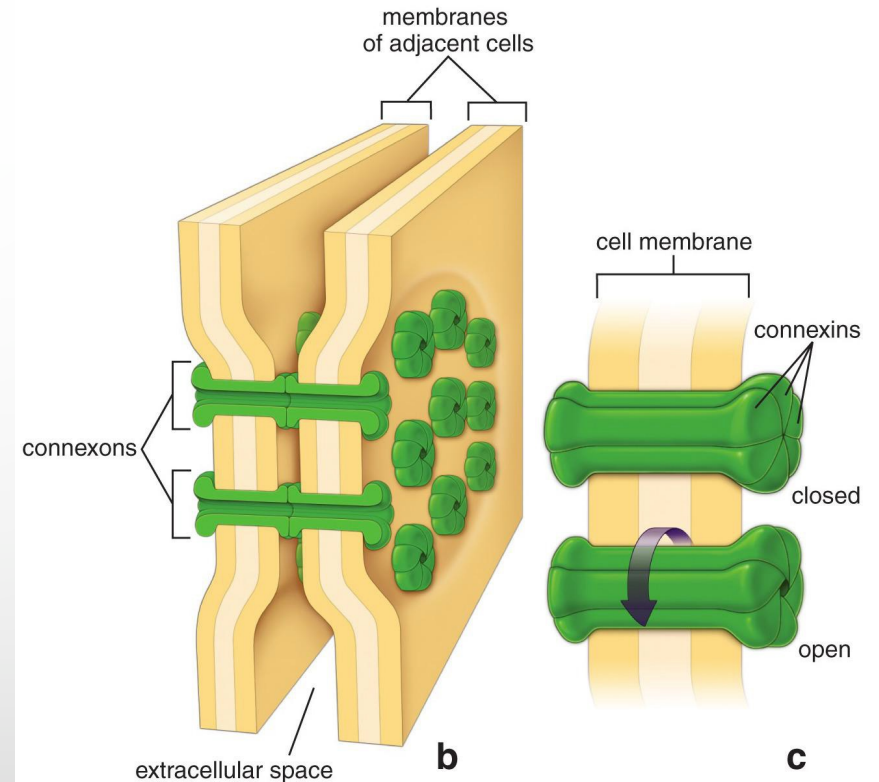
Desmosome



	Shape	Location	How they link between cells	Type of cadherins
Adherent junctions Zonula adherens	belt-shaped	more superior	actin filaments	e-cadherin
Desmosomes - Macula adherens	Disc-shaped	more inferior	intermediate filaments	desmogleins and desmocollins

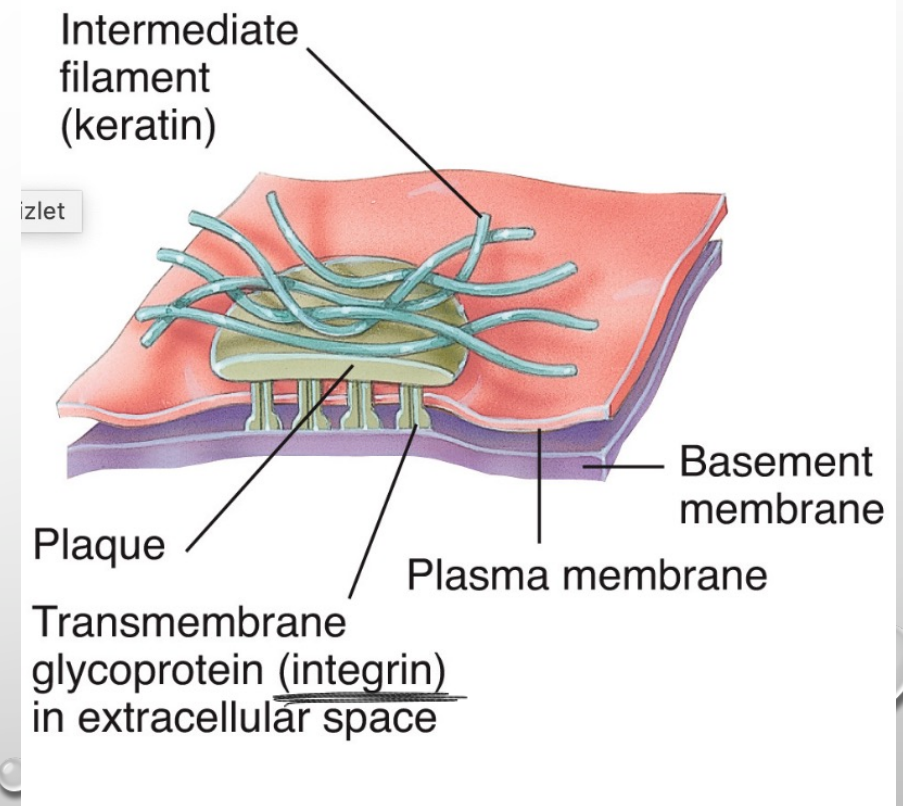
Gap Junctions

- Mediate intercellular communication.
- Present in many other cells.
- **Connexins** (transmembrane proteins) form **hexameric complexes** called **connexons**, each of which has a central hydrophilic pore about 1.5 nm in diameter.
- Permit intercellular exchange of molecules with small molecules < 1.5 nm in diameters.



Hemidesmosomes

- Located on the basal epithelial surface.
- Attach cells to the basal lamina.
- Resemble a half-desmosome ultra structurally, but unlike desmosomes the transmembrane proteins that indirectly link to cyokeratin intermediate filaments are integrins rather than cadherins.
- The integrins of hemidesmosomes bind primarily to laminin molecules in the basal lamina.



Junction	Tight Junction (Zonula Occludens)	Adherent Junction (Zonula Adherens)	Desmosome (Macula Adherens)	Hemidesmosome	Gap Junction (Nexus)
Major transmembrane link proteins	Occludins, claudins, ZO proteins	E-cadherin, catenin complexes	Cadherin family proteins (desmogleins, desmocolin)	Integrins	Connexin
Cytoskeletal components	Actin filaments	Actin filaments	Intermediate filaments (keratins)	Intermediate filaments	<u>None</u>
Major functions	Seals adjacent cells to one another, controlling passage of molecules between them; separates apical and basolateral membrane domains	Provides points linking the cytoskeletons of adjacent cells; strengthens and stabilizes nearby tight junctions	Provides points of strong intermediate filament coupling between adjacent cells, strengthening the tissue	Anchors cytoskeleton to the basal lamina	Allows direct transfer of small molecules and ions from one cell to another
Medical significance	Defects in occludins may compromise the fetal blood-brain barrier, leading to severe neurologic disorders	Loss of E-cadherin in epithelial cell tumors (carcinomas) promotes tumor invasion and the shift to malignancy	Autoimmunity against desmoglein I leads to dyshesive skin disorder characterized by reduced cohesion of epidermal cells	Mutations in the integrin-β4 gene are linked to some types of epidermolysis bullosa, a skin blistering disorder	Mutations in various connexin genes have been linked to certain types of deafness and peripheral neuropathy