

Cell Junctions



Learning Objectives:

- ❖ List the factors which act to bind the cells together.
- ❖ Describe the following junctions: Desmosomes, Tight Junctions, and Gap junctions and mention their function with examples.

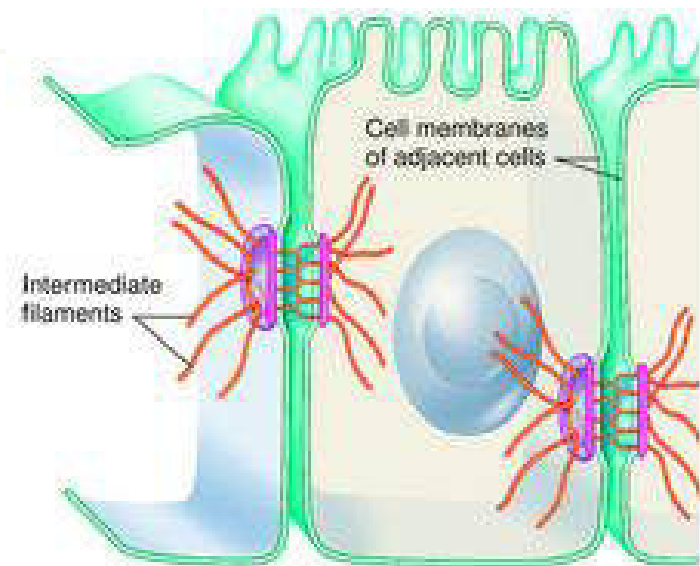
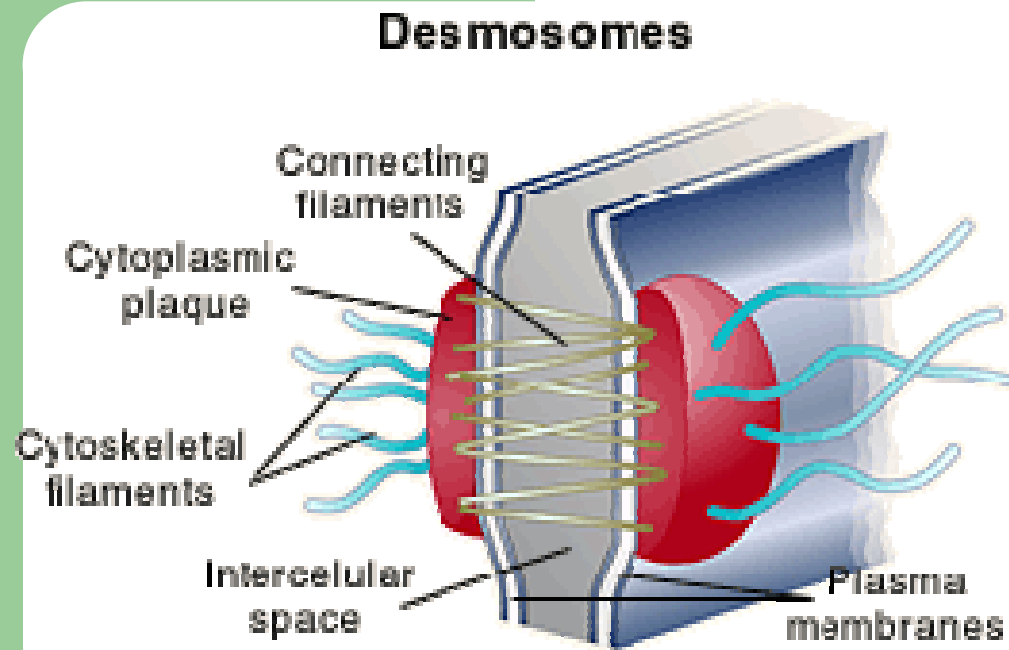
Cell Junctions:

- ❖ Although certain cell types (blood cells, sperm cells, and some immune system cells) are “*footloose*” in the body, many other types are joined into tight communities. Typically, three factors act to bind cells together:
 - **Glycoproteins** in the glycocalyx act as an adhesive (velcro on the cell surface).
 - Wavy contours of the membranes (**transmembrane proteins**) of adjacent cells fit together in a *tongue-and-groove fashion*.
 - *Special cell junctions form & merging of adjacent phospholipid bilayer.*
- ❖ The most important junction types have been classified as follows:
 - **Adhering junctions , or desmosomes.** Confer strength to epithelia.
 - **Occluding junctions, or tight junctions.** Watertight, for digestive/urinary systems.
 - **Connecting junctions, or gap junctions.** Form cytoplasmic connections.

Cell Junctions – Adhering Junctions-Desmosomes:

- ❖ Desmosomes are *anchoring junctions—mechanical couplings scattered like nails along the sides of neighboring cells* to prevent their separation.
- ❖ On the cytoplasmic face of each plasma membrane is *a button like thickening called a plaque*. Adjacent cells are held together by *thin linker protein filaments (cadherins)* that extend from the plaques and *fit together like the teeth of a zipper in the intercellular space*.
- ❖ *Thicker keratin filaments* (intermediate filaments, which form part of the cytoskeleton) *extend from the cytoplasmic side of the plaque* across the width of the cell to *anchor to the plaque on the cell's opposite side*.
- ❖ Extracellular *glycoprotein chains promote adhesion (“velcro”)*.
- ❖ Desmosomes found between cells in tissues subjected to *extreme mechanical stress*.

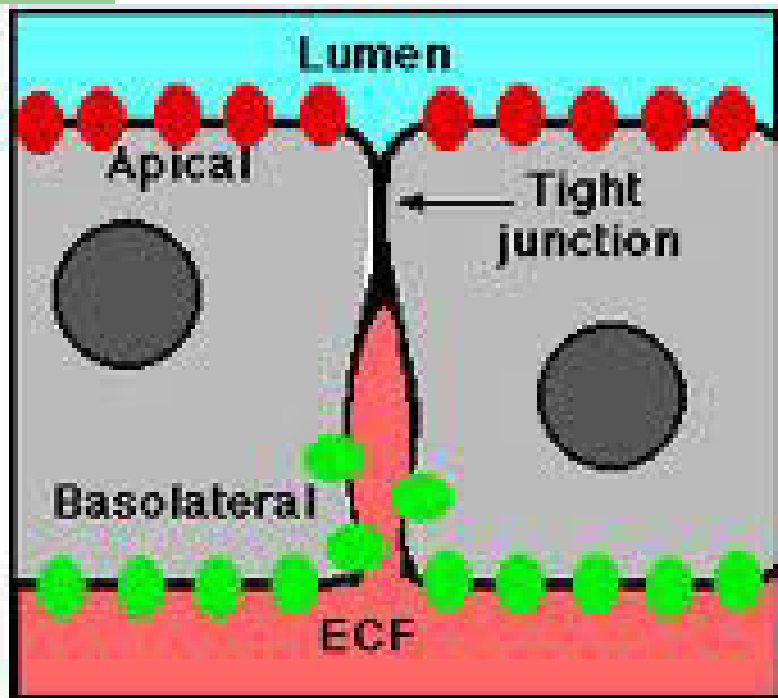
Cell Junctions – Adhering Junctions-Desmosomes:



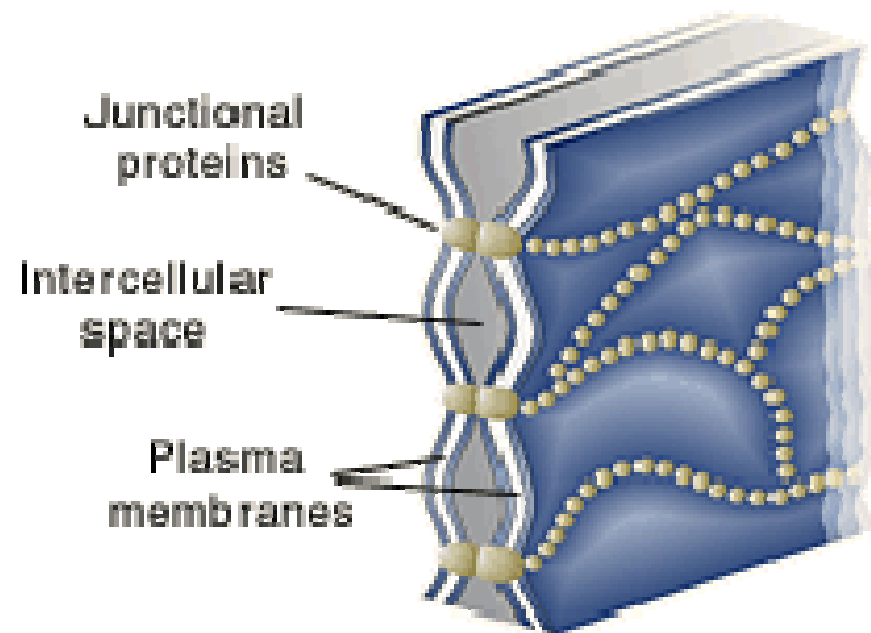
Cell Junctions – Occluding Junctions (Tight Junctions):

- ❖ In a tight junction, a series of integral protein molecules in the plasma membranes of adjacent cells fuse together, forming *an impermeable junction that encircles the cell*. Always form *belt-like structures*, close to apex of simple epithelial cells.
- ❖ *Tight junctions help prevent molecules from passing through the extracellular space between adjacent cells*. e.g. tight junctions between epithelial cells lining the digestive tract keep digestive enzymes and microorganisms in the intestine from seeping into abdominal cavity and the bloodstream.
- ❖ Although called “*impermeable*” junctions, *some tight junctions are leaky and may allow certain ions to pass* serving purposes such as material transport and maintenance of osmotic balance. *So tight junctions hold the cells together and also they have a barrier function.*
- ❖ They prevent the passage of molecules and ions through the space between plasma membranes of adjacent cells, so *materials must actually enter the cells (by diffusion or active transport) in order to pass through the tissue.*

Cell Junctions – Occluding Junctions (Tight Junctions):



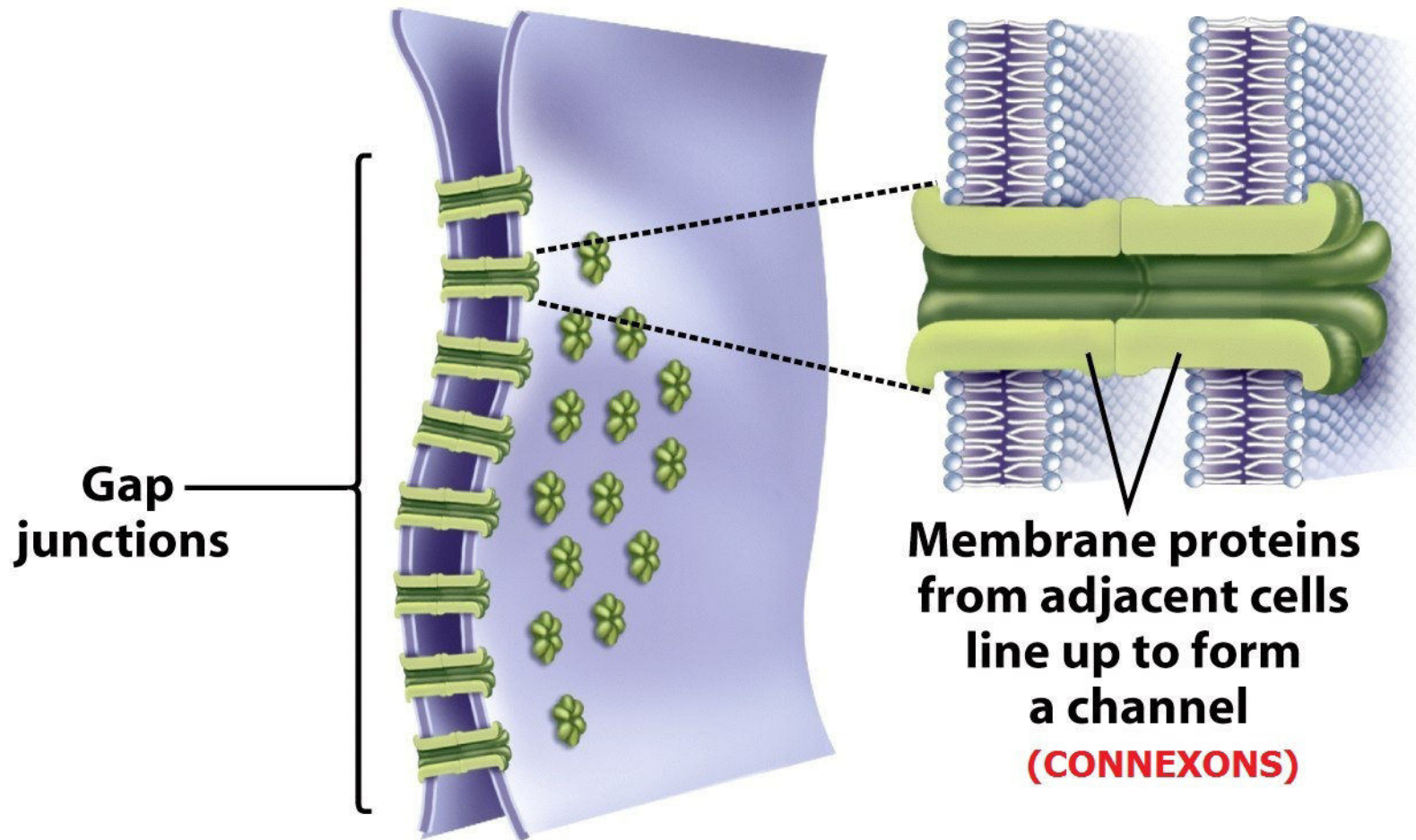
Tight Junctions



Cell Junctions – Communicating Junctions (Gap Junctions):

- ❖ *A gap junction, or nexus*, is a communicating junction between adjacent cells. At gap junctions the adjacent plasma membranes are very close, and the cells are connected by hollow cylinders called *connexons*, composed of transmembrane proteins.
- ❖ The many *different types of connexon proteins vary the selectivity of the gap junction channels (allow molecules of 1200 MW or smaller to pass through)*.
- ❖ *Ions, simple sugars, and other small molecules* pass through these water-filled channels from one cell to the next.
- ❖ Gap junctions are *present in electrically excitable tissues*, such as the *heart, neurons and smooth muscle*, where ion passage from cell to cell helps synchronize their electrical activity and contraction.
- ❖ *In liver and pancreas, the function of gap junctions is not clear* (needed for embryological development).

Cell Junctions – Communicating Junctions (Gap Junctions):



Cell Junctions – Desmosomes, Tight & Gap Junctions:

