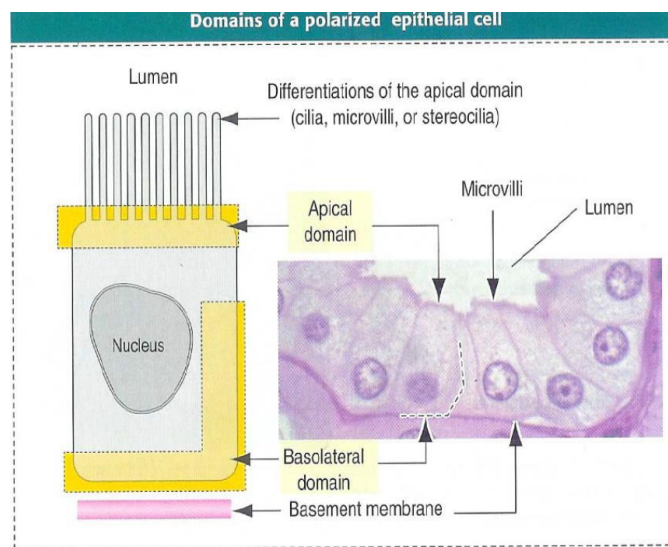


Modification of plasma membrane

Each cell has an apical domain (Free surface) and basolateral domain (lateral surfaces and a basal surface attached to the basal lamina).

The apical Domain is the region of the cell that is exposed to the lumen or external environment, this region of some epithelial cells can have specialized structures like cilia, flagella, microvilli, stereocilia and caveolae.

Apical (Surface or luminal) modifications specialized to carry out functions that occur at these interfaces, including secretion, absorption, and movement of luminal contents.



2- The basolateral domain modifications (proved by cell junctions):

In basolateral domain, between adjacent cells there are structures called cell junctions connect and help to communicate the cells with each other.

The nutrient from blood vessels reach to the epithelium via diffusion across basal lamina and taken up through basolateral surfaces of the cells, also receptors for chemical messengers like hormones that influence the activity of epithelial cells are localized in the basolateral membrane.

Cell junctions:

Epithelial tissue is composed of cells physically close together that are connected by one or all three types of junctions with very little intervening intercellular sub stances.

Water, solutes and ions can move through epithelium by two different pathways:

1-Trans cellular pathway- material going through the cell, involves channel and transporter molecules.

2-para-cellular pathway, materials travel between adjacent cells .This process is regulated by cell junction that present in definite order from the apical to the basal ends of the cells.

There are three major types:

1-**Occluding junctions (zonula occludens, tight junctions)**

All epithelia have at least one important function in common: they serve as selective permeability barriers, separating fluids on either side that have a different chemical composition. This function requires that the adjacent cells be sealed together by occluding junctions.

Occluding or tight junctions have this barrier role in vertebrates such as epithelium of the mammalian small intestine, or gut.

Occluding junctions are symmetrical structures on opposite sides of two adjacent cells separating the apical domain from the basolateral domain. Its form a belt-like seal around the apical surfaces of two adjacent cells and dose not associated with cytoskeletal elements.

Occluding junctions (zonula occludens, tight junctions) are the most apical of junctions, **zonula** indicates that the junctions form bands completely encircling each cell and **occludens** refers to the membrane fusion that close of the space between the cells.

The major components of zonula occludens are cells transmembrane protein called **claudin** which forms linear fibrils in the occluding junction.

The junctions are **tight** and prevent the movement of lipids and proteins between adjacent cells thus setting para-cellular pathway.

Beside forming a seal between compartments on either side of an epithelium, the zonula occludens of epithelial cells help prevent the integral membrane proteins of the apical surface from being transferred to the basolateral surface and vice versa, this allow the two sides of the epithelial to maintain different receptors and function differently. Occluding Junctions form a selective permeability barrier across epithelial cell sheets.

2-**Anchoring or adhesive junctions,**

A- belt- desmosome

B- spot- desmosome

C- hemi- desmosome.

Found bellow the tight junctions and mediated by transmembrane glycoprotein **cadherin's**.

Anchoring junctions are associated with cytoskeletal elements and connect the cytoskeleton of a cell either to the cytoskeleton of its neighbors or to the extracellular matrix.

Belt and spot desmosome are symmetrical structures that anchor adjacent cells at the apical domains which provide strength and rigidity to an epithelial cell layer.

Belt desosome has belt like distribution and associated with actin filaments which connect Intermediate filaments from cell to cell.

Belt desmosome and tight junction are typically close together and each form a ribbon around the cells apical end while **spot desmosome** has a spot like distribution and associated with inter mediate filaments.

Hemidesmosomes are symmetrical structures that anchor the basal domain of the cell to the basal lamina.

Anchoring junctions are widely distributed in animal tissues and most abundant tissues are subjected to several mechanical stresses, such as heart, muscle and epidermis.

3-Gap (communicating) junctions

Button-like structures made up of integral membrane protein called **connexins**, six connexins sub units assemble in the plasma membrane to form a hollow cylinder called **connexons**.

Connexons from adjacent cells when aligned together form direct channels of communication between the cytoplasm of two cells.

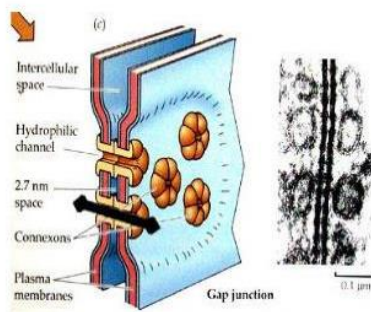
Connexons usually form patches and facilitate the movement of molecules such as Ca^{+2} and AMP between cells.

Most cells in animal tissues are in communication with their neighbors via gap junctions, which present in most mammalian tissues.

Gap junctions have a little strength but serve as intercellular channels for flow materials and allow the passage of small signaling molecules between adjacent cells to coordinate the response.

Gap Junctions

- Also called "Communicating Junctions"
- 2 opposing connexons join across intercellular space.
- Connexons: assembly of six proteins that create gap between two plasma membranes



Functions of gap junctions

1-permit the rapid exchange between cells of molecules with small diameter (1.5 nm).

2-responsible for the heart coordinated beat because some molecules move radially through gap junctions, allowing cells in many tissues to act in coordinated manner rather than as independent units.

