LECTURE 5 – Membranes & Transport

QUESTIONS TO TRY FOR PRACTICE

1) Critical Reading

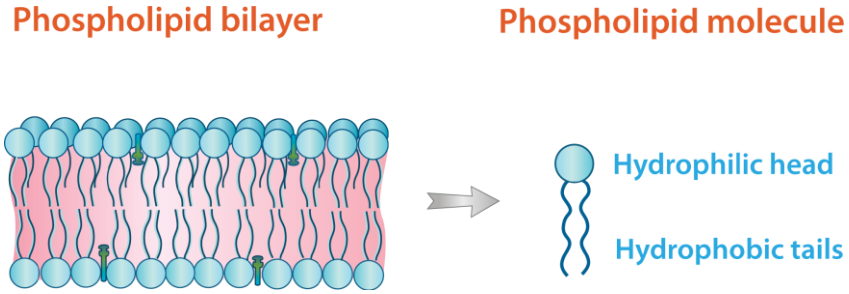
Read these passages from the text and answer the questions that follow.

Plasma Membrane

The plasma membrane forms a barrier between the cytoplasm inside the cell and the environment outside the cell. It protects and supports the cell and also controls everything that enters and leaves the cell. It allows only certain substances to pass through, while keeping others in or out. The ability to allow only certain molecules in or out of the cell is referred to as selective permeability or semi permeability. To understand how the plasma membrane controls what crosses into or out of the cell, you need to know its composition.

Phospholipid Bilayer

The plasma membrane is composed mainly of phospholipids, which consist of fatty acids and alcohol. The phospholipids in the plasma membrane are arranged in two layers, called a phospholipid bilayer. As shown in the figure below, each phospholipid molecule has a head and two tails. The head "loves" water (hydrophilic) and the tails "hate" water (hydrophobic). The water-hating tails are on the interior of the membrane, whereas the water-loving heads point outwards, toward either the cytoplasm or the fluid that surrounds the cell. Molecules that are hydrophobic can easily pass through the plasma membrane, if they are small enough, because they are water-hating like the interior of the membrane. Molecules that are hydrophilic, on the other hand, cannot pass through the plasma membrane — at least not without help — because they are water-loving like the exterior of the membrane.



The phospholipid bilayer consists of two layers of phospholipids (left), with a hydrophobic, or water-hating, interior and a hydrophilic, or water-loving, exterior. A single phospholipid molecule is depicted on the right. *(Image courtesy of CK-12 Foundation and under the Creative Commons license CC-BY-NC-SA 3.0.)*

Other Molecules in the Plasma Membrane

The plasma membrane also contains other molecules, primarily other lipids and proteins. The green molecules in the figure above, for example, are the lipid cholesterol. Molecules of cholesterol help the plasma membrane keep its shape. Many of the proteins in the plasma membrane assist other substances in crossing the membrane.

Extensions of the Plasma Membrane

The plasma membrane may have extensions, such as whip-like flagella or brush-like cilia. In single-celled organisms, the membrane extensions may help the organisms move. In multicellular organisms, the extensions have other functions. For example, the cilia on human lung cells sweep foreign particles and mucus toward the mouth and nose.

Questions

1. What is the plasma membrane?
2. What is the meaning of *semi permeability*?
3. Discuss why the plasma membrane must be a bilayer.
4. What are some of the "other" molecules in the plasma membrane? Describe their function.
5. What are cilia and flagella?

2) True or False

Write true if the statement is true or false if the statement is false.

_____1. Passive transport needs energy.

_____2. Active transport needs energy.

_____3. Carrier proteins change shape when they transport substances.

_____4. Diffusion does not require any help from other molecules.

_____5. Facilitated diffusion does not require any help from other molecules.

_____6. Endocytosis removes large molecules from the cell.

_____7. In diffusion, substances move from an area of lower concentration to an area of higher concentration.

_____8. The sodium-potassium pump is a type of channel protein.

_____9. Ions can easily flow through a carrier protein.

_____10. Diffusion is the osmosis of water.

_____11. Endocytosis and exocytosis are types of vesicle transport.

_____12. Channel proteins form small "holes" in the plasma membrane.

_____13. Transport of substances across the cell membrane helps maintain homeostasis by keeping the cell's conditions within normal ranges.

_____14. Channel proteins and carrier proteins are both transport proteins.

_____15. The plasma membrane controls what enters and leaves the cell.

3) Critical Reading

Read these passages from the text and answer the questions that follow.

Passive Transport

Passive transport occurs when substances cross the plasma membrane without any input of energy from the cell. No energy is needed because the substances are moving from an area where they have a higher concentration to an area where they have a lower concentration. Concentration refers to the number of particles of a substance per unit of volume. The more particles of a substance in a given volume, the higher the concentration. A substance always moves from an area where it is more concentrated to an area where it is less concentrated. It's a little like a ball rolling down a hill. It goes by itself without any input of extra energy.

Simple Diffusion

Diffusion is the movement of a substance across a membrane, due to a difference in concentration, without any help from other molecules. The substance simply moves from the side of the membrane where it is more concentrated to the side where it is less concentrated. Substances that can squeeze between the lipid molecules in the plasma membrane by simple diffusion are generally very small, hydrophobic molecules, such as molecules of oxygen and carbon dioxide.

Osmosis

Osmosis is a special type of diffusion — the diffusion of water molecules across a membrane. Like other molecules, water moves from an area of higher concentration to an area of lower concentration. Water moves in or out of a cell until its concentration is the same on both sides of the plasma membrane.

Facilitated Diffusion

Water and many other substances cannot simply diffuse across a membrane. Hydrophilic molecules, charged ions, and relatively large molecules, such as glucose, all need help with diffusion. The help comes from special proteins in the membrane known as **transport proteins**. Diffusion with the help of transport proteins is called **facilitated diffusion**. There are several types of transport proteins, including channel proteins and carrier proteins.

- Channel proteins form pores, or tiny holes, in the membrane. This allows water molecules and small ions to pass through the membrane without coming into contact with the hydrophobic tails of the lipid molecules in the interior of the membrane.
- Carrier proteins bind with specific ions or molecules, and in doing so, they change shape. As carrier proteins change shape, they carry the ions or molecules across the membrane.

Questions

1. Explain why passive transport does not require energy.
2. What is a main difference between diffusion and facilitated diffusion?
3. Describe how simple diffusion proceeds. What kind of molecules can move across the membrane by simple diffusion?
4. How is water transported across the membrane?
5. What are the two types of transport proteins? Describe how they function.

4) Multiple Choice

1. Controlling what enters and leaves the cell in an important function of the
   (a) nucleus.
   (b) vesicle.
   (c) plasma membrane.
   (d) Golgi apparatus.
2. During diffusion, substances move from an area of _____concentration to an area of _____concentration.
   (a) higher, lower
   (b) lower, higher
   (c) higher, equal
   (d) lower, equal
3. A channel protein does which of the following?
   (a) Carries ions or molecules across the membrane.
   (b) Forms tiny holes in the membrane.
   (c) Changes shape as it transports molecules.
   (d) all of the above
4. The sodium-potassium pump
   (a) uses energy to move sodium ions out of the cell and potassium ions into the cell.
   (b) uses energy to move potassium ions out of the cell and sodium ions into the cell.
   (c) moves sodium ions out of the cell and potassium ions into the cell without using energy.
   (d) moves potassium ions out of the cell and sodium ions into the cell without using energy.
5. Osmosis
   (a) is the diffusion of water.
   (b) is the diffusion of water and other small molecules.
   (c) is the diffusion of water and small ions.
   (d) is the diffusion of small molecules and ions.
6. Types of passive transport include which of the following? (1) simple diffusion, (2) osmosis, (3) facilitated diffusion, (4) active transport, and (5) vesicle transport.
   (a) 1 and 2
   (b) 1, 2, and 3
   (c) 4 and 5
   (d) 1, 2, 3, 4, and 5
7. Endocytosis and exocytosis
   (a) are both a type of vesicle transport.
   (b) move very large molecules either in or out of the cell.
   (c) are both a form of active transport.
   (d) all of the above

8. Which of the following needs energy?

(1) passive transport, (2) active transport, (3) exocytosis, and (4) osmosis.

(a) 1 only

(b) 2 only

(c) 2 and 3

(d) 2, 3, and 4

5) Vocabulary I

Match the vocabulary word with the proper definition.

Definitions

_____1. transport across a membrane without any additional energy requirement

_____2. the diffusion of water

_____3. type of vesicle transport that moves a substance into the cell

_____4. type of vesicle transport that moves a substance out of the cell

_____5. special proteins in the membrane that aid diffusion

_____6. membrane protein that forms a small hole that allows ions to pass through

_____7. an active transport protein

_____8. diffusion with the help of transport proteins

_____9. the movement of a substance across a membrane without any help from other molecules

_____10. the transport of very large molecules, such as proteins

_____11. transport across a membrane in which energy is required

Terms

a. active transport

b. channel protein

c. diffusion

d. endocytosis

e. exocytosis

f. facilitated diffusion

g. osmosis

h. passive transport

i. sodium-potassium pump

j. transport protein

k. vesicle transport

6) Vocabulary II

Name_____**Class**_____**Date**_____

Fill in the blank with the appropriate term.

1. By moving substances into and out of cells, _____, the process of keeping stable conditions inside a cell, is maintained.
2. A _____protein changes shape as it carries ions or molecules across the membrane.
3. Exocytosis is the type of _____transport that moves a substance out of the cell.
4. _____transport is movement across the plasma membrane that does not require an input of energy.
5. The sodium-potassium _____is involved in the active-transport of ions.
6. Facilitated diffusion needs the help of _____proteins
7. _____refers to the number of particles of a substance per unit of volume.
8. _____is the type of vesicle transport that moves a substance into the cell.
9. Energy for active transport is supplied by molecules of _____.
10. _____is the diffusion of water.
11. During active transport, a substance is moving from an area of _____concentration to an area of _____concentration.
12. Moving molecules in and out of the cell is an important role of the _____.

7) Critical Writing

Thoroughly answer the question below.
Use appropriate academic vocabulary and clear and complete sentences.

"Discuss passive and active transport. Describe the main differences between these two types of transport, and provide examples of each type"