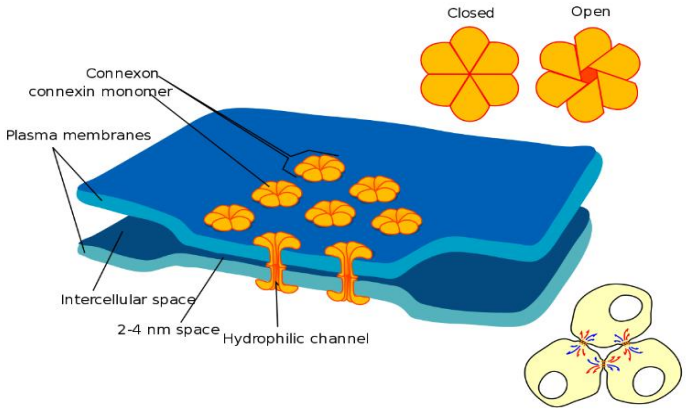
GAP JUNCTIONS

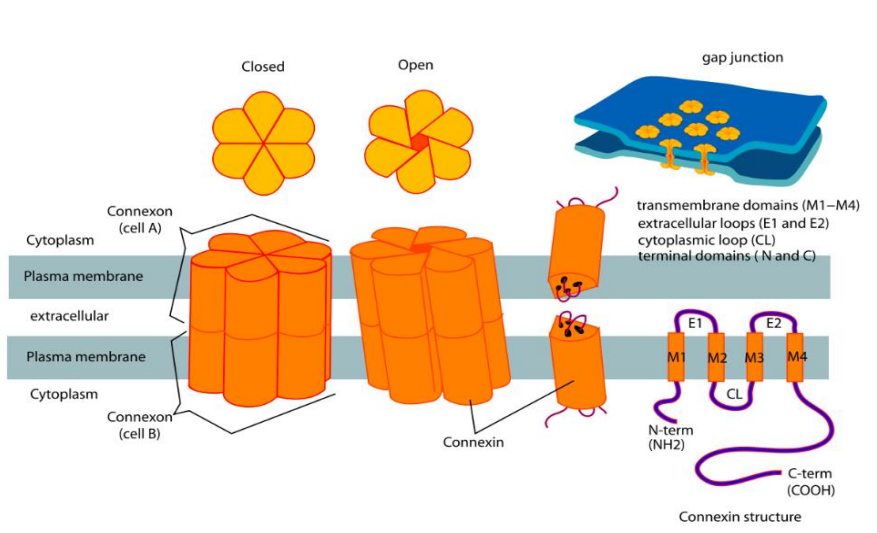
Gap junctions are a specialized intercellular connection between a multitude of animal cell-types. They directly connect the cytoplasm of two cells, which allows various molecules, ions and electrical impulses to directly pass through a regulated gate between cells.



Structure

One gap junction channel is composed of two connexons (or hemichannels), which connect across the intercellular space. One connexon resides in the membrane of one cell. It aligns and joins the connexon of the neighboring cell, forming a continuous aqueous pathway by which ions and small molecules can freely pass (passively) from one cell to the other. Gap junctions are analogous to the plasmodesmata that join plant cells.

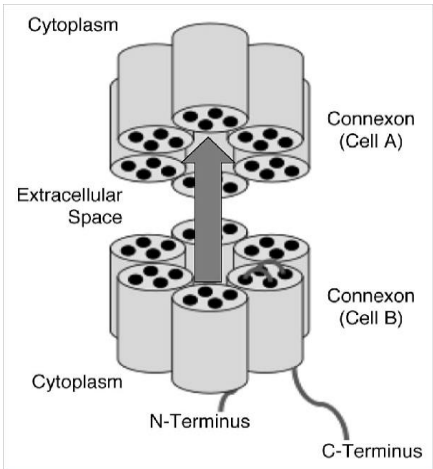
Each **connexon** consist of six subunits called connexins. The connexin genes have been highly conserved during evolution. In some cells the connexons are formed of six identical connexins or of some combination of two different connexins.



- Gap junctions occur in virtually all tissues of the body, with the exception of adult fully developed skeletal muscle and mobile cell types such as sperm or erythrocytes. Gap junctions, however, are not found in simpler organisms such as sponges and slime molds.
- The size and number of gap junctions per cell can change, depending on such factors as the point in the cell cycle and exposure of the cell to environmental stress.

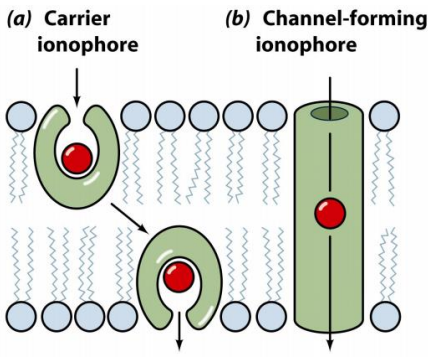
Functions

Gap junctions may be seen to function at the simplest level as a direct cell to cell pathway for electrical currents, small molecules and ions. The control of this communication allows complex downstream effects on multicellular organisms as described below.



Ionophore

An **ionophore** is a chemical species that reversibly binds ions. Many ionophores are lipid-soluble entities that transport ions across a cell membrane. Ionophore means "ion carrier" as these compounds catalyze ion transport across hydrophobic membranes such as liquid polymeric membranes (carrier-based ion selective electrodes) or lipid bilayers found in the living cells or synthetic vesicles.



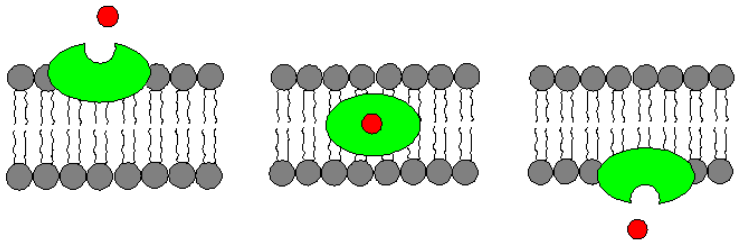


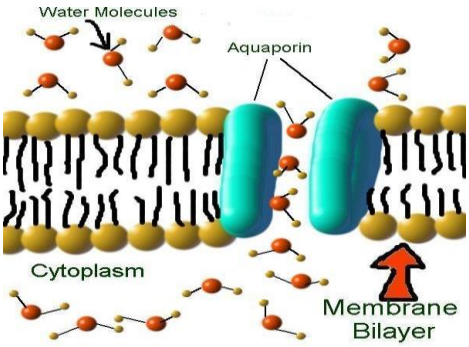
Figure: ionophore

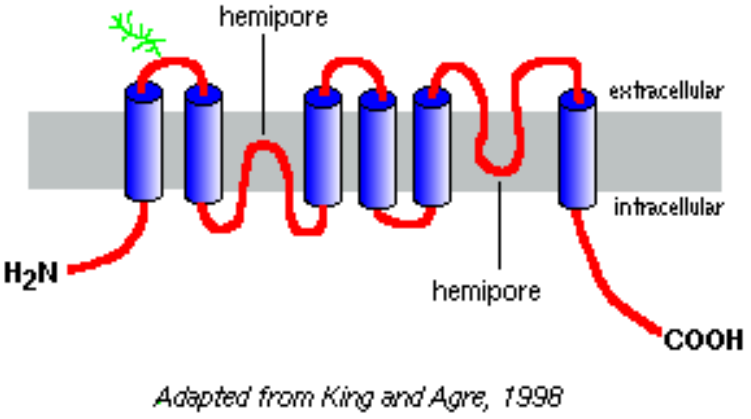
AQUAPORIN (Water Channel)

1. Aquaporin: Also called water channel. Aquaporins form pores in the membranes of cells and selectively conduct water molecules through the membrane, while preventing the passage of ions (such as sodium and potassium) and other small molecules. These channels are so small that water molecules travel through in single file, while larger molecules cannot enter.

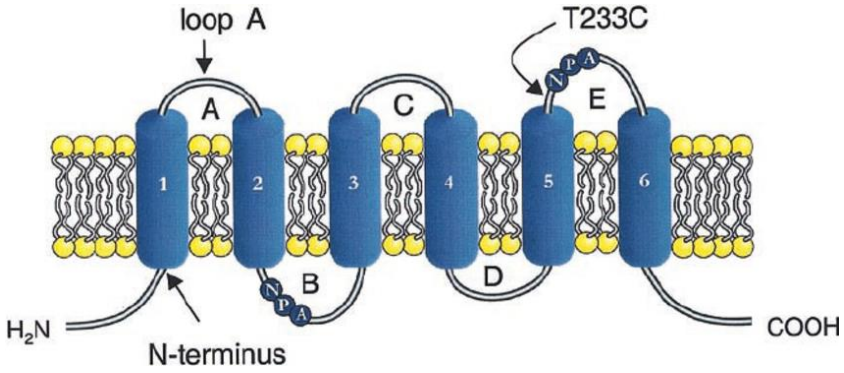
- Aquaporins are typically composed of identical subunit proteins.The presence of water channels increases the permeability of membranes to water by as much as ten-fold. Aquaporins prevent us from dying of dehydration by reabsorbing 99% of the water in the kidney.

2. Aquaporins, also called **water channels**, are integral membrane proteins from a larger family of major intrinsic proteins that form pores in the membrane of biological cells, mainly facilitating transport of water between cells. The cell membranes of a variety of different bacteria, fungi, animal and plant cells contain aquaporins through which water can flow more rapidly into and out of the cell than by diffusing through the phospholipid bilayer.





Adapted from King and Agre, 1998


loop A
T233C
A
C
E
1
2
3
4
5
6
B
D
H_2N
N-terminus
COOH