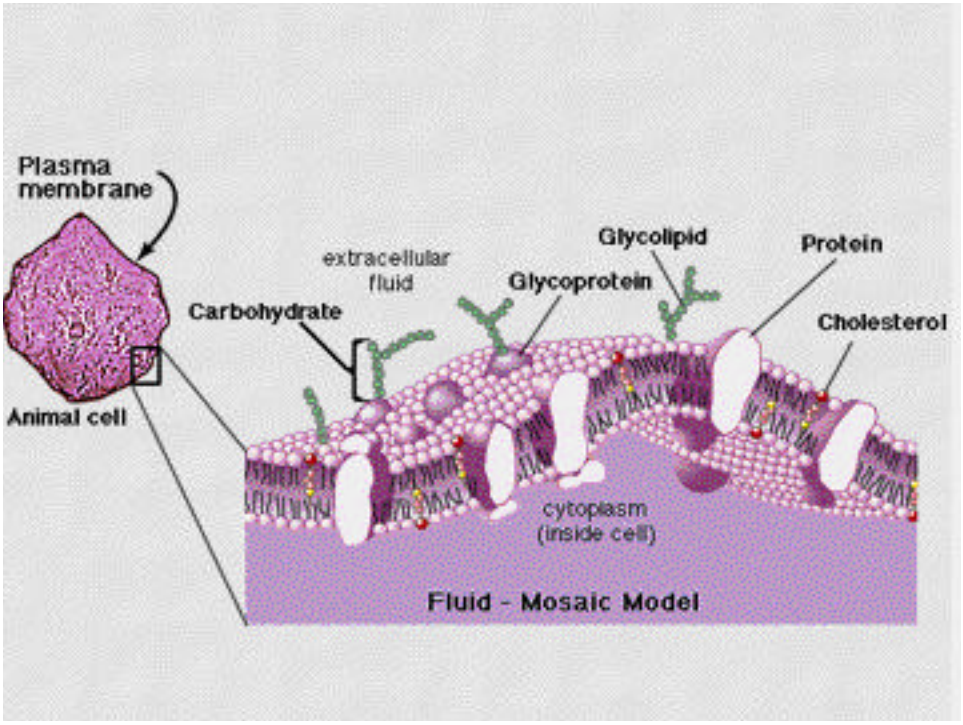
Interactive Biology Multimedia Courseware

The Plasma Membrane & Cellular Transport
Program Supplement



The Plasma Membrane and Cellular Transport
TEACHING OBJECTIVES

The following subject areas are illustrated throughout the *Interactive Biology Multimedia Courseware* program, *The Plasma Membrane and Cellular Transport*. Ideally, these areas would be augmented with additional course work outside of this program. *(Click on a subject to jump ahead.)*

- **Function and structure of the plasma membrane:** Focusing on the phospholipid bilayer and the fluid-mosaic model.

- **Movement of molecules across the plasma membrane - Passive Transport:** Including the concepts of diffusion, osmosis, concentration gradients and facilitated diffusion.

- **Movement of molecules across the plasma membrane - Active Transport:** Examining active transport and receptor-mediated endocytosis.

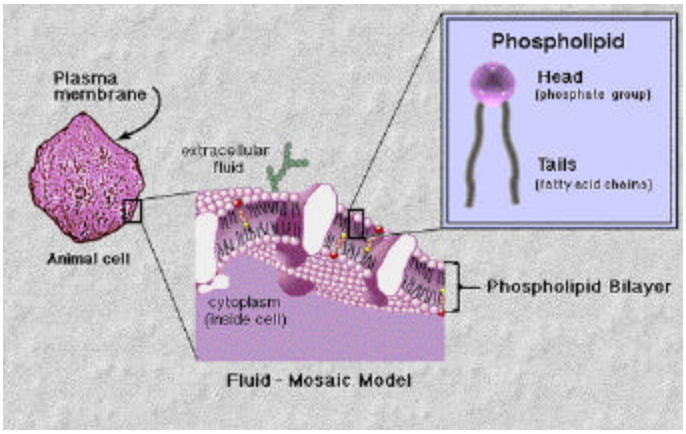
Study Guide #1
FUNCTION AND STRUCTURE OF THE PLASMA MEMBRANE

Phospholipid Bilayer

Perhaps you have read that the cell is the basic unit of life. What do biologist means by this? They mean that all living things are comprised of one or more cells.

Every cell is surrounded by a structure known as a plasma membrane. This plasma membrane is a barrier that separates a cell from its outside environment. If you take one of the approximately 3 trillion cells in your body and compare it to a bacterial cell, you will find both have plasma membranes that are remarkably similar.

The main function of a plasma membrane is to control what enters and what exits a cell. That is, it keeps certain substances inside and other substances on the outside. This function is critical. If needed molecules (such as those used in protein synthesis) were free to leave, then death of the cell would quickly occur.



To understand how a cell controls what enters and what exits, you must examine the structure of its plasma membrane.

The plasma membrane is comprised of a phospholipid bilayer. That is, it is made of two layers of phospholipid molecules. These phospholipids have two main components. One component is a head, which contains a polar phosphate group. The second component is a pair of tails made up of nonpolar fatty acid chains.

A polar molecule is one that is water-soluble. Often it is called a hydrophilic or "water-loving" molecule.

A nonpolar molecule is one that is water insoluble. Often it is called a hydrophobic or "water-hating" molecule. It is this dual nature of phospholipids (being both water-loving and at the same time-water hating) that leads to their alignment into bilayers. The environment inside and outside of cells is mostly water. The heads seek this water and the tails try to avoid it. In doing so, the phospholipid molecules arrange themselves as sheets, or layers, facing opposite directions. One layer has its heads facing the water on the outside of the cell. The second layer has

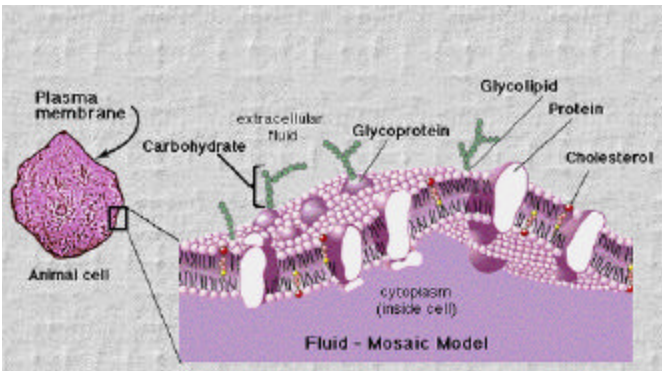
its polar (water-loving) heads facing the interior of the cell. In this arrangement, all nonpolar (water-hating) tails are in the center of the bilayer where their exposure to water is minimal. Through this bilayer, a cell maintains a continuous barrier between its internal environment and the outside world.

Study Guide #2
FUNCTION AND STRUCTURE OF THE PLASMA MEMBRANE

Fluid Mosaic Model

Phospholipids make up a great deal of the plasma membrane, however, they are not its only components.

Many protein molecules are also embedded in the plasma membrane. Some of these molecules extend completely through the bilayer while others are found only on the inside or outside layer of the membrane. A little later, we'll get to the vital role protein plays in moving larger molecules into or out of the cell.



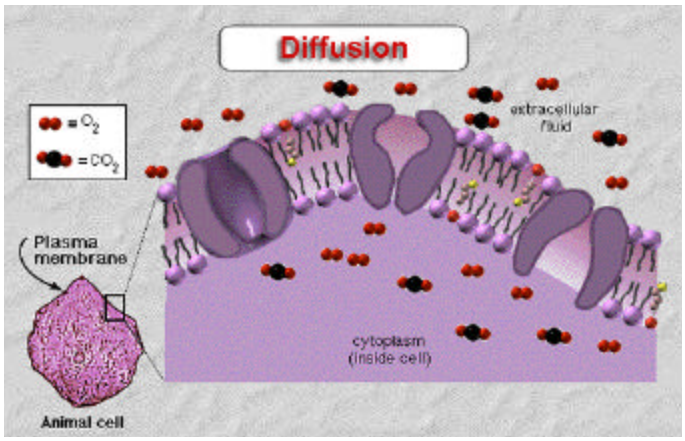
Attached to some of the proteins and lipids on the outside layer of the membrane are sugar, or carbohydrate, molecules. Proteins with a sugar molecule attached are called glycoproteins. Lipids with a sugar molecule attached are called glycolipids. These sugar molecules give a cell a specific look or signature that other cells don't have. For instance, cells in your immune system look at glycolipids and glycoproteins to determine if a cell is part of your body or a foreign invader. A bacterial cell will have different sugar molecules on its membrane than you do.

Also found in the plasma membrane are cholesterol molecules. Cholesterol helps control how rigid a membrane is. Together, phospholipid, protein, cholesterol, and carbohydrate molecules make up the plasma membrane. The large number of different molecules gives the membrane a mosaic look. These components are not anchored to a specific point in the membrane however. They are free to move about. The phospholipids are small and move around very quickly. The proteins are larger and slower, but many of them move around the membrane as well. This constant movement of different molecules lead biologist to adopt the term fluid-mosaic model when describing the plasma membrane.

Study Guide #3
MOVEMENT OF MOLECULES ACROSS THE PLASMA MEMBRANE

Diffusion

The environment inside of a cell must remain stable for that cell to survive. This maintenance of stable internal conditions is known as cellular homeostasis.



A cell maintains its internal conditions in part by the plasma membrane allowing certain molecules to cross into the cell and certain molecules to cross out of the cell.

Some small molecules can easily enter or exit the cell. Other molecules are not able to enter or exit the cell at all. This ability of the plasma membrane to allow certain molecules to cross and other to not cross makes it a selectively permeable membrane.

Small molecules such as water, oxygen, and carbon dioxide cross the plasma membrane through diffusion. Diffusion relies on molecules moving freely, rather than the cell physically moving them, and is referred to as passive transport.

In diffusion, molecules move along a concentration gradient. A concentration gradient simply means that there are more molecules of a certain type found in one area than in another area. These molecules then move from where many are found (high concentration) to the area where less of these molecules are found (low concentration).

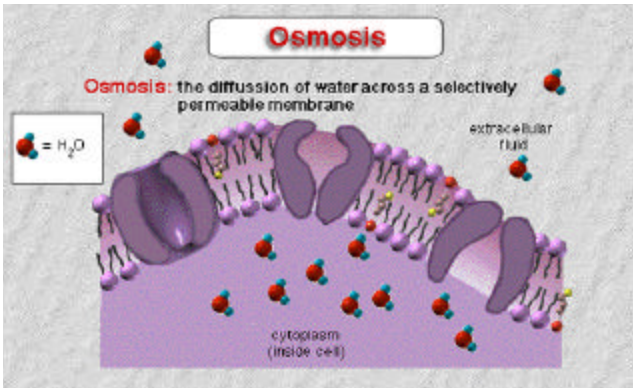
You have seen a concentration gradient in action if you have ever put a drop of food coloring into a glass of water. For an instant, the food color molecules stay grouped together near the surface of the water. Slowly, they begin to spread out, or diffuse, into the rest of the water in the glass. Finally, they are spread out evenly throughout the glass. They have moved from an area of high concentration - one compact drop of colored molecules - into an area of low concentration- the water in the glass with no food color molecules. You will not come back to find the food coloring packed together tightly into one drop. Why? Because that would be diffusion against a concentration gradient.

Diffusion across a plasma membrane also relies on a concentration gradient. For instance, cells are constantly using up the oxygen molecules inside of them. This decreases the amount of oxygen found here. In the blood stream outside of cells, there is a high concentration of oxygen molecules. Which way will oxygen move under these conditions? They move along the concentration gradient from the blood stream and into the cells.

Conversely, carbon dioxide (CO_2) builds up inside of cells. The level of CO_2 is lower in the blood stream. Under these conditions, CO_2 moves out of cells and into the blood, where it is transported to the lungs and expelled from the body.

Study Guide #4
MOVEMENT OF MOLECULES ACROSS THE PLASMA MEMBRANE

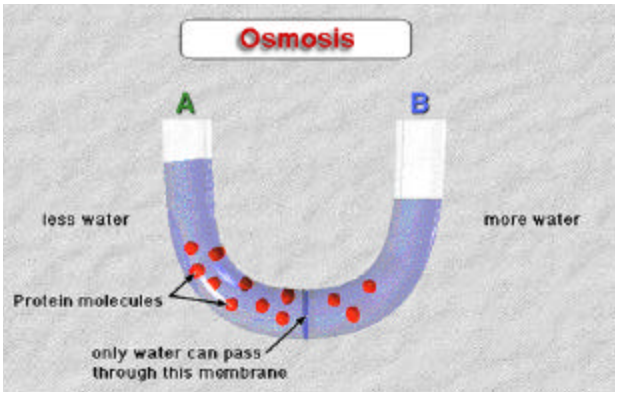
Osmosis



As you learned in the previous study guide, water is one of the molecules small enough to cross the plasma membrane through diffusion. This diffusion of water across a membrane is called osmosis.

Picture a cup filled with sugar. Picture the same sized cup half-filled with sugar and half-filled with salt. Which one has the highest concentration of sugar? The first one does. It is pure sugar. The second cup has a sugar concentration that is only half that of the first cup.

Now picture a selectively permeable membrane separating two compartments. On one side of the membrane are many protein molecules too large to pass through to the other side. On the other side of the membrane are no protein molecules. On both sides of the membrane, water.



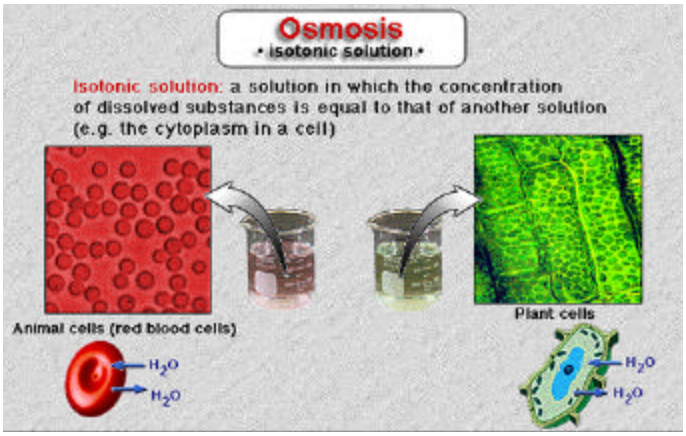
On the side of the membrane with no protein molecules is pure water. Therefore, the concentration of water on this side is high. On the side of the membrane with many protein molecules, water is also found. Since this is a mixture of protein and water, the concentration of water is lower here than on the other side of the membrane.

Which direction is water going to flow through this selectively permeable membrane? Water will flow from high concentration to low concentration, and will therefore flow toward the side containing the protein molecules. The build up of water on this side of the membrane will also increase the water pressure. This increase in water pressure due to osmosis is called osmotic pressure.

Study Guide #5
MOVEMENT OF MOLECULES ACROSS THE PLASMA MEMBRANE

Isotonic, Hypotonic, and Hypertonic Solutions

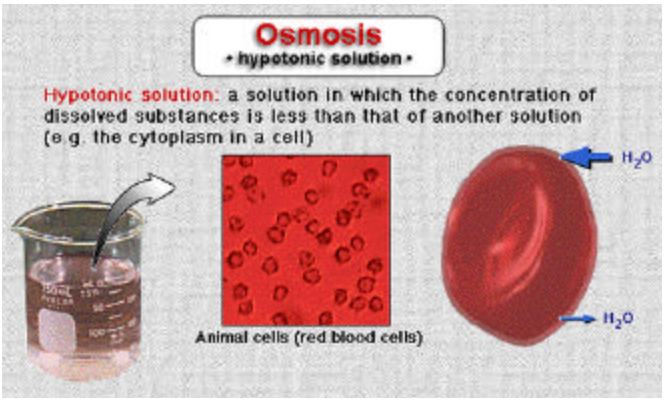
In the last study guide, you learned about the movement of water across a selectively permeable membrane.



Go back to your mental image of the two compartments separated by a permeable membrane. If both compartments have the same concentration of water, they are said to contain isotonic solutions. If the two solutions are isotonic, water will move back and forth between them. However, there will be no net movement of water. As much water moves into one compartment as moves into the second.

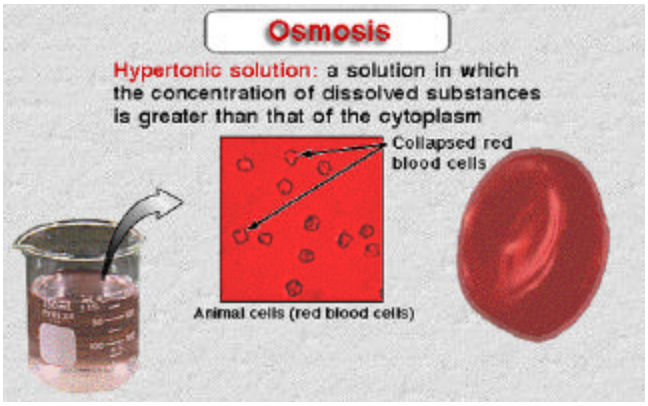
If one compartment has protein molecules dissolved into the water and the second doesn't, a concentration gradient exists. In this situation, the compartment with solutes (protein molecules) in the water is a hypertonic solution. The compartment without solutes in the water is called a hypotonic solution.

If a cell, such as one from the leaf of a plant or a red blood cell, is placed into a beaker of water, several things can happen. Two solutions are involved here. One is the water found in the beaker and the second is the water component, or cytoplasm, found inside the cell.

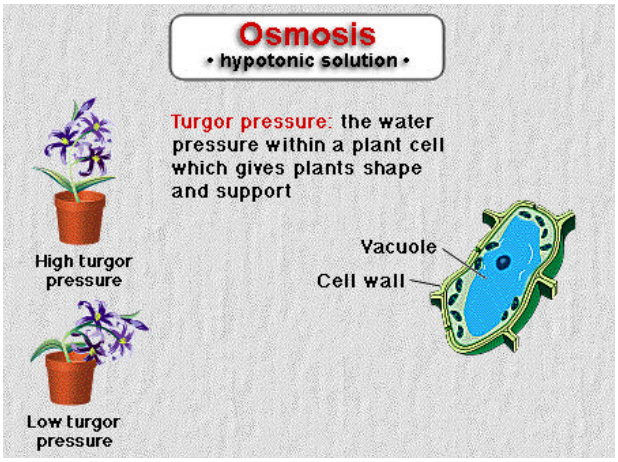


If one of the cells is placed into a beaker containing an isotonic solution, water will flow equally into and out of the cell. The concentration of water is the same in both solutions.

If one of the cells is placed into a beaker containing a hypertonic solution, then water will flow out of the cell and into the beaker. There is a higher concentration of water inside the cell. Shrinking of a cell's cytoplasm by osmosis is plasmolysis. The loss of water pressure inside of a plant cell is referred to as a loss of turgor pressure.



If the cell is placed into a beaker containing a hypotonic solution, water will flow INTO the cell. There is a higher concentration of water in the solution filling the beaker than is found inside the cell. In plant cells, water entering the cell is collected in a structure called a vacuole. As the vacuole fills, it increases the turgor pressure inside the plant cell. If the solution in the beaker is much more hypotonic than the cytoplasm of a cell, so much water can flow into the cell that it may rupture.



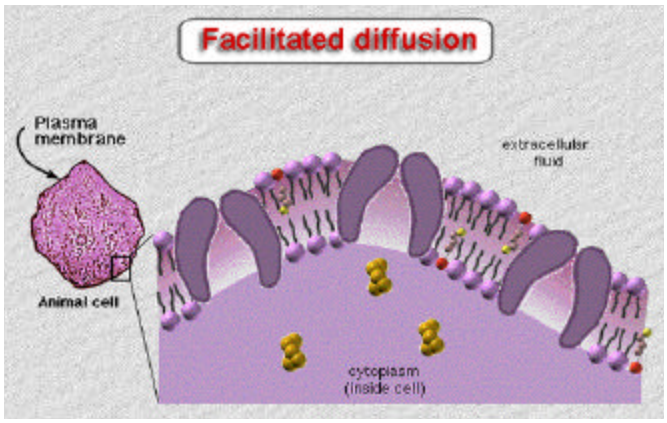
Study Guide #6
MOVEMENT OF MOLECULES ACROSS THE PLASMA MEMBRANE

Facilitated Diffusion

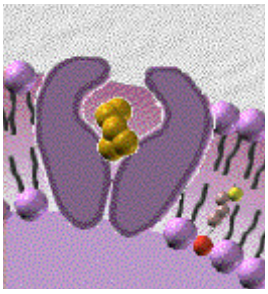
A concentration gradient and a selectively permeable plasma membrane can move small molecules into and out of a cell. Other, larger molecules require something beside passive transport to enter and exit cells.

Cells need many molecules that are too large to cross their membrane. They also need to rid themselves of large waste molecules. One of the methods used by cells to overcome this obstacle is facilitated diffusion.

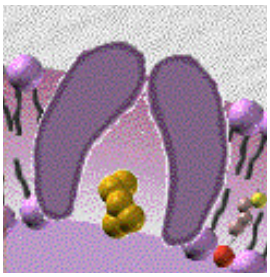
Recall that part of the cell's plasma membrane is composed of protein molecules. Some of these are transport proteins.



Transport proteins have a very specific shape. One portion of these proteins resembles a large molecule that the cell needs to move across its plasma membrane. For instance, cells rely on glucose molecules to provide energy, but glucose is too large to move across the membrane on its own. Some proteins on the cell membrane have a portion that very closely resembles a glucose molecule. Glucose molecules fit extremely well into this site.



Glucose in the blood flows past the surface of cells. Some of this glucose binds with glucose transport proteins. After the protein has bound a glucose molecule, the protein then releases the glucose into the cell's cytoplasm.



Since cells are constantly using up their glucose stores, the concentration of glucose is lower inside of them than it is in the blood found outside. Glucose therefore moves with the concentration gradient (from high to low) and the cell does not have to expend any energy in transporting it across.

Transport proteins are specific for only certain substances. For example, glucose transport proteins cannot bind insulin molecules. Each large substance the

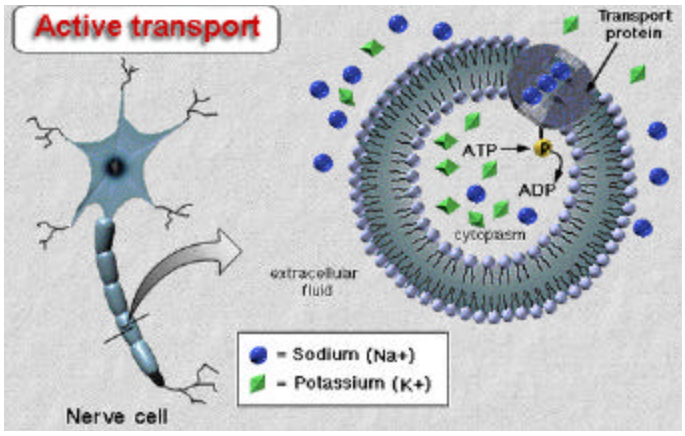
cell needs will have specifically shaped proteins responsible for binding it and moving that substance across the membrane.

Study Guide #7
MOVEMENT OF MOLECULES ACROSS THE PLASMA MEMBRANE

Active Transport

Sometimes, a cell must move large substances against the concentration gradient. In doing so, the cell must expend energy. The movement of substances across the plasma membrane through the use of cellular energy is called active transport.

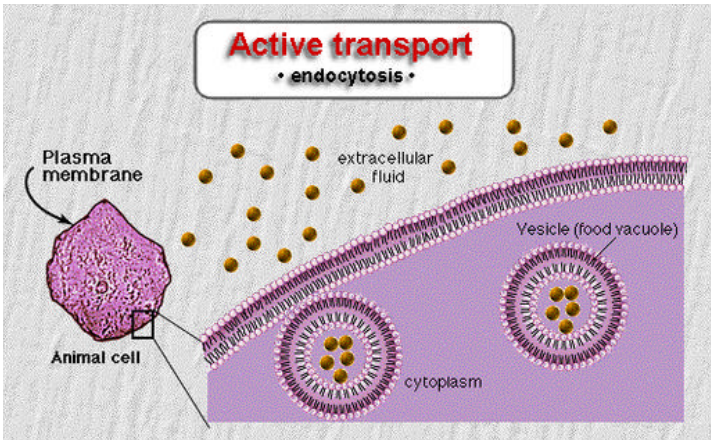
One type of active transport is much like facilitated transport. Both methods rely upon transport proteins binding to needed substances and moving them across the membrane. The major difference is cellular energy, in the form of ATP, being used in active transport. In carrying out active transport, the cell establishes conditions inside of itself that are chemically different than the solution outside.



In nerve cells, the concentration of potassium is higher inside the cell than in the fluid surrounding it.

In nerve cells, the concentration of sodium is lower inside the cell than in the fluid surrounding it.

To maintain these differences, nerve cells use what is called a sodium-potassium PUMP to move potassium to the inside and move sodium to the outside. Both of these chemicals move against the concentration gradient. Without the ability to move sodium and potassium by active transport, nerve cells could not function.

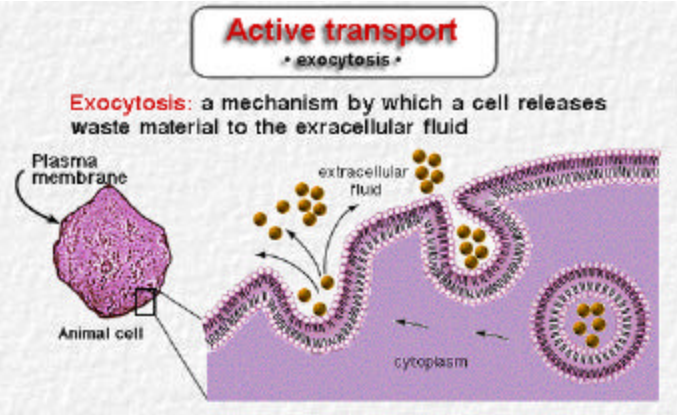


A second method of active transport is called endocytosis. In endocytosis, cellular ATP is again used to move substances.

Endocytosis is a way some cells move food

particles inside. In endocytosis, the cell membrane forms a vesicle or food vacuole, which surrounds substances. This vesicle then pinches off on the inside of the cell. To visualize this, imagine pushing a BB into the side of a balloon. If you push far enough, the wall of the balloon completely surrounds the BB, forming something similar to a vesicle.

Once inside the cell, the vesicle containing food particles fuses with a lysosome. A lysosome is a vacuole filled with digestive enzymes. These enzymes dissolve the food particles on contact, which results in them breaking down into small molecules the cell can utilize.



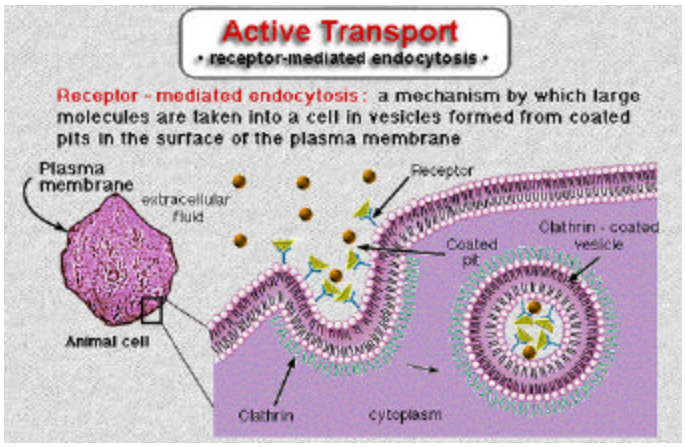
The reverse of endocytosis is a process called exocytosis. Exocytosis takes large waste molecules, forms a vacuole around them, and releases them to the outside by fusing this vacuole with the plasma membrane.

Study Guide #8
MOVEMENT OF MOLECULES ACROSS THE PLASMA MEMBRANE

Receptor-Mediated Endocytosis

One form of active transport is a combination of the two processes outlined on Study Guide #7. This transport technique is called receptor-mediated endocytosis.

In receptor-mediated endocytosis, very large proteins and hormone molecules needed by the cell bind to receptor proteins. These receptor proteins are grouped closely together (as opposed to being spread out evenly over the cell's surface) in small-coated pits on the cell membrane.



Once enough of the receptor proteins are occupied, the pit begins to be drawn into the cell, forming a vesicle. This vesicle ruptures once inside the cell, releasing its contents for use by the cell.

Why are these pits referred to as coated pits? Because a layer of clathrin molecules line the surface of them. This coating provides added support to the developing vacuole.

The Plasma Membrane and Cellular Transport
QUIZ PACK

The following quizzes are meant to test student understanding of specific topic areas covered in the CyberEd program, *The Plasma Membrane and Cellular Transport*. Many, but not all, of these questions have been addressed directly in the study guides designed to strengthen student understanding of these topics.

QUIZ #1	Function and Structure of the Plasma Membrane
QUIZ #2	Diffusion
QUIZ #3	Isotonic, Hypotonic, and Hypertonic Solutions
QUIZ #4	Movement of Molecules across the Plasma Membrane
EXAM	Comprehensive Exam

Quiz #1
FUNCTION AND STRUCTURE OF THE PLASMA MEMBRANE

1. Plasma membranes from very different organisms, such as bacteria and humans, have much in common.

   A. True
   B. False

2. The plasma membrane is able to keep all molecules from crossing, even small ones such as water an oxygen.

   A. True
   B. False

3. A main function of the plasma membrane is to _____.

   A. keep water from entering or exiting the cell
   B. produce chemicals needed by the cell
   C. regulate most of what enters and exits a cell

4. A plasma membrane is _____.

   A. selectively permeable
   B. impermeable
   C. permeable to most substances

5. The plasma membrane is composed of two layers of _____ called a _____.

   A. protein molecules, protein bilayer
   B. phospholipid molecules, phospholipid bilayer
   C. nucleotides, nucleotide bilayer
   D. cellulose molecules, cellulose bilayer

6. The molecules that make up the bilayer have one end that is _____ and another end that is _____.

   A. hydrophilic, hydrophilic as well
   B. hydrophobic, hydrophobic as well
   C. hydrophilic, hydrophobic
   D. Any of these combinations (A, B, or C)

7. Hydrophilic means _____, and hydrophobic means _____.

   A. water neutral, water loving
   B. water neutral, water hating
   C. water loving, water hating
   D. water hating, water loving

8. Which of the following are not found in the plasma membrane?

   A. Proteins
   B. Cholesterol
   C. Carbohydrates
   D. None of the above (they are all found in the membrane)

9. A lipid molecule with a small sugar attached to it is called a _____.

   A. sugar lipid
   B. liposugar
   C. glycolipid
   D. phosphate

10. Biologists often use the term _____ when describing the plasma membrane.

    A. fluid model
    B. mosaic model
    C. fluid-mosaic model
    D. multiple component model

Quiz #2
DIFFUSION

1. The maintenance of stable internal conditions is called cellular homeostasis.

   A. True
   B. False

2. Diffusion is a form of active transport, that is, it requires cellular energy.

   A. True
   B. False

3. The diffusion of water across a membrane is called _____.

   A. hydration
   B. cellular hydration
   C. dehydration
   D. osmosis

4. Which of the following molecules CANNOT diffuse across a plasma membrane?

   A. oxygen
   B. carbon dioxide
   C. large hormones
   D. All of the above CANNOT diffuse across a plasma membrane.

5. To have a concentration gradient, you must find _____.

   A. the exact center of the cell (its nucleus)
   B. two plasma membranes in close contact with one another
   C. more of a particular molecule in one location than in a neighboring location
   D. pores in the plasma membrane

6. When molecules such as water diffuse across a membrane, they move from _____.

   A. high concentration to low concentration
   B. low concentration to high concentration
   C. upper gradient to lower gradient
   D. lower gradient to upper gradient

Quiz #3
ISOTONIC, HYPOTONIC, AND HYPERTONIC SOLUTIONS

1. An increase in water pressure due to osmosis is called an increase in osmotic pressure.

   A. True
   B. False

2. As the vacuole fills in plant cells, what increases?

   A. Photosynthesis
   B. Protein synthesis
   C. Turgor pressure

3. If solution 1 has the SAME amount of dissolved solute as solution 2, then solution 1 is _____.

   A. a hypotonic solution
   B. a hypertonic solution
   C. an isotonic solution

4. If solution 1 has MORE dissolved solute than does solution 2, then solution 1 is _____.

   A. a hypotonic solution
   B. a hypertonic solution
   C. an isotonic solution

5. If solution 1 has LESS dissolved solute than does solution 2, then solution 1 is _____.

   A. a hypotonic solution
   B. a hypertonic solution
   C. an isotonic solution

6. If a cell is placed in a hypotonic solution, water will flow _____.

   A. out of the cell
   B. into the cell
   C. into and out of the cell at equal rates

7. If a cell is placed in a hypertonic solution, water will flow _____.

   A. out of the cell
   B. into the cell
   C. into and out if the cell at equal rates

8. If a cell is placed in an isotonic solution, water will flow _____.

   A. out of the cell
   B. into the cell
   C. into and out of the cell at equal rates

9. Shrinking of a cell's cytoplasm by osmosis is _____.

   A. cytokinesis
   B. plasmolysis
   C. osmocytosis

Quiz #4
MOVEMENT OF MOLECULES ACROSS THE PLASMA MEMBRANE

1. Facilitated diffusion requires the use of cellular energy.

   A. True
   B. False

2. One transport protein can bind many different molecules.

   A. True
   B. False

3. In facilitated diffusion, transport proteins move _____ across the plasma membrane _____.

   A. large molecules, with the concentration gradient
   B. large molecules, against the concentration gradient
   C. Both A and B, depending upon the molecule involved

4. Which of the following are moved by facilitated diffusion?

   A. Oxygen molecules
   B. Water molecules
   C. Glucose molecules
   D. Carbon dioxide molecules

5. In active transport, transport proteins move _____ across the plasma membrane _____.

   A. large molecules, with the concentration gradient
   B. large molecules, against the concentration gradient
   C. Neither A nor B

6. Active transport _____ requires the cell to expend energy.

   A. always
   B. sometimes
   C. never

7. Nerve cells must actively pump _____ to the outside and _____ to the inside.

   A. glucose, protein
   B. protein, glucose
   C. sodium, potassium
   D. potassium, sodium
   E. Both A and D

8. Nerve cells employ _____ to maintain an interior environment that is different from their surroundings.

   A. a glucose-protein pump
   B. a sodium-potassium pump
   C. both glucose-protein and sodium-potassium pumps

9. The method of moving large food particles into a cell by formation of vesicles is called _____.

   A. vesicle cytosis
   B. endocytosis
   C. exocytosis
   D. trans cytosis

10. The method of moving large waste molecules outside of a cell by formation of vesicle is called _____.

    A. vesicle cytosis
    B. endocytosis
    C. exocytosis
    D. trans cytosis

11. A food vacuole will fuse with a _____, which contains digestive enzymes.

    A. plasma membrane
    B. large protein molecule
    C. mitochondrion
    D. lysosome

12. In _____, large molecules such as hormones gather in small coated pits before being brought into the cell.

    A. receptor-mediated vesicle cytosis
    B. receptor-mediated endocytosis
    C. receptor protein vesicle cytosis
    D. receptor protein endocytosis

The Plasma Membrane and Cellular Transport
COMPREHENSIVE EXAM

The following exam is based on the *Interactive Biology* program, *The Plasma Membrane and Cellular Transport*. Most, but not all, of these questions have been addressed directly in the study guides. All of the questions on this exam, however, are based on information put forth in the program.

Please determine if the following statements are True or False.

1. A cell's plasma membrane is permeable to some very small molecules.

   A. True
   B. False

2. The solid-mosaic model is used by biologists to describe the plasma membrane.

   A. True
   B. False

3. The plasma membranes from very different organisms, such as humans and bacteria, have much in common.

   A. True
   B. False

4. Diffusion is a form of passive transport, that is, it does not require cellular energy.

   A. True
   B. False

5. As the vacuole fills in a plant cell, photosynthesis stops.

   A. True
   B. False

6. An increase in water pressure due to osmosis is called an increase in osmotic pressure.

   A. True
   B. False

7. One transport protein can bind to many kinds of molecules.

   A. True
   B. False

8. In facilitated diffusion, no energy is used by to cell in moving molecules across its membrane.

   A. True
   B. False

In the following portion of the exam, please choose the letter beside the word, words, or phrase that best completes each sentence.

9. The plasma membrane is also called the _____.

   A. cell wall
   B. cell membrane
   C. plasma wall

10. The random motion and collision of molecules in solution is called _____.

    A. Brownian motion
    B. Schroedinger's motion
    C. diffusion
    D. osmosis

11. A main function of the plasma membrane is to _____.

    A. keep water from entering and exiting the cell
    B. produce chemicals needed by the cell
    C. regulate most of what enters and exits the cell
    D. manufacture cellular energy

12. The plasma membrane is composed of two layers of _____ called a _____.

A. protein molecules, protein bilayer
B. phospholipids, phospholipid bilayer
C. nucleotides, nucleotide bilayer
D. cellulose, cellulose bilayer

13. A plasma membrane is _____.

A. permeable to most substances
B. selectively permeable
C. impermeable

14. The molecules that make up the bilayer have one end that is _____ and another end that is _____.

A. hydrophilic, hydrophilic as well
B. hydrophobic, hydrophobic as well
C. hydrophobic, hydrophilic
D. Any of these combinations (A, B, or C)

15. Which of the following are not found in the plasma membrane?

A. Proteins
B. Cholesterol
C. Carbohydrates
D. None of the above (they are all found in the membrane).

16. A lipid molecule with a sugar attached is called a _____ and a protein molecule with a sugar attached is a _____.

A. glycolipid, glycoprotein
B. liposugar, protosugar
C. sugar lipid, sugar protein

17. The diffusion of water across a membrane is called _____.

A. hydration
B. hydration pressure
C. osmosis
D. osmotic pressure

18. Which of the following molecules CANNOT diffuse across a plasma membrane?

A. Oxygen
B. Carbon dioxide
C. Hormones
D. All of the above. (NONE can diffuse)

19. To have a concentration gradient, you must find _____.

A. the exact center of a cell
B. more of a particular molecule in one location than in a neighboring location
C. pores in the plasma membrane
D. two plasma membranes in close contact with one another

20. _____ is reached when molecules continue to move and collide, but no change in concentration occurs.

A. Dynamic equilibrium
B. Homeostasis
C. Osmosis
D. A concentration gradient

21. When water diffuses across a membrane, it moves from _____.

A. high concentration to low concentration
B. low concentration to high concentration
C. upper gradient to lower gradient
D. lower gradient to upper gradient

22. When water diffuses into a plant cell, it is collected in an organelle known as _____.

A. the nucleus
B. the cytoplasm
C. a vacuole
D. a ribosome

In questions 23-28, assume red blood cells are placed into beakers containing water. Two solutions are therefore involved: one being the solution in the beaker and one being the solution inside of the red blood cells (their cytoplasm).

23. If solution 1 has the SAME amount of dissolved solute as does solution 2, then solution 1 is _____.

A. a hypotonic solution
B. a hypertonic solution
C. an isotonic solution

24. If solution 1 has MORE dissolved solute than does solution 2, then solution 1 is _____.

A. a hypotonic solution
B. a hypertonic solution
C. an isotonic solution

25. If solution 1 has LESS dissolved solute than does solution 1, then solution 1 is _____.

A. a hypotonic solution
B. a hypertonic solution
C. an isotonic solution

26. If the cells are placed into a hypertonic solution, water will flow _____.

A. out of the cells
B. into the cells
C. into and out of the cell at equal rates

27. If the cells are placed into an isotonic solution, water will flow _____.

A. out of the cells
B. into the cells
C. into and out of the cell at equal rates

28. If the cells are placed into a hypotonic solution, water will flow _____.

A. out of the cells
B. into the cells
C. into and out of the cell at equal rates

29. In facilitated diffusion, transport proteins move _____ across the plasma membrane _____.

A. large molecules, against the concentration gradient
B. large molecules, with the concentration gradient
C. Both A and B

30. Which of the following are moved by facilitated diffusion?

A. Oxygen molecules
B. Carbon dioxide molecules
C. Glucose molecules
D. Water molecules

31. In active transport, transport proteins move _____ across the plasma membrane _____.

A. large molecules, against the concentration gradient
B. large molecules, with the concentration gradient
C. Neither A nor B (active transport does not use proteins)

32. Nerve cells must actively pump _____ to the outside and _____ to the inside.

A. glucose, protein
B. protein, glucose
C. sodium, potassium
D. potassium, sodium

33. The method of moving large food particles into a cell by formation of a vesicle is called _____.

A. vesicle cytosis
B. endocytosis
C. plasmolysis

34. In _____, the cell collects several large molecules, such as hormones, in pits before bringing them all into the cell at once.

A. receptor protein endocytosis
B. receptor protein vesicle cytosis
C. receptor-mediated endocytosis
D. receptor-mediated vesicle cytosis

35. In the process illustrated in question #34, a protein known as _____ coats the pits.

A. clathrin
B. actin
C. myosin

In the following portion of the exam, please fill in the word or phrase that best completes each sentence.

36. _____ is shrinking of a cell's cytoplasm due to osmosis.

37. _____ transport requires the cell to expend energy to move materials across its membrane.

38. Nerve cells employ a _____ pump, which keeps conditions inside the cell chemically different than conditions on the outside of the cell.

39. The method of moving large waste molecules outside of a cell by the formation of a vesicle is called _____.

40. A food vacuole will fuse with a lysosome, which contains _____ that break the food particles into smaller components.

The Plasma Membrane and Cellular Transport
ANSWER GUIDE

QUIZ PACK

QUIZ #1	QUIZ #2	QUIZ #3	QUIZ #4
1. A	1. A	1. A	1. B
2. B	2. B	2. C	2. B
3. C	3. D	3. C	3. A
4. A	4. C	4. B	4. C
5. B	5. C	5. A	5. B
6. C	6. A	6. B	6. A
7. C		7. A	7. C
8. D		8. C	8. B
9. C		9. B	9. B
10. C			10. C
			11. D
			12. B

COMPREHENSIVE EXAM

1. A	11. C	21. A	31. A
2. B	12. B	22. C	32. C
3. A	13. B	23. C	33. B
4. A	14. C	24. B	34. C
5. B	15. D	25. A	35. A
6. A	16. A	26. A	36. Plasmolysis
7. B	17. C	27. C	37. Active
8. A	18. C	28. B	38. sodium-potassium
9. B	19. B	29. B	39. exocytosis
10. A	20. A	30. C	40. digestive enzymes

The Plasma Membrane & Cellular Transport
GLOSSARY

active transport: the movement of substances across a plasma membrane from a region of low concentration to a region of high concentration; active transport expends cellular energy.

ATP (adneosine triphosphate): the compound that stores the energy released during cellular respiration.

Brownian motion: the random motion and collision of molecules in solution as observed by Scottish scientist Robert Brown in 1827.

Clathrin: a fibrous protein that lines the cytoplasmic side of coated pits.

coated pits: indentations in the plasma membrane that contain receptor proteins; coated pits form vesicles containing large essential substances in receptor-mediated endocytosis.

concentration gradient: the difference in concentration between a region of high concentration and region of low concentration.

diffusion: the movement of molecules or particles from a region of high concentration to a region of lower concentration.

dynamic equilibrium: the continuous movement and collision of particles with no change in concentration.

endocytosis: the movement of materials into a cell by vesicles formed from the plasma membrane.

exocytosis: the movement of materials out of a cell by vesicles formed from the plasma membrane.

facilitated diffusion: a process by which certain molecules diffuse across a plasma membrane via transport proteins.

fatty acid: an organic molecule consisting of a carbon chain and one or more carboxyl (COOH) groups.

fluid-mosaic model: a model used to explain the components and properties of a plasma membrane; the membrane includes a phospholipid bilayer in which several types of proteins are embedded.

glycolipids: lipid molecules to which simple sugars are attached.

glycoproteins: protein molecules to which simple sugars are attached.

homeostasis: the maintenance of a relatively constant environment within a cell despite fluctuations in the environment surrounding the cell.

hydrophilic: the property of being "water-loving;" hydrophilic compounds tend to form hydrogen bonds and are therefore easily dissolved in water.

hydrophobic: the property of being "water-hating;" hydrophobic compounds do not dissolve in water.

hypertonic solution: a solution in which the concentration of dissolved substances is greater than that of another solution.

hypotonic solution: a solution in which the concentration of dissolved substances is less than that of another solution.

isotonic solution: a solution in which the concentration of dissolved substances is equal to that of another solution.

osmosis: the diffusion of water across a selectively permeable membrane.

osmotic pressure: the change in pressure resulting from the flow of water in osmosis; the osmotic pressure is equal to the tendency of water to enter a solution due to a concentration gradient.

passive transport: a process by which materials move across a plasma membrane without the expenditure of cellular energy.

phosphate group: a molecule that consists of four oxygen atoms bound to a central phosphorus atom.

phospholipid: a lipid molecule consisting of a phosphate group-containing hydrophilic head linked to two hydrophobic fatty acid tails; the fundamental component of a plasma membrane.

plasma membrane: the bilayer of phospholipid and protein molecules that surrounds the cytoplasm of cells.

plasmolysis: the shrinking of cytoplasm in a cell resulting from the loss of water by osmosis to a hypertonic solution in which the cell is placed.

receptor-mediated endocytosis: the process of endocytosis that enables the cell to engulf large molecules such as hormones and large proteins; this process involves the binding of large molecules to receptors in coated pits.

selective permeability: the property of a plasma membrane that allows some molecules to pass freely through the membrane while other molecules cannot.

transport proteins: proteins in the plasma membrane that enable materials to pass to and from a cell either by facilitated diffusion or active transport.

turgor pressure: the internal pressure of a plant cell.