

Homeostasis and Transport

Module A Anchor 4

Key Concepts:

- Buffers play an important role in maintaining homeostasis in organisms.
- To maintain homeostasis, unicellular organisms grow, respond to the environment, transform energy, and reproduce.
- The cells of multicellular organisms become specialized for particular tasks and communicate with one another to maintain homeostasis.
- All body systems work together to maintain homeostasis.
- Passive transport (including diffusion and osmosis) is the movement of materials across the cell membrane without cellular energy.
- The movement of materials against a concentration differences is known as active transport. Active transport requires energy.
- The structure of the cell membrane allows it to regulate movement of materials into and out of the cell. The structure also determines how materials move through the cell membrane.

Vocabulary:

Buffer	homeostasis	diffusion	isotonic
Hypertonic	hypotonic	facilitated diffusion	osmosis
Endocytosis	exocytosis	Concentration gradient	feedback mechanism
Plasma membrane	channel proteins	feedback inhibition	solute
Fluid mosaic model	equilibrium	multicellular	unicellular
Endoplasmic reticulum		Golgi apparatus	vesicle
vacuole			

Plasma Membrane and Organelles:

1. What is the phospholipid bilayer? How does the structure of a phospholipid relate to its function in plasma membranes?

2. What is the fluid mosaic model?

3. What are the basic parts of the fluid mosaic model of the plasma membrane? Describe each in terms of structure and function.

4. What is the function of the plasma membrane?

5. The cell membrane contains channels and pumps which help in transport. What are these materials made of?

- A. carbohydrate
- B. lipid
- C. Protein
- D. nucleic acid

6. Explain how each of the following organelles is involved in cell transport:
Vacuoles and vesicles –

Golgi apparatus –

Endoplasmic reticulum –

Cytoskeleton –

7. Explain the relationship between the endoplasmic reticulum and Golgi apparatus in terms of cell transport.

Transport Mechanisms:

1. How do passive and active transport differ?

2. List and describe the types of passive transport.

3. Why do some molecules require the use of protein channels, as in facilitated diffusion?

4. Diffusion occurs because:
 - A. molecules are attracted to one another
 - B. molecules constantly move and collide into one another
 - C. cellular energy forces molecules to collide with one another
 - D. cellular energy pumps molecules across the cell membrane

5. During diffusion, when the concentration of molecules on both sides of the membrane is equal, molecules will:
 - A. move across the membrane to the outside of the cell
 - B. stop moving across the membrane
 - C. continue to move across the membrane in both directions
 - D. move across the membrane to the inside of the cell

6. Explain equilibrium.

7. What is the relationship between diffusion and osmosis?

8. Compare and contrast hypertonic, hypotonic, and isotonic solutions.

9. Explain, in terms of osmosis, why a raisin placed in a cup of pure water overnight will puff up.

10. Two solutions are placed on either side of a selectively permeable membrane. The membrane is permeable to solute. There is a higher concentration of solute particles on the left side of the membrane. In which direction will the solute particles move? Why?

11. List and describe the types of active transport.

12. Compare and contrast endocytosis and exocytosis.

13. How do active transport and facilitate diffusion differ?

Homeostasis:

1. Which of the following activities is NOT a way for unicellular organisms to maintain homeostasis?

- A. reproduction
- B. growth
- C. cell specialization
- D. response to environment

2. Explain the relationship between multicellular organisms, cell specialization, and homeostasis.

3. What do unicellular organisms do to maintain homeostasis?

4. The contractile vacuole is an organelle found in paramecia, a group of single-celled organisms. Contractile vacuoles pump out fresh water that accumulates in the organisms by osmosis. Explain how this is an example of the way paramecia maintain homeostasis.

5. How do buffers help an organism to maintain homeostasis?

6. In what way are the characteristics of living things related to homeostasis?
Obtain and use materials:

Obtain and use energy:

Grow and develop:

Reproduce:

Respond to environment:

7. What is a feedback mechanism/feedback inhibition? What is the role of a feedback mechanism in maintaining homeostasis?

8. Briefly explain how animal body systems work together to maintain homeostasis.

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Plasma Membrane and Organelles:

1. What is the phospholipid bilayer? How does the structure of a phospholipid relate to its function in plasma membranes?

The phospholipid bilayer is a double layer of lipids which form into membranes. Phospholipids have a polar head and a nonpolar tail. The watery environment outside of cells causes the tails to turn in towards each other, forming a double layer.

2. What is the fluid mosaic model?

A mosaic is a piece of art comprised of many small tiles pieced together. A cell membrane is comprised of many smaller parts pieced together. It is fluid in that the pieces are not fixed, and can move around within the membrane.

3. What are the basic parts of the fluid mosaic model of the plasma membrane? Describe each in terms of structure and function.

Phospholipid bilayer – forms a barrier around the cell, controls movement into the cell

Carbohydrate markers – serve as chemical identifiers

Channels and pumps – function in transport of materials into and out of the cell

4. What is the function of the plasma membrane?

Controls the flow of substances into and out of the cell

5. The cell membrane contains channels and pumps which help in transport. What are these materials made of?

C. Protein

6. Explain how each of the following organelles is involved in cell transport:

Vacuoles and vesicles – store materials for transport

Golgi apparatus – modifies, stores, and packages molecules for storage or transport

Endoplasmic reticulum – assembles proteins and lipids

Cytoskeleton – transport

7. Explain the relationship between the endoplasmic reticulum and Golgi apparatus in terms of cell transport.

The ER makes the proteins and lipids, the Golgi modifies and stores them

Transport Mechanisms:

1. How do passive and active transport differ?

Active requires energy, passive does not.

2. List and describe the types of passive transport.

Diffusion – substances move from high to low concentration, passing directly through the membrane unassisted

Facilitated diffusion – substances move from high to low concentration, but cannot pass directly through the membrane, instead passing through protein channels

Osmosis – facilitated diffusion of water

3. Why do some molecules require the use of protein channels, as in facilitated diffusion?

Charged or large molecules do not dissolve well in the lipid interior of the phospholipid membrane. They therefore require the use of protein channels.

4. Diffusion occurs because:

B. molecules constantly move and collide into one another

5. During diffusion, when the concentration of molecules on both sides of the membrane is equal, molecules will:

C. continue to move across the membrane in both directions

6. Explain equilibrium.

In equilibrium, the concentration of solute:solvent is equal on both sides of the membrane. Molecules continue to move back and forth across the membrane in equal quantities.

7. What is the relationship between diffusion and osmosis?

Osmosis is a type of diffusion, specifically the facilitated diffusion of water.

8. Compare and contrast hypertonic, hypotonic, and isotonic solutions.

Hypertonic solutions have a greater solute concentration than the cell, causing water to move out of the cell

Hypotonic solutions have a lower concentration of solution than the cell, causing water to move in to the cell

Isotonic solutions have an equal concentration of solute inside and outside the cell, causing no net gain or loss of water

9. Explain, in terms of osmosis, why a raisin placed in a cup of pure water overnight will puff up.

The water is hypotonic to the raisin, causing water to move into the raisin.

10. Two solutions are placed on either side of a selectively permeable membrane. The membrane is permeable to solute. There is a higher concentration of solute particles on the left side of the membrane. In which direction will the solute particles move? Why?

The molecules will move to the right side until equilibrium is reached, then continue to move back and forth with no net change in concentration. This will occur because the membrane is soluble to solute, which will move from high to low concentration.

11. List and describe the types of active transport.

Molecular transport – small molecules move against the concentration gradient through pumps in the cell membrane

Bulk transport – exo- and endocytosis, large materials are moved in or out of the cell via vesicles.

12. Compare and contrast endocytosis and exocytosis.

In both instances, the item to be transported is in a vacuole which fuses with the cell membrane. In exocytosis, substances are moving out. In endocytosis, substances are moving in.

13. How do active transport and facilitated diffusion differ?

Both require protein channels or pumps. However, facilitated diffusion still moves substances from high to low concentration and does not require energy. Active transport moves from low to high concentration, requiring energy.

Homeostasis:

1. Which of the following activities is NOT a way for unicellular organisms to maintain homeostasis?

C. cell specialization

2. Explain the relationship between multicellular organisms, cell specialization, and homeostasis.

Multicellular organisms are large and complex; therefore, they require more complicated systems in order to maintain homeostasis. Multicellular organisms accomplish this by designating particular functions to particular cells. This allows different cells to work together to maintain homeostasis within a larger organism.

3. What do unicellular organisms do to maintain homeostasis?

Grow, respond to the environment, transform energy, and reproduce.

4. The contractile vacuole is an organelle found in paramecia, a group of single-celled organisms. Contractile vacuoles pump out fresh water that accumulates in the organisms by osmosis. Explain how this is an example of the way paramecia maintain homeostasis.

One way in which an organism can NOT maintain a stable environment is through excessive water intake. Water constantly moves from high to low concentration, thus it is constantly moving into the aquatic amoeba. The amoeba pumps the water back out to ensure that water concentrations remain stable.

5. How do buffers help an organism to maintain homeostasis?

Prevent rapid changes in pH.

6. In what way are the characteristics of living things related to homeostasis?

Obtain and use materials:

Obtain materials necessary for life processes

Obtain and use energy:

Energy is required for all cell activities

Grow and develop:

Can develop such things as multicellularity

Reproduce:

Reduces size in unicellular organisms

Respond to environment:

Can obtain needed materials or move from those which threaten to destabilize their internal conditions

7. What is a feedback mechanism/feedback inhibition? What is the role of a feedback mechanism in maintaining homeostasis?

Process in which a stimulus produces a response that opposes the original stimulus. The feedback mechanism corrects the issue which destabilized the internal environment of the organism.

8. Briefly explain how animal body systems work together to maintain homeostasis.

Nervous system – recognizes and coordinates the body's responses to changes in internal and external environments

Integumentary system - regulates temperature

Immune/lymphatic system – protects body from disease, maintains fluid balance in circulatory system

Muscular system – moves blood and food

Circulatory system – transports oxygen, nutrients, and hormones to cells, removes wastes, fights infection, helps regulate temperature

Respiratory system – brings in oxygen and removes excess carbon dioxide

Digestive system – breaks down food, absorbs nutrients, eliminates wastes

Endocrine system – controls growth, development, and metabolism; maintains homeostasis