

Cell Physiology

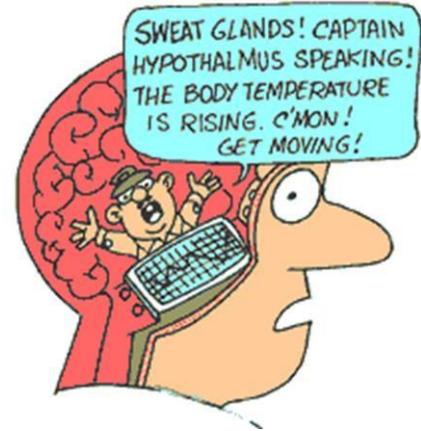
Physiology = the study of the **vital processes** of an organism

1) Homeostasis

= a steady state that a tissue, organ, system or organism maintains by self-regulating adjustments

= **ability to adapt to a change and stay in a balanced state**

- ie) kidney will double in size if the other is removed
 - goose bumps & shivering conserve body heat
 - going into shock in an emergency
- cells maintain homeostasis with their environment by means of the plasma membrane
- the cell membrane is a **differentially permeable** or **semi permeable** membrane between the cell and its environment (or neighboring cell)
 - = allows certain substances to cross into and leave the cell while other substances are prohibited
- Factors Affecting the Selective Permeability of the Plasma Membrane:
 1. Particle **size**
 2. Particle **solubility**
 3. **Concentration** inside or outside of the cell
 4. **Electrical charge** of the Particle
 - (ions move across the membrane slowly if same charge as cell membrane)
 5. Plasma membrane **structure**



[Fluid Mosaic Model https://www.youtube.com/watch?v=ipa1vmQ7H_4](https://www.youtube.com/watch?v=ipa1vmQ7H_4)

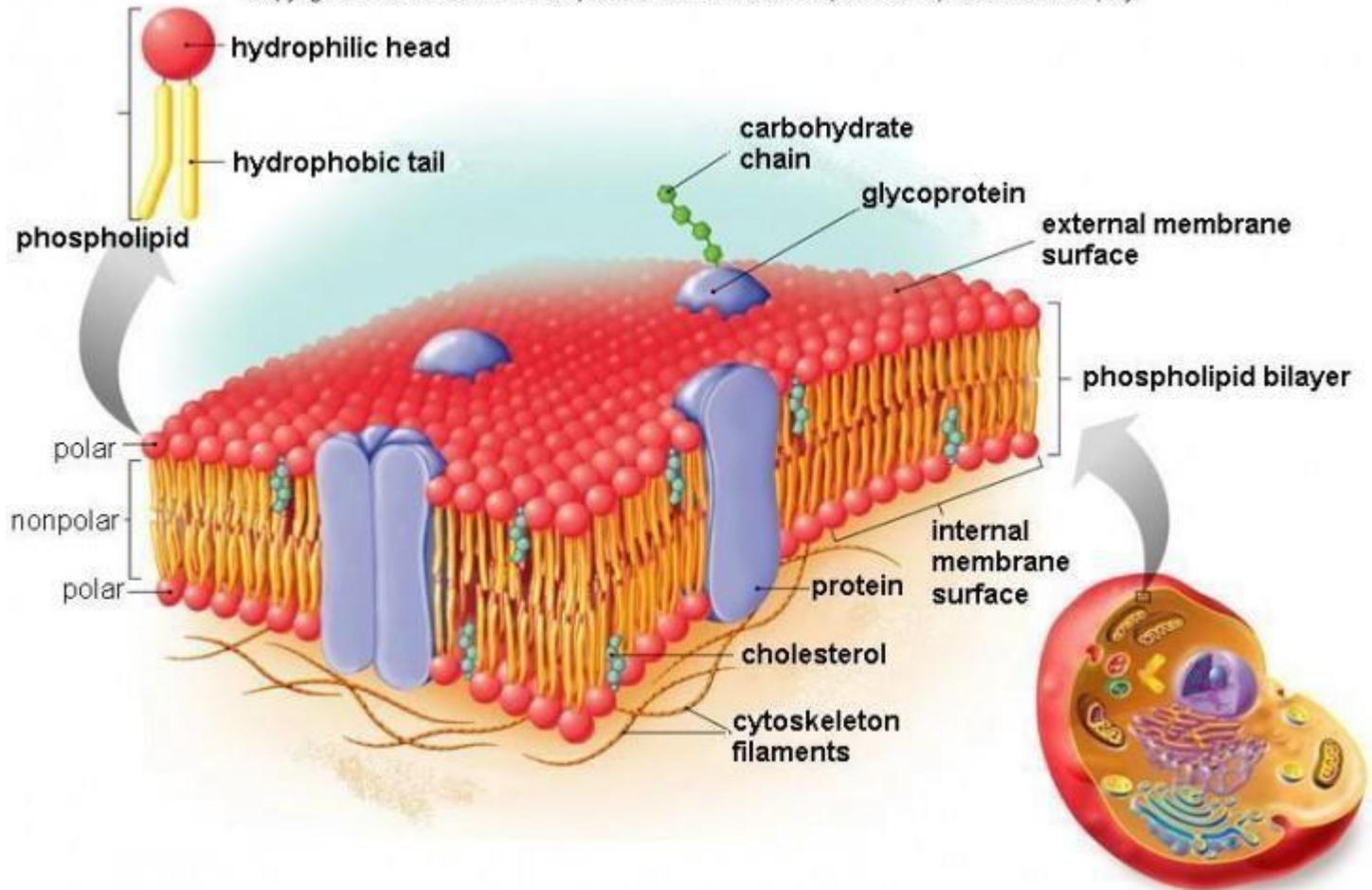
2) Structure of the Plasma Membrane (a.k.a. Fluid Mosaic Model)*

= lipid bilayer embedded with proteins

- the 2 layers are composed of **mobile phospholipid molecules**
 - : phospholipids have a polar water soluble end (hydrophilic) and a non polar fat soluble end (hydrophobic)
 - : the hydrophilic ends face the **outer environment** & the **inner** cell components
- special protein molecules (glycoproteins) embedded in the lipid bilayers serve different functions:
 - a. **Markers** = so cells can identify each other
 - explains transplant and transfusion rejection
 - b. **Receptors** for chemical messages (hormones)
 - c. **Regulators** of what enters or attaches to cells
 - d. **Transporters** carrying specific materials into & out of the cell

FLUID MOSAIC MODEL OF THE PLASMA MEMBRANE

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3) Transport of Substances

- substances are moved through the cell membrane in a variety of ways:

A) Passive Transport

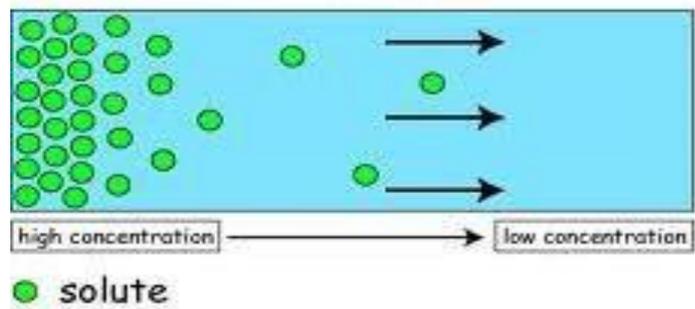
= movement of materials across a cell membrane without the cell using its own energy (with the concentration gradient)

- modes of passive transport:

1. Simple Diffusion

= the random movement of substance from an area of high concentration to an area of low concentration

- establish equilibrium (although motion is not stopped on the microscopic level)
- used for small, non-polar molecules, ions and gases
- factors affecting diffusion = concentration, temperature, & pressure



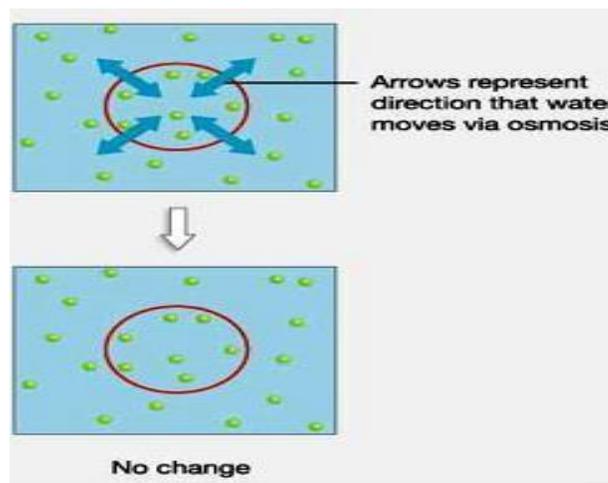
Osmosis

Osmosis <https://www.youtube.com/watch?v=rMa9MzP19zI&t=15s>

- is the diffusion of water
- as water molecules enter a cell, pressure occurs inside against the cell membrane
- in plant cells this pressure is referred to as **turgor pressure**
 - : gives plants their rigidity
 - : when turgor pressure = osmotic pressure, **equilibrium** is reached
- the type of solution the cell is in will affect osmosis:

a) Isotonic Solution

- : iso = **same**, tonic = **strength**
- : solute concentration (**molecules dissolved in water**) inside the cell **equals** the solute concentration outside the cell
- : is perfect for cells

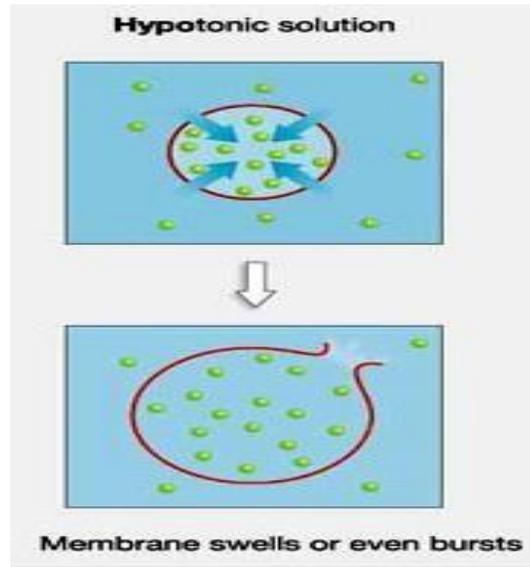


b) Hypotonic Solution

: hypo = lower

: solute concentration outside the cell is less than that found inside the cell

: water flows inward causing increased pressure within the cell



: the cell walls of plant cells allow them to withstand this pressure

: animal cells lack cell walls so would swell and eventually burst (cytolysis) therefore they have water removing mechanisms

- single celled organisms have contractile vacuoles (ie. Paramecium)

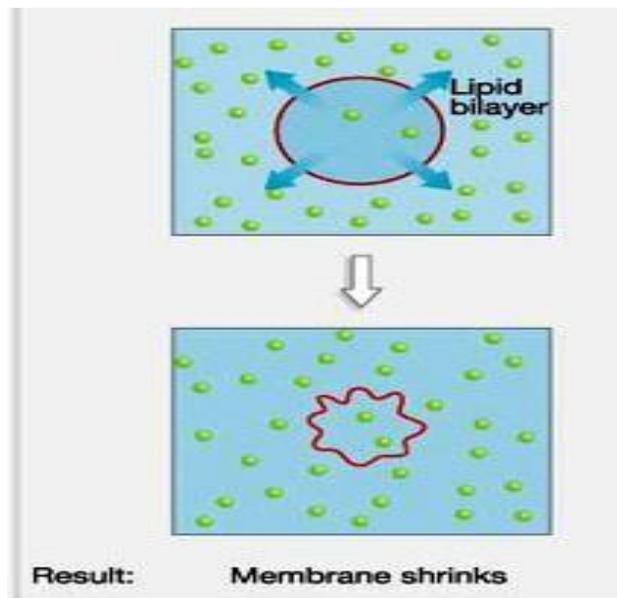
- multicellular organisms have specialized organs (ie. Kidneys, lungs sweat glands)

c) Hypertonic Solution

: hyper = higher

: solute concentration outside the cell is greater than that found inside the cell

: the organism loses water = cells shrink



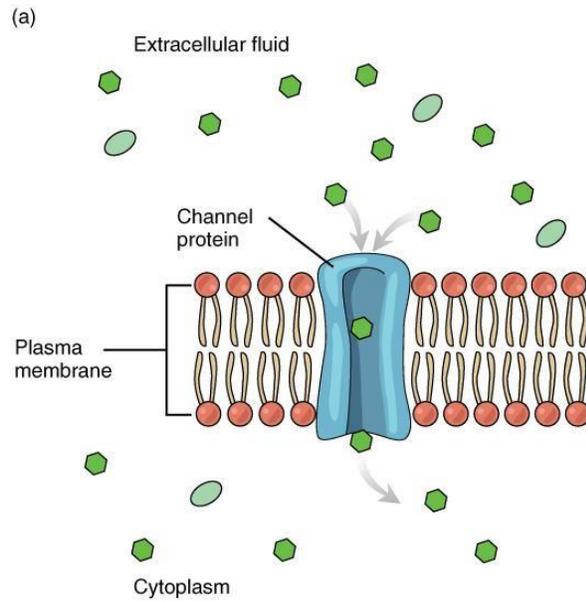
: causes plasmolysis (a.k.a.

Reverse osmosis)

- plants cell **wilt**
(caused by lack of water, excess fertilizer)
- animals cells **dehydrate**
(caused by drinking salt water, swimming in high content saltwater, treating a cut with salt solution)

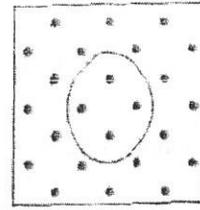
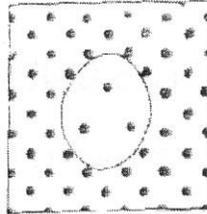
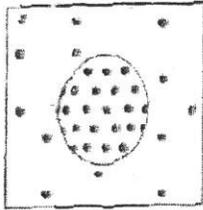
3. Facilitated Diffusion

- special **channel protein** molecules in the cell membrane speed up the movement of molecules **already** moving across the cell membrane
= a '**fast pass**'
- very selective ie. **Glucose diffuses into red blood cells 100's of times faster than other sugars)**



OSMOSIS

Label the pictures below (isotonic, hypertonic, or hypotonic)



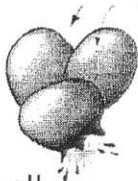
_____ tonic means there is a **GREATER** concentration of solute molecules **OUTSIDE** the cell than inside.

_____ tonic means there is a **LOWER** concentration of solute molecules **OUTSIDE** the cell than inside.

_____ tonic means there is the **SAME** concentration of solute molecules outside the cell as inside.

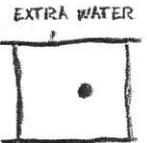
The pressure inside a plant cell caused by water pushing against the cell wall is called _____ pressure.

The **SWELLING AND BURSTING** of animal cells occurs because _____



Cells swell and burst

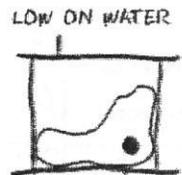
This happens when a cell is placed in a _____ tonic solution.



Placing plant cells in a **HYPOTONIC** solution causes the osmotic pressure to _____.

increase decrease

Plant cells will _____ when water leaves so the cell membrane away from the cell wall.



pulls

It happens when a plant cell is placed into _____ tonic solution.

When water leaves a plant cell, the osmotic pressure will _____.

increase decrease



Cells shrink and shrivel

ANIMAL cells that are placed in a **HYPERTONIC** solution will shrink because _____

Cells stay the same size when placed in an _____ tonic solution because the amount of water leaving the cell is the same and the amount of water entering.

Transport Across The Cell Membrane

Use Figure 1.25 on page 43 to help you answer the following 4 questions:

1. A cell that is 70 % water (30% concentrated) is placed into a 30 % sugar water solution, what will happen to the cell? Water will move ___?___ of the cell equally.

- a) in only b) in and out c) out only

2. A cell that is 60% water (40% concentrated) is placed into a 30 % sugar solution in water. What will happen to the cell? Water will ___?___ move the cell.

- a) into b) in and out c) out of

3. If a cell that is 80% water (20% concentrated) is placed into a 30% sugar in water solution, what will happen to the cell? Water will move ___?___ the cell.

- a) into b) in and out c) out of

4. If a cell that is 80% water (20% concentrated) is placed into a distilled water solution, what will happen to the cell? Water will move ___?___ the cell.

- a) into b) in and out c) out of

Osmosis Diagram

A) Label each of the following diagram as being: **isotonic**; **hypertonic**; **hypotonic**

B) Using a **red pen**, draw arrows to indicate the direction of water flow for each diagram.

