# Specialization of the cell surface, microvilli, stereocilia, cilia, basal and basolateral labyrinth

**Cell Surface Specialization:**

The cell surfaces exhibit apical, lateral and basal domains.

The **Apical domain** and its modifications encompass various structures:

- Microvilli, which are fingerlike cytoplasmic projections measuring approximately 1um in height and 0.08um in width, exhibit a diverse range of appearances. The number and morphology of microvilli in a cell correlate with its absorptive capacity: cells with tall, densely packed microvilli are likely to be involved in the transportation and absorption of metabolites, whereas cells with small, irregularly shaped microvilli may be less active in these processes. Within microvilli, clusters of actin filaments are cross-linked to each other and to the surrounding plasma membrane by several other proteins.

- Stereocilia, or stereovilli, are extremely long, immotile microvilli that facilitate absorption. They are found exclusively in the epididymis and sensory hair cells of the inner ear.

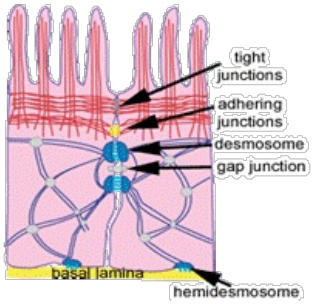
- Cilia and flagella are motile processes covered by the cell membrane and possess a highly organized microtubule core. Cilia primarily function to sweep fluid along the surface of cell sheets. Both cilia and flagella share the same structure, composed of nine peripheral microtubules surrounding two central microtubules, known as the "9+2 pattern" or axoneme.

**Lateral Domain:**

• Tight junctions, also known as occluding junctions, act as seals to obstruct the passage of materials between cells. These junctions are constructed from occludin proteins.

• Adhesive or anchoring junctions, comprised of cadherin proteins, serve as sites of adhesion between cells.

• Gap junctions, formed by connexin proteins, function as channels for communication between adjacent cells.




Tight junctions - adhering junctions - desmosome - gap junctions - hemidesmosome.

The tight junction (zonula occludens) and adherent junction (zonula adherens) are typically situated in close proximity to each other, forming continuous bands around the cell's apical end. Tight junctions, also known as occluding junctions, prevent passive material flow between cells, but they possess limited strength. Therefore, adhering junctions are located immediately below them to stabilize and reinforce these circular bands, aiding in holding the layer of cells together. Desmosomes form exceptionally strong attachment points bound to intermediate filaments, complementing the role of zonulae adherens and playing a crucial role in maintaining the cohesion of an epithelium. Gap junctions, where connexons attach in adjacent cell membranes, have minimal strength but serve as intercellular channels for the flow of molecules.

These junctions are systematically arranged from the apical to the basal ends of the cells.

**Basal Domain:**

1. The basement membrane (referred to in light microscopy) facilitates the attachment of epithelial cells to the underlying connective tissue. It provides support, nourishment, and binds the cell to neighboring structures.

2. Junctions between cells and the extracellular matrix (ECM) include:

• Focal adhesions: These structures anchor actin filaments of the cytoskeleton into the basement membrane, thereby creating a dynamic link between the actin cytoskeleton and ECM proteins.

• Hemidesmosomes: These junctions anchor the intermediate filaments of the cytoskeleton into the basement membrane.

3. Folding of the basal cell membrane:

This folding increases the surface area of the basal cell domain, facilitating the presence of more transport proteins and channels. It is particularly abundant in cells engaged in active transport of molecules. Consequently, mitochondria are typically concentrated at this basal site to provide the energy required for active transport.