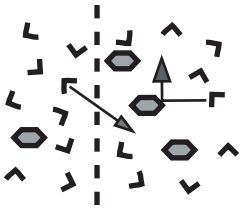
Osmosis

An Introduction to

Mechanisms of Osmosis

and its effect on

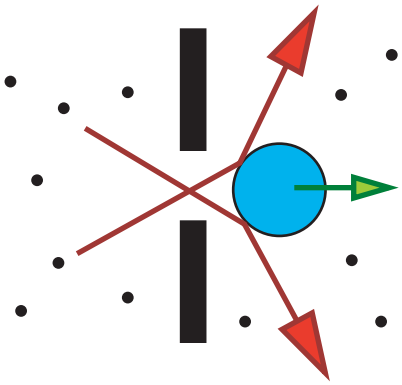
Water Balance



By Noel Ways

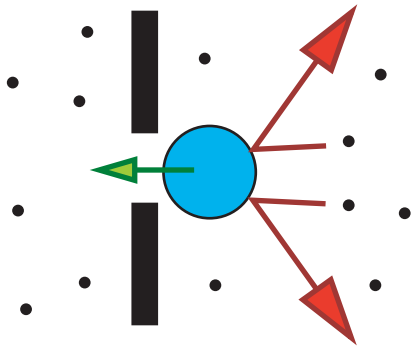
Osmosis

Osmosis is the movement of a solvent through a semi-permeable membrane into a region of higher solute concentration. To understand this, it must be first understood that any such system is in constant motion. Water molecules as well as the solute are in constant movement and this random movement increases when temperature increases.

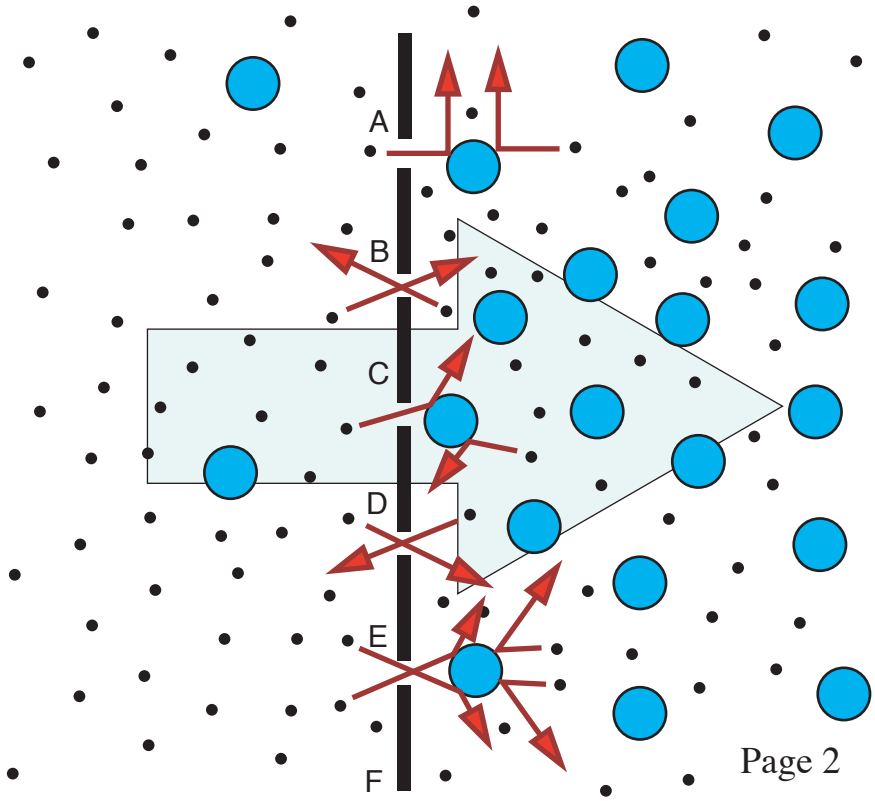


Consider the diagram at left. A solute molecule in close proximity to a pore permits water to pass through the pore into the other side of the membrane. The solute will also move in such manor so as to allow additional water to pass to the right.

In the diagram to the right, water molecules heading for the same pore hit a solute molecule and bounce off of it, and are not permitted to pass through. Furthermore, the solute moves toward the pore and will make more difficult the passage of any other water molecules from right to left.



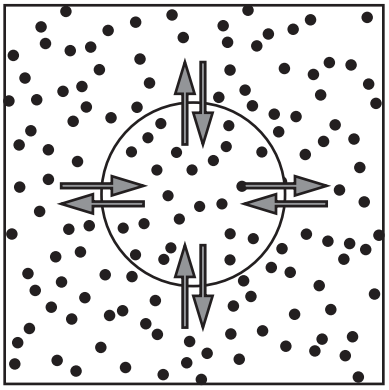
In short, the pore-solute system is acting like a ***one-way valve.*** It is important to realize that all movement is random, and indeed some water will slip in the other way. But for certain, the net movement of water (the solvent) will always be from lower solute concentration to higher solute concentration.

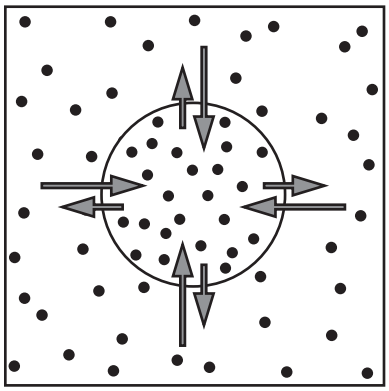


In the diagram at left, the higher solute concentration is clearly on the right side and the many "one-way valves" cause a net movement of water from the left to the right. And although there may be "one-way valves" on both sides of the semi-permeable membrane, the side with the greater concentration will see a greater movement of water to that side.

In the illustrations below, the dots represent solute, not water. The water is not seen, but inferred.

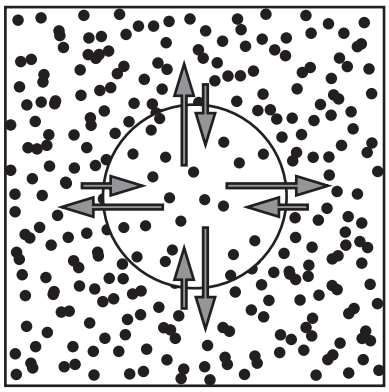
Solutes that cause osmosis are called, "osmotically active substances". If the concentration of osmotically active substance is equal on either side of the membrane, then the solution surrounding the cell is said to be ***isotonic***. The osmotic pressure will be equal on either side of the membrane. This is a stable situation in this model.





If the solution surrounding the membrane has a lower concentration of osmotically active substances, then the solution is said to be ***hypotonic***. Here, there is a greater osmotic pressure drawing water into the cell. If the osmotic pressure is great enough, the cell will burst, sometimes called ***hemolysis***.

If the solution surrounding the membrane has a greater concentration of osmotically active substances, then the solution is said to be ***hypertonic***. Now the osmotic pressure will be greater outside the membrane and water will be drawn out of the cell. The cell will shrivel up, a process called ***crenation***.



Notice below, as the concentration ("one-way valves") increases, the osmotic pressure increases.