

Homeostasis and Transport

1: Diffusion and Osmosis

- **Homeostasis**: the biological balance between a cell or an organism and its environment
 - Cells maintain homeostasis by controlling and regulating what gets into and out of the cell.
- **Diffusion**: the process by which molecules move from an area of greater concentration to an area of lower concentration
 - Brownian Motion: molecules are in a constant state of random motion
 - Concentration Gradient: the difference in concentration of a substance across a space
 - Equilibrium: a state that exists when the concentration of a substance is the same throughout a space
 - Dynamic Equilibrium
- **Diffusion Across Membranes**
 - Permeable: referring to a membrane through which molecules can pass
 - Not all molecules can diffuse through all membranes.
 - The ability of a molecule to pass through a membrane depends on the size and type of molecule and the molecular structure of the membrane.
- **Osmosis**: the diffusion of water molecules through a selectively permeable membrane from an area of high water concentration to an area of lower water concentration
 - Osmotic Pressure: the pressure that exists in a cell
 - Tonicity: the term used to describe the osmotic environment of cells
 - Three Types of Solutions:
 - isotonic solution: a solution in which the concentration of dissolved substances is the same as the concentration inside the cell
 - The amount of water on both of the sides of the membrane is equal, so osmosis will not occur.
 - hypotonic solution: a solution in which the concentration of dissolved substances is lower than the concentration inside the cell
 - The amount of water in the solution is greater than the amount of water inside the cell. Water will enter the cell causing an increase in osmotic pressure.
 - hypertonic solution: solution in which the concentration of dissolved substances is higher than the concentration inside the cell
 - The amount of water in the solution is less than the amount of water inside the cell. Water will exit the cell causing a decrease in osmotic pressure.
 - Turgor Pressure: the force directed against a cell wall after the influx of water and the swelling of a plant cell due to osmosis
 - Plasmolysis: the shrinking or wilting of a plant cell from low turgor pressure
 - Cytolysis: the intake by an animal cell of so much water that it bursts
 - Contractile Vacuole: an organelle in microorganisms that excretes water
 - collect excess water → contract → squeeze out water

2: Other Kinds of Transport

- The structure of the cell membrane (hydrophilic and hydrophobic areas) ensures that molecules that dissolve in water do not automatically pass through. Mechanisms serve to ensure the passage of biologically important materials across the membrane.
- Carrier Molecule (permeases): a protein that functions in transport of molecules across a membrane

- In general, each carrier molecule is specialized to allow the movement of one type of molecule across the membrane.
- **Passive Transport**: the movement of any substance across a cell membrane without the use of cell energy
 - Diffusion
 - Osmosis
 - Facilitated Diffusion: a process in which substances move down their concentration gradient across the cell membrane with the assistance of carrier proteins
 - Example: glucose
 - Gated Channel: a protein-lined gated passage making cell membranes permeable to certain large molecules as needed
 - Example: neuromuscular function
- **Active Transport**: the movement of any substance across a cell membrane with the use of energy from ATP
 - Sodium-Potassium Pump: an active transport mechanism that moves ions in order to achieve polarization
 - Proton Pump: an active transport mechanism that consumes ATP (energy) to force Hydrogen ions against the concentration gradient
- **Endocytosis**: the process by which a cell engulfs and surrounds large substances
 - Pinocytosis: the movement into cells of solutes or fluids
 - Phagocytosis: the engulfing of large particles or whole cells (food) by a cell
- **Exocytosis**: the process by which wastes are packaged in vesicles and leave the cell