

### 3.4 Cellular Transport

#### I. Diffusion and osmosis are types of passive transport.

Passive transport *does not require energy* input from a cell.

Molecules can move across the cell membrane through passive transport.

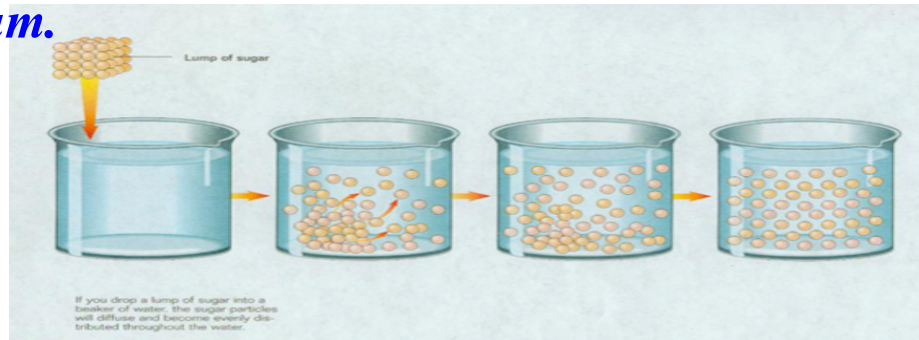
There are two types of passive transport.

- *diffusion*
- *osmosis*

II. **Diffusion** is when molecules move down a concentration gradient.

**Movement is from** a region of **higher concentration** to a region of **lower concentration**.

Until the molecules have reached a **dynamic equilibrium**.



### III. Osmosis: Diffusion of **water**

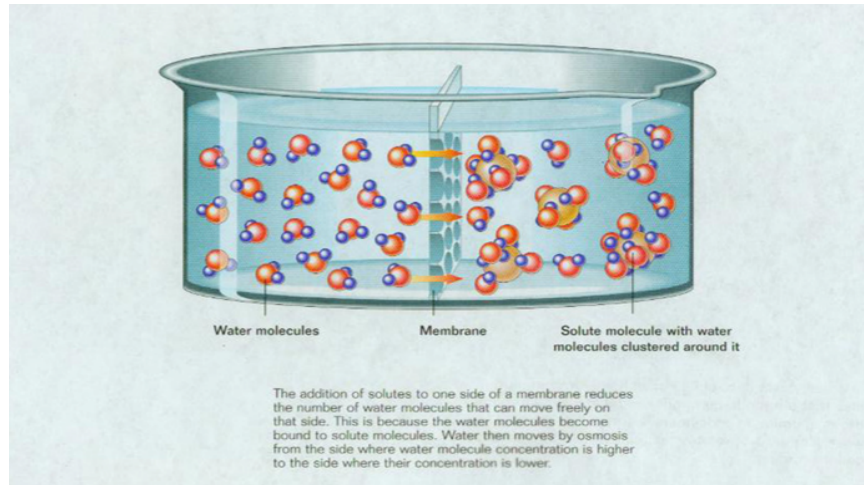
\*Osmosis = diffusion water across a **selectively permeable membrane** in the direction of **higher solute concentration**.

\***Regulating water** flow through a plasma membrane is an important factor in maintaining **homeostasis** within a cell.

#### A. What Controls Osmosis?

\*Unequal distribution of particles, a **concentration gradient**, is one factor that controls osmosis.

1. Water will flow to the side of the membrane where water concentration is *low*.
2. Water continues to diffuse until it is in *equal* concentration on both sides.

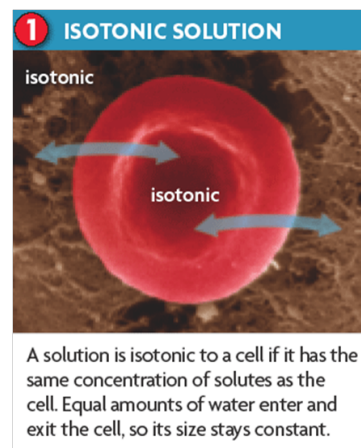


## B. Cells in an isotonic solution

\*Most cells are subject to *osmosis* because they are surrounded by water solutions.

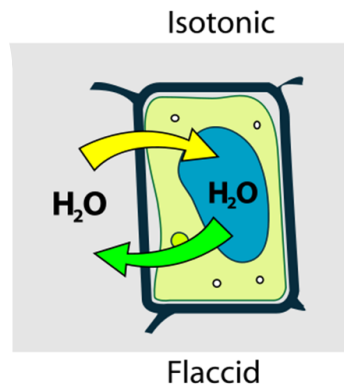
\**Isotonic solution* = a solution in which the concentration of dissolved substances **in the solution** is *the same* as the concentration of dissolved substances **inside the cell**.

In an isotonic, water molecules move *into* and *out* of the cell randomly, at the same rate, and the cells retain their normal *shape*



Add to notes:**Flaccid = Isotonic**

same amount of water & solute  
inside & outside the cell

**C. Cells in a hypotonic solution**

\* **Hypotonic solution** = a solution where the concentration of dissolved substances is **lower outside** the cell than **inside** cell.

1. Water moves through the **plasma membrane** into the cell, the cell swells and its internal pressure increases.
2. In **plant** cells this increase in pressure helps to make the plant cell **firm**.

Ex: Grocers keep produce looking fresh by misting the fruits and vegetables with water.



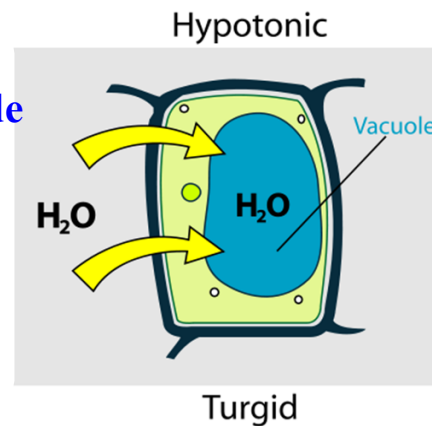
A hypotonic solution has fewer solutes than a cell. Overall, more water enters a cell in hypotonic solution, causing the cell to expand or even burst.



Add to notes:**Turgid = Hypotonic**

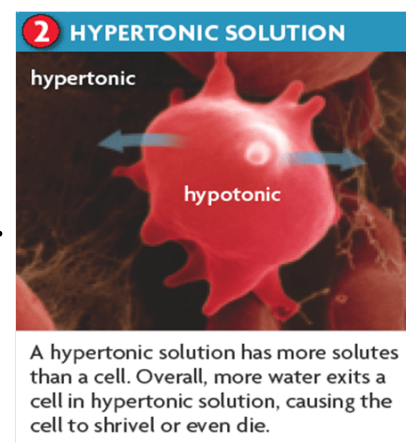
less solutes, more water outside  
the cell

-water inside cell (swells)

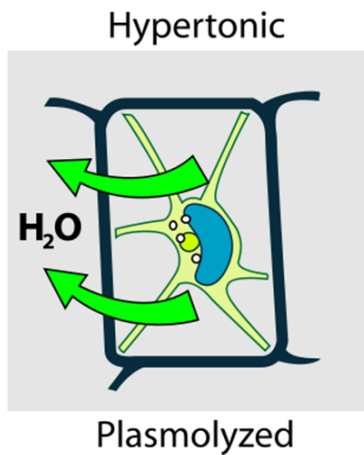
**D. Cells in a hypertonic solution**

\* **Hypertonic solution** = the concentration of dissolved substances **outside** the cell is **higher** than the concentration **inside** the cell.

1. Cells in a hypertonic solution experience **osmosis** that causes water to flow out.
2. **Loss** of water in a plant cell results in a drop in pressure and explains why plants **wilt**.



## Add to notes:



**Plasmolyzed = Hypertonic**  
 more solutes, less water outside the cell

-water moves out of cell

**Plasmolysis** occurs if **too much water is lost** from the cell, the plasma membrane and the cell's contents shrink.

- *may lead to death of the cell*

## IV. Passive Transport

= *the movement of particles across the membrane.*

-This requires no *energy*.

-The movement of particles is *with* the concentration gradient.

\*Passive transport by proteins

-*Facilitated diffusion* = passive transport of materials across the membrane using transport proteins.

1. Some transport proteins, called *channel* proteins, allow specific molecules to flow through.
2. *Carrier* proteins are another type of transport protein.

-They change *shape* to allow a substance to pass through the plasma membrane.

**Facilitated Diffusion**



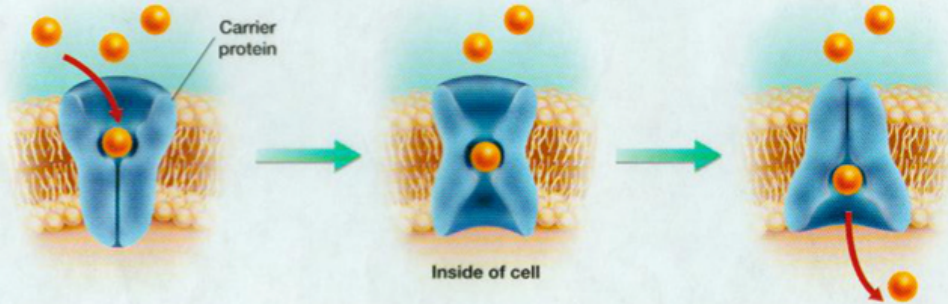
**Facilitated Diffusion**




Carrier proteins transport substances down their concentration gradient.

**1** A molecule outside the cell binds to a carrier protein on the cell membrane.

**2** The carrier protein transports the molecule across the cell membrane.

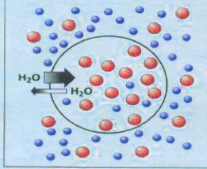
**3** The molecule is released from the carrier protein inside the cell.



	Conditions	Environment Solution Is	Cell Solution Is	Water Will Move
<b>Hypotonic solution</b> 	Solute concentration in the environment is lower than in the cell.	Hypotonic	Hypertonic	Into the cell, and cell will burst
<b>Isotonic solution</b> 	Solute concentration in the environment is equal to that in the cell.	Isotonic	Isotonic	Equal amounts will move into and out of the cell, and cell volume is maintained
<b>Hypertonic solution</b> 	Solute concentration in the environment is higher than that in the cell.	Hypertonic	Hypotonic	Out of the cell, and cell will shrivel

**Hypertonic, and Isotonic Solutions**

**Hypotonic Solution**

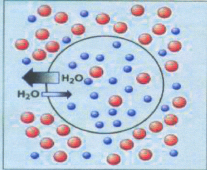


**Approximate ratio of water molecules to dissolved particles**

Inside cell:  
 1 water molecules: 3 dissolved particles

Outside cell:  
 4 water molecules: 1 dissolved particles

**Hypertonic Solution**

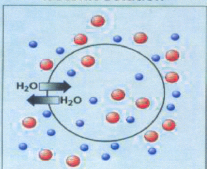


**Approximate ratio of water molecules to dissolved particles**

Inside cell:  
 5.5 water molecules: 1 dissolved particles

Outside cell:  
 1 water molecules: 2.5 dissolved particles

**Isotonic Solution**



**Approximate ratio of water molecules to dissolved particles**

Inside cell:  
 1 water molecules: 1 dissolved particles

Outside cell:  
 1 water molecules: 1 dissolved particles

● Water molecules  
 ● Dissolved particles

Count the water molecules and dissolved particles inside and outside each cell.

Science 1003: Obj. 2, 4B (10, 11); Obj. 4, 5A (10, 11)  
 BIOLOGY: The Dynamics of Life overlay 12a  
 RETEACHING SKILLS TRANSPARENCIES

### 3.5 Active Transport

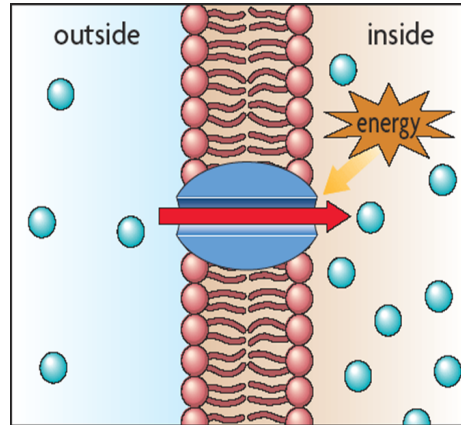
= the movement of materials through a membrane *against* a concentration gradient.

-This *requires* energy.

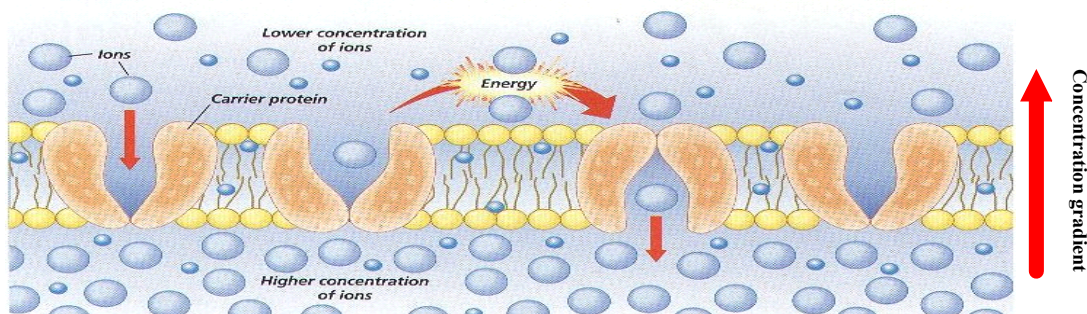
- I. How active transport occurs
  - A. Transport of substances across the cell membrane is required for a cell to maintain *homeostasis*.
    1. Transport protein called a *carrier* protein or first binds with particle being transported.
    2. Once across membrane carrier protein *releases* particle.



3. Active transport is powered by *chemical energy (ATP)*.
4. Active transport occurs through *transport protein pumps*.

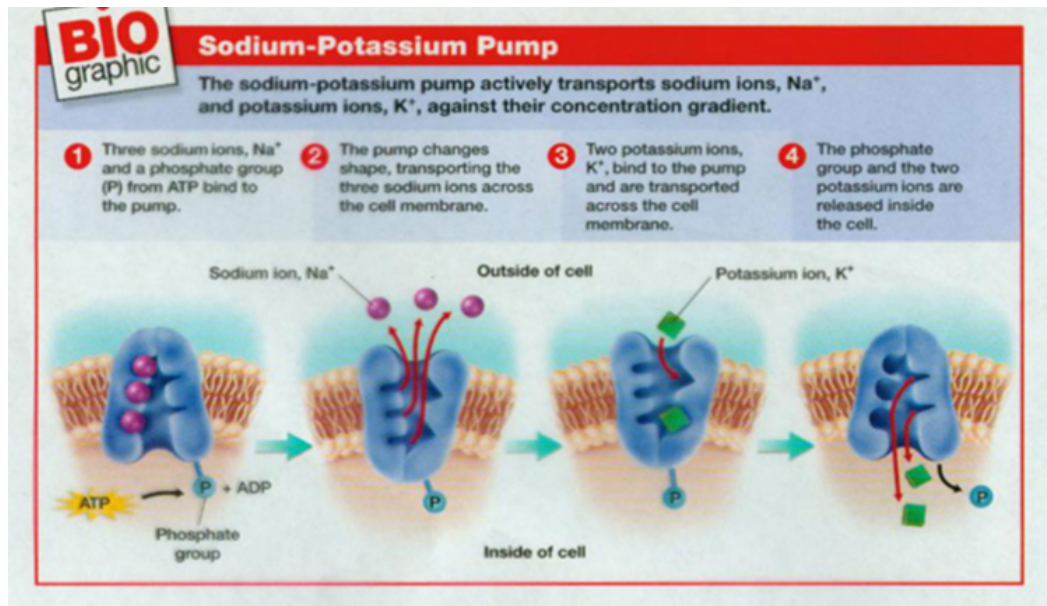


- B.** Transport proteins span the membrane, and *most change shape* when they bind to a target molecule or molecules.
1. Some transport proteins bind to *only one type of molecule*.
  2. Others bind to *two different types*.
    - a. Some proteins that bind to two types of molecules *move both types in the same direction*.





b. Others *move the molecules in opposite directions*



## II. Transport of Large Particles

A. **Endocytosis** = a process by which a cell surrounds and *takes in* material from its environment.

There are three types of endocytosis:

1. *phagocytosis*,
2. *pinocytosis*, and
3. *receptor-mediated endocytosis*.

In **phagocytosis** or “cellular eating,” the cell’s *plasma membrane* surrounds a molecule from the extracellular environment and buds off to *form a food vacuole*. The newly-formed vacuole then *fuses with a lysosome* whose enzymes digest the “food” inside.

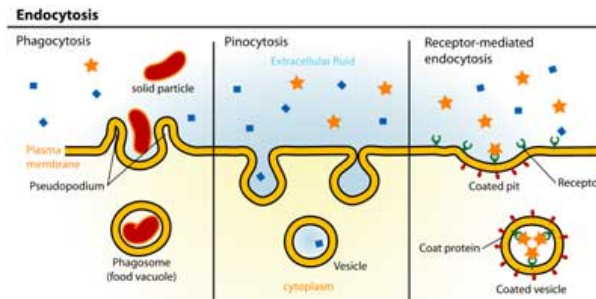
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In **pinocytosis** or “cellular drinking,” the cell *engulfs drops of fluid* by pinching in and forming vesicles. Like phagocytosis, pinocytosis is a *non-specific* process in which the cell *takes in whatever solutes* that are dissolved in the liquid it envelops.

In **receptor-mediated** endocytosis, the cell will *only take in an extracellular molecule* if it binds to its *specific receptor protein* on the cell’s membrane. Like phagocytosis, this coated vesicle then fuses with a lysosome to digest the engulfed material and *release it into the cytosol*.

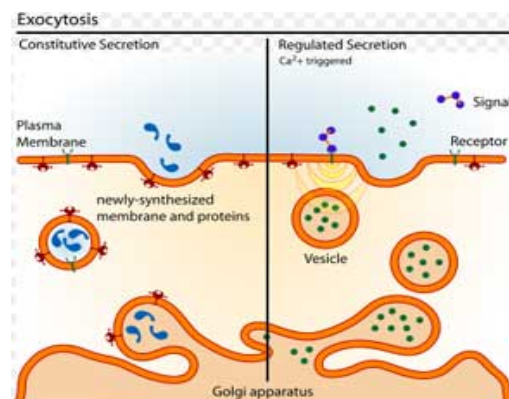
**Ex: cholesterol in mammalian cells**



B. **Exocytosis** = the *expulsion of waste* and *secretion of products* out of the cell

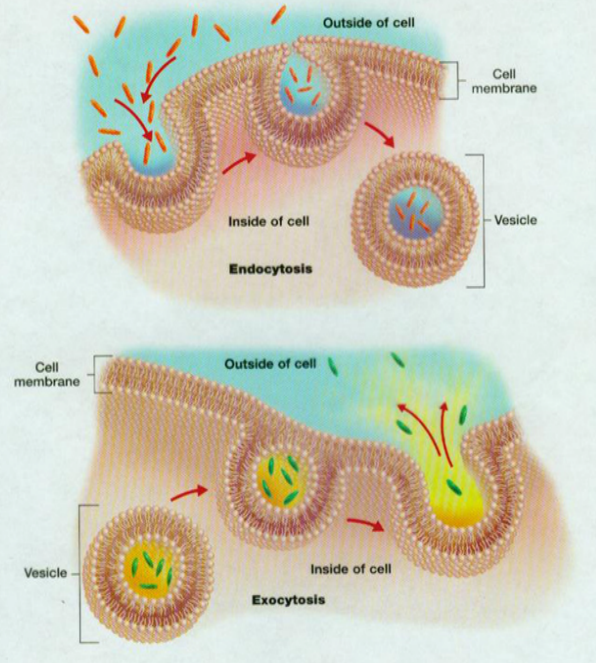
In this process, the **Golgi complex** *packages molecules* into transport vesicles that travel to and fuse with the plasma membrane. The vesicle then spills its contents *out of the cell*.

**Ex: digestive enzymes or hormones.**



### Endocytosis and Exocytosis

Vesicles transport substances into and out of cells.



### Active and Passive Transport 10

