

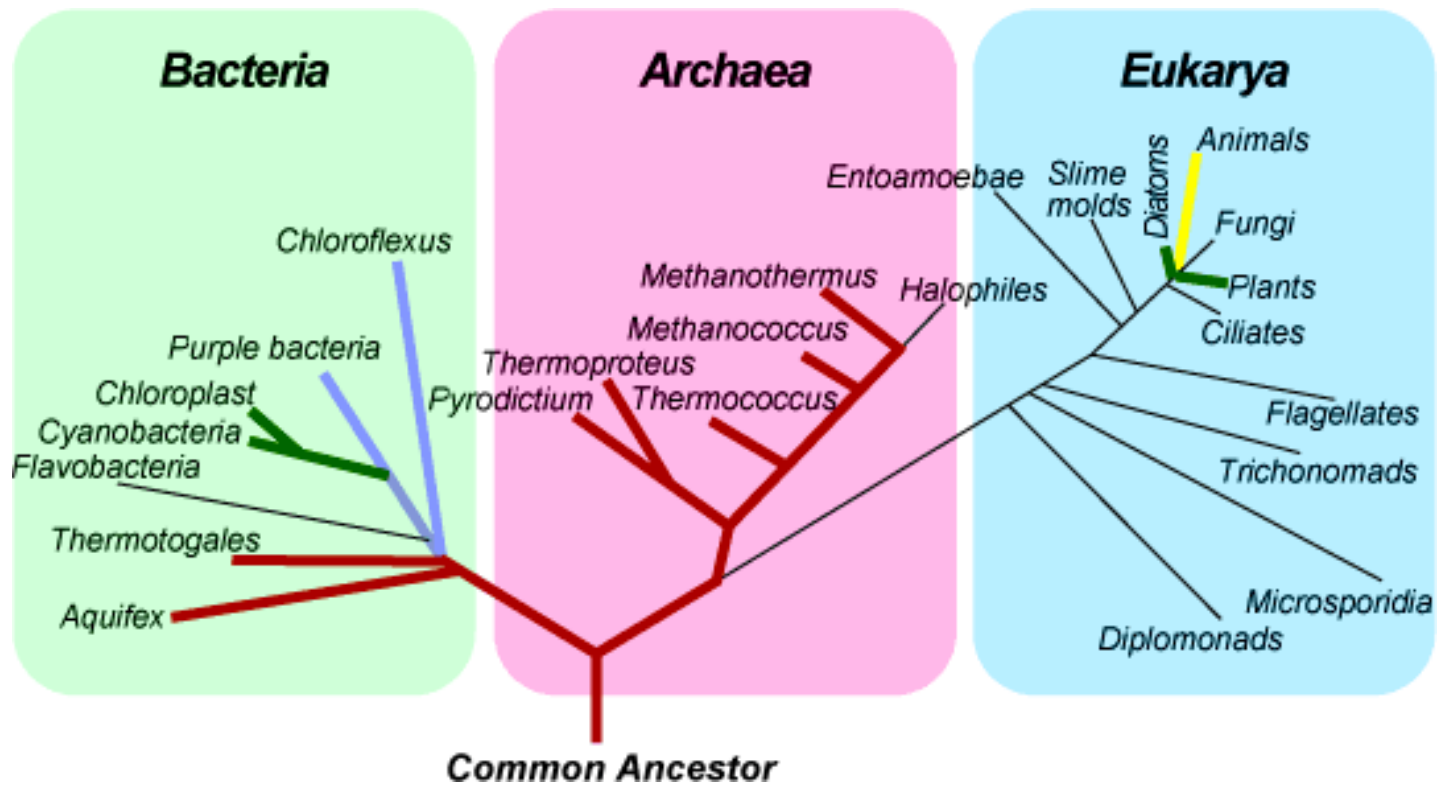
The Cell Theory

- All living things are made of one or more cells
- All cells come from pre-existing cells
- Cells are the basic unit of structure and function of all organisms

Types of cells

- All cells can be divided into two categories:
Prokaryotic and ***Eukaryotic***

The 3 domains of life



Prokaryotic vs. Eukaryotic Cells

Prokaryotic

- Domains *Bacteria* and *Archaea*
- **no nucleus**
- Very small (1-10 μm)
- Have no membrane bound organelles
- Prokaryotic organisms are unicellular

Eukaryotic

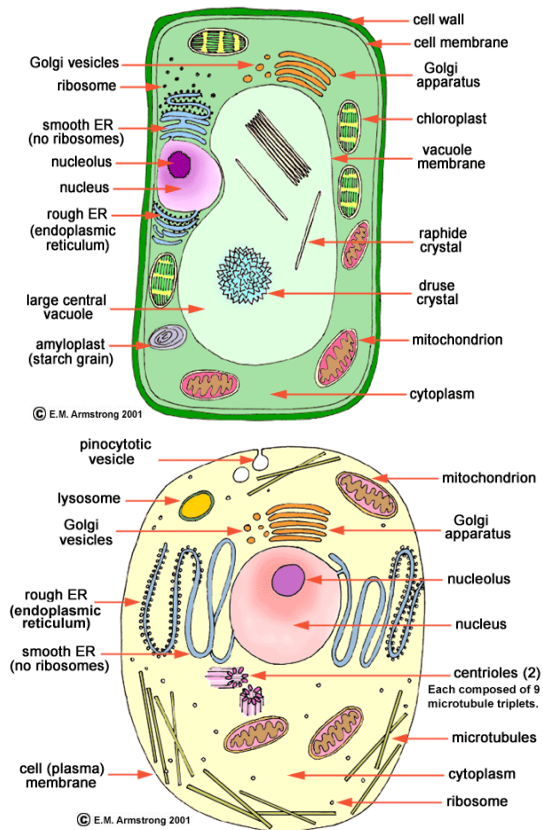
- Domain *Eukarya*
- **have a nucleus**
- Larger 10-100 μm (some larger)
- Have many organelles
- Eukaryotic organisms can be unicellular (protists and some fungi) or multicellular (plants, animals and some fungi)

Cell structure

- All cells are surrounded by a plasma (cell) membrane made mainly of lipids
- Eukaryotic cells contain **organelles** - small structures inside cells that perform various jobs
- The organelles are suspended in a watery environment called the cytosol

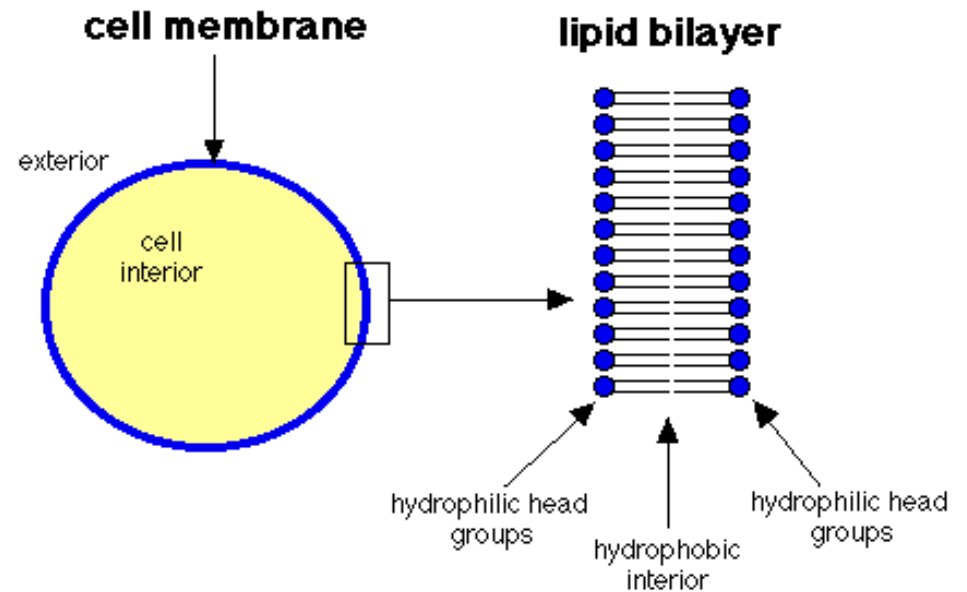
Plant vs. Animal Cells

- Both are eukaryotic
- Plant cells have cell walls for structural support (animal cells do not)
- Many plant cells have chloroplasts for photosynthesis
- Many plant cells have large vacuoles for water storage



Plasma (cell) membrane

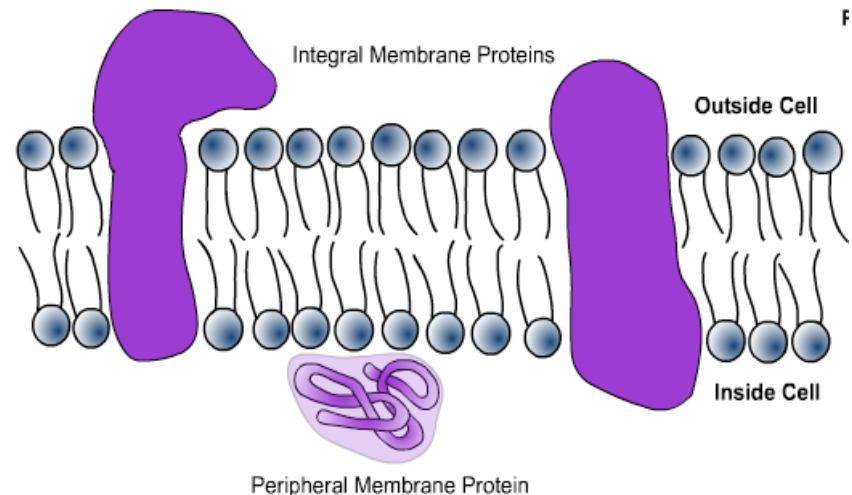
- Consists of a **bilayer of lipids** with embedded **proteins** and **cholesterol** molecules
- ***fluid-mosaic model*** – molecules in the membrane move freely in the lipid bilayer
- The outside and inside of the membrane is ***hydrophilic***
- The interior of the membrane is ***hydrophobic*** (see diagram at right)
- It is ***“selectively permeable”*** - it lets in some substances but not others



video

Integral and Peripheral Membrane Proteins

- **Peripheral proteins** are only on one side of the membrane
- **Integral proteins** go all the way through the membrane (can act as channels for molecules to pass through)



Types of Membrane Transport

Passive Transport (requires NO energy)

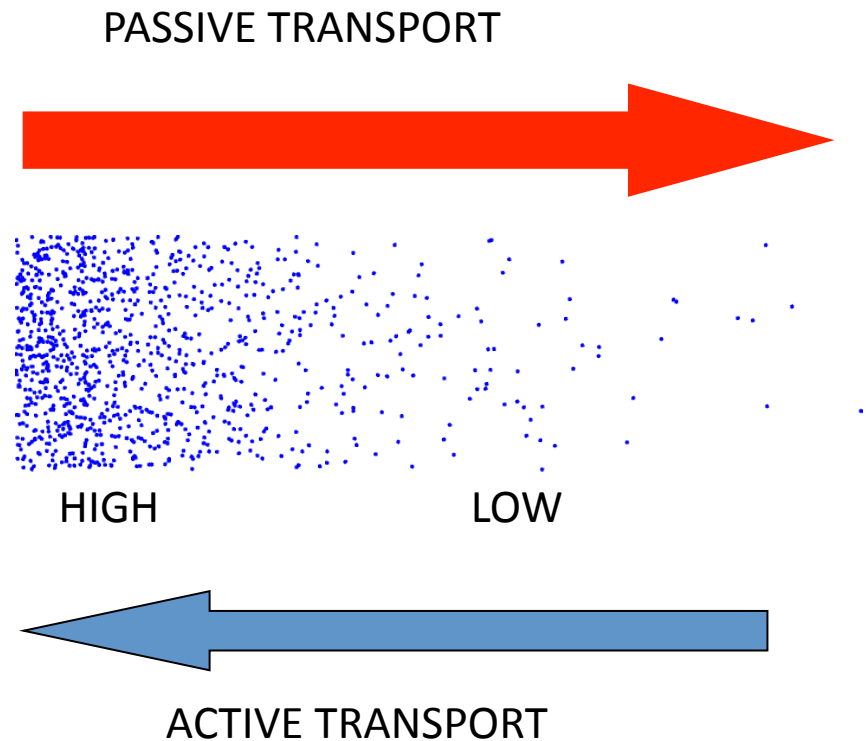
- Moves substances from a high to a low concentration
- Ex. simple diffusion, osmosis, facilitated diffusion

Active Transport (requires energy)

- Substances move from a low to a high concentration
- Ex. Endocytosis & exocytosis, ion pumps

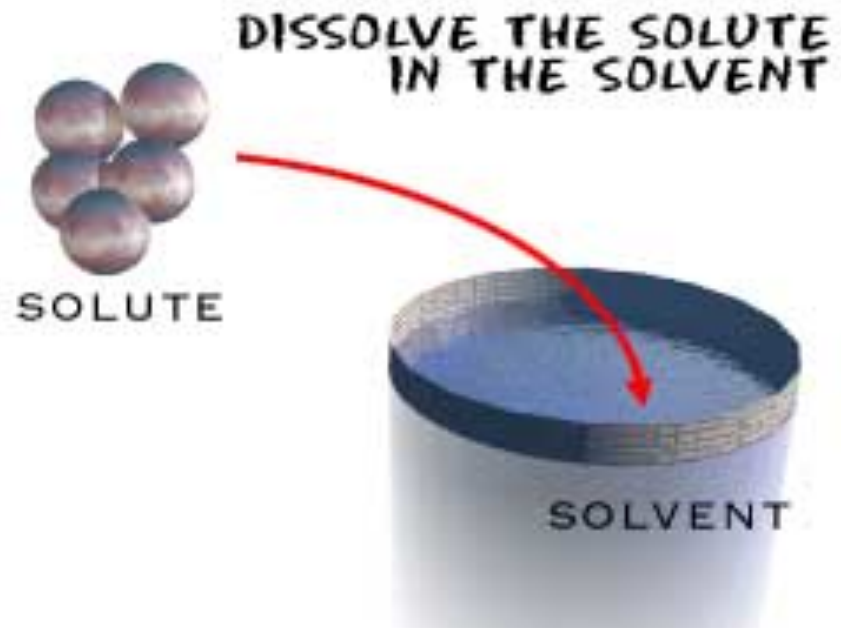
Concentration gradient

- Passive transport moves substances **WITH** (or **DOWN**) their concentration gradient
- Active Transport moves substances **AGAINST** their concentration gradients



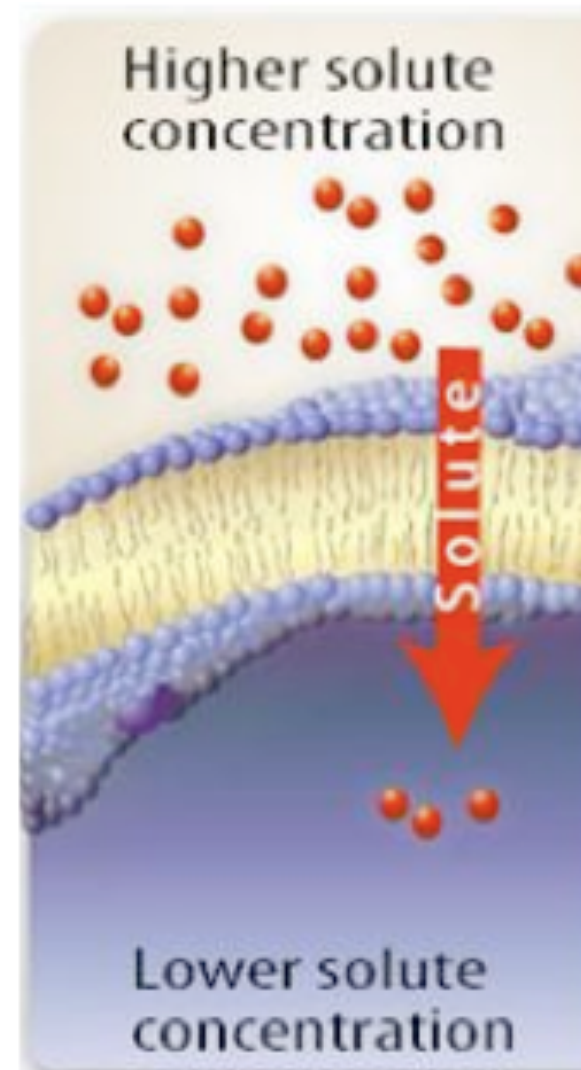
Solute vs. Solvent

- The **solvent** is a liquid in which other substances are dissolved (water is the main solvent in organisms)
- The **solute** is the substance that is dissolved (ex. sugar, salt, etc) in the solvent



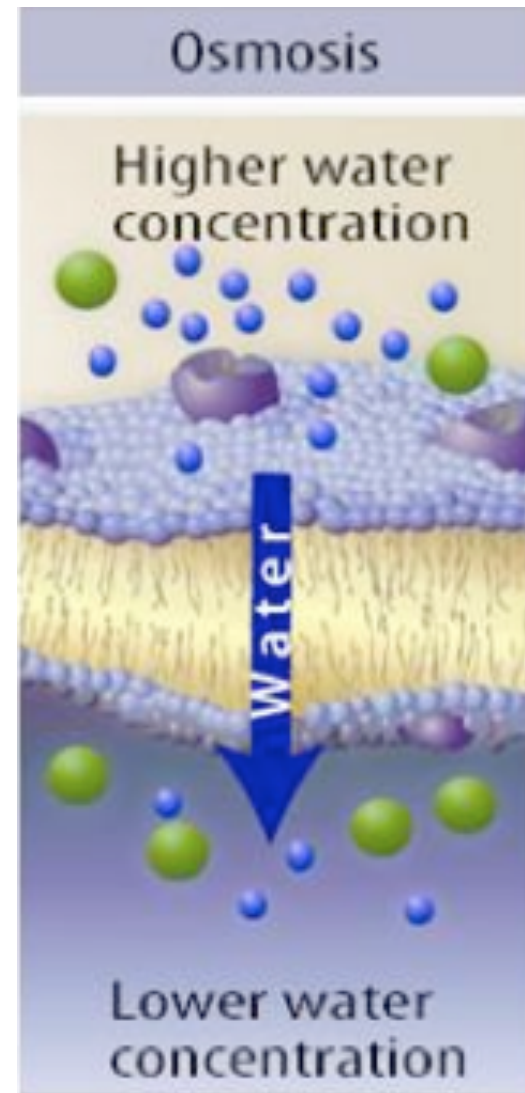
Simple Diffusion

- Movement of a substance from a high concentration to a low concentration (**NO energy** is needed)
- Only hydrophobic molecules can diffuse through the lipid bilayer on their own (charged ions need a protein channel to diffuse)



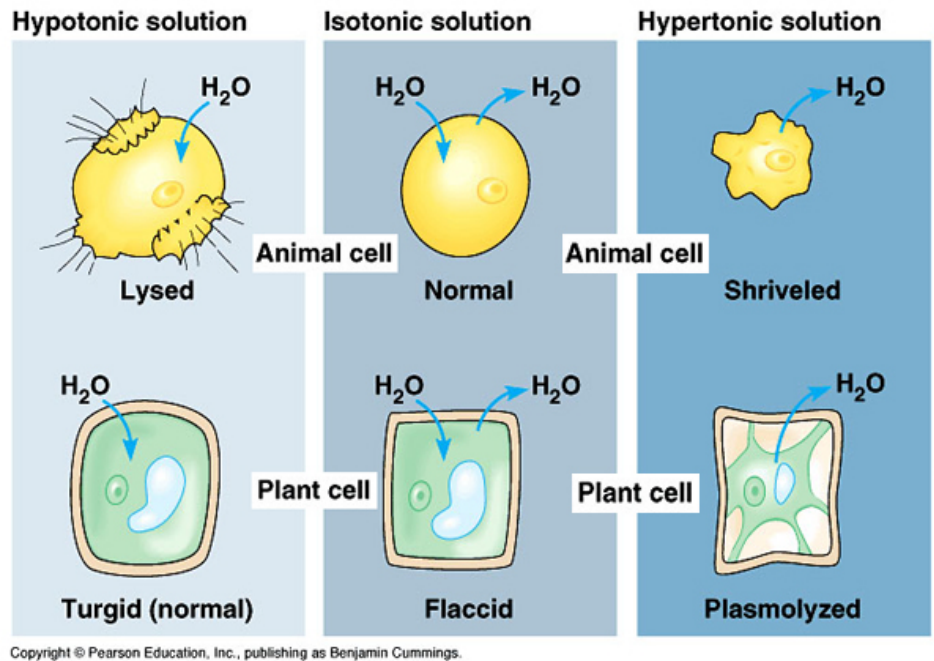
Osmosis

- Movement of **water** from a high water concentration to a low water concentration (**no energy** needed)



Different Concentrations of Extracellular Fluids

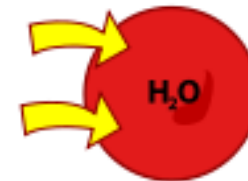
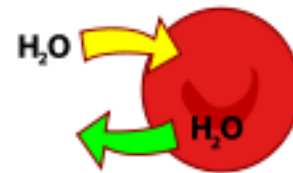
- Hypotonic - solution with a **lower solute concentration** than the cytoplasm of the cell
- Hypertonic - solution with a **higher solute concentration** than the cytoplasm of the cell
- Isotonic - has **same solute concentration** as the cytoplasm of the cell
- *A 0.9% NaCl solution is isotonic to human RBC*



Hypertonic

Isotonic

Hypotonic

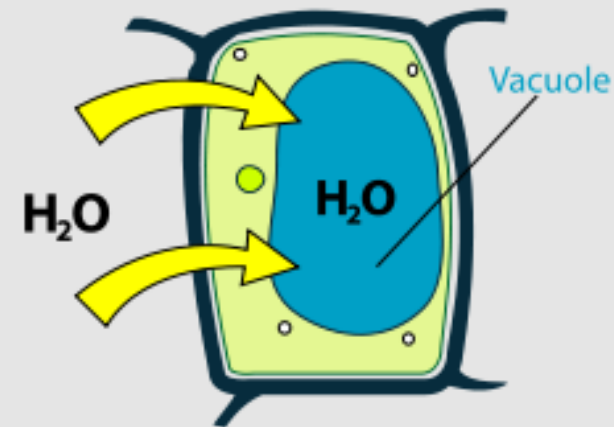
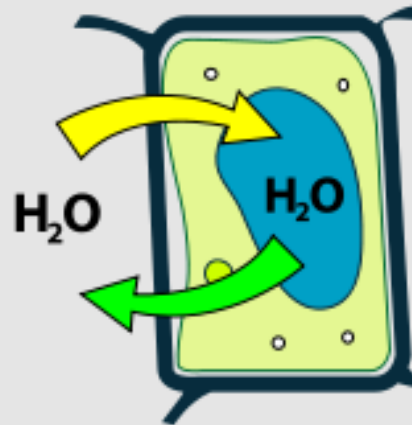
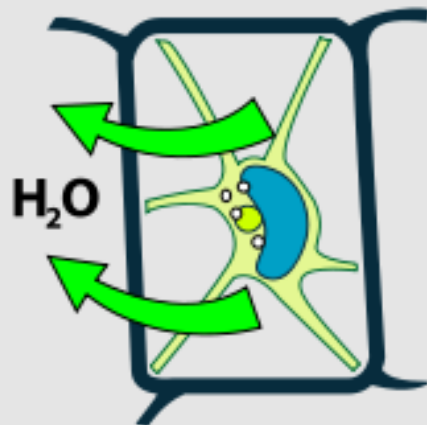
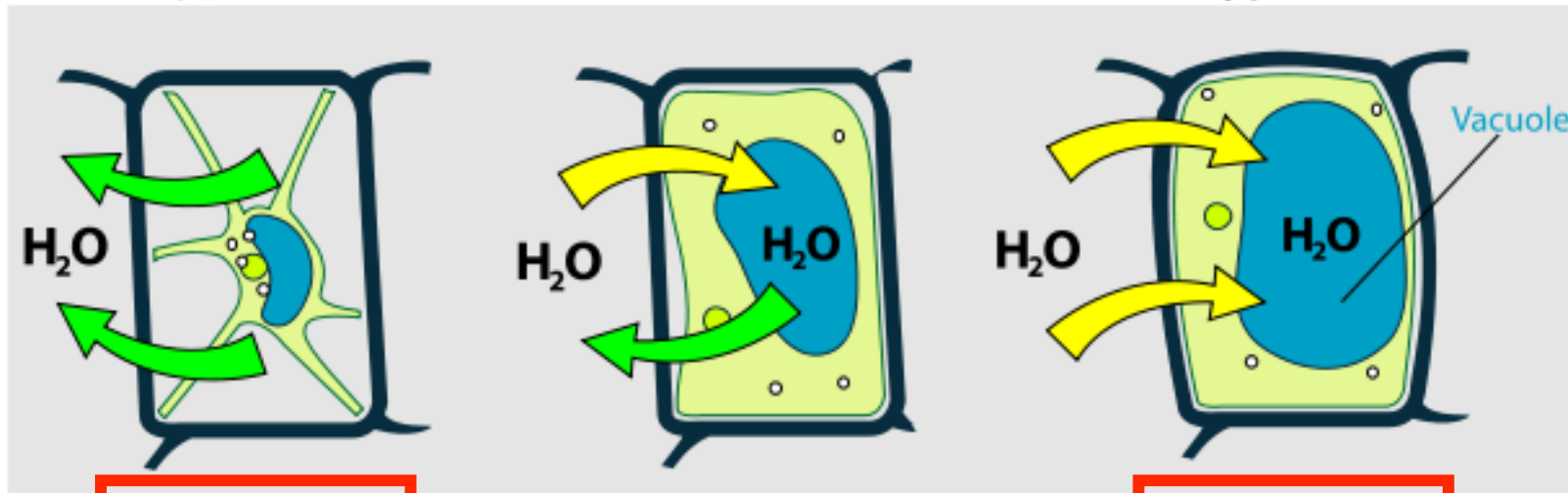


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Hypertonic

Isotonic

Hypotonic



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Plasmolyzed

Flaccid

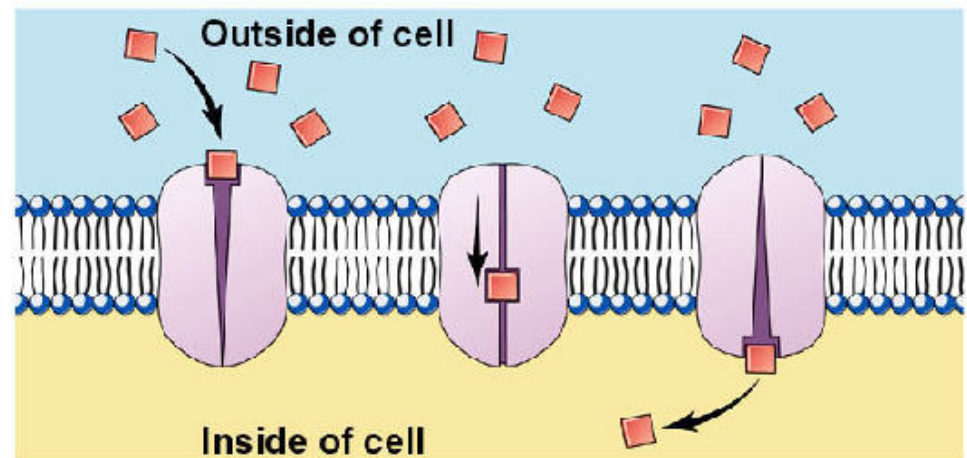
Turgid

Facilitated Diffusion

- Diffusion using membrane proteins (channel or carrier proteins) (**no energy** needed)
- Large polar molecules and ions must use protein channels since they cannot pass through the nonpolar lipid bilayer

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Facilitated Diffusion



- Turgor pressure - pressure (from water stored in the vacuole and cytosol) pushing against the cell wall of a plant (makes plant cells firm and causes herbaceous plants to stand upright)
- Plasmolysis - shrinking of the cytoplasm of a cell caused by the loss of water (causes plants to wilt due to loss of turgor pressure)

Active Transport

- Requires the input of energy to move a substance against its concentration gradient (low to high)
- Energy is used in the form of **ATP** (energy molecule produced in mitochondria)

