Cell Transport

Cell Membrane

Osmosis/Diffusion

Essay Entry: Cell Transport and Stability
"All living things maintain homeostasis."

Standard Biology/Life Science

CELL BIOLOGY

1. **Fundamental life processes of plants and animals depend on a variety of chemical reactions, that are carried out in specialized areas the organism's cells.** As a basis for understanding this concept, students know:

Concept

a. that cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.

Standard STRUCTURE AND FUNCTION IN LIVING SYSTEMS

9. **As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic), despite changes in the outside environment.** As a basis for understanding this concept, students know:

Concept

g. *the homeostatic role of the kidneys in the removal of nitrogenous wastes, and of the liver in blood detoxification and glucose balance.

Cell Transport is a vital function for all cells for without it nutrients could not enter and waste products could not leave the cell. Cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.

With this in mind

1. **DISCUSS** how the structure of the cell membrane and WHY it is referred to as semi-permeable. **DISCUSS** how things are transported into and out of the cell by including Passive Transport (diffusion, osmosis, facilitated diffusion) and Active Transport. What is the energy that is used for active transport and where does it come from. **GIVE EXAMPLES** don't just list definitions!!!!

2. **DISCUSS** the homeostatic role of the kidneys in the removal of nitrogenous wastes, water and glucose balance. **INCLUDE** what homeostasis is and why it is important to the cell and body.

3. DISCUSS what happens to the body when there is an extreme excess of fresh water or salt water in the body. Be sure to include what **happens to the cells** and **the whole individual.**

Area	Got it	Almost There	Start Again	Not Present
DISCUSS how the structure of the cell membrane and **WHY** it is referred to as semi-permeable				
DISCUSS how things are transported into and out of the cell by including Passive Transport (diffusion, osmosis, facilitated diffusion) and Active Transport.				
What is the energy that is used for active transport and where does it come from. **GIVE EXAMPLES** don't just list definitions!!!!				
DISCUSS the homeostatic role of the kidneys in the removal of nitrogenous wastes, water and glucose balance.				
INCLUDE what homeostasis is and why it is important to the cell and body.				
DISCUSS what happens to the body when there is an extreme excess of fresh water or salt water in the body. Be sure to include what **happens to the cells** and **the whole individual**				

Vocabulary: Osmosis & Diffusion

Name _____

Word Part	Meaning	Vocabulary Word
erythro	red	erythrocyte
hemo	blood	hemolysis
cyte	cell	cytology
hypo	below	hypotonic
hyper	above	hypertonic
tonus	tension, pressure	
iso	same	isotonic
homeo	same	homeostasis
stasis	state	
		osmosis
		diffusion
lysis	split	cytolysis
		plasmolysis
endo	inside	endocytosis
exo	out of	exocytosis

Format

Word	Part of speech	Word parts/meanings
Definition		

erythrocyte		

hemolysis		

Cytology		

Hypotonic		

hypertonic		

Isotonic		

homeostasis		

Osmosis		

Diffusion		

cytolysis		

plasmolysis		

endocytosis		

exocytosis		

F2

Cell organelle - CELL MEMBRANE

CLT: Homeostasis: _____

Temperature: _____

_____

Water: _____ is controlled by the hypothalamus and kidneys.

Too little: _____

Too much: _____

Ion: _____ (Na), _____ (K), _____ (P) by the

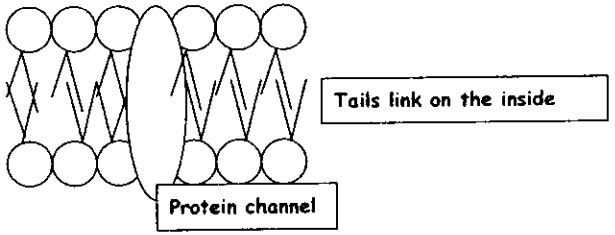
_____

Cell Membrane

- _____: phosphate and fat
- _____ serve as doors for larger molecules
- Heads are _____
- Tails _____

Two _____

OUTSIDE CELL



INSIDE CELL

Transport of molecules into and out of the cell.

PASSIVE TRANSPORT

Diffusion - _____

_____

_____

_____

- _____
- _____

Osmosis - _____

_____

_____

- _____
- _____

Hypertonic Solution - _____ (less water)_____

the cell - _____

examples

* Cells in salt water _____
* Egg in glucose _____
* Soaking _____

Hypotonic Solution - _____ (more water)

than inside the cell - _____ and _____

_____ and _____.

examples

* Cells in fresh water _____
* Egg in fresh water _____
* Animal cells _____ or the ion concentration will

be diluted so that _____.

Isotonic - _____ in and out of the cell - _____

Facilitated Diffusion - moves materials _____ from a _____ concentration to a _____

* _____
* _____
* _____

Glucose -

- needed to make _____
- moves in via _____
- _____ is the "_____" to open _____
- _____

Diabetes

Type 1 - _____

Type 2 - _____

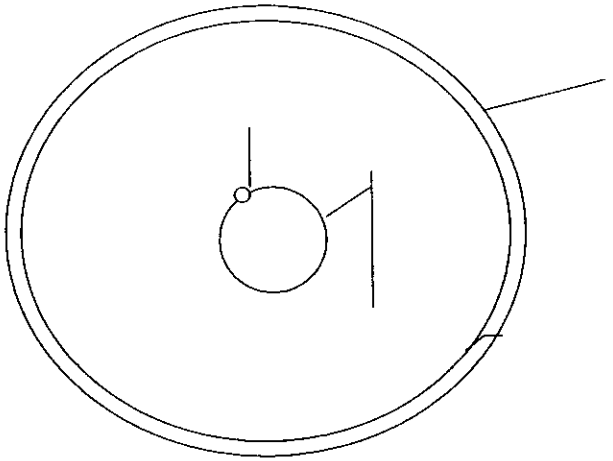
Symptoms

1. _____
2. _____
3. _____ overall feeling as _____ is getting in the cells _____

ACTIVE TRANSPORT

* _____
* _____ move across the membrane through _____
* From _____ concentration to _____ concentration
* _____ the concentration gradient
* "STUFF" _____
* _____ random
* _____

Structure of an Egg



1. _____
   - Vinegar: _____

_____

_____

_____

7.2 The Plasma Membrane
Pages 181-184
Maintaining Balance

Main Idea			

Plasma Membrane

Homeostasis

Selective Permeability

Structure of the Plasma Membrane

Main Idea			

Phospholipids

Phospholipid heads

Fatty acid tails

Fluid Mosaic Model

Transport Proteins

Name_____

Section Assessment

Respond to each question completely and include diagrams where necessary.

1. How is the plasma membrane a bilayer structure?

2. Explain how selective permeability maintains homeostasis within the cell.

3. What are the components of the phospholipid bilayer and how are they organized to form the plasma membrane?

4. Why is the plasma membrane referred to as a fluid mosaic?

5. Suggest (IN DETAIL) what will happen if the cell were to grow and reproduce in an environment where no cholesterol is available.

Chapter 6: The Chemistry of Life

6.2 Water and Diffusion

Pages 156-160

Water and Its Importance

Main Idea

Supporting Detail			

Polar Molecule:

Hydrogen Bond:

Diffusion

Main Idea

Supporting Detail			

Diffusion:

Dynamic Equilibrium:

Name _____

Section Assessment 1-5

1. Explain why water is a polar molecule.

2. How does a hydrogen bond compare to a covalent bond?

3. What property of water explains why it can travel to the tops of trees?

4. What is the eventual default of diffusion? Describe concentration prior to and at this point.

5. Explain why water dissolves so many different substances.

Chapter 8: Cellular Transport and the Cell Cycle

8.1 Cellular Transport

Pages: 201-206

Osmosis: Diffusion of Water

Main Idea

Supporting Detail			

Osmosis:

Isotonic Solution:

Hypotonic Solution:

Hypertonic Solution:

Word Origin: iso - hypo- hyper-

Passive Transport

Main Idea

Supporting Detail			

Name _____

Passive Transport:

Facilitated Diffusion:

Active Transport

Main Idea

Supporting Detail			

Active Transport:

Endocytosis:

Exocytosis:

Section Assessment 1-5

1. What factors affect the diffusion of water through a membrane by osmosis?

2. How do animal cells and plant cells react differently to osmosis in a hypotonic solution?

3. Compare and contrast active transport and facilitated diffusion.

4. How do carrier proteins facilitate passive transport of molecules across a membrane?

5. A paramecium expels water when an organism is surrounded by freshwater. What can you deduce about the concentration ingredient in the organisms environment.

Membrane Properties

1. The study of cells has disclosed that the cell membrane does far more than merely serve as a container to hold a cell together. Many of the activities of cells that we regard as unique to living organisms turn out to be properties of the cell membrane itself and of the membranes of the organelles within the cell.

2. Among the very first discoveries with the microscope was the one celled water animal known as the amoeba, which captures smaller organisms and devours them by simply flowing around them and engulfing them in a process called phagocytosis (Greek: phagein, "to eat;" kytos, "hollow vessel"). (Our own white blood cells do the same thing to invading bacteria.) The cell membrane bulges out on all sides of the prey to be captured, and the cytoplasm follows. When the two portions of the membrane contact each other on the far side of the prey, they fuse together and pinch together to form a vacuole. A portion of what was formally cell membrane is now vacuole membrane. Such a vacuole is called a food vacuole, and the cell passes enzymes into the vacuole to digest the prey within. When cells take in tiny droplets of liquid in this same way, the process is called pinocytosis ("cell drinking"), and the resulting tiny vacuole is called a pinocytic vesicle. Some cases,; though, are intermediate between phagocytosis and pinocytosis, so many biologists lump the two processes together as endocytosis.

3. When you fry bacon in the kitchen, it isn't long before you can detect the aroma all through the house. Some of the molecules of the bacon spread out spontaneously to distribute themselves evenly throughout all the space available to them. This process is called diffusion and can be summarized by saying that molecules always tend to move from any place where they are highly concentrated to places where they are in low concentration unless some barrier prevents them from doing so. One of the surprising characteristics of cell membranes is that many small molecules can diffuse right through them. IF you add fatty acids to the medium surrounding the cell, they rapidly diffuse into the cell. Water also diffuses in rapidly. Starch, however, does not diffuse in at all. The membrane is therefore said to be selectively permeable (or semipermeable). Molecules that can diffuse into the cell can diffuse out as well. Selective permeability has some peculiar consequences for living cells, which will be discussed in the next plate.

4. Some molecules, such as glucose, that are moderately large and do not easily pass through cell membranes under most circumstances can have their passage through the membrane helped or facilitated when the cell has a use for those molecules. This facilitated transport is believed to be accomplished by protein molecules embedded in the membrane that help the molecules to pass through in some way not entirely understood. The membrane proteins that perform this function are called permeases.

5. In certain cases, cells need a higher or lower concentration of a particular substance than is present in the environment and must work against the ordinary forces of diffusion to maintain that situation. The most dramatic example of that situation involves sodium and potassium ions. Many cells require a concentration of potassium ion (K^+) inside the cell that is 100 times the concentration in the environment outside the cell and a concentration of sodium ion (Na^+) inside the cell that is only 1/100 of the concentration outside. Sodium and potassium ions are so small that they are constantly diffusing through the membrane, so the cell has to be constantly pumping sodium ions out as fast as they come in and pumping potassium ions back in as fast as they escape. To work against the forces of diffusion like this requires as considerable expenditure of energy, so this is called active transport.

Name _____

Summary Sentences

Paragraph 1
Paragraph 2
Paragraph 3
Paragraph 4
Paragraph 5
Summary

Questions

1. Describe how a white blood cell "eats".

2. What does it mean to be 'selectively permeable'?

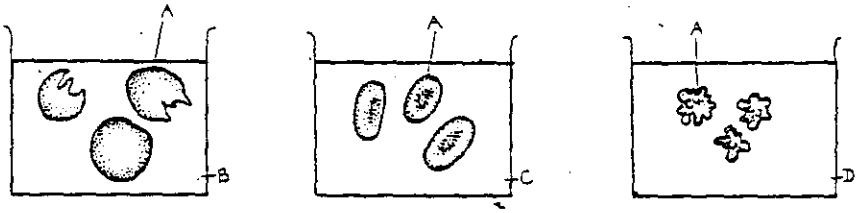
Give an example.

3. Describe the "sodium/potassium pump" and what it requires.

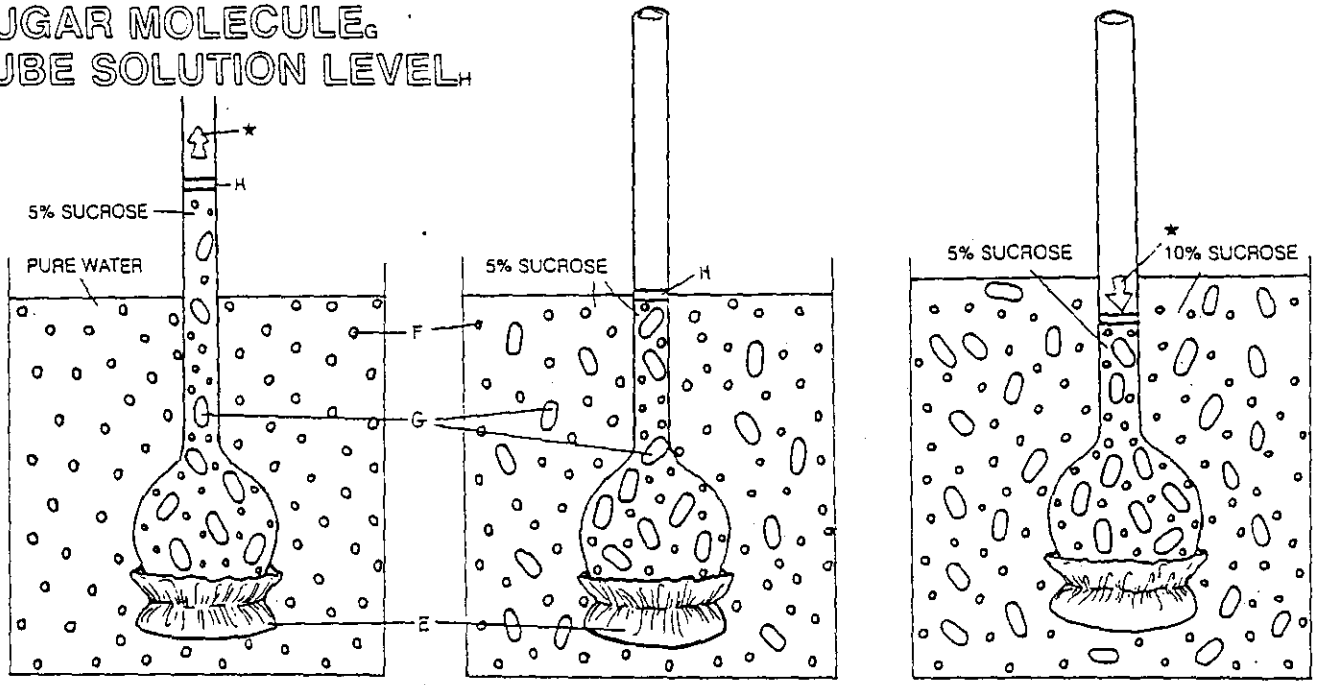
BT

OSMOSIS.

ERYTHROCYTE$_A$
PURE WATER$_B$
0.85% SALT SOLUTION$_C$
2% SALT SOLUTION$_D$

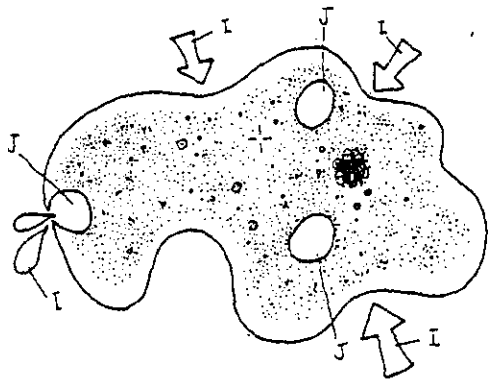


OSMOMETER$_\star$
SELECTIVELY PERMEABLE MEMBRANE$_E$
WATER MOLECULE$_F$
SUGAR MOLECULE$_G$
TUBE SOLUTION LEVEL$_H$

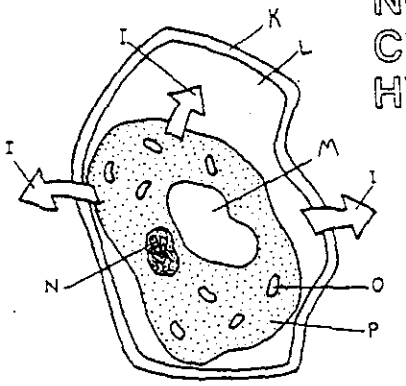


HYPOTONIC$_\star$ ISOTONIC$_\star$ HYPERTONIC$_\star$

AMOEBA$_\star$
WATER$_I$
CONTRACTILE VACUOLE$_J$



WILTING PLANT CELL$_\star$
CELL WALL$_K$
AIR SPACE$_L$
SHRUNKEN VACUOLE$_M$
NUCLEUS$_N$
CHLOROPLAST$_O$
HYALOPLASM$_P$



OSMOSIS

1. The selective permeability of the cell membrane creates some unusual properties, which are readily illustrated by immersing human red blood cells in pure water and in two different solutions of common table salt (NaCl)If you place some erythrocytes (red blood cells) in pure water, water will flow into the cells until the pressure is so great that the cells swell up and burst. This process is called hemolysis (Greek: hemo, "blood"; lysis, "loosening" or "breaking"). If you place erythrocytes in a 0.85 percent salt (NaCl) solution, a few water molecules will flow into the cells, but the same number will flow out, and the cells will retain their normal double-concave shape. In a 2 percent salt solution, water will flow out of the cells, and they will shrink and shrivel up in a process called crenation. All three of these situations involve a process called osmosis.

2. Osmosis is defined as the diffusion of solvent - water whenever we are dealing with living systems - through a selectively permeable membrane. Osmosis can be demonstrated with a simple device called an osmometer, which will also indicate the resulting osmotic pressure. A membrane is stretched over the mouth of a thistle tube (a common laboratory item) and securely tied there. The membrane can be some tissue from an animal, such as intestine or bladder, or it can be something artificial, such as a cellophane dialysis membrane, as long as it allows water to pass through, but not larger molecules. Suppose that inside the thistle tube we place a 5 percent solution of sucrose and we immerse the end with the membrane so that the liquid inside the tube is at the same level as the liquid outside. Since the solution inside the thistle tube is 5% sucrose, it is therefore only 95 percent water. The pure water outside is 100 percent water. Since molecules always diffuse from regions where their concentration is higher go regions where their concentration is lower, the water molecules will diffuse through the membrane into the thistle tube. Some water molecules will also diffuse out, but not nearly as many as will diffuse in. The sugar molecules will tend to diffuse from inside, where their concentration is 5 percent, to outside, where their concentration is 0 percent, but the membrane will not allow them to pass through. Since there is a net flow of water into the tube and no flow of sugar out of it, a pressure, called osmotic pressure, builds up in the tube, and the liquid level rises. The height of the liquid is a measure of the osmotic pressure. Because the osmotic pressure of the solution outside is less than that of the solution inside, the solution outside is said to be hypotonic (Greek: hypo, "below"; tonus, "tension" or "pressure"). In the experiment illustrated at the top of the plate, the pure water was hypotonic to the red blood cells.

3. If we put the same 5 percent sucrose solution outside the tube as we have inside it, there will be no net flow of water in either direction. Water molecules will diffuse out of the tube just as fast as they diffuse in, and the liquid level in the tube will remain the same. In this case, the solution outside the tube is said to be isotonic (Greek: isos, "same")

4. If we put a 10 percent solution outside the tube while we will have only 5 percent inside, we will have the reverse of the original hypotonic situation: there will now be a net diffusion of water molecules out of the tube, the level in the tube will drop, and the level in the beaker will rise. In this case the solution outside is said tube hypertonic: (Greek: hyper, 'above'). The 2 percent salt solution at the top of the plate was hypertonic to the red blood cells.

5. To survive the forces of osmosis, different living organisms have adopted various strategies. Single celled fresh water animals, such as amoeba, use active transport to pump excess incoming water into special contractile vacuoles, which collect that water and then contract to force it out of the cell through a tiny opening. Cells of plants, algae, and fungi have cell walls to resist being burst by osmotic pressure. Plants actually depend on osmotic pressure to keep them erect. If you let plant cells lose water (or make them lose water by placing them in a hypertonic solution), they shrink away from their cells walls, and the plant wilts That is why supermarkets spray their vegetables frequently and smart cooks keep vegetables damp in a humidifier drawer in their refrigerator.

F10

Name _____

Summary Sentences

Paragraph 1
Paragraph 2
Paragraph 3
Paragraph 4
Paragraph 5
Overall Summary

Questions:

1. **What happens to red blood cells in**
   - **Fresh water**
   - **2% Salt water solution**

2. **What happens to the water in a cell placed in a 2% salt water solution -**

   WHY does this occur?

3. **What are some of the strategies that animals and plants use to survive.**

Lesson 5

Name _____

Passive Transport

Key Words

diffusion:	the movement of molecules from areas of greater concentration to areas of lesser concentration
concentration:	amount of a substance in a given area
osmosis:	diffusion of water across a membrane
passive transport:	movement of molecules across a cell membrane without the use of energy
carrier protein:	protein in the cell membrane that moves large molecules through the membrane

KEY IDEAS

Passive transport is the movement of molecules across a cell membrane without the use of energy. The constant motion of molecules causes them to move by diffusion from areas of greater concentration to areas of lesser concentration. Water moves in or out of a cell by a special kind of diffusion called osmosis. Other molecules move in or out of a cell with the help of carrier proteins.

Have you ever been in a supermarket's produce aisle when suddenly a mist of water shot out over the fruits and vegetables? You might have wondered why plants that have already been picked need water. The reason for misting the produce is to keep it from wilting. The water droplets land on the produce and pass into the plant's cells.

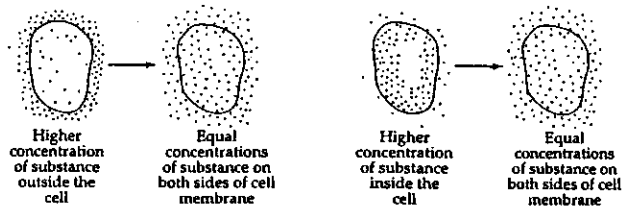
A cell must take in water to carry out its life processes. A cell also must take in certain other substances. These substances enter the cell through the cell membrane. A cell must also rid itself of waste products to work properly. Wastes leave the cell by passing through the cell membrane.

Recall that the cell membrane controls the flow of substances into and out of the cell. Not every substance can pass through the cell membrane. The cell membrane is selectively permeable. It allows only certain materials to pass into the cell and certain others to pass out. For example, the cell membrane allows food and oxygen molecules to enter the cell. It allows only waste products such as carbon dioxide to leave the cell.

Diffusion. Molecules move across the cell membrane in several ways. Some kinds of molecules, such as oxygen and carbon dioxide, pass through the cell membrane by diffusion. **Diffusion** (dih-FYOO-zhuhn) is the movement of molecules from an area of greater concentration to an area of lesser concentration. **Concentration** (KAHN-sen-TRAY-shuhn) is the amount of a substance in a given area.

Carbon dioxide is constantly made by cells as they use energy. Therefore, the concentration of carbon dioxide inside the cell is higher than that outside the cell. This causes the carbon dioxide to diffuse out of the cell. On the other hand, the cell constantly uses oxygen to perform its life processes, so the concentration of oxygen outside the cell is higher than it is inside the cell. This causes the oxygen molecules to diffuse through the cell membrane into the cell. The diffusion of molecules continues until equal amounts of the molecules lie on both sides of the cell membrane. Fig. 5-1 shows how a substance moves into or out of a cell by diffusion.

Fig. 5-1



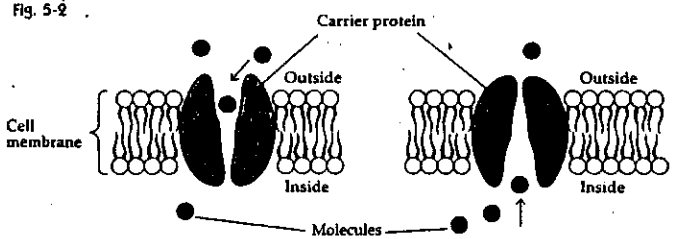
Diffusion occurs because molecules are constantly in motion. The moving molecules collide and spread out in all directions. As they spread out, molecules tend to move into and out of the cell. Small molecules such as water and oxygen are able to pass through spaces between the lipids that make up the cell membrane.

Osmosis. The diffusion of water across a membrane is called **osmosis** (ahs-MOH-sihs). Water molecules move into or out of a cell by osmosis. In osmosis, water molecules diffuse across the cell membrane until they are in equal concentration on both sides. The misting of produce in a supermarket is an attempt to trigger osmosis. Since the plant parts were removed from the live plant, they have no water supply. The cells begin to wilt. By misting the produce, osmosis can occur. The water can pass into the produce and keep it crisp.

Diffusion and osmosis occur without the use of energy. For this reason, they are said to be forms of **passive transport** (PAS-ihv TRANS-port).

Carrier Proteins. Another type of passive transport is a form of diffusion that involves carrier proteins. **Carrier proteins** (KA-ree-yer PROH-teenz) are in the double layer of lipids that form the cell membrane. Most types of molecules are too large to pass through the spaces between lipids in a cell membrane. Carrier proteins move these large molecules across the cell membrane and into or out of the cell. See Fig. 5-2.

Fig. 5-2

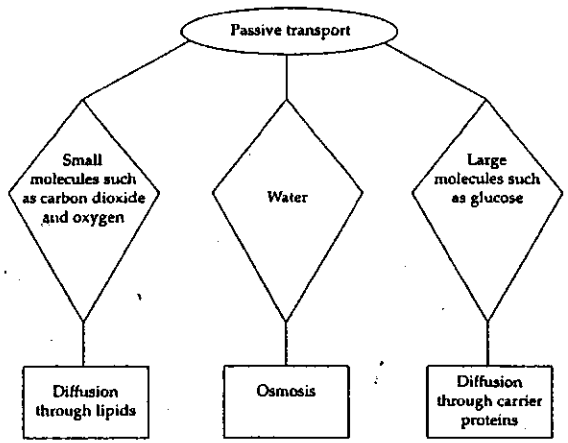


Passive transport always moves molecules from a place of higher concentration to a place of lower concentration. For example, a cell uses up glucose molecules soon after they enter the cell. So the concentration of glucose molecules inside the cell is often lower than outside it. Carrier proteins move glucose molecules into the cell faster than they could move without carrier proteins.

TAKE ANOTHER LOOK

Fig. 5-3 shows the different forms of passive transport.

Fig. 5-3



F12

Check Your Understanding

1. Explain the relationship between diffusion and osmosis.

_____

_____

Complete the paragraph with the following terms: *diffusion, higher, lipids, lower, osmosis, passive transport, carrier proteins, selectively permeable.*

The cell membrane is made up of a double layer of (2)_____. Buried in these layers are (3)_____. Only certain substances can move into or out of the cell through the cell membrane. It is said to be (4)_____. In the process of (5)_____, molecules move from an area of (6)_____ concentration to an area of (7)_____ concentration. Water diffuses across the cell membrane by (8)_____. Both diffusion and osmosis are forms of (9)_____.

10. Why are osmosis and diffusion called passive transport?

_____

_____

11. How does the motion of molecules trigger diffusion?

_____

_____

12. How do carrier proteins help substances enter the cell?

_____

_____

13. While conducting an experiment, you discover a certain substance passing out of a cell by diffusion. What might you conclude about the concentration of this substance?

_____

_____

_____

What Do You Know?

Lesson

Name _____

Cell Energy Transport and Use

Key Words

active transport: process in which energy is used to transport materials across the cell membrane

cellular respiration: process in which glucose is broken down in the presence of oxygen to supply a cell with energy

fermentation: process in which glucose is broken down in the absence of oxygen to supply a cell with energy

KEY IDEAS

Active transport is the use of energy to move substances across the cell membrane. Cellular respiration and fermentation are two processes that supply cells with the energy needed for active transport.

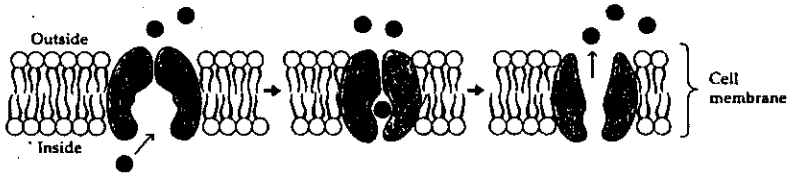
Have you ever baked bread? If so, you probably added yeast to the bread dough. After some time passed, you may have noticed that the dough had risen. Did you wonder why this happened? If you thought the yeast caused the change, you were correct. Yeast breaks down a sugar in the flour. As the sugar breaks down, it releases gas bubbles into the dough. The gas bubbles cause the dough to expand, or rise. In this lesson, you will find out more about processes that release energy from food.

You may recall that diffusion is a process in which molecules move from an area of higher concentration to an area of lower concentration. Sometimes molecules need to move in the opposite direction. They need to get from an area of lower concentration to an area of higher concentration. In such cases, energy is needed to move the molecules across the cell membrane. Processes in which energy is used to move a substance across the cell membrane are called **active transport** (AK-tihv TRANS-port). There are two types of active transport.

In one type of active transport, molecules are carried across the cell membrane. Energy is used to change the shape of the membrane and pull the molecules through it. This kind of active transport is used to move molecules both into and out of the cell.

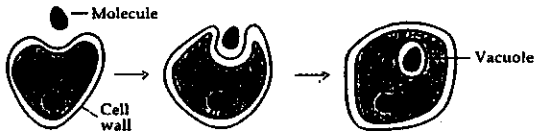
Fig. 6-1 shows one way molecules are moved through the cell membrane by active transport. This type of transport is similar to passive transport through carrier proteins. However, in this type of active transport, molecules move from an area of low concentration to an area of high concentration.

Fig. 6-1



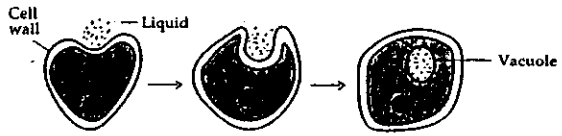
Another type of active transport is used to take large molecules into a cell. The cell membrane forms a sac around the molecule. Once the molecule is surrounded, the sac breaks away from the cell membrane and moves into the cytoplasm. The sac forms a vacuole. The vacuole stores the molecule for use by the cell. This process is shown in Fig. 6-2.

Fig. 6-2



The cell can take in liquids through a similar type of active transport. As shown in Fig. 6-3, the cell membrane forms tiny sacs. These sacs fill up with liquids in the environment outside the cell. Once full, the sacs move into the cytoplasm and form a vacuole. The vacuole stores the liquids for use by the cell.

Fig. 6-3

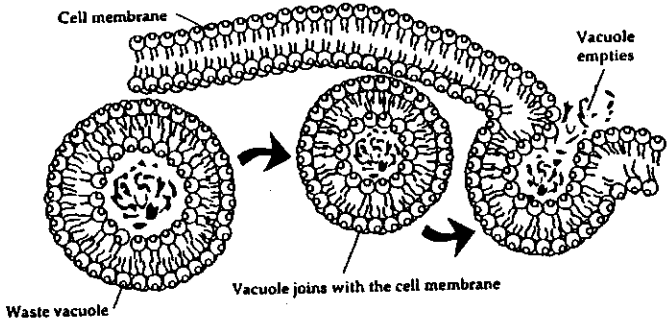


F13

1. **What is active transport?** _____

Materials can exit a cell in a similar manner. The cell stores its waste materials in a vacuole. The sac of wastes attaches to the cell membrane. Once the sac is joined to the membrane, its contents are released from the cell. The steps of this kind of transport are shown in Fig. 6-4.

Fig. 6-4



Cellular Respiration. In each process of active transport, the cell uses energy. Cells get the energy needed for active transport through cellular respiration. **Cellular respiration** (SEHL-yoo-luhr rehs-pih-RAY-shuhn) is the process by which glucose is broken down with the help of oxygen. Glucose is a type of sugar found in food. Plants and a few other organisms make their own glucose. Animals obtain glucose from the organisms they eat. All organisms need to break down glucose to gain energy. This process of cellular respiration occurs in the mitochondria of a cell. Recall from Lesson 3 that mitochondria are organelles that supply the cell with energy.

During cellular respiration, oxygen combines with glucose. Through a series of steps, the glucose is broken down. Water and carbon dioxide are released as waste products. The energy that is released forms high-energy molecules called ATP. The cell can directly use the energy in the ATP.

glucose + oxygen $\longrightarrow$ carbon dioxide + water + energy

$C_6H_{12}O_6$ $6\,O_2$ $6\,CO_2$ $6\,H_2O$ ATP

Fermentation. Sometimes, oxygen is not available to the cell. Yet, the cell still needs energy. In such cases, the cell obtains energy by fermentation. **Fermentation** (FER-mehn-TAY-shuhn) is the process by which glucose is broken down without the help of oxygen. Fermentation occurs in the cytoplasm of a cell. During fermentation, a compound called lactic acid is released as a waste product. Energy is also released. As with cellular respiration, energy-rich molecules of ATP are produced. However, fermentation produces fewer ATP molecules than cellular respiration does.

When you observe bread dough rise, you are seeing the result of fermentation. The yeast breaks down the glucose in the dough. Bubbles of carbon dioxide are released into the dough, causing it to expand.

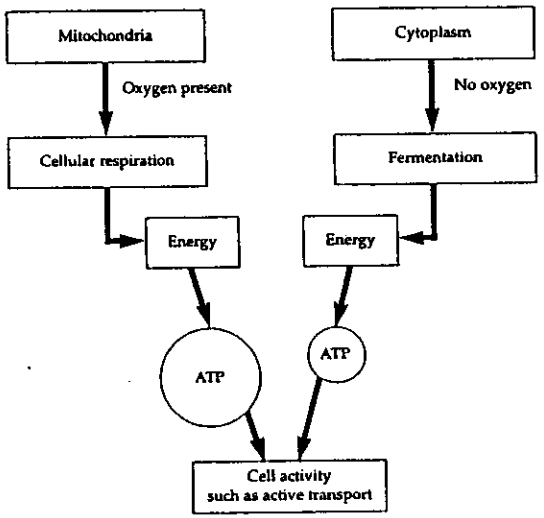
2. **What is fermentation?** _____

3. **How do the waste products of fermentation differ from those of cellular respiration?** _____

Cellular respiration and fermentation are processes that release energy from glucose. ATP is a molecule that carries the energy until the cell needs it. Fig. 6-5 compares how cellular respiration and fermentation produce ATP molecules.

TAKE ANOTHER LOOK

Fig. 6-5



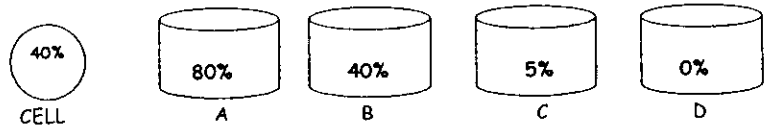
Name _____ Period____

DIRECTION OF OSMOSIS

What determines the direction in which the water molecules diffuse across a cell membrane? The direction depends on the concentrations of water AND solute dissolved in the solution. Use the following table as a reference.

Conditions	Environment solution	Cell solution	Water will move
If the solute concentration in the environment is LOWER than in the cell	HYPOTONIC	HYPERTONIC	Into the cell
If the solute concentration in the environment is HIGHER than in the cell	HYPERTONIC	HYPOTONIC	Out of the cell
If the solute concentration in the environment is EQUAL to that in the cell	ISOTONIC	ISOTONIC	Overall concentration of water will not change

Concentration of SOLUTE MOLECULES in a CELL and FOUR BEAKERS



1. Solution A is (hypertonic, hypotonic, isotonic) relative to the cell BECAUSE

2. Solution B is (hypertonic, hypotonic, isotonic) relative to the cell BECAUSE

3. Solution C is (hypertonic, hypotonic, isotonic) relative to the cell BECAUSE

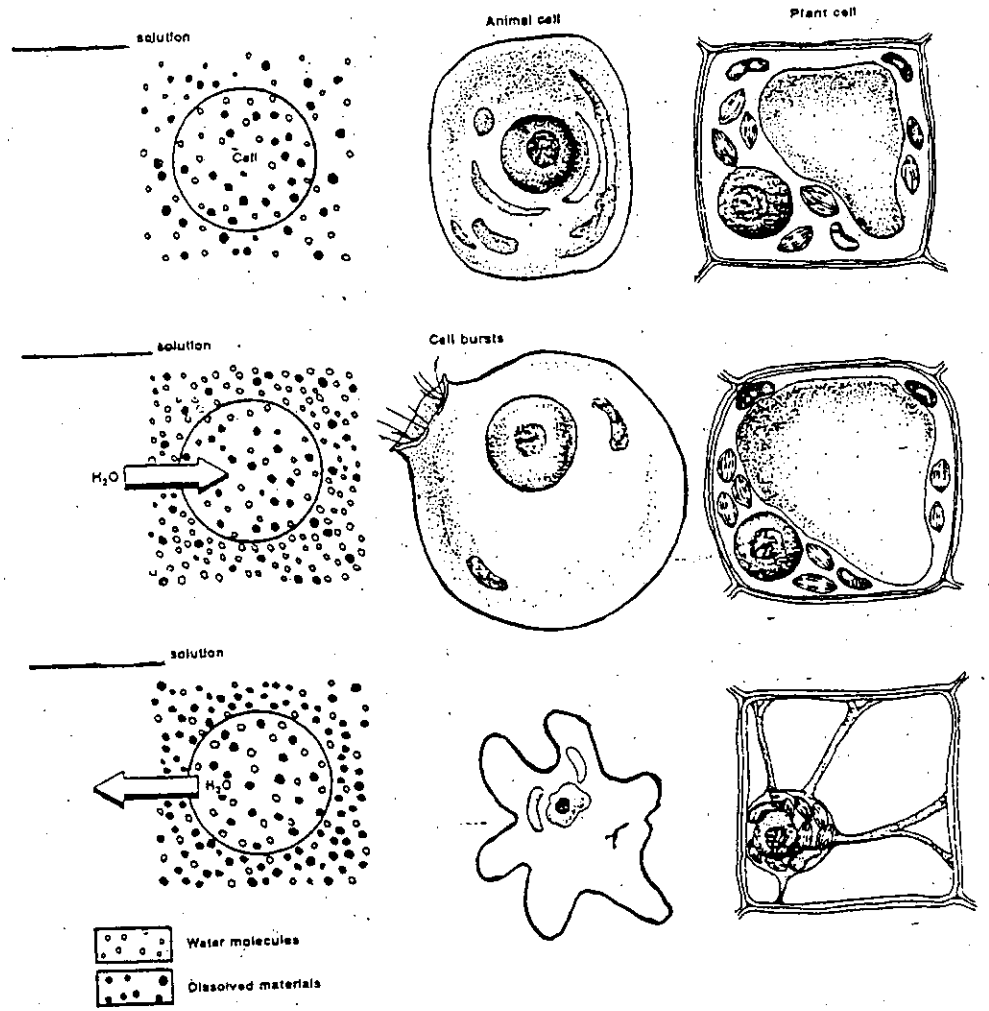
4. Solution D is (hypertonic, hypotonic, isotonic) relative to the cell BECAUSE

5. Solute molecules from which solution would be MOST LIKELYY to diffuse into the cell
   _____ BECAUSE

6. What would happen to the cell if it was place in solution C?
   WHY?

7. Which solution best represents the solution that surrounds the cells in our bodies?
   _____ WHY?

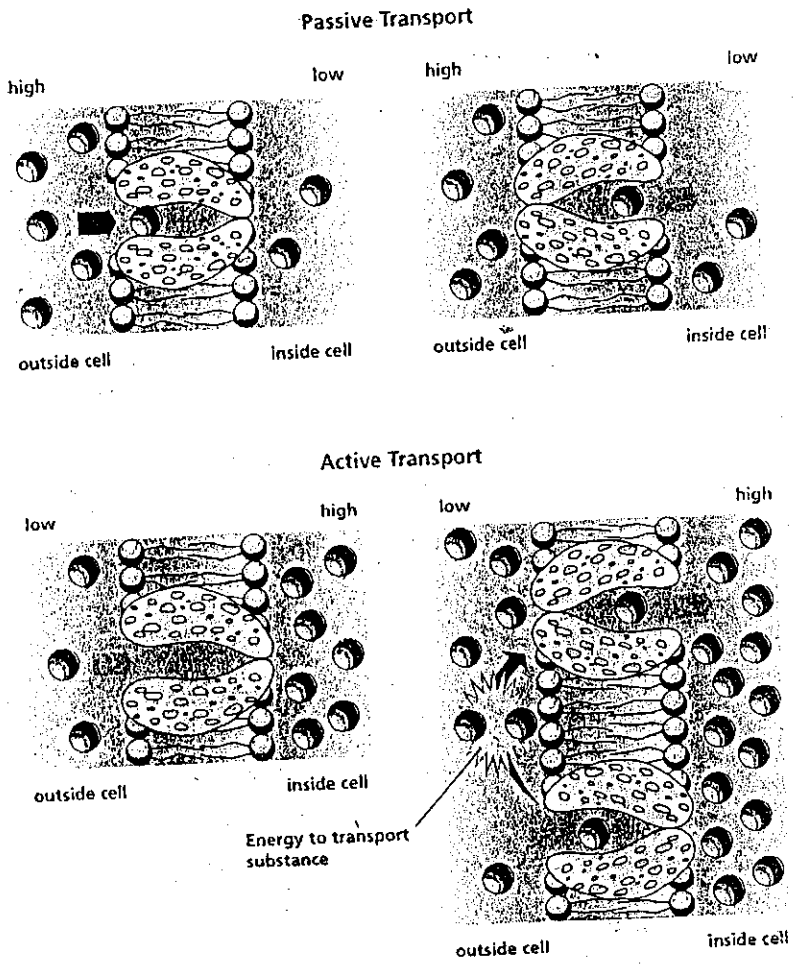
EFFECTS OF SOLUTION CONCENTRATION IN CELLS



E5 F

Name _____

Use with Chapter 8, Section 8.1



ACTIVE VERSUS PASSIVE TRANSPORT

1. Some people describe diffusion as the process by which 'something moves from where it is to where it is not.' EXPLAIN why this description is accurate and where it is not.

2. Explain what is meant by concentration gradient.

A **Passive Transport**
B **Active Transport**

3. In space **A**, draw an arrow that shows the direction in which the molecules will move during **PASSIVE TRANSPORT**

4. In space **B**, draw an arrow that shows the direction in which the molecules will move during **ACTIVE TRANSPORT**

5. What type of passive transport is shown in the picture at the left? **EXPLAIN**

6. Why is passive transport called *passive*?

7. In the illustration of active transport, why is energy needed to move the particles across the plasma membrane?

8. Describe the role of carrier proteins during active transport.

F16

ACTIVTY: Cell Membrane Model

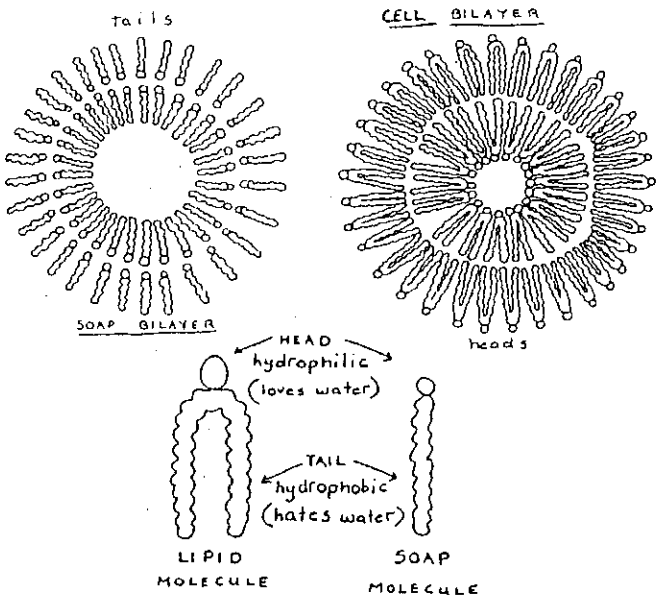
Introduction: A cell membrane is made up of **two rows of molecules** in which each molecule possesses both a **hydrophilic head and a hydrophobic tail.** When it forms, the tail directs **itself toward the air while the head seeks water.**

Life has adapted this architectural wonder into a dynamic and complex structure of cell-to-cell interactions along with the ability to respond to internal and external environments. **In this activity, you will explore the behavior of the cell membrane by using a soap bubble as a model.**

1. Demonstrate **flexibility of membranes** by bending the holder and soap film into assorted configurations.

2. Demonstrate the **self-sealing ability of membranes.** Get plenty of the soap solution on your finger and gently insert your finger through the soap film. Move your finger around.

3. All cells regulate their internal environment by **selectively allowing passage of substances through pores.** Display this in a macro sense by taking a piece of thread, tying it into a small circle, and placing it in the soap mixture. Lift the bubble holder carefully - it should be covered with a soapy film. Gently place the wet thread circle on the film. Use a dry piece of paper to pop the soap film inside the thread circle. A round pore will form, through which you can stick a finger.



Name _____

SYNTHESIS QUESTIONS

1. How is a soap bubble like a cell membrane? How is a soap bubble NOT like a cell membrane?

Same **Different**

2. Explain how a large molecule (like proteins) might get into and out of the cell. **(3 ways)**

3. Which type of cell, Prokaryotic or Eukaryotic might have existed on earth first? Explain.

4. How might a Eukaryotic cell actually have evolved on earth?

Plant Cell Observation

1. Get 2 slides and 2 cover slips
2. Make the first slide with elodea and salt water and the second slide with elodea and fresh water.

* View the freshwater slide first. Draw ONLY ONE CELL and DESCRIBE. Be sure to label the parts

* View the freshwater slide first. Draw ONLY ONE CELL and DESCRIBE. Be sure to label the parts

Extension: If these represented your body cells, which organ, when affected, would have the most drastic effect on your behavior and WHY?

Name _____

Egg Osmosis

Day 1

MASS (g)		VOLUME (ML)	
Mass of egg without shell.		**VOLUME** of Corn Syrup used	20 ml
Mass of egg when out of corn syrup		Volume of Liquid in cup	
Amount of water lost/gained		Amount of liquid gained or lost	

Diagram:

What type of solution was it in and WHY.

Day 2

MASS (g)		VOLUME (ML)	
Mass of egg From Day 1.		**VOLUME** of water used	50 ml
Mass of egg when out of water		Volume of Liquid in cup	
Amount of water lost/gained		Amount of liquid gained or lost	

Diagram

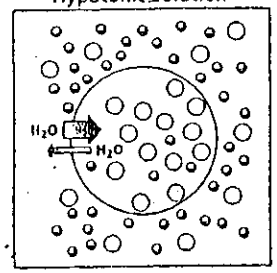
What type of solution was it in and WHY.

Osmosis and Hypotonic, Hypertonic, and Isotonic Solutions

Use with Chapter 8 section 8.1

Name _____

Hypotonic Solution



Approximate ratio of water molecules to dissolved particles

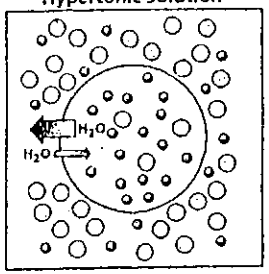
Inside cell:

____ water molecules: ____ dissolved particles

Outside cell:

____ water molecules: ____ dissolved particles

Hypertonic Solution



Approximate ratio of water molecules to dissolved particles

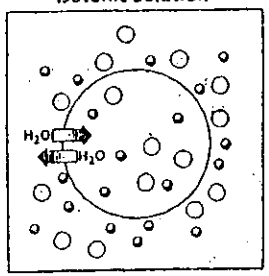
Inside cell:

____ water molecules: ____ dissolved particles

Outside cell:

____ water molecules: ____ dissolved particles

Isotonic Solution



Approximate ratio of water molecules to dissolved particles

Inside cell:

____ water molecules: ____ dissolved particles

Outside cell:

____ water molecules: ____ dissolved particles

Water molecules

Dissolved particles

Count the water molecules and dissolved particles inside and outside each cell.

1. Define the following terms:
   a. osmosis
   b. hypotonic solution
   c. hypertonic solution
   d. isotonic solution
2. When a cell is in a hypotonic solution, where will the water molecules move?
3. When a cell is in a hypertonic solution, where will the water molecules move?
4. When a cell is in an isotonic solution, where will the water molecules move?
5. EXPLAIN how hypotonic and hypertonic solutions can make a plant rigid and firm or make it wilt.
6. Osmosis is a form of PASSIVE TRANSPORT. Explain how facilitated diffusion, which is another form of passive transport, is different from osmosis.

Kidneys and the Excretory System

1. a. The body _____ and _____ with nitrogen, into _____ which is poisonous.

   b. The liver _____ with _____ to form _____ which is _____.

   c. _____ is _____ through the body as _____ and the _____ goes through the _____.

Kidney

The kidneys are a _____ located toward the _____ _____.

General

1. they play an important part in _____
   a. _____ and other wastes
   b. _____ the _____ in the blood
   c. _____ the concentration of _____.
   d. _____ about _____ of blood a day

Form: made up of _____ called **nephrons.**

Function: filtration

a. _____ through this unit _____ that contains nitrogenous _____

b. _____ and _____ remain in the blood and _____ , _____ and _____ are _____

reabsorption

a. _____ of all the glucose, water, salts _____ and _____ to _____

b. _____ in your body is _____ your _____ by the _____

1. ADH makes the _____
   a. When your body needs to _____ concentration is _____ and the _____ are _____

b. When your body needs to _____ is _____ and the _____ are _____

c. _____ in the nephrons is _____ where it is _____ it is _____.

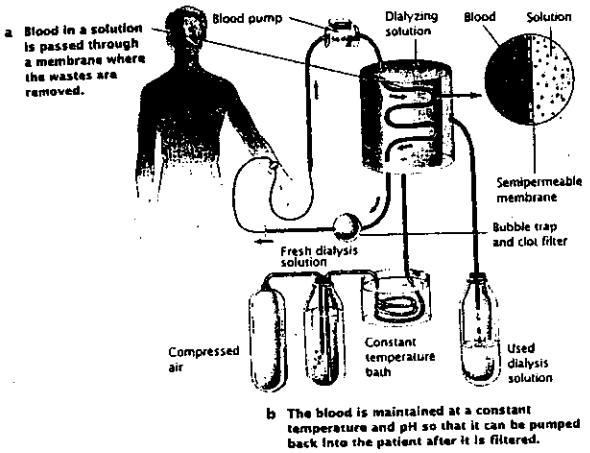
DISORDERS

1. 13 million people suffer from _____

   a. _____ : _____, _____ collect and become _____ in the _____ and later _____.

   b. _____ from disease or injury

2. _____; the _____ of the blood.
   a. Can be used 2 X a week or a _____ by the patient and the blood is _____ a day



Kidney Videos

Urinary System

1. The urinary system consists of a group of organs concerned with the conservation of body water and the acid-base balance of body fluids, as well as the excretion of undesired molecules. The principal organ of the urinary system is the kidney (Latin: renes; Greek: nephros). An individual normally has two kidneys, located on the posterior (back) wall of the abdominal cavity, partly protected by the curve of the 11^{th} and 12^{th} ribs. Many people have lived normal lives with only one kidney, but it is impossible to live without at least one unless supported by a blood filtration (dialysis) unit.

2. In this median section of the kidney you can see the four major divisions: the outer layer, the cortex (Greek: "bark"); a middle belt of conical pyramids, the medulla (Latin: "marrow"); an inner area containing the cuplike calyces (singular, calyx; Greek: kalix, "cup") with the renal pelvis (Greek: "basin"); and the concavity known as the hilus (Latin: "a trifle"), where the renal artery enters the kidney and where the ureter and renal vein exit.

3. The basic structural and functional unit of the kidney is the nephron. Each kidney has about one million nephrons. The nephron is a tubule, highly modified at the one end to filter blood. The filtration occurs in a globular cluster of highly specialized capillaries called a glomerulus, which is enclosed by a thin capsule. The capsule is comprised of a single layer of squamous epithelium and has the shape of a partly deflated ball pushed in on one side by the glomerulus so that the capsule largely surrounds the glomerulus. The interface between glomerulus and capsule is characterized by numerous pores in the capillary and slits in the epithelial capsule, enhancing filtration of blood plasma. Blood enters the glomerulus from the afferent arteriole, a sixth-order branch of the renal artery and large quantities of fluid filter out of the blood into the capsule, forming a glomerular filtrate. Only water, ions, and small molecules are normally found in the filtrate. Proteins and the various "formed elements" (cells) of the blood do not pass through the glomerular-capsular barrier except in disease states (one reason why urine tests are valuable in diagnosis).

4. Each capsule opens into a duct called the proximal convoluted tubule, and the filtrate passes into it. Both the capsule and the proximal tubule are located in the cortex. The proximal tubule enters the medulla as the descending segment of the loop of Henle. The ascending segment of the loop enters the cortex to become the distal convoluted tubule, which then empties into the collecting duct.

5. The efferent arteriole leaving the capsule divides into to a network of peritubular capillaries (not shown), which pass around all the parts of the tubule before emptying into a vein that will take the blood out of the kidney. As the filtrate passes through the nephron, approximately 99 percent of it is reabsorbed by the cells in the tubule wall and passed on into the peritubular capillaries. At the same time, various substances are secreted into the filtrate, including hydrogen and ammonium ions to reduce blood acidity. These tubular reabsorptions and secretions are carefully regulated by osmotic and hormonal mechanisms to maintain body homeostasis.

6. The collecting duct does not function in tubular reabsorption or secretion. It passes through the medulla, joining with others to form a larger collecting duct, which opens at the base of a renal pyramid. Here the urine (no longer called filtrate) is caught by the minor calyces, ducted into the major calyces, through the renal pelvis, and into the ureter.

7. The ureters conduct urine into the urinary bladder. Their epithelial lining is similar to that of the urinary bladder (see below). Smooth muscle, along with fibrous tissue, is found in the walls of the ureters and contributes to the expulsion of urine by peristaltic contractions.

8. The urinary bladder is situated in the front part of the pelvis. It is a fibromuscular sac lined with transitional (stratified, cuboidal) epithelium and has the capacity to distend in response to increasing volumes of urine or to contract in response to decreasing volumes. A tube called the urethra, lined with transitional epithelia in the upper portion and stratified columnar epithelia in the lower portion, exits from the base of the bladder and conveys urine to the outside of the body. The urethra is about 4 centimeters long in females, but about 20 centimeters in males because of its convoluted course.

Name _____

Summary Sentences

Paragraph 1
Paragraph 2
Paragraph 3
Paragraph 4
Paragraph 5
Paragraph 6
Paragraph 7
Paragraph 8
Overall Summary

Question:

1. Describe the basic structure of the kidney.

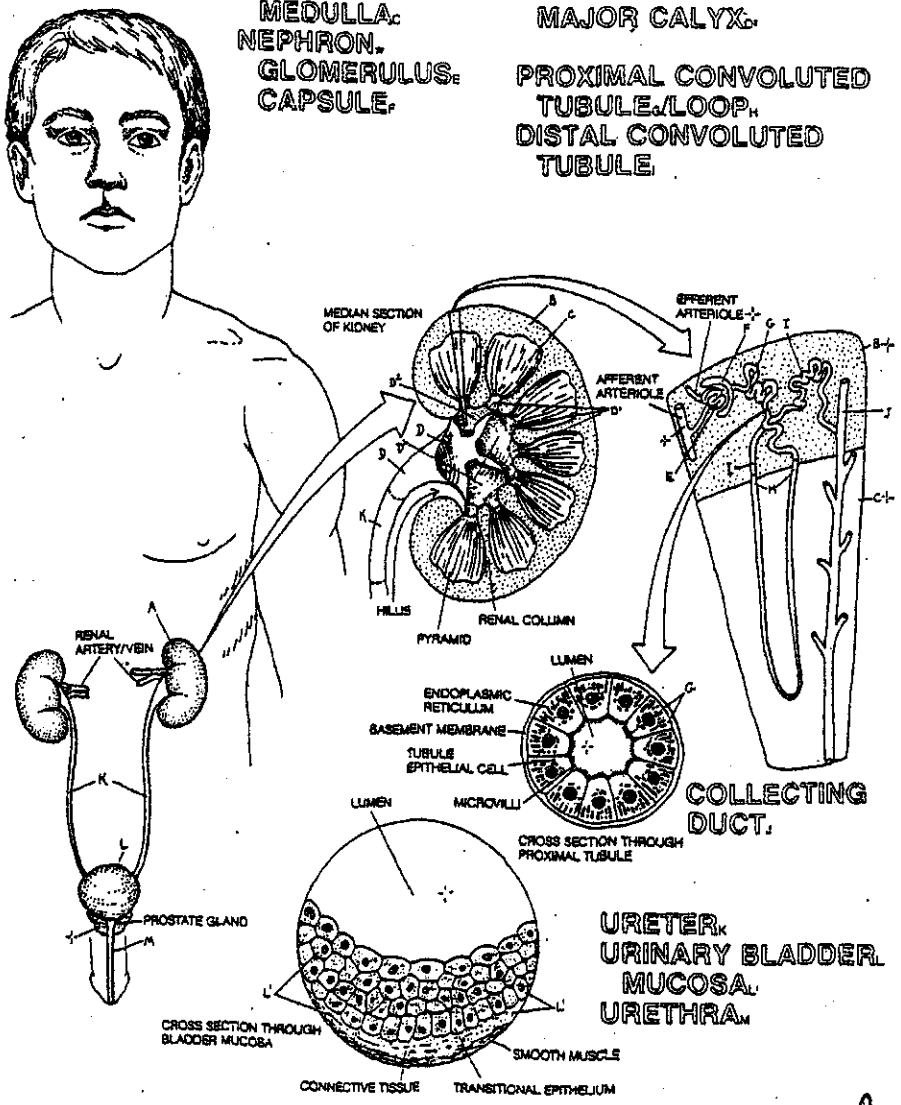
2. Describe how the kidney works.

URINARY SYSTEM.

KIDNEY$_A$
CORTEX$_B$
MEDULLA$_C$
NEPHRON.
GLOMERULUS$_E$
CAPSULE$_F$

RENAL PELVIS$_G$
MINOR CALYX$_{D'}$
MAJOR CALYX$_D$

PROXIMAL CONVOLUTED TUBULE$_I$/LOOP$_H$
DISTAL CONVOLUTED TUBULE



COLLECTING DUCT.

URETER$_K$
URINARY BLADDER$_L$
MUCOSA$_{L'}$
URETHRA$_M$

A

F22

Kidney Video

Parts of the kidney and what they do.

What molecules are moved by and WHY

Active Transport

Passive Transport

B