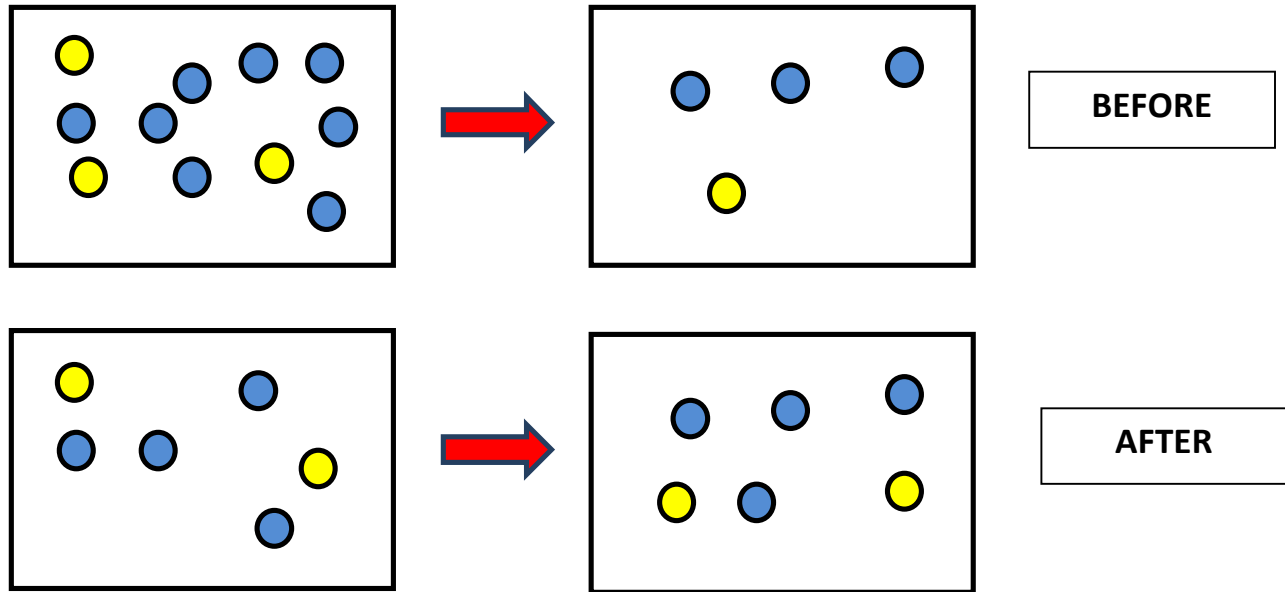
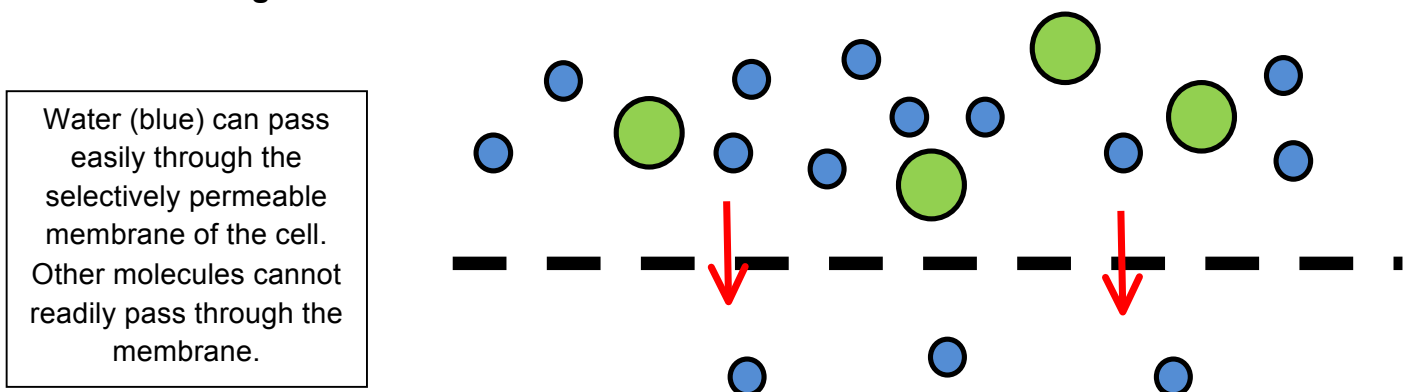


## Transport Through a Cell

**Diffusion** is the movement of molecules from an area of high concentration to an area of low concentration. No external energy is required for this process to occur. **Brownian movement** of particles (the random movement of particles) allows for the particles to be in constant motion. The molecules will collide and move until they reach dynamic equilibrium. This means there are equal numbers of molecules on each side. The random movement of particles never stops. They will continue to migrate back and forth, but will always move to achieve equilibrium.



**Osmosis** is the diffusion of water across a semi permeable membrane. It is in this way that water can enter and leave a cell. Water moves at varying speeds depending on the concentration of water in the surrounding environment of the cell (usually the cytoplasm). An **osmotic potential** will develop when water molecules move from an area of high concentration to low concentration. The membrane of a cell is selectively permeable. This means that water alone can readily diffuse through the membrane and no other substances. Osmosis, like diffusion does not require energy. The particles are moving with the **concentration gradient**.



Plant and animal cells respond differently to osmotic potential. An **animal cell** has a thin and **flexible cell membrane**. This membrane does not readily resist rupture should it rapidly fill with water. An animal cell will also shrivel if there is a rush of water out of the cell. **Plant cells** are reinforced by a **cell wall**. The cell wall helps them to resist rupture. In fact, plant cells are made to be filled with water. Plant cells will also shrivel (but not as much) when they are without water.

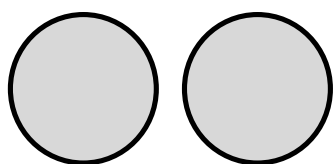
### There are three types of osmotic conditions that can occur in cells:

**Isotonic solutions** are those that help cells maintain an equal number of particles inside and out of the cell. An IV that is given to a person in the hospital will have an isotonic solution.

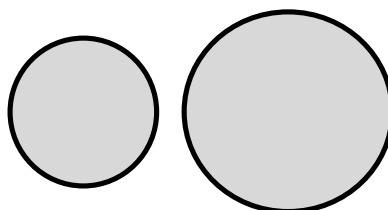
**Hypertonic solutions** are those that will cause a cell to lose water.

**Hypotonic solutions** are those that will cause a cell to take up water.

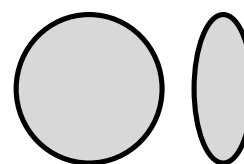
### Animal Cells



An **isotonic solution** will cause equal amounts of water. The cell size will not change.

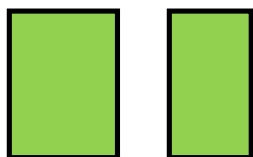


A **hypotonic solution** will cause water to rush in. The cell will expand and can burst.

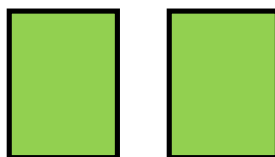


A **hypertonic solution** will cause water to rush out. The cell will shrivel.

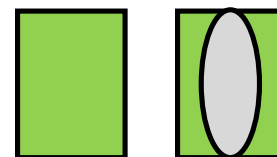
### Plant Cells



An **isotonic solution** will cause a plant cell to shrink. Plants in this type of solution wilt.



A **hypotonic solution** will cause water to rush in. Plant cells are full in this type of solution.



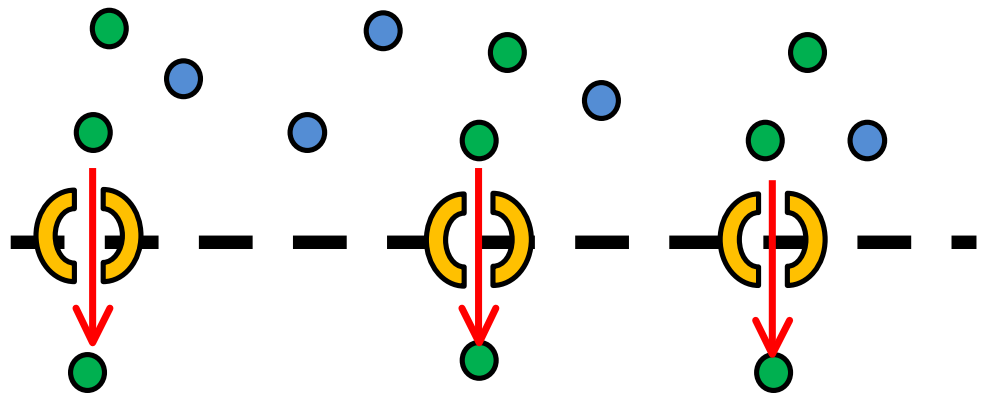
A **hypertonic solution** will cause water to rush out. The cell membrane inside of the cell wall will shrivel.

## Facilitated Diffusion

**Facilitated diffusion** occurs when a substance is helped across the membrane by a molecule known as an **ionophore**. An ionophore allows membranes to stay selectively permeable. They only allow some substances to pass through the membrane and not others. This will speed up the rate of diffusion for that molecule. Facilitated diffusion does not require energy. It works with the concentration gradient. This means that the molecules that diffuse through the membrane will flow from an area of high concentration to low concentration.

There are also many types of protein ionophore channels that let a variety of substances through the cell membrane. If a protein channel is defective in a human it can lead to disease. Cystic fibrosis is one example of defective ion channels.

**Facilitated diffusion** allows for faster diffusion of particles. These protein channels make the membranes selectively permeable.



## Ion Gated Channels

Some of the protein channels that are utilized during facilitated diffusion are ion specific. For example, a  $\text{Na}^+ / \text{K}^+$  pump is designed to only pump those ions through the cell. There are specific types of ion channels that are designed solely for this purpose.