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

## Description/Function

____ 1. Lipids manufactured here
____ 2. Small structure that makes protein
____ 3. Contains chromatin
____ 4. Sac of digestive enzymes
____ 5. Carries secretions for export from cell
____ 6. Breaks down drugs and toxins in liver
____ 7. Makes cell membranes
____ 8. Cell control center
____ 9. Numerous ribosomes give it its name
____ 10. "Ships" products to plasma membrane, outside, or other organelles
____ 11. May store water, needed chemicals, wastes, pigments in plant cell
____ 12. Buds off from Golgi apparatus
____ 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
____ 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
____ 24. Digests food, wastes, foreign substances
____ 25. Phosopholipid bilayer with proteins controls flow in and out of cell
____ 26. Drug tolerance results from enlarging this
____ 27. Fuses with food vacuole and digests contents

## Organelle

A. Nucleus
B. Transport vesicle
C. Central vacuole
D. Smooth ER
E. Lysosome
F. Golgi apparatus
G. Rough ER
H. Contractile vacuole
I. Ribosome
J. Plasma membrane

## 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 μm on each side. (Cells are not perfect cubes, but this assumption simplifies the question.) What is the surface area of the cell, in $\mu m^2$? What is its volume, in $\mu m^3$? What is the ratio of surface area to volume for this cell? (Sketches may help.) Now imagine a second cell, this one 10 μm 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?

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.

# DO YOU KNOW THESE TERMS?

Chapter 4:

## Key Terms

[redacted]
cell theory
cell wall
[redacted]
central vacuole
centriole
chloroplast
[redacted]
[redacted]
cilia
[redacted]
cytoplasm
cytoskeleton
[redacted]
endomembrane system
endoplasmic reticulum (ER)
[redacted]
eukaryotic cell
extracellular matrix (ECM)
flagellum (**plural**, flagella)
glycoprotein
Golgi apparatus
[redacted]
integrins
intermediate filament
intermembrane space
[redacted]
lysosome
microfilament
[redacted]
microtubule
[redacted]
mitochondrion (**plural**, mitochondria)
nuclear envelope
[redacted]
[redacted]
nucleus (**plural**, nuclei)
organelle
peroxisome
plasma membrane
plasmodesma (**plural**, plasmodesmata)
prokaryotic cell
ribosome
rough endoplasmic reticulum
[redacted]
smooth endoplasmic reticulum
[redacted]
[redacted]
[redacted]
transport vesicle
vacuole
vesicle

# Movement of Substances Matching

_____ 1. Diffusion across a biological membrane
_____ 2. Moves solutes against concentration gradient
_____ 3. Any spread of molecules from area of higher concentration to area of lower concentration
_____ 4. Diffusion with the help of a transport protein
_____ 5. Three types of endocytosis
_____ 6. Engulfing of fluid in membrane vesicles
_____ 7. Diffusion of water across selectively permeable membrane, from hypotonic to hypertonic solution
_____ 8. Transport molecules need ATP to function
_____ 9. Enables cell to engulf bulk quantities of specific large molecules
_____ 10. How oxygen and carbon dioxide enter and leave cells
_____ 11. Two types of passive transport
_____ 12. Engulfing of particle in membrane vesicle
_____ 13. Fusion of membrane-bound vesicle with membrane, and dumping of contents outside cell
_____ 14. How a cell might capture a bacterium
_____ 15. Helped by aquaporins

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

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
    a. active transport.
    b. osmosis.
    c. exocytosis.
    d. passive transport.
    e. facilitated diffusion.

### Essay

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

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
    a. the plans for the factory.
    b. the machines in the factory.
    c. the power plant for the factory.
    d. the raw materials used by the factory.
    e. 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?
   a. No change will occur because it is a plant cell.
   b. The cell will shrivel because of osmosis.
   c. The cell will swell because of osmosis.
   d. The cell will shrivel because of active transport of water.
   e. 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?
   a. active transport
   b. exocytosis
   c. receptor-mediated endocytosis
   d. passive transport
   e. pinocytosis

5. Which of the following would be least likely to diffuse through a cell membrane without the help of a transport protein?
   a. a large polar molecule
   b. a large nonpolar molecule
   c. a small polar molecule
   d. a small nonpolar molecule
   e. 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.
   a. less than . . . greater than
   b. greater than . . . less than
   c. equal to . . . equal to
   d. less than . . . equal to
   e. 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
   a. osmosis.
   b. passive transport.
   c. exocytosis.
   d. active transport.
   e. 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.

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

[redacted]
active transport
adenosine triphosphate (ATP)
aquaporin
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]
concentration gradient
diffusion
[redacted]
endocytosis
[redacted]
[redacted]
[redacted]
[redacted]
exocytosis
facilitated diffusion
[redacted]
[redacted]
fluid mosaic
[redacted]
hypertonic solution
hypotonic solution
[redacted]
isotonic solution
[redacted]
[redacted]
[redacted]
osmoregulation
osmosis
passive transport
phagocytosis
[redacted]
pinocytosis
[redacted]
receptor-mediated endocytosis
[redacted]
selective permeability
[redacted]
[redacted]
tonicity