

HOMEOSTASIS AND THE PLASMA MEMBRANE

Objectives:

1. Explain how a cell's plasma membrane functions
2. Relate the function of the plasma membrane to the fluid mosaic model

I. Maintaining A Balance

- A. All organisms must adjust to changes in their environment in order to survive
- B. Living cells maintain a balance by controlling materials that enter and leave the cell
 1. Water
 2. Glucose
 3. Wastes
- C. Plasma membrane controls the passage of materials into and out of the cell
- D. By controlling the movement of materials, plasma membrane maintains homeostasis in a cell
- E. Selective Permeability
 1. Property of a membrane that allows some materials to pass through while keeping others out

2. Allows different cells to carry on different activities within the same organism
 - a. EXAMPLE-only nerve cells respond to a chemical that all cells are exposed to
 - b. Why? because the membrane of the nerve cell allows the chemicals to pass through; other cells' membranes do not

II. Structure of the Plasma Membrane

- A. Bilayer
- B. Each layer is a sheet of lipid molecules
- C. Protein molecules embedded (like raisins in a slice of bread)
- D. Makeup of the lipid bilayer
 1. Phospholipids
 - a. Tail- 2 fatty acids- nonpolar (insoluble in H₂O)
 - b. Head- a phosphate group- polar; soluble in H₂O
 - c. Consequences of this polar-nonpolar structure:
 - 1) In cells' watery environment, the phosphate end aligns toward the water
 - 2) forms 2 layers with the water-soluble end toward the outside of each layer
 - 3) Non-polar tails lie inside the bilayer

d. Fluid Mosaic Model

- 1) Within each layer- phospholipids molecules can move sideways through their layer
- 2) Different proteins are associated with the membranes of different organelles
- 3) This explains selective permeability
- 4) Organelles with this type of plasma membrane include nucleus, vacuoles, mitochondria, and chloroplasts

E. Saturated versus Unsaturated Fatty Acids

1. Phospholipids can be made up of saturated or unsaturated fatty acids
2. Why important?
 - a. Membranes with more unsaturated fatty acids are more fluid
 - b. Unsaturated fatty acids remain liquid at low temperatures
 - c. arctic animals like the caribou have unsaturated fatty acids in the cells in their legs and hooves- this allows their legs to drop to almost freezing and not be damaged by frost
3. Cholesterol in eukaryotic cells has the function of making the membrane more stable

F. The function of membrane proteins

1. Proteins carry out most of the functions of the membrane
2. Proteins extend through the bilayer and on both sides of the membrane
3. Proteins determine which particles may pass
4. Proteins may act as enzymes
5. Proteins act as markers to other chemicals- important in fighting disease- immune system can distinguish between your cells and those of an invading bacterium

Cellular Transport

Objectives:

1. Explain how the process of diffusion, passive transport, and active transport occur and why they are important to the cells
2. Predict the direction of diffusion of a dissolved substance

DIFFUSION

1. Brownian Motion: all particles, living and nonliving, move constantly in random patterns
2. Diffusion occurs when the random movement of molecules tends to even out the distribution of all- the overall (or net) movement is from areas of high concentration to areas of low concentration of substances (“with the concentration gradient”)
3. Dynamic Equilibrium- no further change, even though particles continue to move
4. diffusion across the plasma membrane- water, oxygen, nitrogen, carbon dioxide and a few other nonpolar molecules can diffuse directly across the plasma membrane

OSMOSIS

1. Diffusion of water across the plasma membrane- “with the concentration gradient”
2. Isotonic Solution- no osmosis occurs
3. Hypotonic Solution- osmosis will occur- water moves into the cell (results from a lower concentration of water outside the cell). Increases turgor pressure inside the cell
4. Hypertonic Solution- osmosis will occur- water moves out of the cell (results from higher concentration of water outside the cell). Results in plasmolysis (cell wilting)

PASSIVE TRANSPORT

1. No energy is used by the cell.
2. Materials include water, lipids, and lipid soluble materials (sugars & amino acids)
3. Transport proteins also move materials across the membrane by facilitated diffusion-
 - a. channel proteins
 - b. carrier proteins

ACTIVE TRANSPORT

1. Processes to move materials against a concentration gradient
2. Requires energy
3. Transport of large particles
 - a. Endocytosis
 - b. Exocytosis