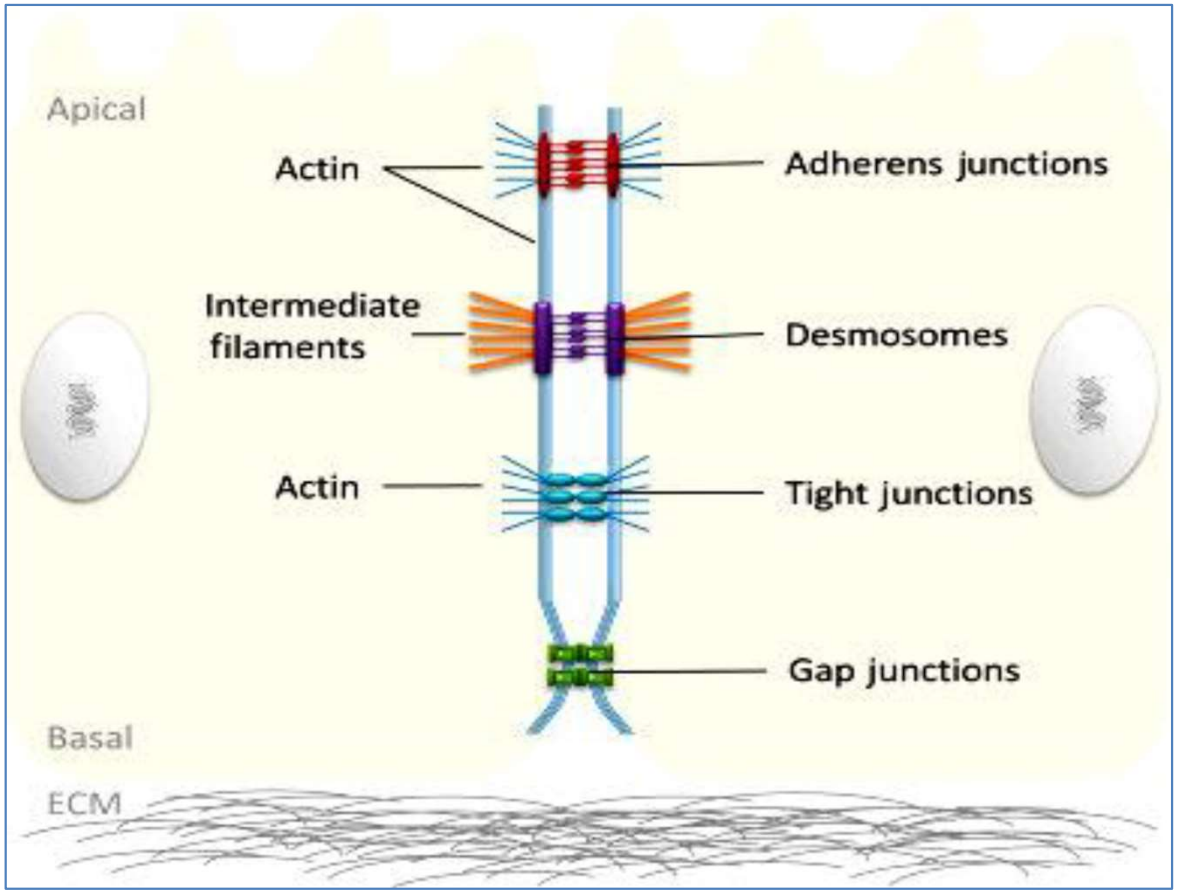
Cell-cell junctions:

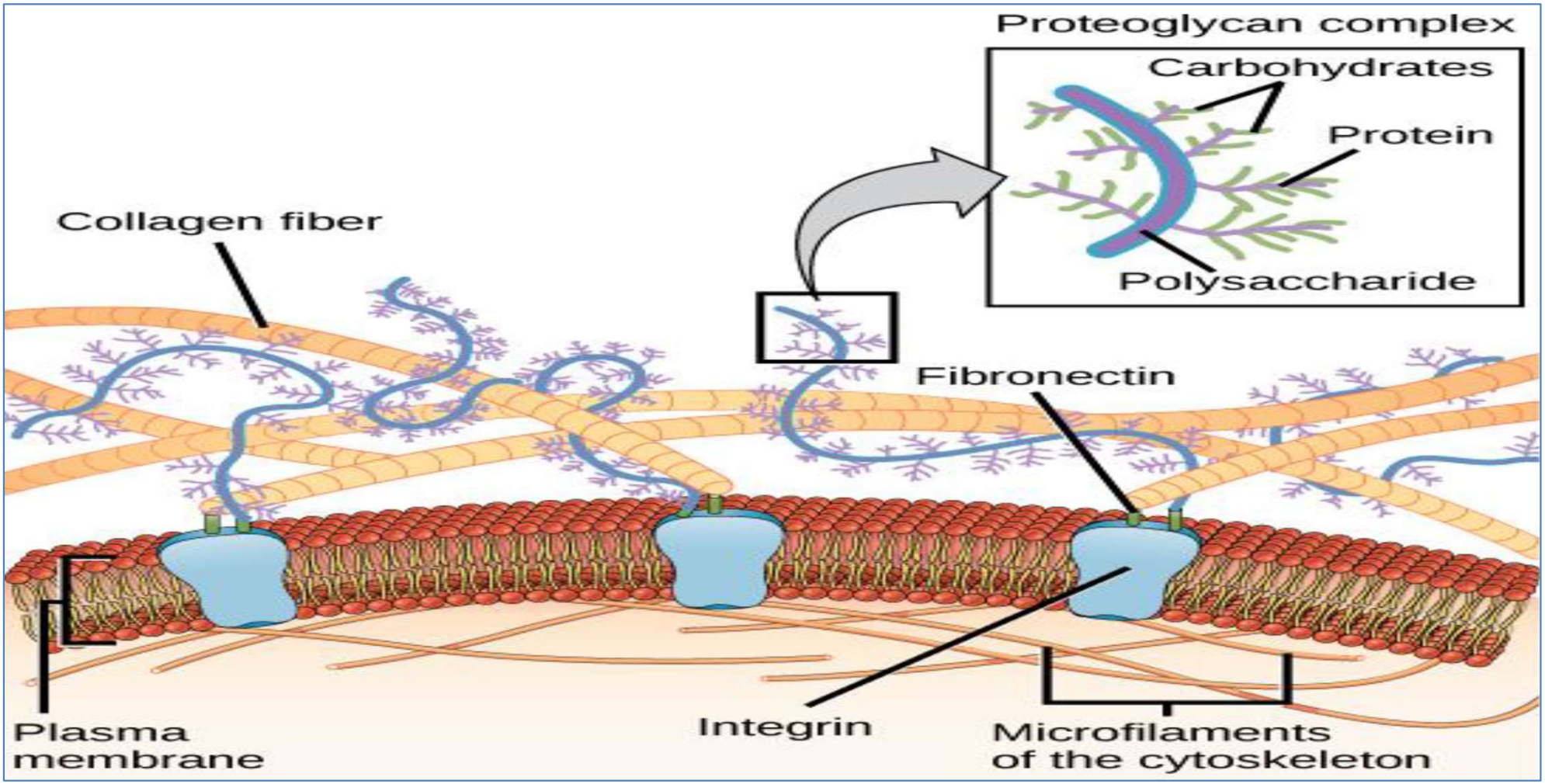
Tight junctions
Adherens junctions
Desmosomes
Gap junctions

There are 4 principle types of junctions between animal cells. These junctions involve proteins that act as rivets or bolts to bind neighbouring cells together. these junctions may occur wherever neighbouring cells contact one another and these contact areas are often highly folded to form inter-digitating processes that interlock and help bind the cells more strongly.



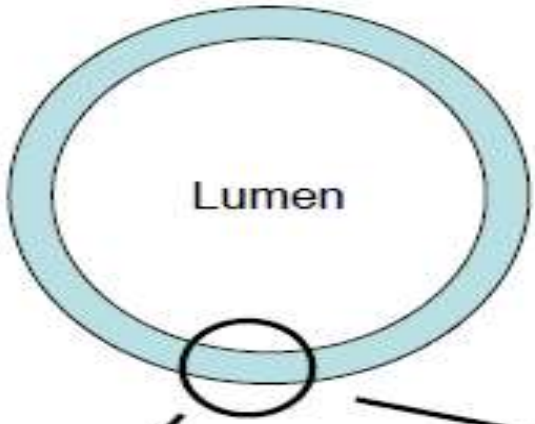
Cell Junctions

Most animal cells release materials into the extracellular space. The primary components of these materials are proteins, and the most abundant protein is collagen. Collagen fibers are interwoven with carbohydrate-containing protein molecules called proteoglycans. Collectively, these materials are called the **extracellular matrix**.

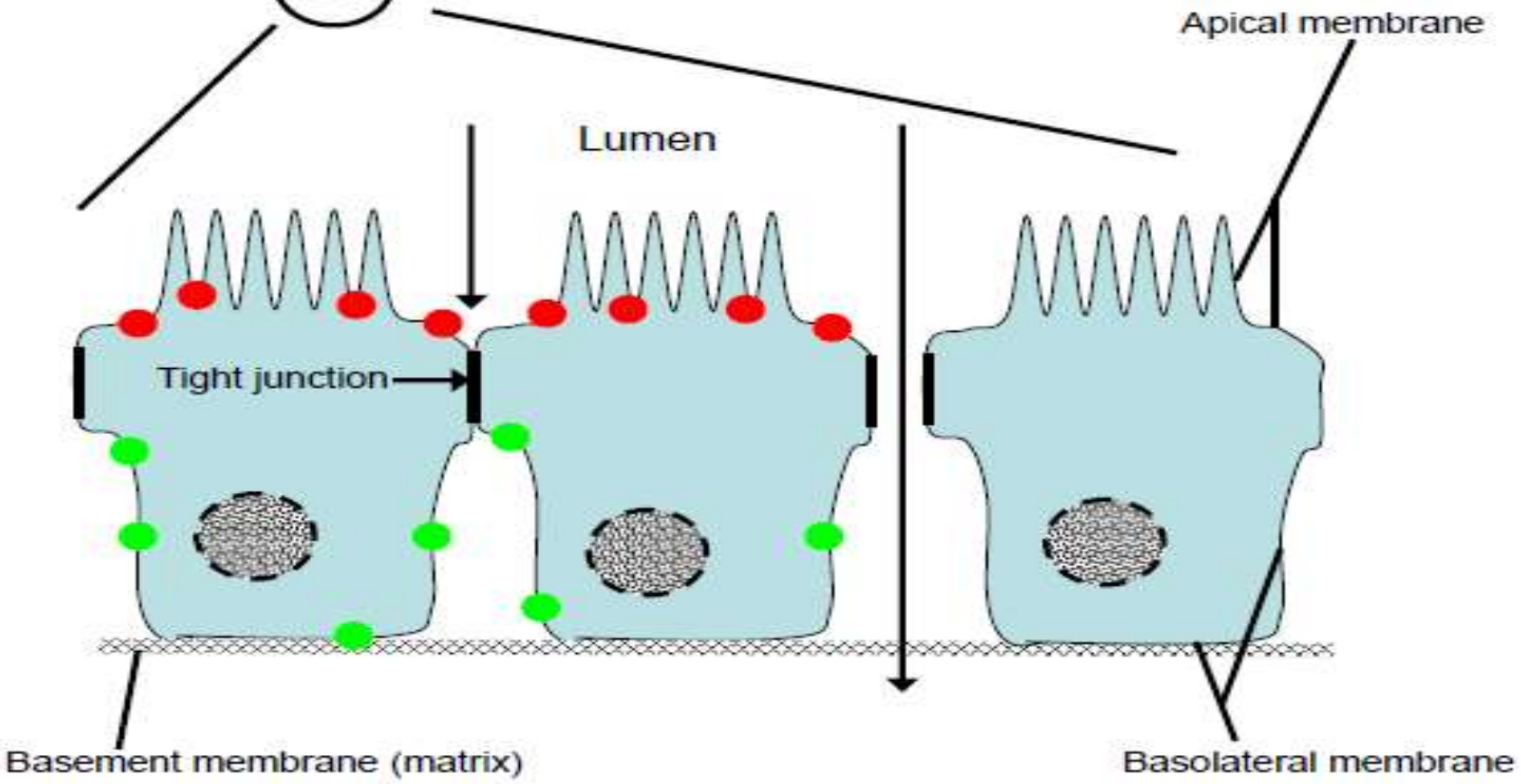


Occluding junctions (Tight Junctions)

A tubular organ, formed by an epithelium:



Tight junctions seal epithelial layers to prevent materials leaking across the epithelium between the cells (which would be non-selective) – instead materials must pass through the cells and this transport can be regulated. E.g. endocytosis may occur at the apical membrane and exocytosis at the basolateral. They also divide the epithelial cell membrane into apical (luminal) and basolateral membranes and keep the proteins of these membrane regions separate (red and green spheres).



Tight junctions perform vital functions:

- They limit the passage of molecules and ions through the space between cells. So most materials must actually enter the cells (by diffusion or active transport) in order to pass through the tissue. This pathway provides tighter control over what substances are allowed through.

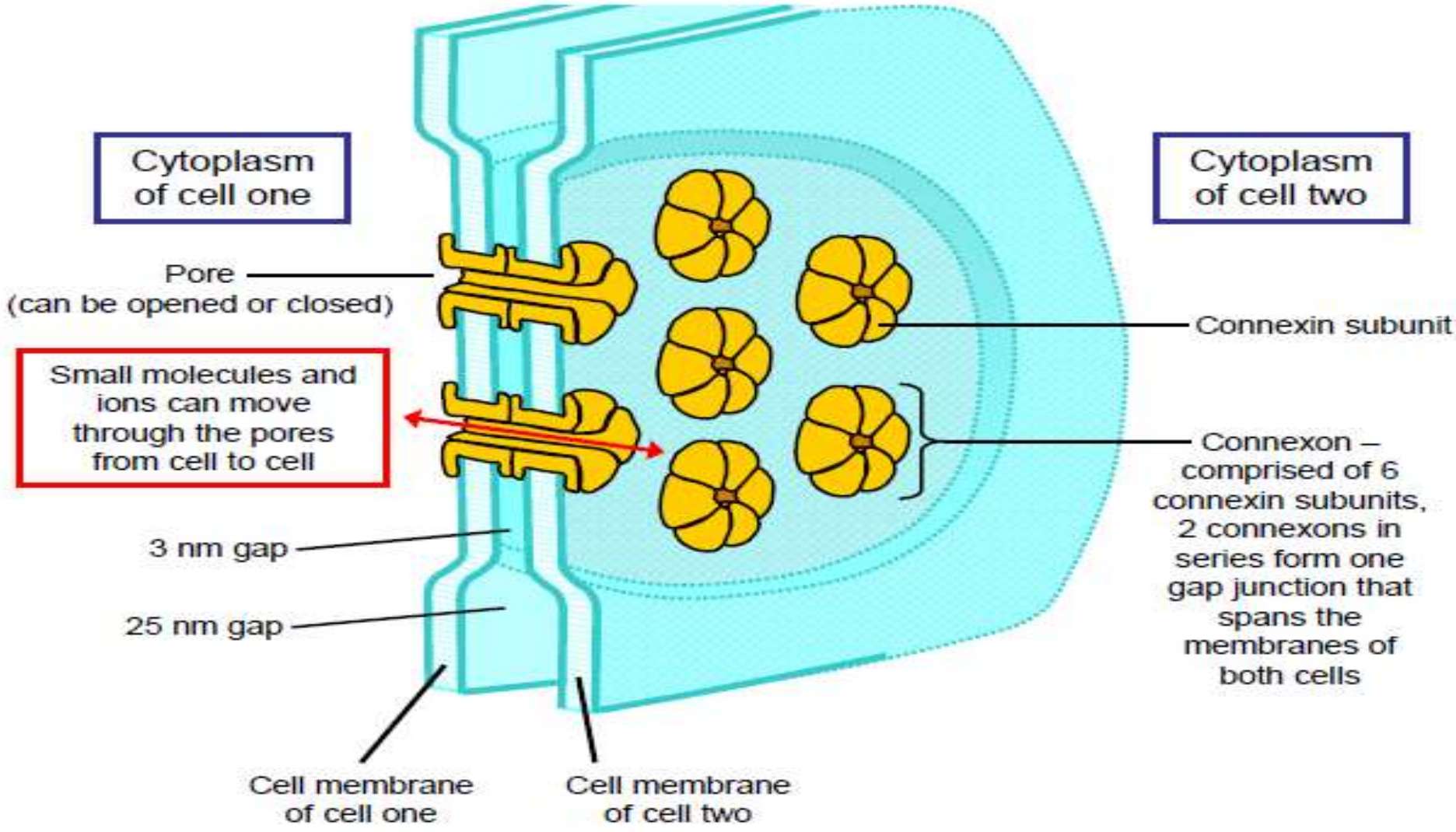
- They block the movement of integral membrane proteins between the apical and basolateral surfaces of the cell.

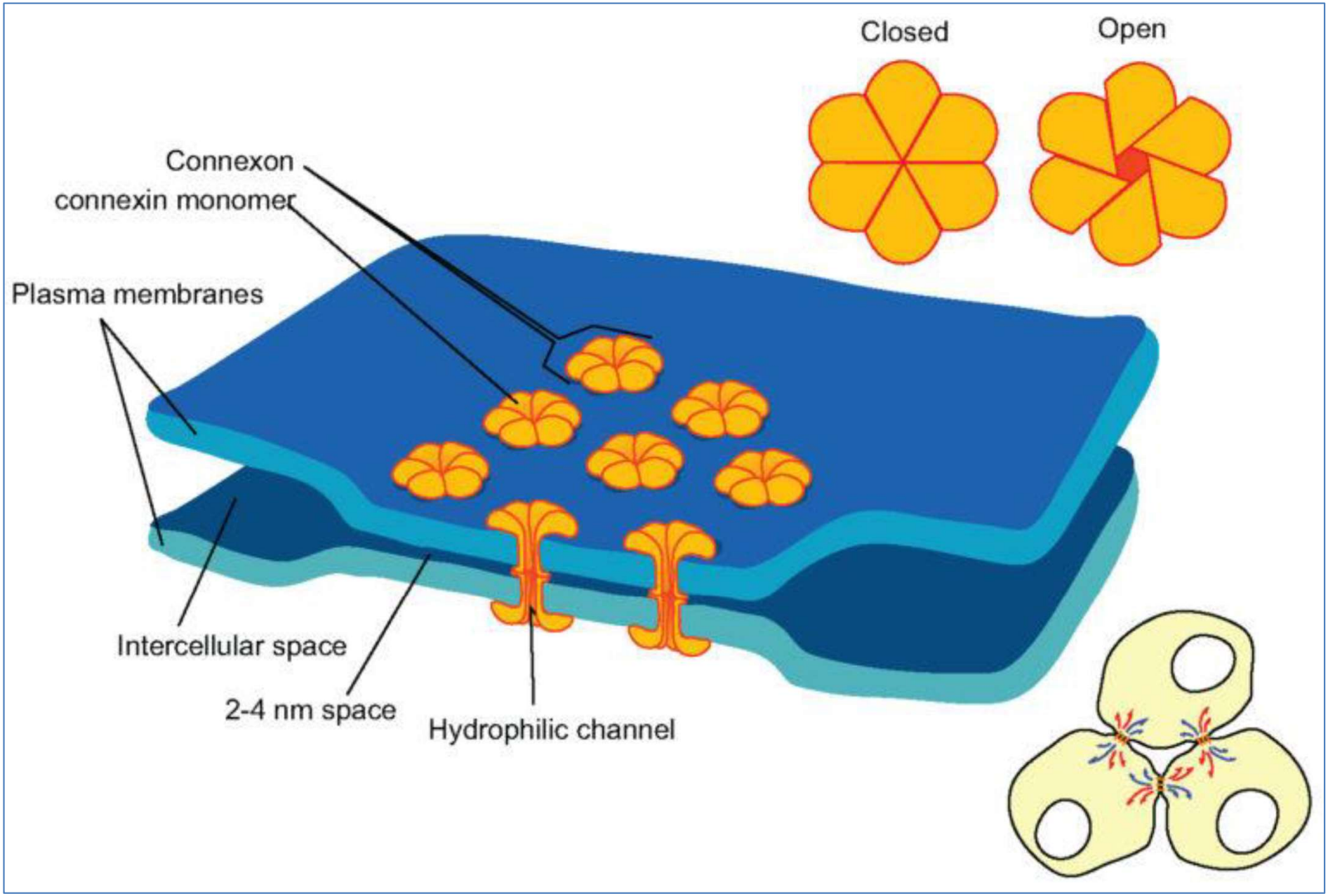
- Tight junctions also serve as a structural support mechanism that helps keep the epithelium together.

Gap Junctions

Gap junctions

These are formed from proteins in the cell membranes that form hollow tubes through which small molecules and ions (with a molecular mass below 1000) electrochemical signals, such as Ca^{2+} (a second messenger) or Na^{+} can be delivered from one cell to its neighbours. If you touch a single cell in an epithelial sheet, then not only that cell will respond, but also its neighbours, as an electrical signal passes from the stimulated cell to the neighbouring cells via the gap junctions.

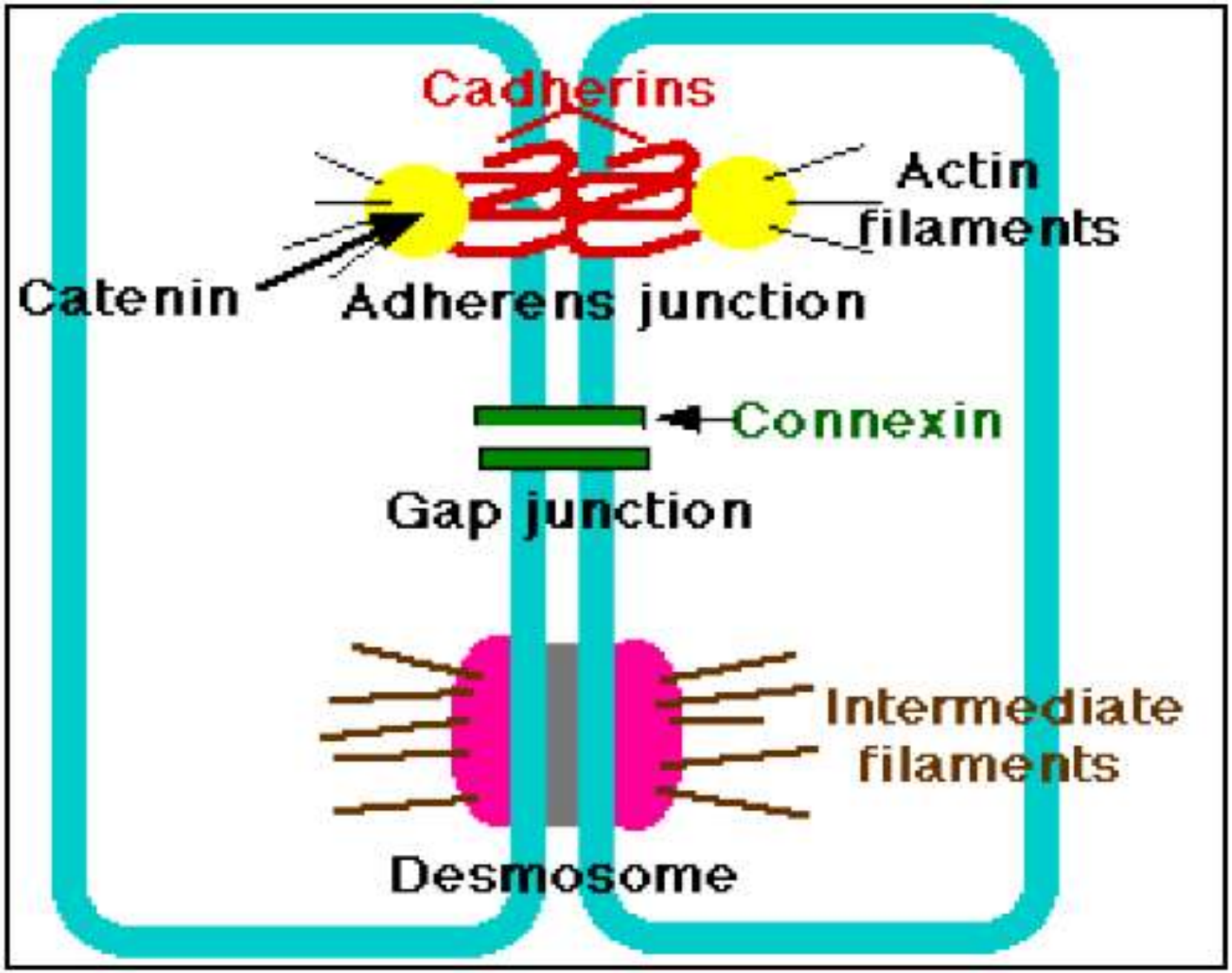




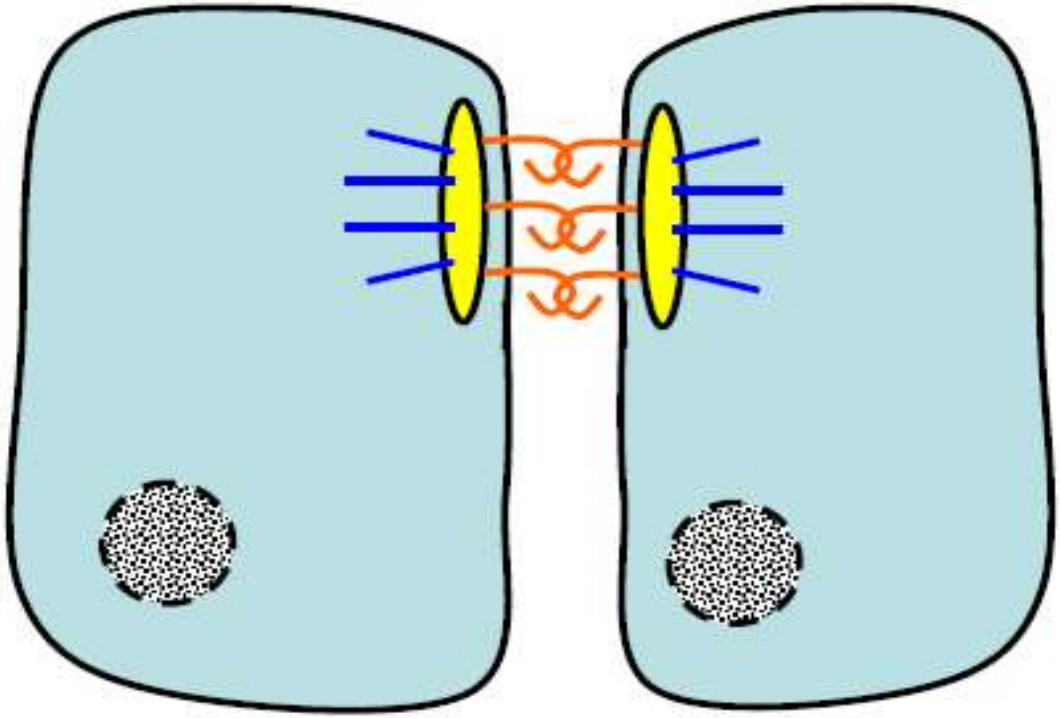
Because ions can flow through them, gap junctions permit changes in membrane potential to pass from cell to cell.

Anchoring junctions (Adherens Junctions)

Also referred to as zonula adherens, intermediate junction, or as belt desmosomes.



Adherens junctions bond cells together strongly, for example they bond cardiac muscle cells together, to stop the tissue tearing when the heart contracts:



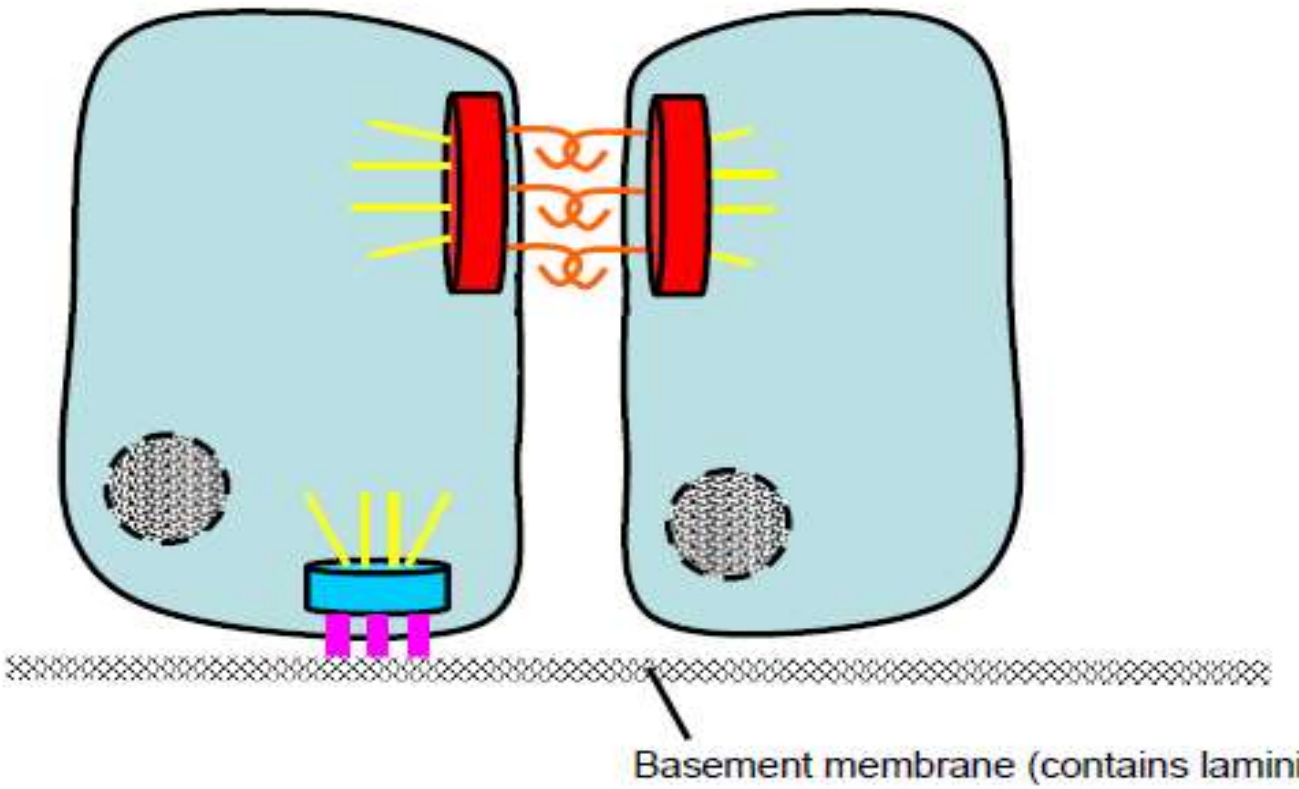
Cadherin

Catenin

Actin filament

The cadherins bind to one another (in the presence of Ca^{2+}) in the space between the cells, like velcro, and to catenin inside the cell. The catenin connects to actin filaments of the cell cytoskeleton.

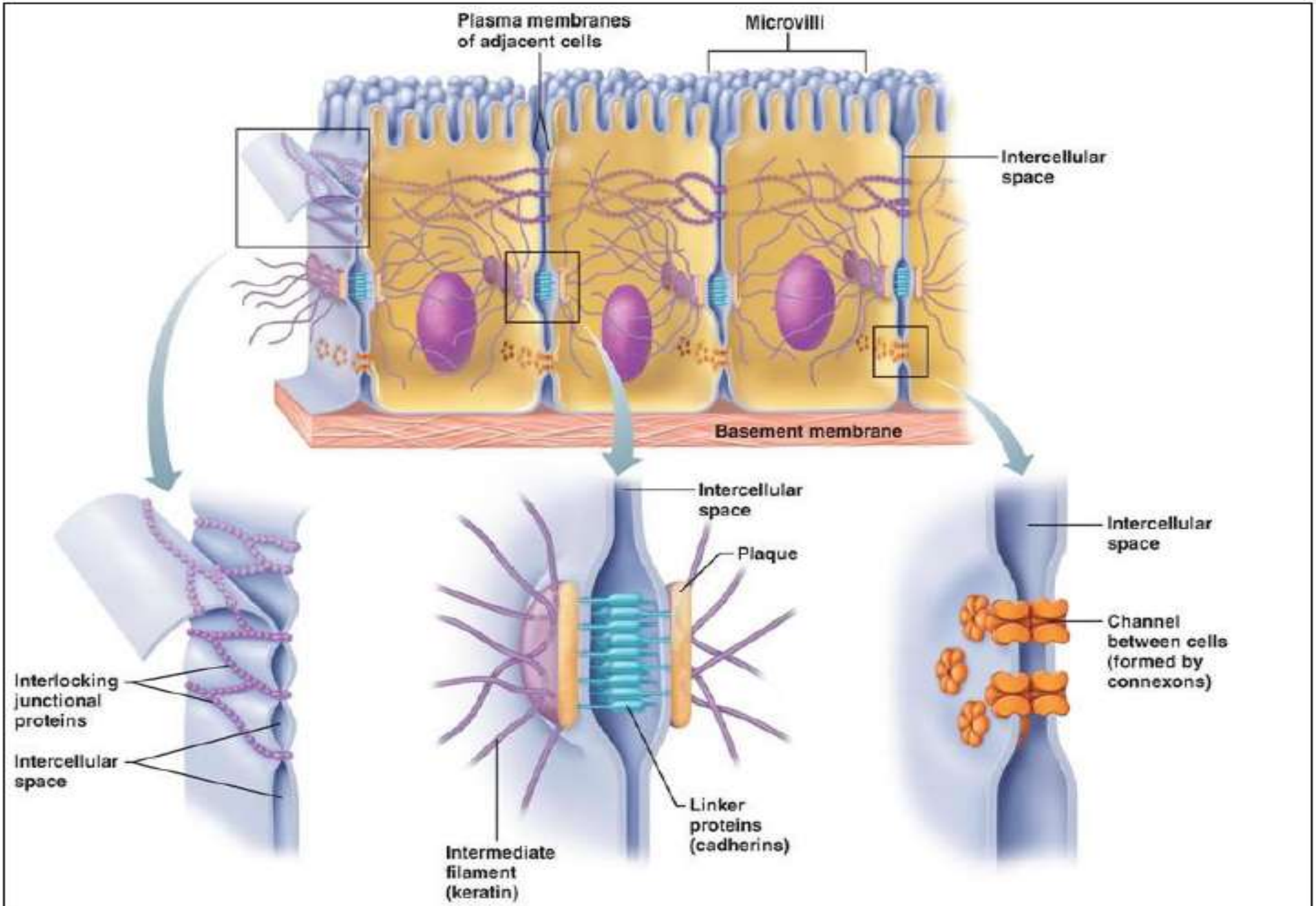
Desmosomes are similar in some respects to focal adhesions of the adherens type and also contain cadherins, but they link in to the intermediate filaments of the cytoskeleton:



Desmosomes

Desmosomes function like rivets. Pemphigus vulgaris is an autoimmune disorder in which antibodies are produced against desmoglein 3 (a type of cadherin). This results in blistering of the skin.

In the skin, the intermediate filaments are primarily keratin and the desmosomes hold the epithelial cells together and give the skin mechanical strength.



(a) Tight junctions: Impermeable junctions prevent molecules from passing through the intercellular space.

(b) Desmosomes: Anchoring junctions bind adjacent cells together like a molecular "Velcro" and help form an internal tension-reducing network of fibers.

(c) Gap junctions: Communicating junctions allow ions and small molecules to pass for intercellular communication.

- Animal cells **communicate via their extracellular matrices** and are **connected to each other via** tight junctions, adherens, desmosomes, and gap junctions.
- When protein receptors on the surface of the plasma membrane of an animal cell bind to a substance in the extracellular matrix, a **chain of reactions** begins that changes activities taking place within the cell.
- **Plasmodesmata** are channels between adjacent plant cells while **gap junctions** are channels between adjacent animal cells. However their structures are quite different.
- A **tight junction** is a watertight seal between two adjacent cells, while a **desmosome** acts like a spot weld.