concentration of solutes, such as distilled water, water will enter the cell by osmosis (again causing the dilution of the greater solute concentration). This is **deplasmolysis**. For animal cells this causes a gain in turgidity and swelling. In the case of red blood cells in distilled water or some alcohols the osmosis into the cells can rupture the membrane and cause them to burst, a phenomenon known as **hemolysis**. For plant cells, the osmosis increases the turgidity, but the cell wall (again) resists movement.

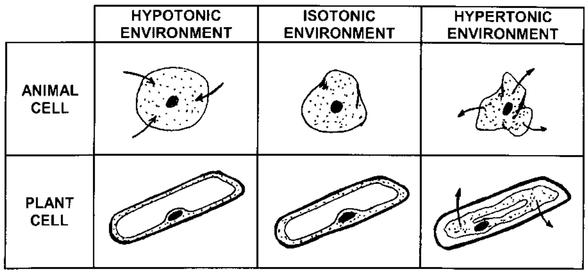

Figure D-2. Osmosis. *Cells gain and lose water depending on the relative difference in concentration between their cytoplasm and their environment, In a hypotonic environment, cells will gain water, increasing their inner turgidity. This causes swelling in animal cells. No significant change is noticeable in plant cells due to the rigidity of the cell wall. In hypertonic environments, both cell types will lose water. The animal cell and the protoplasm of the plant both shrivel. The cell wall remains intact.*

PROTEIN ASSISTED TRANSPORT

Some proteins embedded in the phospholipid bilayer of a cell membrane are involved in the transport of substances other than water. These transmembrane proteins have three-dimensional configurations with surface regions that are sensitive to the presence of specific solute particles. This specificity of these protein carriers contributes to the selective nature of the membrane. When the solute particles attach to the protein, they cause a change in its shape, which propels the solute particles through the membrane either in or out of the cell. There are two variations of this:

1. ***Facilitated transport*** - where the substances are transported according to the laws of diffusion (down a concentration gradient). No energy is required for this type of transport.
2. ***Active transport*** - where the substances are transported against the laws of diffusion, i.e., up a concentration gradient. For example, the **thyroid gland** accumulates the iodine needed to manufacture the hormone **thyroxin**. The iodine concentration can be as much as 25 times more concentrated in the thyroid than in blood. Another example is the **Na/K pump**, which restores electrical order in a neuron after an impulse has traveled along it. Energy from the hydrolysis of ATP is required for active transport.

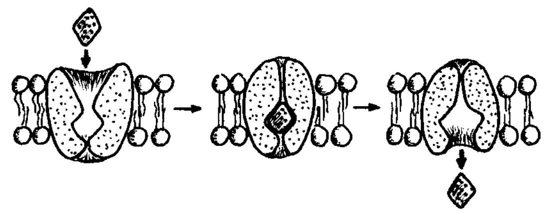

Figure D-3. Protein Assisted Transport. *Some membrane proteins extend all the way through a membrane. These are called transmembrane proteins. Generally, they function as transport proteins by propelling ions or small molecules through the membrane. If the direction of movement is down a concentration gradient, then the process is termed facilitated transport. If the direction is the other way, ATP is required and the process is known as active transport.*

TRANSPORT INVOLVING VESICLES

The largest substances that have to enter or leave a cell do through the use of membranous vesicles. When cytoplasmic vesicles containing wastes or products for secretion come in contact with a cell membrane, they fuse onto it and open its surface, thus spilling their contents to the other side. This is **exocytosis**. **Endocytosis** is a similar sort of process only in reverse.

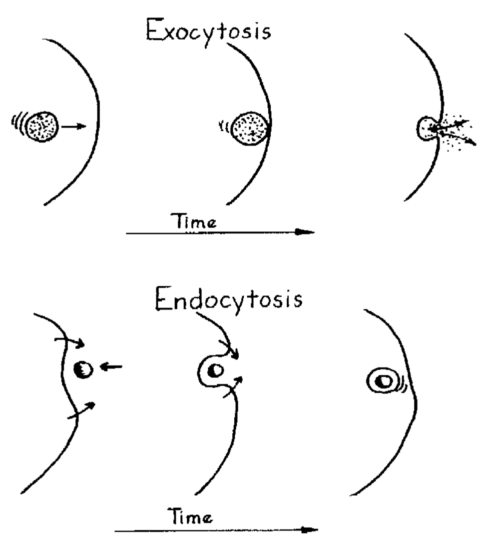

Figure D-4. Exocytosis and Endocytosis. *Substances that are too large to fit through the membrane are transported across by vesicles. Cytoplasmic vesicles fuse with the membrane to release their contents to the outside. This is exocytosis. Substances are taken into a cell by endocytosis, which forms vesicles, such as food vacuoles.*