

Topic 3: Cells & Cell Transport

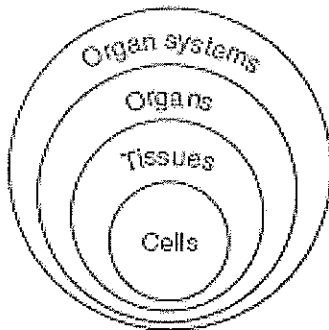
Cell Theory:

- All living are made of cells. (Cells are the basic units of structure)
- All living things carry out life functions (Cells are the basic units of function)
- Cells come from pre-existing cells.

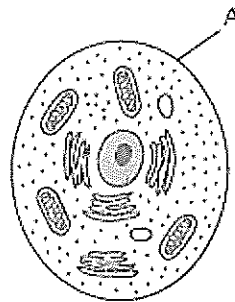
Exceptions to Cell Theory:

- Viruses do not contain any organelles
- Chloroplasts and Mitochondria have their own DNA
- Where did the very first cell come from

Organization in Multicellular Organisms:

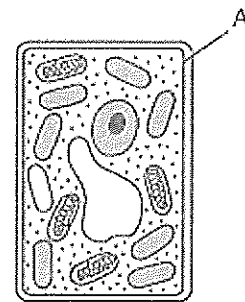


Animal Cell:



Cell X

Plant Cell:

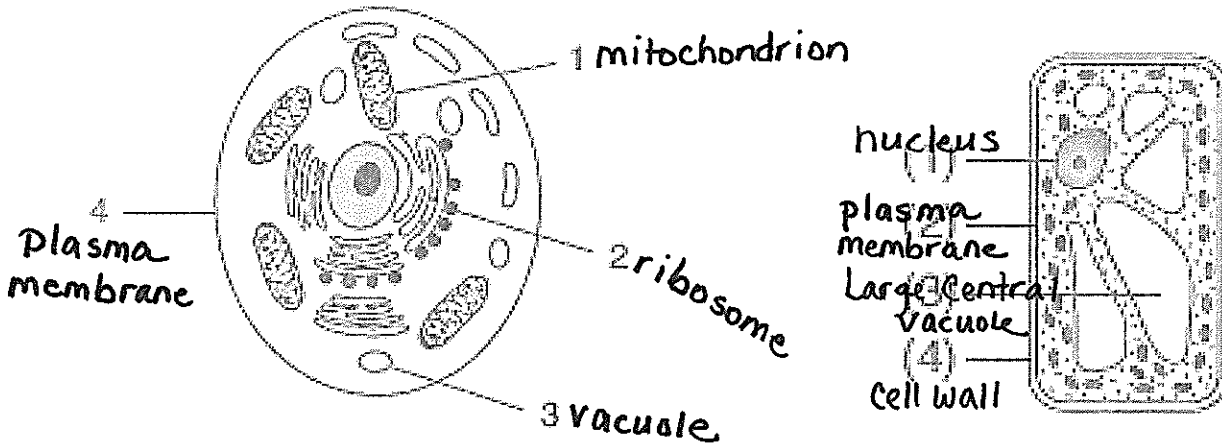


Cell Y

Organelle	Function
1. Nucleus	Contains DNA
2. Cytoplasm	Fluid that contains organelles, site of chemical reactions
3. Ribosomes	Protein synthesis
4. Endoplasmic Reticulum	Manufacturing and transport Smooth – no ribosomes Rough - ribosomes
5. Golgi Apparatus	Modifies and packages into vesicles (sacs)
6. Mitochondria	site of cellular respiration (produce ATP)
7. Plasma Membrane	controls what enters and leaves the cell
8. Vacuole	Storage
9. Lysosome	contains digestive enzymes for digestion
10. Centrioles	Aids in cell division (animal cells only)
11. Chloroplast	transforms light energy into chemical energy site of photosynthesis (plant cells only)
12. Cell Wall	Protection and support, made of cellulose (plant cells only)

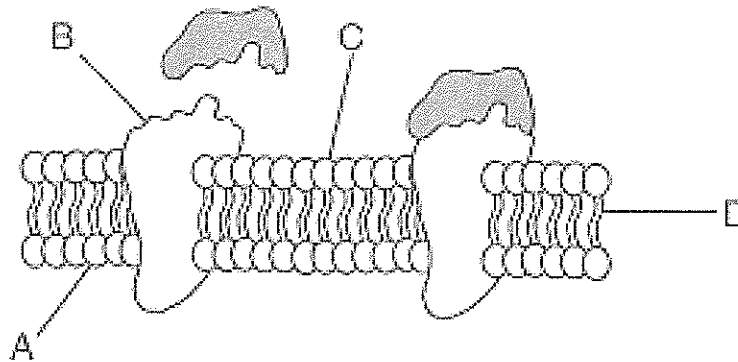


Label the Diagrams Below:

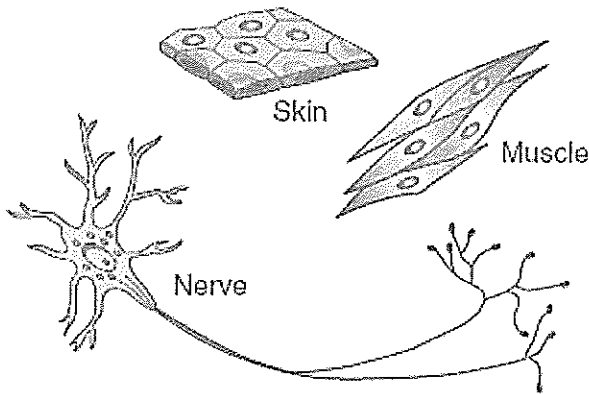


Cell Membrane: a bilipid layer with proteins embedded in it

- Important in cell communication and cell transport
- What letter(s) represent the proteins? B
- What letter(s) represent the lipids? A, C, D



Cells Make Up Different Kinds of Tissues: they perform different functions but all work together to maintain homeostasis



How do the chromosome numbers of these cells compare with one another?

Same

How do the genes compare?

Same

How are the cells able to perform such different functions?

Different cells are utilizing different parts of the genetic code.

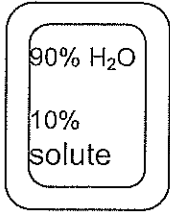
Different genes have different genes turned on, and different genes turned off.

- Osmosis: Movement of water molecules from an area of high concentration to an area of low concentration (FOCUS on is the cell shrinking or swelling??)

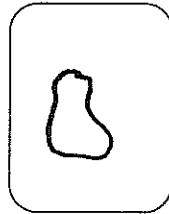
Plant Cells:

Draw what happens:

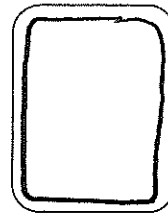
Draw what happens:



→
add 15% salt
solution



→
add distilled
water



This cell will

plasmolyze

This cell will

gain water

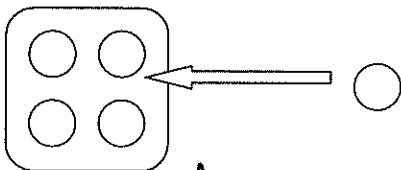
THINK: What might happen to plants along roadways that are salted in winter?

The excess salt makes the soil hypertonic. The plant cells will lose water and plasmolyze.

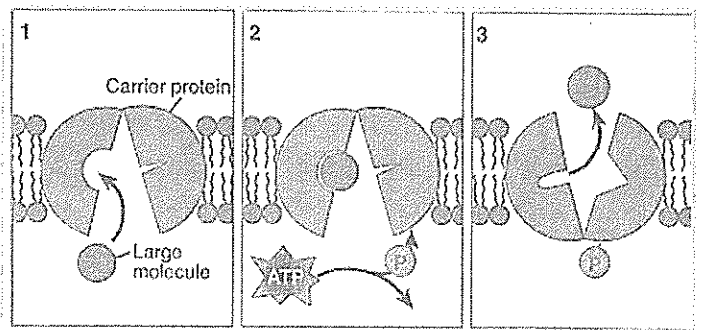
- Active Transport: Moving molecules from an area of low concentration to an area of high concentration (requires ATP)

Example: molecules in our cells

○ = Ca molecules
High concentration low concentration



Against the concentration gradient.



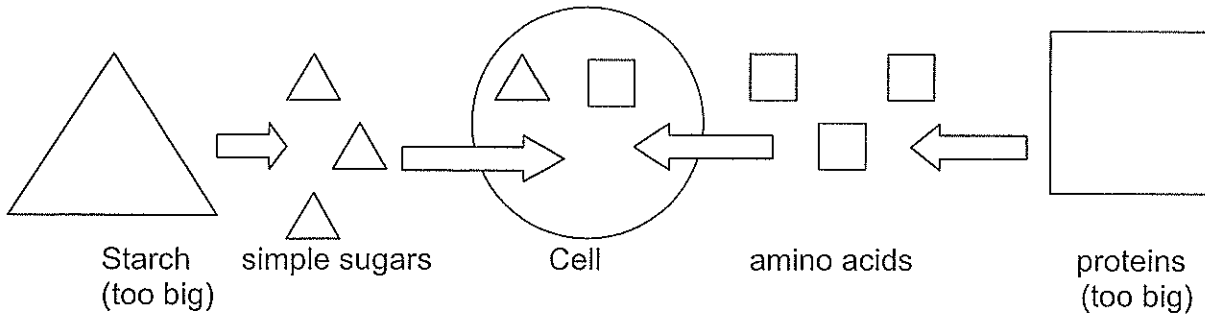
Using ATP and a carrier protein to move molecules across the membrane.

Molecules in Cells:

All cells require nutrients for energy. Some of these are too large to pass through the cell membrane and must first be broken down.

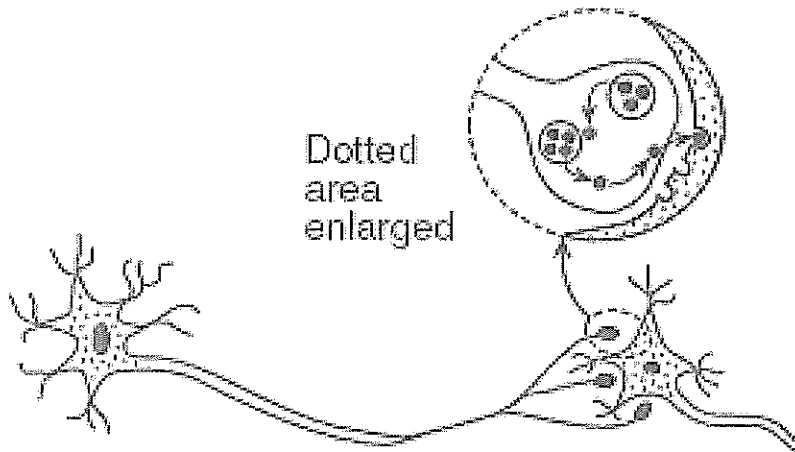
- Organic molecules such as ^(starch) polysaccharides & ^(protein) polypeptides are too big and must first be broken down in a process called hydrolysis, so that the molecules are small enough to pass through the cell membrane. Proteins must be digested into amino acids. Starches must be digested into monosaccharides (simple sugars).

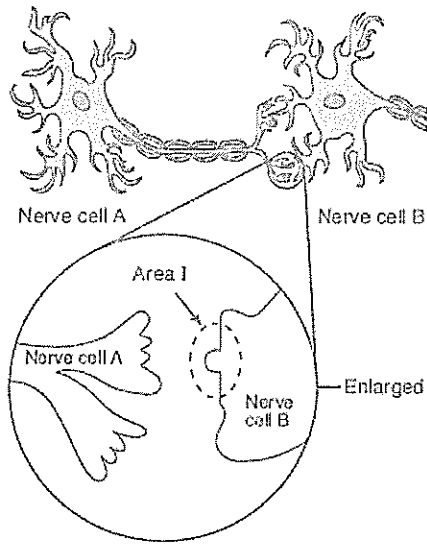
Directions: Shade in the two arrows representing digestion.



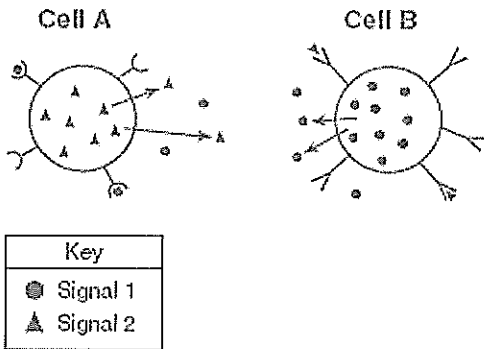
Receptor Molecules play an important role in cell communication:

- Receptor molecules and their chemical messengers fit together like a lock and key. They are specific, just like enzyme/substrate and antibody/antigen reactions.
- Examples of chemical messengers include neurotransmitters and hormones.
- This shows a diagram of communication between two neurons (nerve cells).



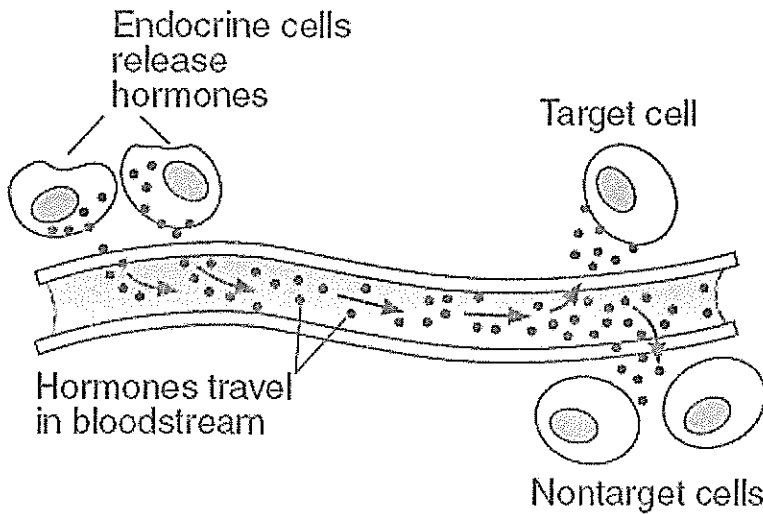


In the space below, sketch a chemical molecule that might be released from nerve cell A and be recognized and bind to area I of nerve cell B.



Information can be sent from

- (1) cell A to cell B because cell B is able to recognize signal 1
- (2) cell A to cell B because cell A is able to recognize signal 2
- (3) cell B to cell A because cell A is able to recognize signal 1
- (4) cell B to cell A because cell B is able to recognize signal 2



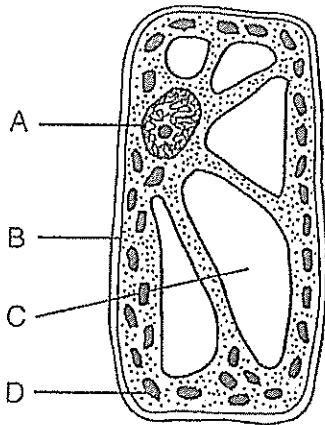
Explain why the hormones attach to the target cells and not the other cells in the diagram.

Target cells have specific receptors that match specific hormones.

CELLS & CELL TRANSPORT

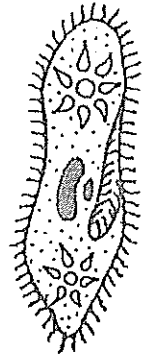
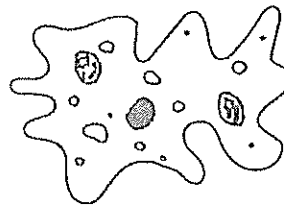
29

- Which organism is considered an exception to the cell theory because it has a noncellular structure?
 - alga
 - bacterium
 - virus
 - moss
- Which statement is *not* a part of the cell theory?
 - Cells are the basic unit of structure of living things.
 - Cells are the basic unit of function of living things.
 - Cell parts such as chloroplasts are self-replicating.
 - Cells come from preexisting cells.
- Which cell organelle is most directly involved with the bonding of amino acids?
 - mitochondrion
 - endoplasmic reticulum
 - cell wall
 - ribosome
- Which letter indicates a cell structure that directly controls the movement of molecules into and out of the cell?



- A
 - B
 - C
 - D
- Communication between cells is affected if there is decreased ability to produce
 - digestive enzymes and gametes
 - antibodies and chloroplasts
 - hormones and nerve impulses
 - antibiotics and guard cells

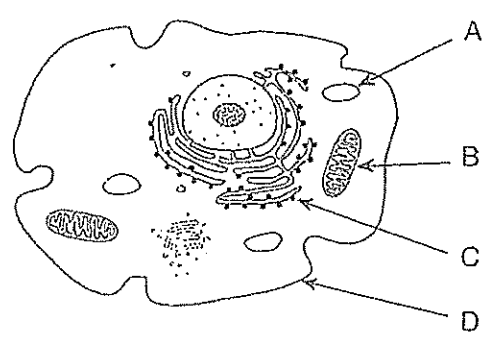
- Studies of fat cells and thyroid cells show that fat cells have fewer mitochondria than thyroid cells. A biologist would most likely infer that fat tissue
 - does not require energy
 - has energy requirements equal to those of thyroid tissue
 - requires less energy than thyroid tissue
 - requires more energy than thyroid tissue
- The diagram below represents two single-celled organisms.



These organisms carry out the activities needed to maintain homeostasis by using specialized internal

- tissues
 - organelles
 - systems
 - organs
- Most of the hereditary information that determines the traits of an organism is located in
 - only those cells of an individual produced by meiosis
 - the nuclei of body cells of an individual
 - certain genes in the vacuoles of body cells
 - the numerous ribosomes in certain cells
 - As a human red blood cell matures, it loses its nucleus. As a result of this loss, a mature red blood cell lacks the ability to
 - take in material from the blood
 - release hormones to the blood
 - pass through artery walls
 - carry out cell division

10. Which letter in the diagram below indicates the structure that is responsible for storing wastes?



- 1) A
- 2) B
- 3) C
- 4) D

11. Which sequence illustrates the increasing complexity of levels of organization in multicellular organisms?

- 1) organelle → cell → tissue → organ → organ system → organism
- 2) cell → organelle → tissue → organ → organ system → organism
- 3) organelle → tissue → cell → organ → organ system → organism
- 4) cell → organism → organ system → organ → tissue → organelle

12. A human liver cell is very different in structure and function from a nerve cell in the same person. This is best explained by the fact that

- 1) different genes function in each type of cell
- 2) liver cells can reproduce while the nerve cells cannot
- 3) liver cells contain fewer chromosomes than nerve cells
- 4) different DNA is present in each type of cell

13. A protein on the surface of HIV can attach to proteins on the surface of healthy human cells. These attachment sites on the surface of the cells are known as

- 1) receptor molecules
- 2) genetic codes
- 3) molecular bases
- 4) inorganic catalysts

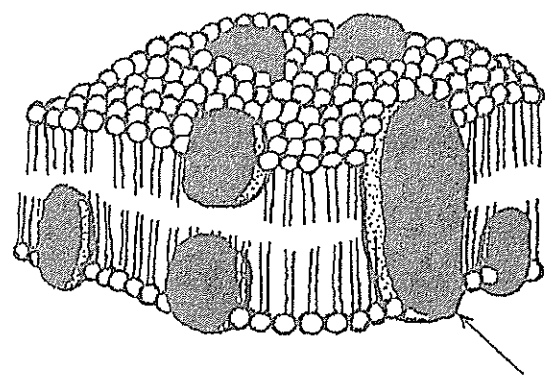
14. One difference between plant and animal cells is that animal cells do *not* have

- 1) a nucleus
- 2) chloroplasts
- 3) a cell membrane
- 4) centrioles

15. Which order of metabolic processes converts nutrients consumed by an organism into cell parts?

- 1) digestion → absorption → circulation → diffusion → synthesis
- 2) absorption → circulation → digestion → diffusion → synthesis
- 3) digestion → synthesis → diffusion → circulation → absorption
- 4) synthesis → absorption → digestion → diffusion → circulation

16. The diagram below represents the fluid-mosaic model of a cell membrane.



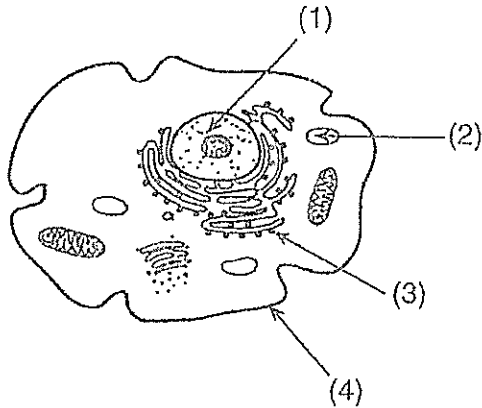
The arrow points to a component of the membrane that is best described as a

- 1) sugar floating in lipids
- 2) protein floating in lipids
- 3) lipid floating in proteins
- 4) lipid floating in sugars

17. Which statement regarding the functioning of the cell membrane of all organisms is *not* correct?

- 1) The cell membrane forms a boundary that separates the cellular contents from the outside environment.
- 2) The cell membrane is capable of receiving and recognizing chemical signals.
- 3) The cell membrane forms a barrier that keeps all substances that might harm the cell from entering the cell.
- 4) The cell membrane controls the movement of molecules into and out of the cell.

18. In the diagram below, which structure performs a function similar to a function of the human lungs?

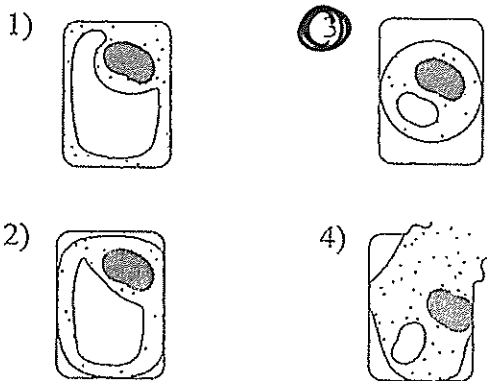


- 1) 1 3) 3
 2) 2 4) 4

19. A student using a compound light microscope to study plant cells observed that most of the cells resembled the diagram shown below.



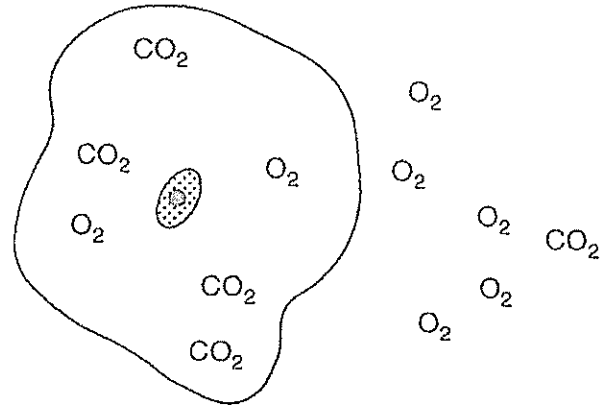
Which diagram best illustrates how these plant cells will appear after they are placed in a solution having a lower water concentration than the cells have?



20. State *one* factor that influences which molecules can pass through the cell membrane of a human cell.

Size of the molecule
 or
Selectivity of the membrane

21. The diagram below represents a cell in water. Formulas of molecules that can move freely across the cell membrane are shown. Some molecules are located inside the cell and others are in the water outside the cell.



Based on the distribution of these molecules, what would most likely happen after a period of time?

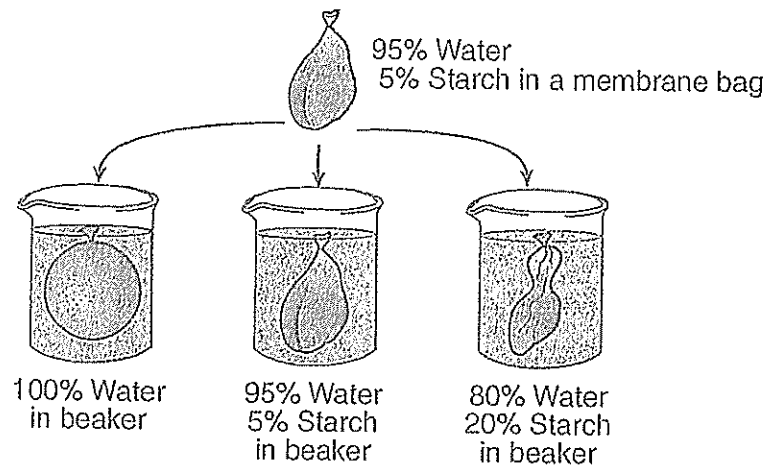
- 1) The concentration of O₂ will increase inside the cell.
 2) The concentration of CO₂ will remain the same inside the cell.
 3) The concentration of O₂ will remain the same outside the cell.
 4) The concentration of CO₂ will decrease outside the cell.

22. Which row in the chart below best describes the active transport of molecule X through a cell membrane?

Row	Movement of Molecule X	ATP
(1)	high concentration → low concentration	used
(2)	high concentration → low concentration	not used
(3)	low concentration → high concentration	used
(4)	low concentration → high concentration	not used

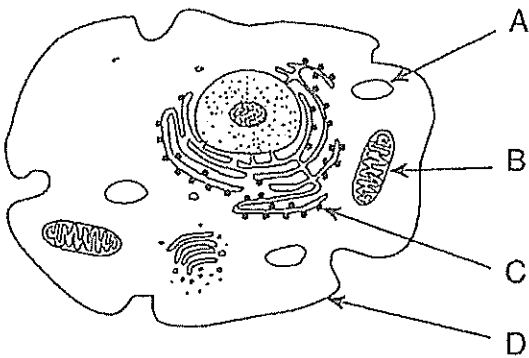
- 1) 1 3) 3
 2) 2 4) 4

23. An investigation was set up to study the movement of water through a membrane. The results are shown in the diagram below.



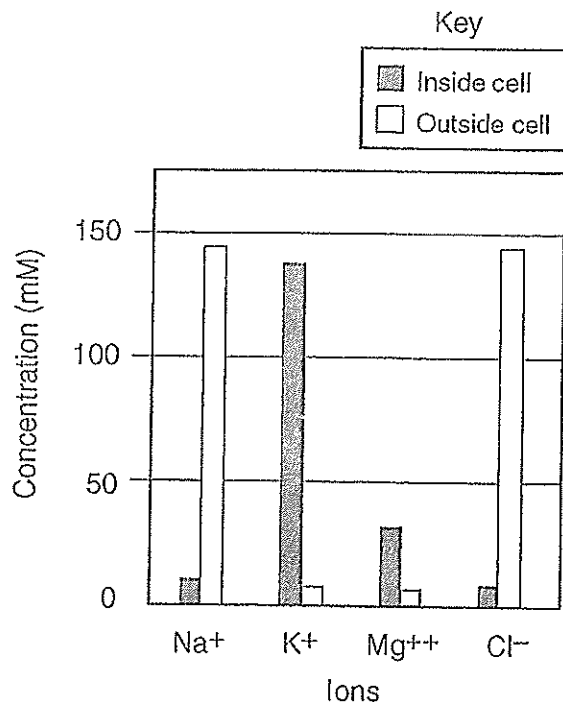
Based on these results, which statement correctly predicts what will happen to red blood cells when they are placed in a beaker containing a water solution in which the salt concentration is much higher than the salt concentration in the red blood cells?

- 1) The red blood cells will absorb water and increase in size.
 - 2) The red blood cells will lose water and decrease in size.
 - 3) The red blood cells will first absorb water, then lose water and maintain their normal size.
 - 4) The red blood cells will first lose water, then absorb water, and finally double in size.
-
24. Which letter in the diagram below indicates an organelle that functions primarily in the process of cellular respiration?



- 1) A
- 2) B
- 3) C
- 4) D

25. The graph below shows the relative concentrations of different ions inside and outside of an animal cell.



Which process is directly responsible for the net movement of K⁺ and Mg⁺⁺ into the animal cell?

- 1) electrophoresis 3) active transport
 2) diffusion 4) circulation
26. Which statement best describes the plasma membrane of a living plant cell?
- 1) It selectively regulates the passage of substances into and out of the cell.
 2) It is composed of proteins and carbohydrates only.
 3) It has the same permeability to all substances found inside or outside the cell.
 4) It is a double protein layer with floating lipid molecules.

27. Base your answer to the following question on the information below and on your knowledge of biology.

In a class, each student made three models of the small intestine using three artificial membrane tubes. They filled each of the three tubes with equal amounts of water, starch, protein, and vitamin C. They added starch-digesting enzyme to tube 1. They added protein-digesting enzyme to tube 2. No enzyme was added to tube 3. The ends of the membrane tubes were sealed and the tubes were soaked for 24 hours in beakers of pure water. The beakers were numbered 1, 2, and 3, corresponding to the number of the tube they contained. At the end of the experiment, the students removed the tubes and tested the water in the beakers for the presence of nutrients.

Which statement would be a valid inference if vitamin C had been present in the water in each beaker?

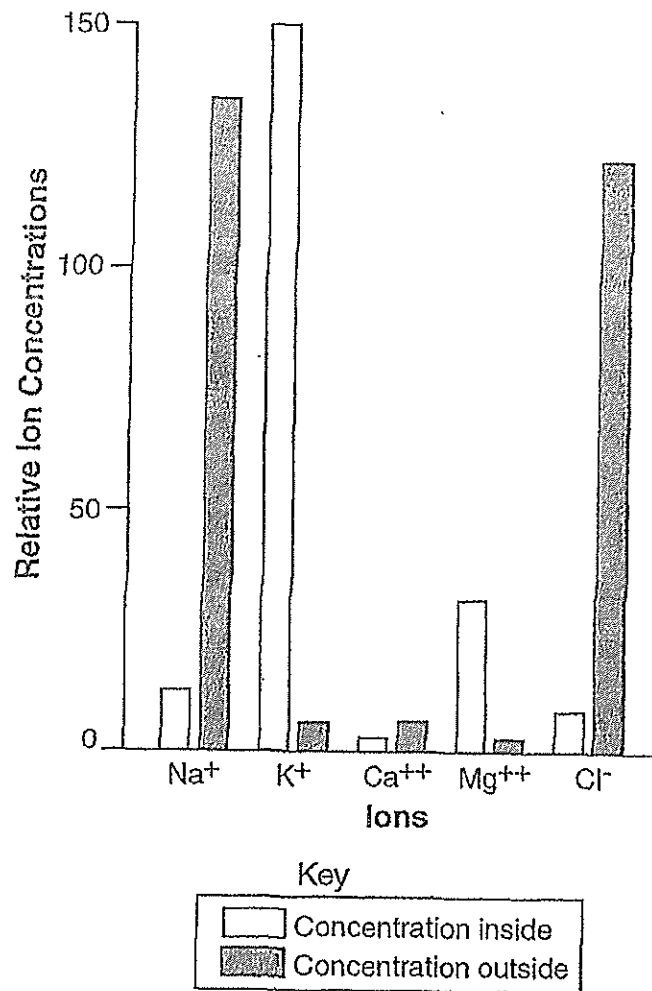
- 1) The water synthesized vitamin C.
 2) Vitamin C is a small molecule.
 3) The membrane tube produced vitamin C.
 4) The concentration of vitamin C is higher in the beaker than in the membrane tube.
28. A red onion cell has undergone a change, as represented in the diagram below.



This change is most likely due to the cell being placed in

- 1) distilled water 3) salt water
 2) light 4) darkness

Base your answers to questions 29 and 30 on the graph below. The graph shows the relative concentrations of different ions inside and outside of an animal cell.



29. Write the symbol of the ion that is closest to equilibrium inside and outside of the cell. Ca^{++}

30. Name the process responsible for maintaining high concentrations of K^+ ions inside the cell.

Active Transport

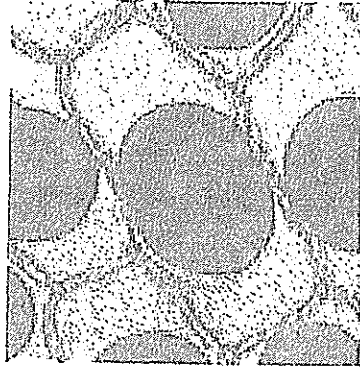


Diagram 1: red onion cells

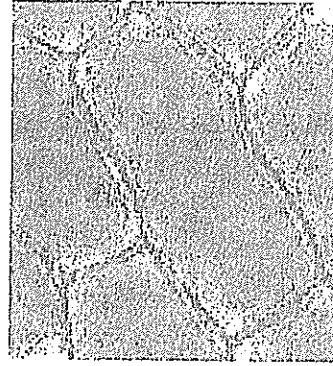


Diagram 2: red onion cells

31. Describe how to prepare a wet-mount slide of red onion cells with the cell membrane shrinking away from the cell wall, as shown in diagram 1. The following materials are available: microscope slide, pipettes, cover slips, paper towels, water, salt solution, and red onion sections.
32. List the laboratory procedures to follow that would cause the cells in diagram 1 to resemble the cells in diagram 2.

-
- 31.)
- 1) Place a drop of water on a slide
 - 2) Add the onion cells to the slide
 - 3) Place the edge of a coverslip down on the slide and slowly lower the other edge.
 - 4) Add salt solution to one edge of the coverslip.
 - 5) Place corner of paper towel to the opposite edge so the salt solution is drawn under the coverslip.

-
- 32.)
- Add distilled water to one edge of the coverslip
Place paper towel on the opposite edge to draw the water under the cover slip.

Base your answers to questions 33 and 34 on the information below and on your knowledge of biology.

36

Students prepared four models of cells by using dialysis tubing containing the same blue solution. Each of the model cells originally weighed 10 grams. They then placed each model cell in a beaker containing a different concentration of water. After 24 hours, they recorded the mass of the model cells as shown in the data table below.

Data Table

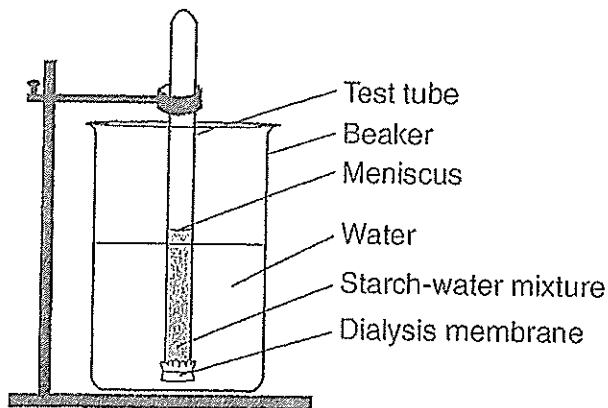
Concentration of Water Surrounding the Model Cell	Mass of Model Cell
100%	12 grams
90%	11 grams
80%	10 grams
70%	9 grams

33. Why did the model cell that was placed in 100% water increase in mass? *The solution was hypotonic to the cell. Water diffused into the cell*

34. What was the concentration of water in the original blue solution? State evidence in support of your answer.

80%. The cell did not gain or lose water.

35. A laboratory setup for a demonstration is represented in the diagram below



Describe how an indicator can be used to determine if starch diffuses through the membrane into the beaker. In your answer, be sure to include:

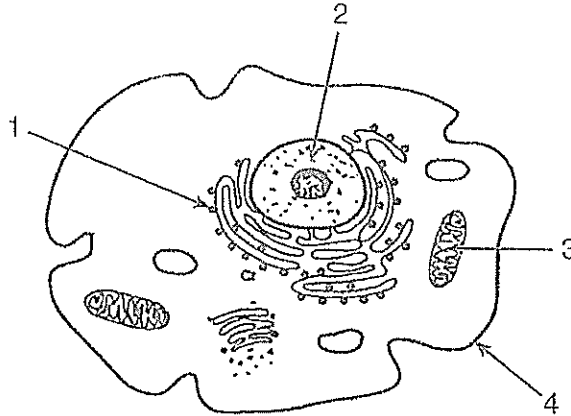
- the procedure used
- how to interpret the results

• Lugol's solution turns from amber to blue/black in the presence of starch.

• The student could add Lugol's indicator to the beaker.

• If the contents in the beaker turn blue/black the starch diffused out.

36. Molecules *A* and *B* are both organic molecules found in many cells. When tested, it is found that molecule *A* cannot pass through a cell membrane, but molecule *B* easily passes through. State one way the two molecules could differ, that would account for the difference in the ability to pass through the cell membrane.
- Molecule *A* is too large to pass through the membrane
 Molecule *B* is small enough to pass through the membrane
37. Base your answer to the following question on the diagram of a cell below.



Describe how structures 1 and 2 interact in the process of protein synthesis. (1) - ribosome - site of protein synthesis. (2) - Nucleus contains DNA - instructions for making protein

38. Just like complex organisms, cells are able to survive by coordinating various activities. Complex organisms have a variety of systems, and cells have a variety of organelles that work together for survival. Describe the roles of two organelles. In your answer be sure to include:

a the names of two organelles and the function of each

b an explanation of how these two organelles work together

c the name of an organelle and the name of a system in the human body that have similar functions

a). Plasma membrane - regulates transport of materials into and out of the cell

Mitochondria - site of cellular respiration. Glucose → ATP

b). The plasma membrane transports O_2 and glucose into the cell so that the mitochondrion can use these materials to generate ATP (cellular energy)

c). Plasma membrane and human lungs both carry-out gas exchange.