

| <i>Characteristic</i>        | <i>Prokaryotic Cell</i> | <i>Plant Cell</i> | <i>Animal Cell</i> |
|------------------------------|-------------------------|-------------------|--------------------|
| Prokaryotic structure        | X                       |                   |                    |
| Eukaryotic structure         |                         | X                 | X                  |
| Relatively large size        |                         | X                 | X                  |
| Relatively small size        | X                       |                   |                    |
| Membranous organelles        |                         | X                 | X                  |
| Plasma membrane              | X                       | X                 | X                  |
| Cell wall                    | X                       | X                 |                    |
| Cytoplasm                    | X                       | X                 | X                  |
| Ribosomes                    | X                       | X                 | X                  |
| Bacterial flagellum          | X                       |                   |                    |
| Nucleus                      |                         | X                 | X                  |
| Nuclear envelope             |                         | X                 | X                  |
| Rough endoplasmic reticulum  |                         | X                 | X                  |
| Smooth endoplasmic reticulum |                         | X                 | X                  |
| Golgi apparatus              |                         | X                 | X                  |
| Lysosome                     |                         |                   | X                  |
| Peroxisome                   |                         | X                 | X                  |
| Central vacuole              |                         | X                 |                    |
| Mitochondrion                |                         | X                 | X                  |
| Chloroplast                  |                         | X                 |                    |
| Cytoskeleton                 |                         | X                 | X                  |
| Flagellum                    |                         |                   | X                  |
| Centriole                    |                         |                   | X                  |
| Extracellular matrix         |                         |                   | X                  |
| Plasmodesmata                |                         | X                 |                    |
| Cell junctions               |                         |                   | X                  |

## Description/Function

## Organelle

- |                   |                                                                         |                        |
|-------------------|-------------------------------------------------------------------------|------------------------|
| smooth ER         | 1. Lipids manufactured here                                             | A. Nucleus             |
|                   | 2. Small structure that makes protein                                   | B. Transport vesicle   |
| nucleus           | 3. Contains chromatin                                                   | C. Central vacuole     |
|                   | 4. Sac of digestive enzymes                                             | D. Smooth ER           |
| transport vesicle | 5. Carries secretions for export from cell                              | E. Lysosome            |
|                   | 6. Breaks down drugs and toxins in liver                                | F. Golgi apparatus     |
| rough ER          | 7. Makes cell membranes                                                 | G. Rough ER            |
|                   | 8. Cell control center                                                  | H. Contractile vacuole |
|                   | 9. Numerous ribosomes give it its name                                  | I. Ribosome            |
| golgi apparatus   | 10. "Ships" products to plasma membrane, outside, or other organelles   | J. Plasma membrane     |
| central vacuole   | 11. May store water, needed chemicals, wastes, pigments in plant cell   |                        |
|                   | 12. Buds off from Golgi apparatus                                       |                        |
| lysosome          | 13. Defective in Tay-Sachs disease                                      |                        |
|                   | 14. Proteins made and modified here for secretion from cell             |                        |
|                   | 15. Pumps out excess water from some cells                              |                        |
|                   | 16. Nonmembranous organelle                                             |                        |
|                   | 17. Takes in transport vesicles from ER and modifies their contents     |                        |
|                   | 18. Boundary between the cell and its surroundings                      |                        |
| nucleus           | 19. Surrounded by double layer of membrane with pores                   |                        |
|                   | 20. How proteins, other substances get from ER to Golgi apparatus       |                        |
|                   | 21. Stores calcium in muscle cells                                      |                        |
|                   | 22. Marks and sorts molecules to be sent to different destinations      |                        |
|                   | 23. Buds from here become lysosomes                                     |                        |
| lysosome          | 24. Digests food, wastes, foreign substances                            |                        |
|                   | 25. Phospholipid bilayer with proteins controls flow in and out of cell |                        |
| smooth ER         | 26. Drug tolerance results from enlarging this                          |                        |
|                   | 27. Fuses with food vacuole and digests contents                        |                        |

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## Multiple Choice

1. To enter or leave a cell, substances must pass through
  - a. a microtubule.
  - b. the Golgi apparatus.
  - c. a ribosome.
  - d. the nucleus.
  - e. the plasma membrane.**
2. Which of the following would *not* be considered part of a cell's cytoplasm?
  - a. a ribosome
  - b. the nucleus**
  - c. a mitochondrion
  - d. a microtubule
  - e. fluid between the organelles
3. Which of the following consist of prokaryotic cells?
  - a. plants and animals
  - b. bacteria and archaea**
  - c. plants, fungi, bacteria, and archaea
  - d. animals
  - e. plants, bacteria, and archaea
4. Organelles involved in energy conversion are the
  - a. rough ER and Golgi apparatus.
  - b. nucleus and smooth ER.
  - c. nucleus and chloroplast.
  - d. lysosome and ribosome.
  - e. mitochondrion and chloroplast.**
5. The maximum size of a cell is limited by
  - a. its need for enough surface area for exchange with its environment.**
  - b. the number of organelles that can be packed inside.
  - c. the materials needed to build it.
  - d. the amount of flexibility it needs to be able to move.
  - e. the amount of food it needs to survive.
6. You would expect a cell with an extensive Golgi apparatus to
  - a. make a lot of ATP.
  - b. secrete a lot of material.**
  - c. move actively.
  - d. perform photosynthesis.
  - e. store large quantities of food.

7. Which of the following correctly matches a structure with its function?
- a. mitochondrion—photosynthesis
  - b. nucleus—cellular respiration
  - c. ribosome—manufacture of lipids
  - d. lysosome—movement
  - e. central vacuole—storage**
8. Cellular metabolism is
- a. a type of cell division.
  - b. the process by which certain parts cause a cell to "self-destruct."
  - c. the chemical activity of a cell.**
  - d. movement of a cell.
  - e. control of the cell by the nucleus.
9. Which of the following stores calcium, important in muscle contraction?
- a. mitochondria
  - b. smooth ER**
  - c. the Golgi apparatus
  - d. contractile vacuoles
  - e. rough ER
10. Which group below is involved in manufacturing substances needed by the cell?
- a. lysosome, vacuole, ribosome
  - b. ribosome, rough ER, smooth ER**
  - c. vacuole, rough ER, smooth ER
  - d. smooth ER, ribosome, microtubule
  - e. rough ER, lysosome, peroxisome
11. The internal skeleton of a cell is composed of
- a. microtubules, intermediate filaments, and microfilaments.**
  - b. cellulose and intermediate filaments.
  - c. cellulose, microtubules, and centrioles.
  - d. microfilaments and collagen.
  - e. microfilaments and cellulose.

1. A cell has mitochondria, ribosomes, smooth ER, and other parts. Based on this information, it could *not* be
  - a. a cell from a pine tree.
  - b. a grasshopper cell.
  - c. a yeast (fungus) cell.
  - d. a bacterium.
  - e. Actually, it could be any of the above.
8. A cell possesses ribosomes, a plasma membrane, a cell wall, and other parts. It could *not* be
  - a. a bacterium.
  - b. a cell from a fungus.
  - c. a cell from a mouse.
  - d. an oak tree cell.
  - e. a bacterium or a plant cell.
9. A mutant plant cell unable to manufacture cellulose would be unable to
  - a. build a cell wall.
  - b. divide.
  - c. capture sunlight.
  - d. move.
  - e. store food.
10. A plant cell was grown in a test tube containing radioactive nucleotides, the parts from which DNA is built. Later examination of the cell showed the radioactivity to be concentrated in the
  - a. rough ER.
  - b. Golgi apparatus.
  - c. smooth ER.
  - d. central vacuole.
  - e. nucleus.

2. Imagine a cell shaped like a cube, 5  $\mu\text{m}$  on each side. (Cells are not perfect cubes, but this assumption simplifies the question.) What is the surface area of the cell, in  $\mu\text{m}^2$ ? What is its volume, in  $\mu\text{m}^3$ ? What is the ratio of surface area to volume for this cell? (Sketches may help.) Now imagine a second cell, this one 10  $\mu\text{m}$  on each side. What are its surface area, volume, and surface-to-volume ratio? Compare the surface-to-volume ratios of the two cells. How is this comparison significant to the functioning of cells? How could the surface-to-volume ratio of the larger cell be increased?

larger cells have LESS SA:V making the efficiency of diffusion (how much of the cell is affected by diffusion in a given period of time) much less than a cell that is small.

3. An enzyme (a type of protein) called salivary amylase is manufactured in the cells of your salivary glands and secreted as part of saliva. Explain how these parts of the cell cooperate to produce and secrete salivary amylase: transport vesicles, rough ER, plasma membrane, nucleus, Golgi apparatus, ribosomes.

Nucleus contains instructions on how to build the protein, instructions are sent out of the nucleus to the ribosome which does the building, protein is sent through the rough ER and into a transport vesicle which fuses to the golgi where it may then be modified and shipped out of the cell through the plasma membrane

# DO YOU KNOW THESE TERMS?

## Chapter 4:

### Key Terms

~~biology~~

cell theory

cell wall

~~cellular metabolism~~

central vacuole

centriole

chloroplast

~~chromatin~~

~~chromosome~~

cilia

~~cilia (plural, cilia)~~

cytoplasm

cytoskeleton

~~cytoskeleton (TEM)~~

endomembrane system

endoplasmic reticulum (ER)

~~endosymbiosis~~

eukaryotic cell

extracellular matrix (ECM)

flagellum (plural, flagella)

glycoprotein

Golgi apparatus

~~glycoprotein (plasma, glycocalyx)~~

integrins

intermediate filament

intermembrane space

~~light micrograph (LM)~~

lysosome

microfilament

~~micrograph~~

microtubule

~~mitochondrial matrix~~

mitochondrion (plural,

mitochondria)

nuclear envelope

~~nucleoid~~

~~nucleolus~~

nucleus (plural, nuclei)

organelle

peroxisome

plasma membrane

plasmodesma (plural,

plasmodesmata)

prokaryotic cell

ribosome

rough endoplasmic

reticulum

~~scanning electron~~

~~microscope (SEM)~~

smooth endoplasmic

reticulum

~~stroma~~

~~thylakoid~~

~~transmission electron~~

~~microscope (TEM)~~

transport vesicle

vacuole

vesicle

## Movement of Substances Matching

- |              |                                                                                                    |                                  |
|--------------|----------------------------------------------------------------------------------------------------|----------------------------------|
| <u>E</u>     | 1. Diffusion across a biological membrane                                                          | A. Diffusion                     |
| <u>B</u>     | 2. Moves solutes against concentration gradient                                                    | B. Active transport              |
| <u>A</u>     | 3. Any spread of molecules from area of higher concentration to area of lower concentration        | C. Osmosis                       |
| <u>F</u>     | 4. Diffusion with the help of a transport protein                                                  | D. Phagocytosis                  |
| <u>D G H</u> | 5. Three types of endocytosis                                                                      | E. Passive transport             |
| <u>G</u>     | 6. Engulfing of fluid in membrane vesicles                                                         | F. Facilitated diffusion         |
| <u>C</u>     | 7. Diffusion of water across selectively permeable membrane, from hypotonic to hypertonic solution | G. Pinocytosis                   |
| <u>B</u>     | 8. Transport molecules need ATP to function                                                        | H. Receptor-mediated endocytosis |
| <u>H</u>     | 9. Enables cell to engulf bulk quantities of specific large molecules                              | I. Exocytosis                    |
| <u>E</u>     | 10. How oxygen and carbon dioxide enter and leave cells                                            |                                  |
| <u>C F</u>   | 11. Two types of passive transport                                                                 |                                  |
| <u>D</u>     | 12. Engulfing of particle in membrane vesicle                                                      |                                  |
| <u>I</u>     | 13. Fusion of membrane-bound vesicle with membrane, and dumping of contents outside cell           |                                  |
| <u>D</u>     | 14. How a cell might capture a bacterium                                                           |                                  |
| <u>C</u>     | 15. Helped by aquaporins                                                                           |                                  |

1. The movement of molecules from an area of higher concentration to an area of lower concentration is called
  - a. diffusion.
  - b. endocytosis.
  - c. catalysis.
  - d. active transport.
  - e. osmosis.
3. Phospholipid molecules in a membrane are arranged with their \_\_\_\_ on the exterior and their \_\_\_\_ on the interior.
  - a. hydrophobic heads . . . hydrophilic tails
  - b. hydrophilic heads . . . hydrophobic tails
  - c. nonpolar heads . . . polar tails
  - d. hydrophobic tails . . . hydrophilic heads
  - e. hydrophilic tails . . . hydrophobic heads
4. In osmosis, water always moves toward the \_\_\_\_ solution, that is, toward the solution with the \_\_\_\_ solute concentration.
  - a. isotonic . . . greater
  - b. hypertonic . . . greater
  - c. hypertonic . . . lesser
  - d. hypotonic . . . greater
  - e. hypotonic . . . lesser
5. Which of the following enables a cell to pick up and concentrate a specific kind of molecule?
  - a. passive transport
  - b. diffusion
  - c. osmosis
  - d. receptor-mediated endocytosis
  - e. pinocytosis

12. Diffusion of water across a selectively permeable membrane is called
- active transport.
  - osmosis.
  - exocytosis.
  - passive transport.
  - facilitated diffusion.

### Essay

1. Describe the kinds of molecules that cannot easily diffuse through cell membranes. How do proteins facilitate diffusion of these substances?

larger, polar substances like glucose

proteins provide channels for passage

Water is gained or lost due to differences in osmotic conditions inside vs outside the cell

Plant cells are less affected by this than animal cells due to their cell walls

5. Describe the circumstances under which plant and animal cells gain and lose water by osmosis. Which of the following is the least serious problem: water gain by a plant cell, water loss by a plant cell, water gain by an animal cell, or water loss by an animal cell? Why?

## Apply the Concepts

### Multiple Choice

1. If a cell is like a factory, then enzymes are like
- the plans for the factory.
  - the machines in the factory.
  - the power plant for the factory.
  - the raw materials used by the factory.
  - the walls of the factory.

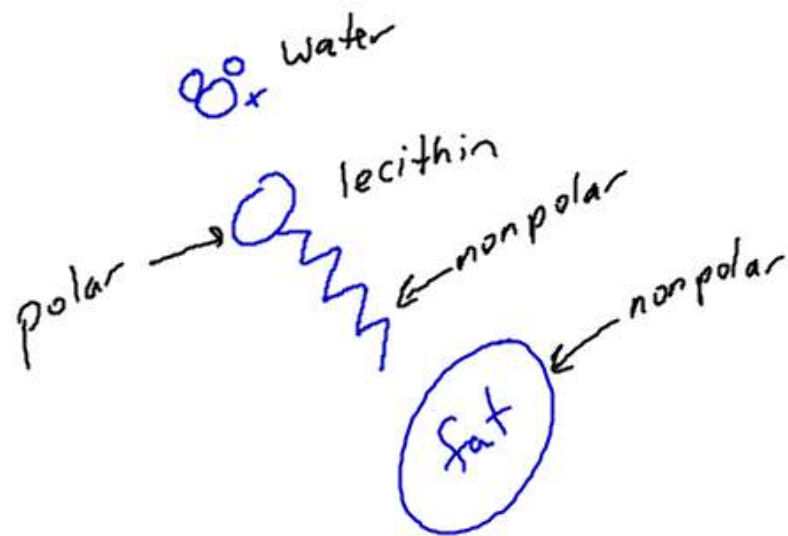
3. A plant cell is placed in a solution whose solute concentration is twice as great as the concentration of the cell cytoplasm. The cell membrane is selectively permeable, allowing water but not the solutes to pass through. What will happen to the cell?
- No change will occur because it is a plant cell.
  - The cell will shrivel because of osmosis.
  - The cell will swell because of osmosis.
  - The cell will shrivel because of active transport of water.
  - The cell will swell because of active transport of water.
4. A white blood cell is capable of producing and releasing thousands of antibody molecules every second. Antibodies are large, complex protein molecules. How would you expect them to leave the cell?
- active transport
  - exocytosis
  - receptor-mediated endocytosis
  - passive transport
  - pinocytosis
5. Which of the following would be least likely to diffuse through a cell membrane without the help of a transport protein?
- a large polar molecule
  - a large nonpolar molecule
  - a small polar molecule
  - a small nonpolar molecule
  - Any of the above would easily diffuse through the membrane.
6. Red blood cells shrivel when placed in a 10% sucrose solution. When first placed in the solution, the solute concentration of the cells is \_\_\_\_ the concentration of the sucrose solution. After the cells shrivel, their solute concentration is \_\_\_\_ the concentration of the sucrose solution.
- less than . . . greater than
  - greater than . . . less than
  - equal to . . . equal to
  - less than . . . equal to
  - greater than . . . equal to
7. A nursing infant is able to obtain disease-fighting antibodies, which are large protein molecules, from its mother's milk. These molecules probably enter the cells lining the baby's digestive tract via
- osmosis.
  - passive transport.
  - exocytosis.
  - active transport.
  - endocytosis.

11. Which of the following is a difference between active transport (AT) and facilitated diffusion (FD)?
- a. AT involves transport proteins, and FD does not.
  - b. FD can move solutes against a concentration gradient, and AT cannot.
  - c. FD requires energy from ATP, and AT does not.
  - d. FD involves transport proteins, and AT does not.
  - e. AT requires energy from ATP, and FD does not.**

2. Seawater is hypertonic in comparison to body tissues. Explain what would happen to his stomach cells if a shipwrecked sailor drank seawater.

cells lining the stomach would shrivel as water moves out of the cells due to the hypertonicity of the sea water

5. Lecithin is a substance used in foods such as mayonnaise as an emulsifier, which means that it helps oil and water mix. Lecithin is a phospholipid; a lecithin molecule has a polar (hydrophilic) "head" and a nonpolar (hydrophobic) "tail." How might the structure of lecithin allow water to surround fat droplets? Sketch a microscopic view of some fat droplets in mayonnaise, and show how you think the fat, surrounding water, and lecithin molecules might be arranged.



## DO YOU KNOW THESE TERMS?

Chapter 5:

### Key Terms

~~active site~~  
active transport  
adenosine triphosphate  
(ATP)  
aquaporin  
~~cellular respiration~~  
~~chemical energy~~  
~~coenzyme~~  
~~cofactor~~  
~~competitive inhibitor~~  
concentration gradient  
diffusion  
~~endocytosis~~  
endocytosis  
~~energy coupling~~  
~~energy of activation ( $E_A$ )~~  
~~enzyme~~

~~entropy~~  
~~enzyme~~  
~~exocytosis~~  
exocytosis  
facilitated diffusion  
~~feedback inhibition~~  
~~first law of thermodynamics~~  
fluid mosaic  
~~home~~  
hypertonic solution  
hypotonic solution  
~~induced fit~~  
isotonic solution  
~~kinetic energy~~  
~~metabolic pathway~~  
~~metabolism~~  
~~noncompetitive inhibitor~~

osmoregulation  
osmosis  
passive transport  
phagocytosis  
~~phosphorylation~~  
pinocytosis  
~~potential energy~~  
receptor-mediated  
endocytosis  
~~second law of~~  
~~thermodynamics~~  
selective permeability  
~~substrate~~  
~~thermodynamics~~  
tonicity