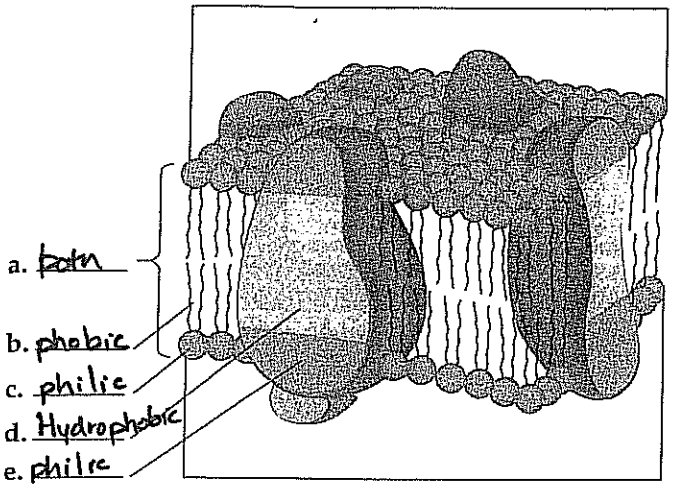
KEY

INTERACTIVE QUESTION 8.1

Label the components in this diagram of the fluid mosaic model of membrane structure. Indicate the regions that are hydrophobic and those that are hydrophilic.



INTERACTIVE QUESTION 8.4

What types of molecules have difficulty crossing the plasma membrane? Why?

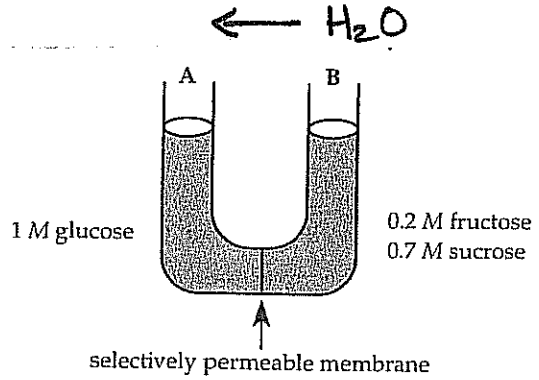
ions, lg polar mol. } hydrophilic

lg nonpolar mol. } too bulky

INTERACTIVE QUESTION 8.2

a. Cite some experimental evidence that shows that membrane proteins drift. See notes on human mouse cell fusion

b. How might the plasma membrane of a plant cell change in response to the cold temperatures of winter? inc. unsat. fatty acids in phospholipids



INTERACTIVE QUESTION 8.6

a. What osmotic problems do freshwater protists face?

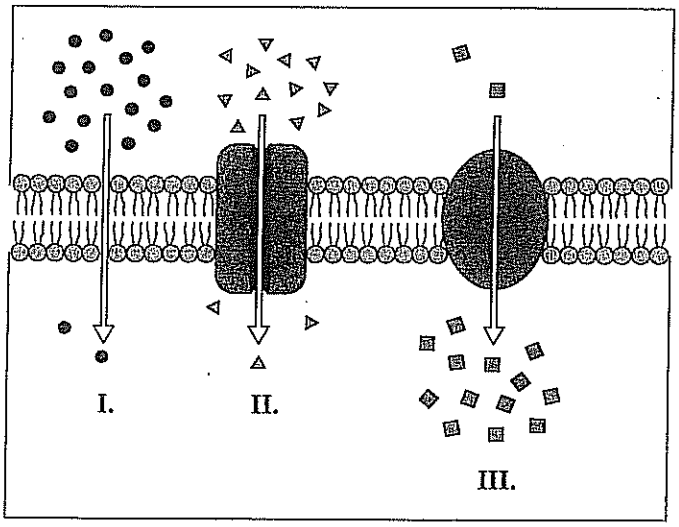
excess water enters cell

b. What adaptations may help them osmoregulate?

Contractile vacuole

STRUCTURE YOUR KNOWLEDGE

1. Create a concept map to illustrate your understanding of osmosis. This exercise will help you practice using the words *hypotonic, isotonic,* and *hypertonic,* and it will help you focus on the effect of these osmotic environments on plant and animal cells. Explain your map to a friend.
2. The following diagram illustrates passive and active transport across a plasma membrane. Use it to answer questions a–d.



a. Which section represents facilitated diffusion? II

How can you tell? movement from high to low

Does the cell expend energy in this transport? No

Why or why not?

What types of solute molecules may be moved by this type of transport?

ions, polar mol.

b. Which section shows active transport? III

How can you tell? movement from ↓ to ↑

Does the cell expend energy in this transport? Yes

Why or why not? against gradient

c. Which section shows diffusion? I

What types of solute molecules may be moved by this type of transport? very small polar mol. like H_2O or small nonpolar mol.

d. Which of these sections are considered passive transport?

I + II

TEST YOUR KNOWLEDGE

MULTIPLE CHOICE: *Choose the one best answer.*

1. Glycoproteins and glycolipids are important for
   a. facilitated diffusion.
   b. active transport.
   c. cell-cell recognition.
   d. cotransport.
   e. signal-transduction pathways.

2. A single layer of phospholipid molecules coats the water in a beaker. Which part of the molecules will face the air?
   a. the phosphate groups
   b. the hydrocarbon tails
   c. both head and tail because the molecules are amphipathic and will lie sideways
   d. the phospholipids would dissolve in the water and not form a membrane coat
   e. the glycolipid regions

3. Which of the following is *not* true about osmosis?
   a. It increases free energy in a system.
   b. Water moves from a hypotonic to a hypertonic solution.
   c. Solute molecules bind to water and decrease the water available to move.
   d. It increases the entropy in a system.
   e. There is no net osmosis between isotonic solutions.

4. Support for the fluid mosaic model of membrane structure comes from
   a. the freeze-fracture technique of electron microscopy.
   b. the movement of proteins in hybrid cells.
   c. the amphipathic nature of membrane proteins.
   d. both a and c.
   e. all of the above.

5. A freshwater *Paramecium* is placed into salt water. Which of the following events would occur?
   a. an increase in the action of its contractile vacuole
   b. swelling of the cell until it becomes turgid
   c. swelling of the cell until it lyses
   d. shriveling of the cell
   e. diffusion of salt ions out of the cell

6. Ions diffuse across membranes down their
   a. electrochemical gradient.
   b. electrogenic gradient.
   c. electrical gradient.
   d. concentration gradient.
   e. osmotic gradient.

7. The fluidity of membranes in a plant in cold weather may be maintained by
   a. increasing the number of phospholipids with saturated hydrocarbon tails.
   b. activating an H^+ pump.
   c. increasing the concentration of cholesterol in the membrane.
   d. increasing the proportion of peripheral proteins.
   e. increasing the number of phospholipids with unsaturated hydrocarbon tails.

8. A plant cell placed in a hypotonic environment will
   a. plasmolyze.
   b. shrivel.
   c. become turgid.
   d. become flaccid.
   e. lyse.

9. Which of the following is *not* true of the carrier molecules involved in facilitated diffusion?
   a. They increase the speed of transport across a membrane.
   b. They can concentrate solute molecules on one side of the membrane.
   c. They may have specific binding sites for the molecules they transport.
   d. They may undergo a conformational change upon binding of solute.
   e. They may be inhibited by molecules that resemble the solute to which they normally bind.

10. The membrane potential of a cell favors the
    a. movement of cations into the cell.
    b. movement of anions into the cell.
    c. action of an electrogenic pump.
    d. movement of sodium out of the cell.
    e. action of a proton pump.

11. Cotransport may involve
    a. active transport of two solutes through a transport protein.
    b. passive transport of two solutes through a transport protein.
    c. ion diffusion against the electrochemical gradient created by an electrogenic pump.
    d. a pump such as the Na^+-K^+ pump that moves ions in two different directions.
    e. transport of one solute against its concentration gradient in tandem with another that is diffusing down its concentration gradient.

12. Exocytosis involves all of the following *except*
    a. ligands and coated pits.
    b. the fusion of a vesicle with the plasma membrane.
    c. a mechanism to transport carbohydrates to the outside of plant cells during the formation of cell walls.
    d. a mechanism to rejuvenate the plasma membrane.
    e. a means of exporting large molecules.

13. The proton pump in plant cells is the functional equivalent of an animal cell's
    a. cotransport mechanism.
    b. sodium-potassium pump.
    c. contractile vacuole for osmoregulation.
    d. receptor-mediated endocytosis of cholesterol.
    e. ATP pump.

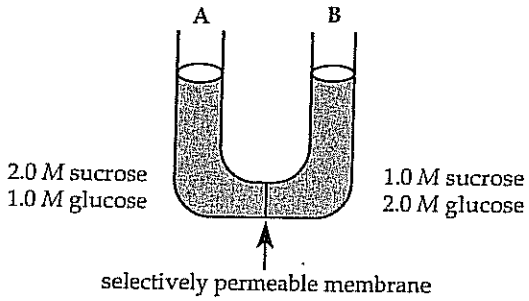
14. Pinocytosis involves
    a. the fusion of a newly formed food vacuole with a lysosome.
    b. receptor-mediated endocytosis and the formation of vesicles.
    c. the pinching in of the plasma membrane around small droplets of external fluid.
    d. pseudopod extension as vesicles move along the cytoskeleton and fuse with the plasma membrane.
    e. the accumulation of specific large molecules in a cell.

15. Watering a houseplant with too concentrated a solution of fertilizer can result in wilting because
    a. the uptake of ions into plant cells makes the cells hypertonic.
    b. the soil solution becomes hypertonic, causing the cells to lose water.
    c. the plant will grow faster than it can transport water and maintain proper water balance.
    d. diffusion down the electrochemical gradient will cause a disruption of membrane potential and accompanying loss of water.
    e. the plant will suffer fertilizer burn due to a caustic soil solution.

16. A cell is manufacturing receptor proteins for cholesterol. How would those proteins be oriented in the following membranes before they reach the plasma membrane?
    a. facing inside the ER lumen but outside the transport vesicle membrane
    b. facing inside the ER lumen and inside the transport vesicle
    c. attached outside the ER and outside the transport vesicle
    d. attached outside the ER but facing inside the transport vesicle
    e. completely embedded in the hydrophobic center of both the ER and transport vesicle membranes

17. Which of the following is the most probable description of an integral, transmembrane protein?
    a. amphipathic with a hydrophilic head and a hydrophobic tail region
    b. a globular protein with hydrophobic amino acids in the interior and hydrophilic amino acids arranged around the outside
    c. a fibrous protein coated with hydrophobic sugar residues
    d. a glycoprotein with oligosaccharides attached to the portion of the protein facing the exterior of the cell and cytoskeletal elements facing inside the cell
    e. a middle region composed of α-helical stretches of hydrophobic amino acids, with hydrophilic regions at both ends of the protein

Use the U-tube setup to answer questions 18 through 20.



The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is filled with a solution of 2.0 *M* sucrose and 1.0 *M* glucose. Side B is filled with 1.0 *M* sucrose and 2.0 *M* glucose.

glucose 1.5 sucrose 2 = 3.5

glucose 1.5 sucrose 1 = 2.5

18. *Initially*, the solution in side A, with respect to that in side B, is
    a. hypotonic.
    b. hypertonic.
    c. isotonic.
    d. lower.
    e. higher.

19. *After* the system reaches equilibrium, what changes are observed?
    a. The water level is higher in side A than in side B.
    b. The water level is higher in side B than in side A.
    c. The molarity of glucose is higher in side A than in side B.
    d. The molarity of sucrose has increased in side A.
    e. Both a and c have occurred.

20. During the period *before* equilibrium is reached, which molecule(s) will show net movement through the membrane?
    a. water
    b. glucose
    c. sucrose
    d. water and sucrose
    e. water and glucose

21. Facilitated diffusion across a cellular membrane requires _____ and moves a solute _____ its concentration gradients.
    a. energy and transport proteins . . . down
    b. energy and transport proteins . . . up (against)
    c. energy . . . up
    d. transport proteins . . . down
    e. transport proteins . . . up

22. The extracellular fluids that surround the cells of a multicellular animal must be _____ to the cells.
    a. buffers
    b. isotonic
    c. hypotonic
    d. hypertonic
    e. homeotonic

23. LDLs (low-density lipoproteins) enter animal cells by
    a. diffusion through the lipid bilayer.
    b. pinocytosis.
    c. exocytosis.
    d. receptor-mediated endocytosis.
    e. diffusion through transport proteins

24. The fluid mosaic model describes biological membranes as consisting of
    a. a phospholipid bilayer with proteins sandwiched between the layers.
    b. a lipid bilayer with proteins coating the outside of this hydrophobic structure.
    c. a phospholipid bilayer with proteins embedded in and attached to it.
    d. a protein bilayer with phospholipids embedded in it.
    e. a cholesterol bilayer with proteins embedded in the hydrophobic center.

25. You observe plant cells under a microscope that have just been placed in an unknown solution. First the cells plasmolyze; after a few minutes, the plasmolysis reverses and the cells appear normal. What would you conclude about the unknown solute.
    a. It is hypertonic to the plant cells, and its solute cannot cross the plant cell membranes.
    b. It is hypotonic to the plant cells, and its solute cannot cross the plant cell membranes.
    c. It is isotonic to the plant cells, but its solute can cross the plant cell membranes.
    d. It is hypertonic to the plant cells, but its solute can cross the plant cell membranes.
    e. It is hypotonic to the plant cells, but its solute can cross the plant cell membranes.