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Chpt 3, cont'd

Animal Physiology

Osmosis: movement of water from high to low concentrations.

Blood osmolarity is approximately 300mMols/L.

Know hypo, hyper, and Iso-tonic solutions. These are usually relative to the red blood cells they surround.

Tonicity is a comparism of cell volume when placed in a solution.

Plasmolysis - when cells explode from being in a hypotonic solution.

Crenation - when cell implode from being in a hypertonic solution.

Mediated transport: limited and substances being transported vary in size, polarity, solubility, etc. Thus large, poor lipid soluble molecules such as proteins, glucose and amino acids do not cross the plasma membrane on their own.

Three hallmarks of Mediated Transport.

Specificity

Competition

Saturation

1-Using carriers

Carrier mediated transport takes two forms. Facilitated diffusion and Active transport. All have specificity, competition, and saturation. However active transport requires energy in other to transport substances against their concentration gradient. Active transport can be either uniport or synport. A popular example of active transport is the Na+ K+ ATPASE Pump. 3 Mols of Na are pumped out from every 2 Mols of K pumped in. In a cell this creates a net positive charge in the cell and is also called an Electrogenic pump.

Vesicular transport: this is when vesicles are used as transport within the cell. Material is wrapped in a membrane and transported either into the cell or out of the cell.

Examples are phagocytosis & pinocytosis (collectively called Endocytosis), and exocytosis.

Endocytosis can decrease cell surface area where as exocytosis can increase cell surface area. This is called up and down regulation.

Transcytosis: when a molecule or substance is transported from one compartment of the cell to another incorporating both pinocytosis and exocytosis within the cell structure.

Intercellular Communication

-Gap junctions

-Surface signaling molecules (direct link, very popular in the gastrointestinal tract and cardiovascular system)

-Intercellular

A) Paracrine: one cell secretes and communicates with neighboring cell, in relatively short distances. The receiving cell must have the appropriate cell receptors. Another type is called Autocrine where a cell can secrete a chemical that affects itself.

B) Neurotransmitters: Chemical sent from a neuron and receiving cell must have the receptor in order to receive message. Electrical signal, very fast, very specific, and short range messengers.

C) Hormones: long range chemical messengers, released by endocrine glands/cells into the blood and only affect cells carrying the appropriate receptors. Some hormones affect the entire body while others only affect specific organs/cells.

D) Neurohormones: Secreted by nervous system, carried by the blood and affect a distal target tissue. Again, target tissue must have appropriate cellular receptors.

E) Pheromones: Secreted by certain organisms. Usually gives rise to innate responses such as finding a mate, food, distress signal to the hive (bees and wasps), etc.

F) Cytokines: can act both locally and long distances. Produced on demand and not generally stored. Can act as hormones or paracrines. Involved in development, immunization, and specialization.

Classification of chemical messengers

Eicosanoids

Gases

Purines

Amines

Peptides and Proteins

Steroids

Retinoids

First messengers may open a membrane channel. Such as a leaked or gated channel. Examples of first messengers are epinephrine and acetylcholine.

However, these first messengers that work out in the interstitial fluid triggers the action of a second messenger (via G protein which has three components) such as Calcium, potassium, etc that relay the signal into the cell.

Signal Transduction:

Involves a second messenger, a signal cascade, and signal amplification.

Ligan binds to receptor, receptor triggers internal cellular signal such as activating adenylyl cyclases, which amplifies the signal using cAMP, which in turn amplifies the signal throughout the cell.

Major ions responsible for membrane potential.

Na^+, K^+, and Anions. The cell membrane is 50-75 times more permeable to Potassium than it is to Sodium.

Membrane potential: sodium ions line up on the outside of the cell membrane while negatively charged proteins line up on the inside of the cell membrane balancing each other. However the membrane is more permeable to k^+ than Na^+, thus making these two ions the determining factors for establishing membrane potential. Though Na is being pulled in both directions, the net movement is moving into the cell. The presence of Cl^- ions outside of the cell pull Na ions, however, the inside of the cell more very negative and attracts some Na ions as well. Since Cl^- ions are balancing the Na ions outside the cell, it's concentration is usually about that of Na ions.

Equilibrium is when there is no difference in rate of exchange of ions across the membrane.