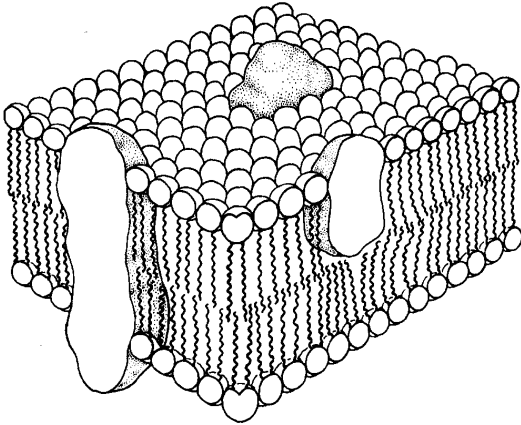


## CELL TRANSPORT

### MEMBRANE PROPERTIES

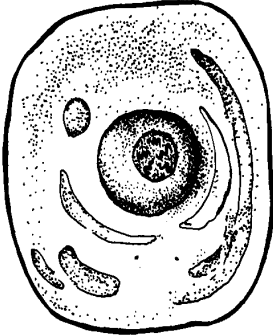
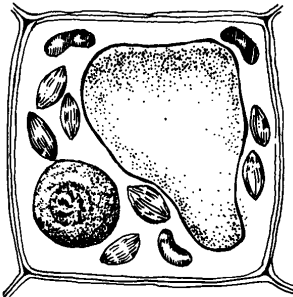
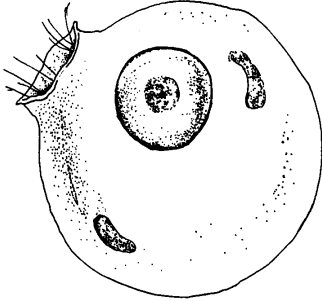
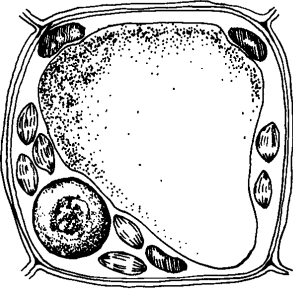
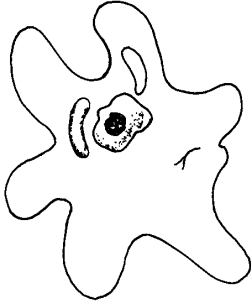
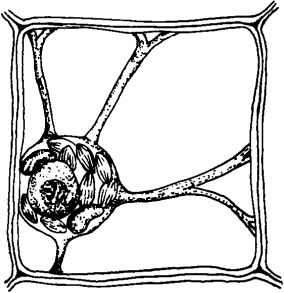


### PASSIVE TRANSPORT

|                         |
|-------------------------|
| <b>CHARACTERISTICS:</b> |
| <b>DIFFUSION:</b>       |

A diagram illustrating the process of diffusion in three stages, shown in three beakers connected by arrows. The first beaker shows a high concentration of black dots at the bottom and a low concentration of white dots at the top. The second beaker shows arrows pointing from the bottom to the top, indicating the movement of particles. The third beaker shows a uniform distribution of both black and white dots throughout the liquid.

|                 |                  |                   |
|-----------------|------------------|-------------------|
| <b>OSMOSIS:</b> |                  |                   |
| <b>ISOTONIC</b> | <b>HYPOTONIC</b> | <b>HYPERTONIC</b> |

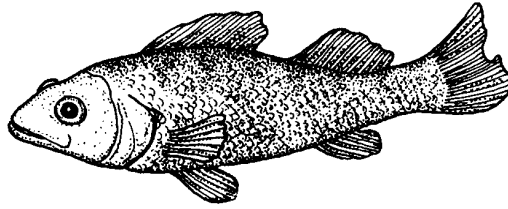
| <b>ANIMAL CELLS</b>   | <b>PLANT CELLS</b>   |
|---|--|
|    |    |
|  |  |
|  |  |

**OSMOREGULATION – ADAPTATIONS**

**Paramecium**



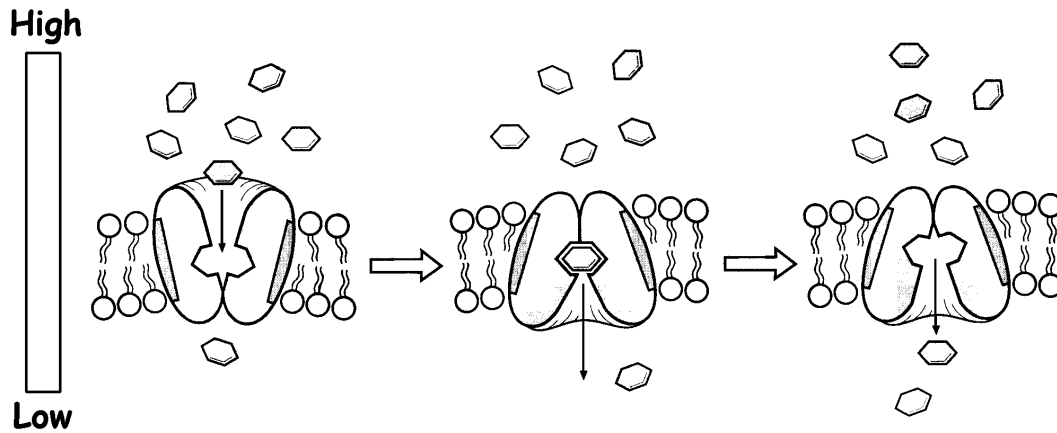
**Fresh Water Bony Fish**



**Marine Bony Fish**



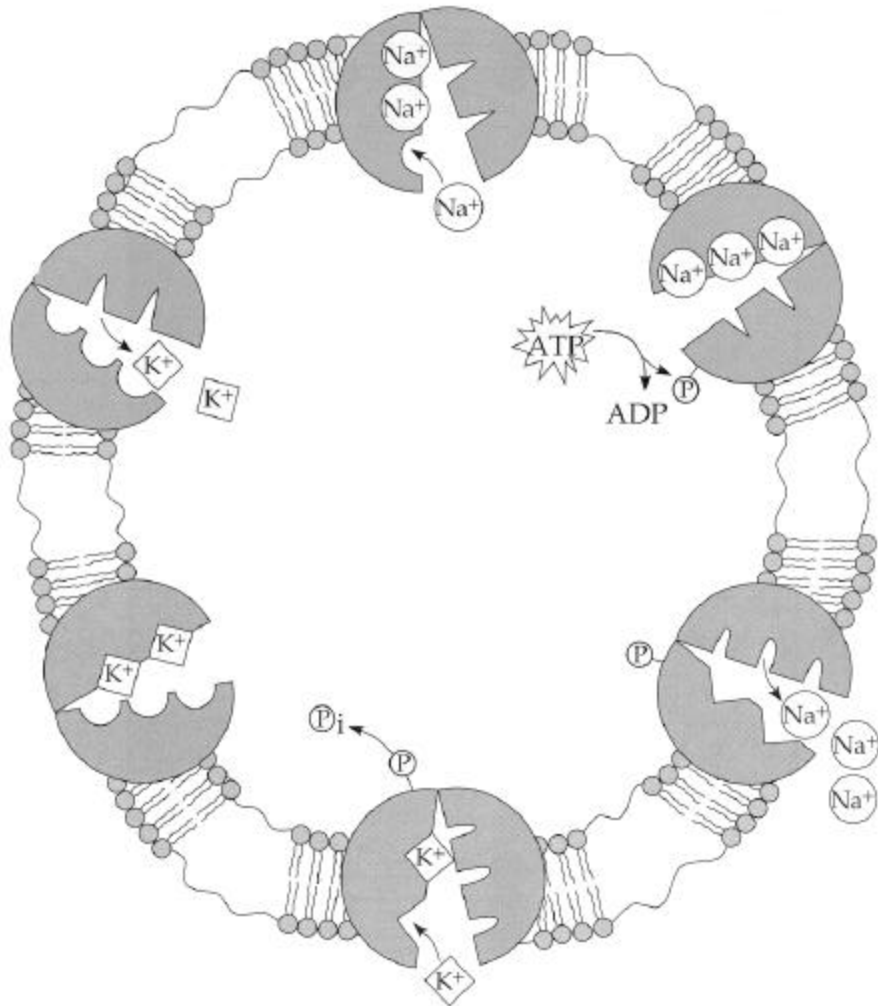
**FACILITATED DIFFUSION:**



# ACTIVE TRANSPORT

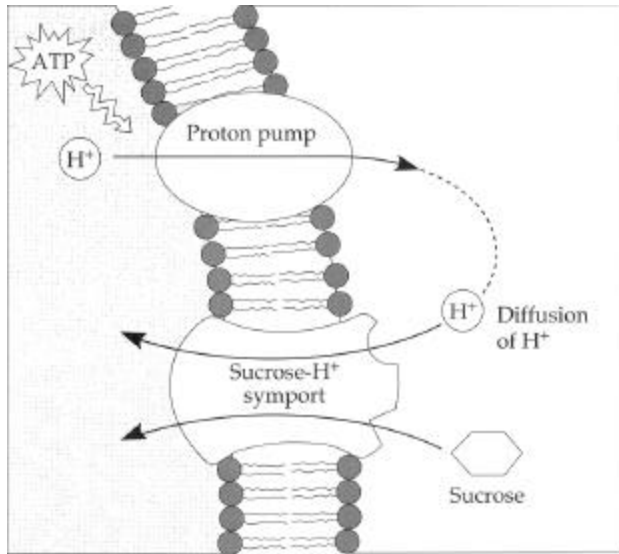
CHARACTERISTICS:

Na<sup>+</sup>/K<sup>+</sup> PUMPS:

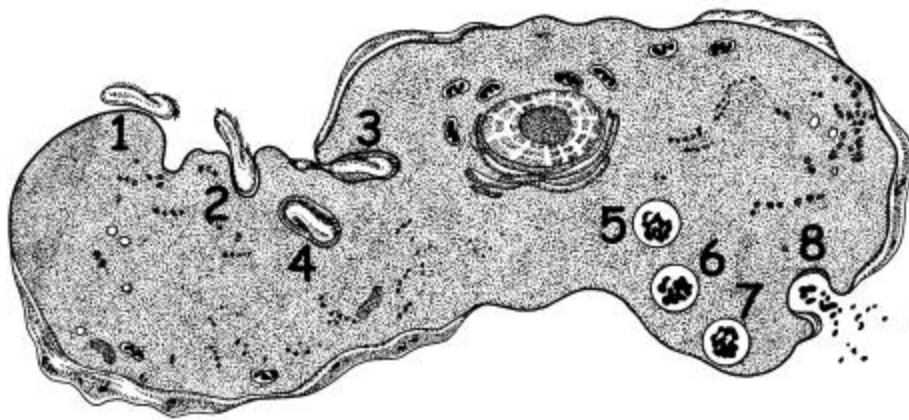


OTHER EXAMPLES:

**COTRANSPORT:**



**TRANSPORT OF LARGE MOLECULES:**



| TYPES OF ENDOCYTOSIS                     |  |
|--|--|
| <b>PHAGOCYTOSIS</b>                      |  |
| <b>PINOCYTOSIS</b>                       |  |
| <b>RECEPTOR-MEDIATED<br/>ENDOCYTOSIS</b> |  |

**QUESTIONS:**

1. Use the key below to indicate how each class of materials is transported across the membrane.

- A. Diffuses through the membrane.
- B. Small enough to pass through the spaces between the phospholipid molecules.
- C. Requires the assistance of transport proteins.

\_\_\_\_\_ Nonpolar materials

\_\_\_\_\_ Water

\_\_\_\_\_ Ions

\_\_\_\_\_ Large polar uncharged molecules

\_\_\_\_\_ Small polar uncharged molecules

2. What is the role of transport proteins in biological membranes?

---

---

3. Describe how each of the following affect the rate of diffusion.

a. Molecular size: \_\_\_\_\_

b. Temperature: \_\_\_\_\_

4. A semipermeable sac, containing 4% NaCl, 9% glucose, and 10% albumin, is suspended in a solution with the following composition: 10% NaCl, 10% glucose, and 40% albumin. Assume the sac is permeable to all substances **except** albumin. Use the key provided to determine how each substance will move.

\_\_\_\_\_ Glucose

A. Moves into the sac

\_\_\_\_\_ Albumin

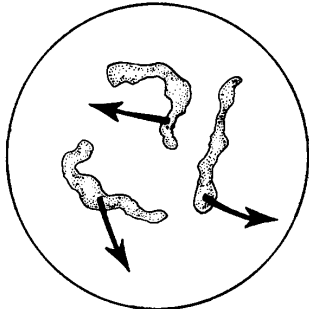
B. Moves out of the sac

\_\_\_\_\_ Water

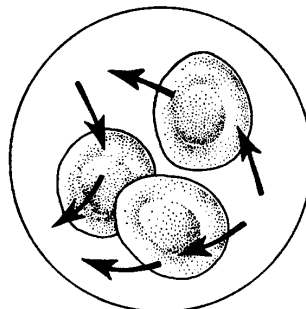
C. Does not move

\_\_\_\_\_ NaCl

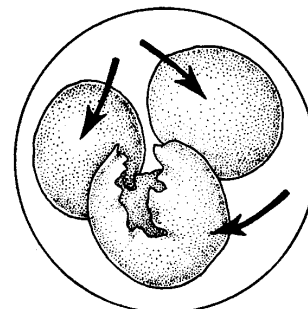
5. The diagrams below show three microscopic fields (A-C) containing red blood cells. Arrows indicate the direction of net water movement. Answer the following questions.



**Diagram A**



**Diagram B**



**Diagram C**

a. Which microscopic field shows a hypertonic environment? \_\_\_\_\_

b. Which microscopic field shows a cell hypertonic to its environment?

---

c. Which microscopic field shows an isotonic environment? \_\_\_\_\_

d. Describe what is happening to the cells in Field C.

\_\_\_\_\_

Explain why this is happening. \_\_\_\_\_

\_\_\_\_\_

6. The table below describes the experimental procedure designed to investigate the effect of temperature and concentration on the rate of diffusion.

| Beaker A  | Beaker B   | Beaker C  | Beaker D   | Beaker E   | Beaker F  |
|---|--|---|--|--|---|
| Fill with 200 mL of tap water                           | Fill with 200 mL of tap water                            | Fill will 200 mL of tap water                           | Fill will 200 mL of tap water                            | Fill will 200 mL of tap water                                  | Fill will 200 mL of tap water                                   |
| Room Temp.  | Room Temp.   | Place 4 ice cubes in beaker                             | Place 4 ice cubes in beaker                              | Heat beaker until water boils                                  | Heat beaker until water boils                                   |
| Place 5 g of potassium permangana te crystals in beaker | Place 10 g of potassium permangana te crystals in beaker | Place 5 g of potassium permangana te crystals in beaker | Place 10 g of potassium permangana te crystals in beaker | Place 5 g of potassium permangana te crystals in boiling water | Place 10 g of potassium permangana te crystals in boiling water |
| Do not stir.  | Do not stir.   | Do not stir.  | Do not stir.   | Do not stir.   | Do not stir.  |
| Time how long water takes to become completely colored  | Time how long water takes to become completely colored   | Time how long water takes to become completely colored  | Time how long water takes to become completely colored   | Time how long water takes to become completely colored         | Time how long water takes to become completely colored          |
| Record time.  | Record time.   | Record time.  | Record time.   | Record time.   | Record time.  |

In summarizing the data, the class ordered the beakers according to the rate of time it took for the water to become colored. The list is shown below:

- F Beaker in which water became completely colored first
- E
- B
- A
- D
- C Beaker in which water became completely colored last

a. What effect did the concentration of potassium permanganate have on the rate of diffusion in:

Beakers A and B? \_\_\_\_\_



Beakers C and D? \_\_\_\_\_

Beakers E and F? \_\_\_\_\_

b. What effect did temperature have on the rate of diffusion?

\_\_\_\_\_

c. Which set of beakers -- A and B, C and D, or E and F -- served as the control in this investigation?

\_\_\_\_\_

d. Why did the water in beaker F become colored the fastest?

\_\_\_\_\_

e. What would happen if the concentration of potassium permanganate in beaker D were increased?

\_\_\_\_\_

7. Examine the drawing at the right. The tube, filled with 10% sucrose solution, was placed in a 5% sucrose solution. The membrane covering the bottom of the tube is impermeable to sucrose.

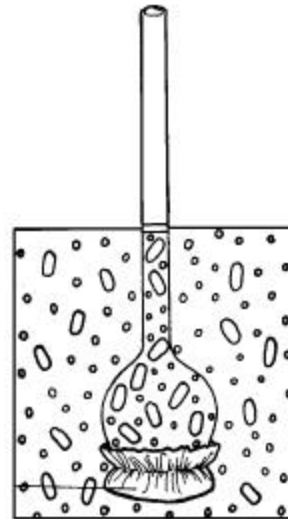
a. In what direction does water move?

\_\_\_\_\_

b. Explain why in terms of osmotic pressure.

\_\_\_\_\_

\_\_\_\_\_

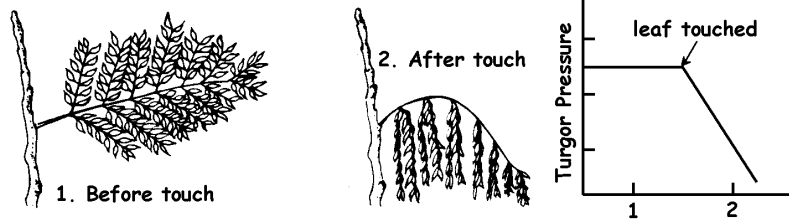


c. Is the tube contents hypertonic, hypotonic, or isotonic? \_\_\_\_\_

d. Is the solution outside the tube hypertonic, hypotonic, or isotonic?

\_\_\_\_\_

8. The following diagrams show what happens when a leaf of a *Mimosa pudica* is touched. The graph to the right shows the changes in turgor pressure in the cells at the base of the leaf. Study the drawings and graph below.



Explain what is happening. \_\_\_\_\_

\_\_\_\_\_

9. Define the following terms:

|                                 |  |
|---------------------------------|--|
| <b>Membrane potential</b>       |  |
| <b>Electrochemical gradient</b> |  |

10. What two forces drive the passive transport of ions across a membrane?

\_\_\_\_\_

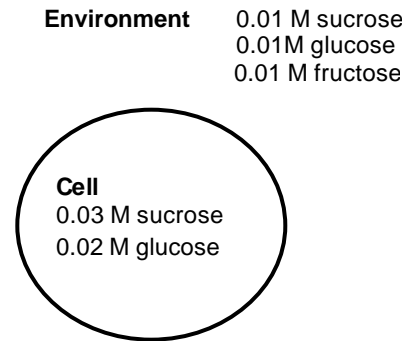
\_\_\_\_\_

11. What factors contribute to the membrane potential of a cell?

\_\_\_\_\_

\_\_\_\_\_

12. An artificial cell with an aqueous solution enclosed in a selectively permeable membrane has just been placed in a environment containing a different solution. The membrane is permeable to water and to the simple sugars glucose and fructose, but is completely impermeable to sucrose. Use this information and the diagram at the right to answer the questions that follow.



- a. Which solute(s) will exhibit a net diffusion into the cell?  
\_\_\_\_\_
- b. Which solute(s) will exhibit a net diffusion out of the cell?  
\_\_\_\_\_
- c. In which direction will there be a net osmotic movement of water?  
\_\_\_\_\_
- d. After the cell is placed into the environment, which of the following changes would occur? (Check the correct box.)
- The artificial cell would be become flaccid.
  - The artificial cell would become more turgid.
  - There would be no net change in the cell.

13. Match the description / definition / example with the correct transport process.

- |                                  |                |
|----------------------------------|----------------|
| A. Active transport              | B. Diffusion   |
| C. Endocytosis                   | D. Exocytosis  |
| E. Facilitated diffusion         | F. Osmosis     |
| G. Phagocytosis                  | H. Pinocytosis |
| I. Receptor-mediated endocytosis |                |

\_\_\_\_\_ movement of water across a semipermeable membrane down its concentration gradient.

\_\_\_\_\_ The movement of materials across a semipermeable membrane down their concentration gradients with the assistance of transport proteins

- \_\_\_\_\_ The movement of materials down their concentration gradients
- \_\_\_\_\_ Pumping of materials across a membrane against their concentration gradients
- \_\_\_\_\_ Intake of small droplets of liquid by endocytosis
- \_\_\_\_\_ Occurs when a vesicle/vacuole fuses with the cell membrane releasing the contents to the outside
- \_\_\_\_\_ Intake of solids by endocytosis
- \_\_\_\_\_ Occurs when a small region of the plasma membrane invaginates, pinches off, and forms a vesicle/vacuole
- \_\_\_\_\_ The molecule to be transported binds to a receptor protein in the plasma membrane; the complex migrates to a specialized coated pit; the pit pinches off forming a vesicle/vacuole
- \_\_\_\_\_ Low-density lipoproteins outside the cell bind to LDL receptor proteins on the cell membrane; the LDL protein complex migrates through the cell membrane to specialized coated pits; the pit pinches off forming a vesicle/vacuole
- \_\_\_\_\_ Sodium / potassium pump
- \_\_\_\_\_ Transport proteins are used to transport glucose or amino acids down their concentration gradients into the cell
- \_\_\_\_\_ White blood cells engulf a harmful bacterium
- \_\_\_\_\_ Drinking sea water causes the loss of water from cells lining the digestive tract

14. Complete the following chart comparing the different transport processes.

| <b>Transport Method</b> | <b>Requires Cell Energy<br/>Yes or No</b> | <b>Transport Direction:<br/>Down gradient (H to L) or<br/>Against gradient (L to H)</b> |
|-------------------------|---|---|
| Diffusion               |   |   |
| Facilitated Diffusion   |   |   |
| Osmosis                 |   |   |
| Active Transport        |   |   |
| Endocytosis             |   |   |
| Exocytosis              |   |   |

15. Examine the drawing at the right.

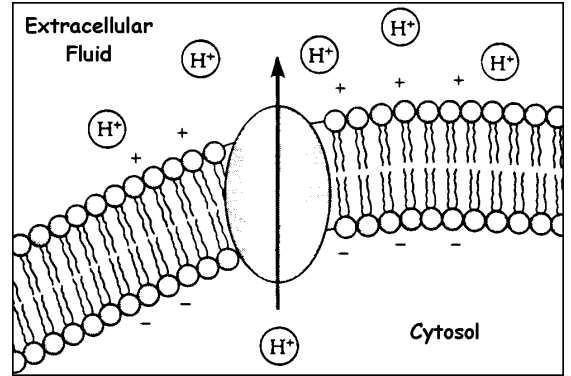
a. Does this drawing represent facilitated diffusion or active transport?

\_\_\_\_\_

b. How can you tell?

\_\_\_\_\_

\_\_\_\_\_



16. Examine the drawing at the right.

a. Does this drawing represent facilitated diffusion or active transport?

\_\_\_\_\_

b. How can you tell?

\_\_\_\_\_

\_\_\_\_\_

