

Skills Worksheet

Directed Reading A

Section: The Diversity of Cells

1. The smallest unit that can perform all the processes necessary for life is a(n) _____.

CELLS AND THE CELL THEORY

Match the correct description with the correct name. Write the letter in the space provided.

- | | |
|--|----------------|
| _____ 2. He was the first person to describe cells. | a. Schleiden |
| _____ 3. He discovered single-celled organisms including bacteria. | b. Virchow |
| _____ 4. He concluded that all plant parts were made of cells. | c. Hooke |
| _____ 5. He concluded that all animal tissues were made of cells. | d. Leeuwenhoek |
| _____ 6. He concluded that all cells came from existing cells. | e. Schwann |
7. What kind of cells have cell walls?

8. What are the three parts of the cell theory?

CELL SIZE

- _____ 9. Why can a chicken egg grow so large?
- a. It is a single cell.
 - b. It has a yolk and a shell.
 - c. It does not have to take in nutrients.
 - d. It grows faster than small cells.
- _____ 10. What limits most cells to a very small size?
- a. the surface area-to-volume ratio of the cell
 - b. the thickness of the cell membrane
 - c. the amount of cytoplasm in the cell
 - d. the number of surrounding cells

Directed Reading A *continued*

- _____ 11. How would you calculate the surface area-to-volume ratio?
- a. Divide the volume by the surface area.
 - b. Divide the total surface area of the cell by the cell's volume.
 - c. Multiply the area of each side times the number of sides.
 - d. Multiply the surface area times the volume.

PARTS OF A CELL

Match the correct description with the correct term. Write the letter in the space provided.

- | | |
|---|------------------|
| _____ 12. a protective layer that covers a cell's surface | a. DNA |
| _____ 13. the fluid inside a cell | b. cell membrane |
| _____ 14. a structure that performs a specific function in the cells | c. nucleus |
| _____ 15. the genetic material that carries information needed to make new cells or new organisms | d. organelle |
| _____ 16. an organelle that contains DNA and has a role in growth, metabolism, and reproduction | e. cytoplasm |

TWO KINDS OF CELLS

17. What parts do all cells have?

18. What are the two basic kinds of cells?

PROKARYOTES: BACTERIA AND ARCHAEA

19. What are prokaryotes?

20. What are the most common prokaryotes (and the smallest cells)?

Directed Reading A *continued*

21. What are ribosomes?

22. What is one way that bacteria and archaea differ?

23. What are three types of archaea?

EUKARYOTIC CELLS AND EUKARYOTES

_____ **24.** How do eukaryotes compare in size to prokaryotes?

- a. Eukaryotes have more cells.
- b. They are about the same size.
- c. Eukaryotes are about 10 times smaller.
- d. Eukaryotes are about 10 times larger.

_____ **25.** What does a eukaryote have that a prokaryote does not?

- a. one or more cells
- b. cells with a nucleus
- c. cells with DNA
- d. cells with membranes

_____ **26.** Which of these words describes humans?

- a. eukaryote
- b. prokaryote
- c. protist
- d. fungus

27. What does “multicellular” mean?

Directed Reading A

Section: Eukaryotic Cells

CELL WALL

1. What is the function of a cell wall?

2. What are the cell walls of plants and algae made of?

3. What are the cell walls of fungi made of?

CELL MEMBRANE

4. What is a cell membrane?

5. What are three types of compounds contained in the cell membrane?

6. What two substances control the movement of materials into and out of the cell?

CYTOSKELETON

_____ 7. A web of proteins in the cytoplasm is known as the

- | | |
|------------------|-------------------|
| a. phospholipid. | c. cell membrane. |
| b. cytoskeleton. | d. organelle. |

8. What are the two functions of the cytoskeleton?

Directed Reading A *continued*

NUCLEUS

- _____ 9. What is the genetic material contained inside a cell's nucleus?
- a. protein
 - b. lipids
 - c. DNA
 - d. nucleolus
- _____ 10. The function of proteins in a cell is to
- a. control chemical reactions.
 - b. store genetic information.
 - c. cover the nucleus.
 - d. copy messages from DNA.
- _____ 11. What is the nucleolus?
- a. the opposite of the nucleus
 - b. another name for DNA
 - c. a network of fibers in the cytoplasm
 - d. a dark area of the nucleus that stores materials and begins to make ribosomes

RIBOSOMES

12. Organelles that make proteins are called _____.
13. Proteins are made of _____.

ENDOPLASMIC RETICULUM

14. A system of folded membranes in which proteins, lipids, and other materials are made is the _____.
15. Two forms of endoplasmic reticulum are _____ and _____.

MITOCHONDRIA

- _____ 16. What function does a mitochondrion perform?
- a. It breaks down sugar to produce energy.
 - b. It makes proteins.
 - c. It breaks down toxic materials.
 - d. It stores material used to make ribosomes.
17. The site of cellular respiration is the _____.
18. Energy produced in mitochondria is stored in a substance called _____.

Directed Reading A *continued*

CHLOROPLASTS

- _____ 19. Chloroplasts are organelles that are found in the cells of
a. animals. c. mitochondria.
b. plants and algae. d. all eukaryotic cells.
- _____ 20. Which process happens inside a chloroplast?
a. production of ATP c. photosynthesis
b. production of DNA d. formation of animal cells
- _____ 21. Chloroplasts are green because they contain
a. sugar. c. chlorophyll.
b. proteins. d. DNA.

GOLGI COMPLEX

- _____ 22. The function of the Golgi complex is to
a. produce sugar and water.
b. package and deliver proteins.
c. produce oxygen.
d. trap energy from the sun.

CELL COMPARTMENTS

23. A small sac that surrounds material to be moved into or out of a cell
is a(n) _____.

CELLULAR DIGESTION

24. What is a lysosome?

25. What is the function of lysosomes?

26. What function do vacuoles perform in plant and fungal cells?

Directed Reading A

Section: The Organization of Living Things

THE BENEFITS OF BEING MULTICELLULAR

1. How do multicellular organisms grow?

2. What are three benefits of being multicellular?

CELLS WORKING TOGETHER

3. What is a tissue?

4. What are four basic types of tissues in animals?

5. What are three basic types of tissues in plants?

TISSUES WORKING TOGETHER

6. A structure that is made up of two or more tissues working together is called a(n) _____.

7. A group of organs working together to perform a particular function is called a(n) _____.

Directed Reading A *continued*

8. What are examples of plant organs?

ORGANISMS

_____ 9. Anything that can perform life processes is

- a. a cell.
- b. an organ system.
- c. a tissue.
- d. an organism.

_____ 10. The term for any organism with only one cell is

- a. protist.
- b. unicellular.
- c. specialized.
- d. bacteria.

_____ 11. Which of these is the lowest level of organization?

- a. cells
- b. tissues
- c. organs
- d. systems

_____ 12. Which of these is the highest level of organization?

- a. cells
- b. tissues
- c. organs
- d. organ systems

STRUCTURE AND FUNCTION

13. The arrangement of parts in an organism is the _____.

14. The job the part does within the organism is the _____.

15. The millions of tiny air sacs in the lungs are called _____.

Skills Worksheet

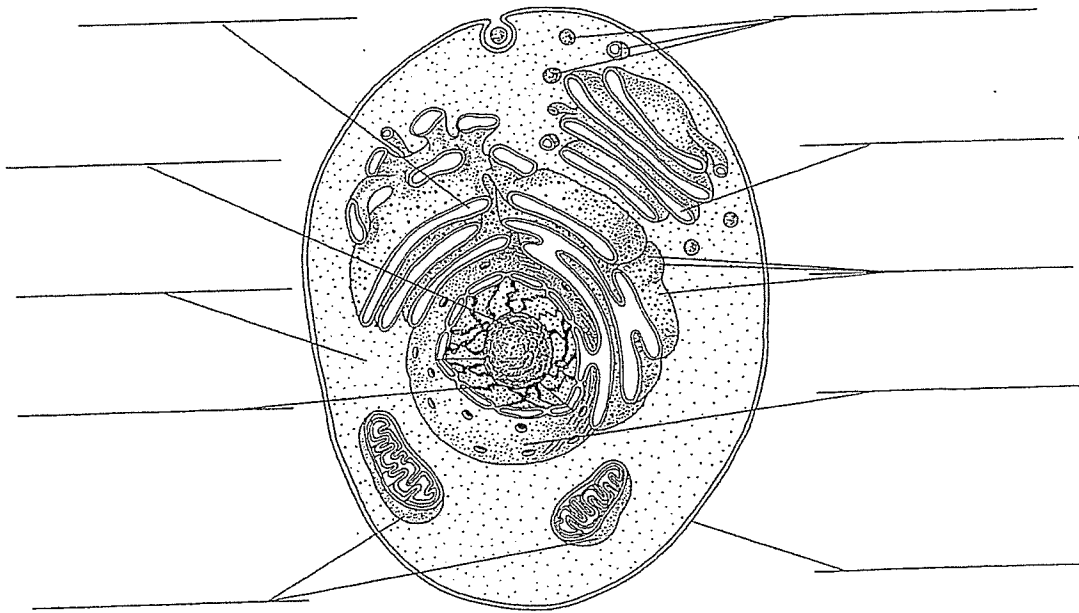
Reinforcement

Building a Eukaryotic Cell

Complete this worksheet after you finish reading the section "Eukaryotic Cells." Below is a list of the features found in eukaryotic cells. Next to each feature, write P if it is a feature found only in plant cells and a B if it is a feature that can be found in both plant and animal cells.

- | | |
|--------------------------------|------------------------|
| _____ 1. endoplasmic reticulum | _____ 7. Golgi complex |
| _____ 2. mitochondria | _____ 8. cell wall |
| _____ 3. nucleus | _____ 9. vesicles |
| _____ 4. cell membrane | _____ 10. DNA |
| _____ 5. cytoplasm | _____ 11. nucleolus |
| _____ 6. ribosomes | _____ 12. chloroplasts |

In the space provided, label the structures of the eukaryotic cell drawn below. Include only the structures that you labeled B.



Skills Worksheet

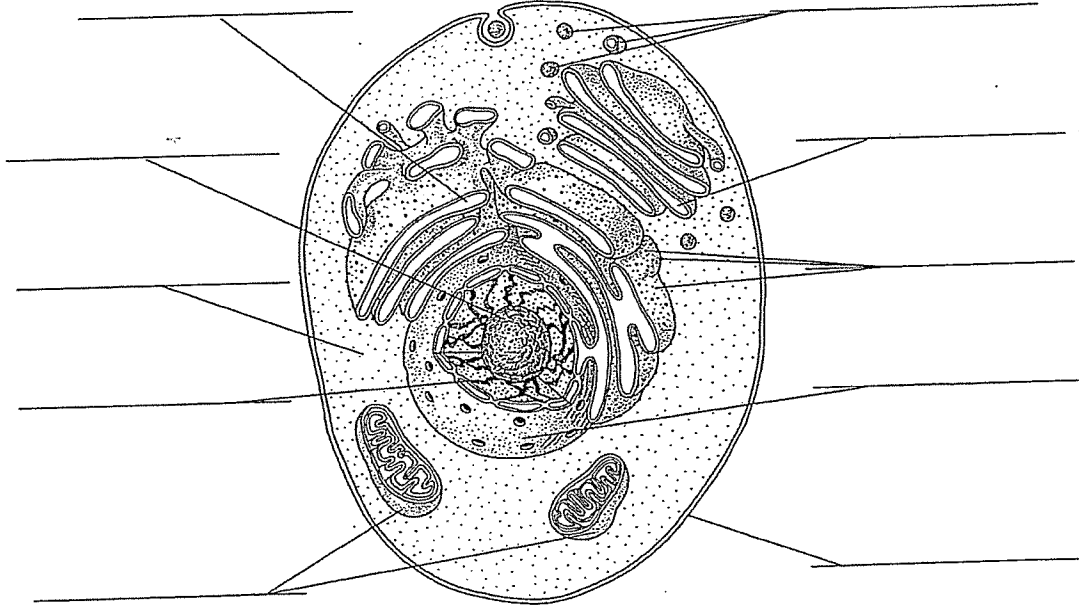
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- | | |
|--------------------------------|------------------------|
| _____ 1. endoplasmic reticulum | _____ 7. Golgi complex |
| _____ 2. mitochondria | _____ 8. cell wall |
| _____ 3. nucleus | _____ 9. vesicles |
| _____ 4. cell membrane | _____ 10. DNA |
| _____ 5. cytoplasm | _____ 11. nucleolus |
| _____ 6. ribosomes | _____ 12. chloroplasts |

In the space provided, label the structures of the eukaryotic cell drawn below. Include only the structures that you labeled B.



SECTION

Reinforcement

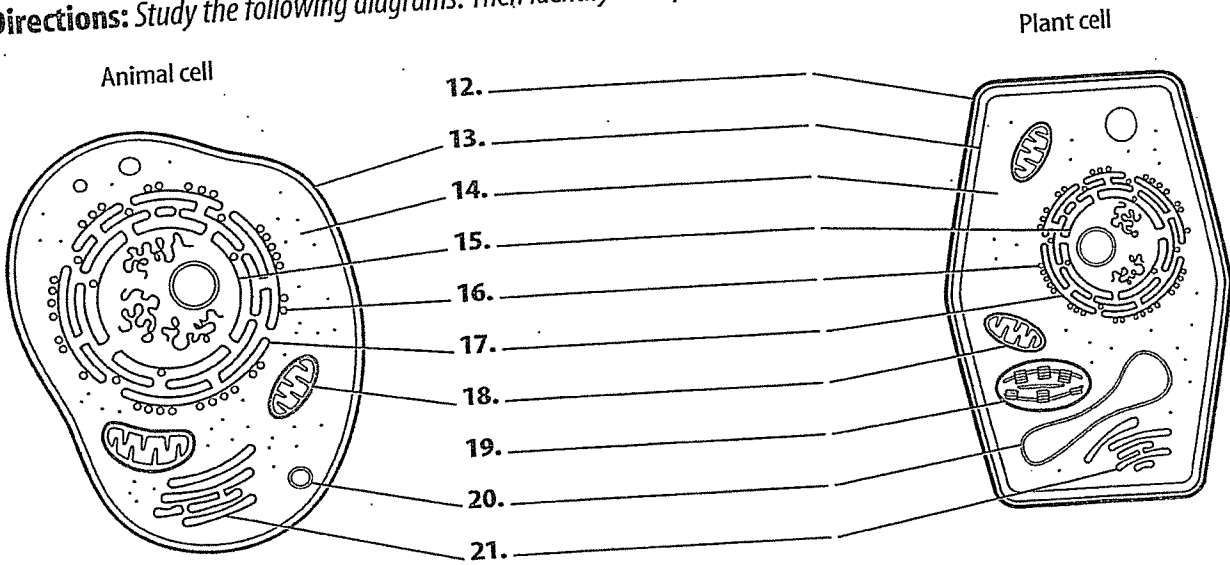
Cell Structure

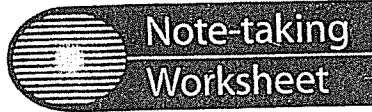
Directions: Complete the following table using the correct cell part or function.

Cell part	Function
1.	gelatinlike mixture that flows inside the cell membrane
cell membrane	2.
3.	directs all cell activities
endoplasmic reticulum	4.
5.	makes protein
6.	releases energy stored in food
chloroplast	7.
cell wall	8.
9.	stores water, waste products, food, and other cellular materials
Golgi bodies	10.
11.	breaks down food molecules, cell wastes, and worn-out cell parts

Meeting Individual Needs

Directions: Study the following diagrams. Then identify each part by filling in the blanks in the center.





Cells

Section 1 Cell Structure

A. Common cell structures—outer covering called _____ and internal gelatinlike _____

1. Comparing cells—size and shape relate to _____
2. Two cell types
 - a. _____ cells lack membrane-bound internal structures.
 - b. _____ cells contain membrane-bound internal structures.

B. Cell organization

1. Composed of cellulose, a **cell wall** grows, gives shape to, and protects the cells of _____, algae, fungi, and most bacteria.
2. Cell _____—protective layer around all cells
 - a. For cells with cell _____, the cell membrane is inside the cell wall
 - b. A cell _____ allows food and oxygen into the cell and waste products out of the cell.
3. Cytoplasm—gelatinlike substance inside cell membrane
 - a. _____—scaffolding-like structure in cytoplasm which helps cell keep its shape
 - b. In the cytoplasm, eukaryotic cells have _____ which help with cell life processes.
4. **Nucleus**—contains instructions for everything cell does; includes DNA
5. Energy-processing organelles—help cells do their _____
 - a. Green organelles in plant cells contain _____ to make food.
 - b. Organelles which release _____ from food are called **mitochondria**.
6. Manufacturing organelles
 - a. **Ribosomes** make _____ for cell activities.
 - b. Some ribosomes attach to the rough part of the **endoplasmic reticulum**, a series of smooth or rough _____ that move materials around in a cell.

Note-taking Worksheet (continued)

7. Transporting and storing organelles

- a. _____ move substances out of a cell or to other parts of a cell.
- b. _____—membrane-bound temporary storage spaces

8. Recycling organelles—_____ break down food molecules and cell wastes.

C. From cell to organism

1. _____—group of similar cells working together on one job
2. Different types of tissues working together make up an _____.
3. A group of organs working together on a particular function form a(n) _____
_____.

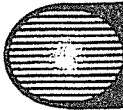
Section 2 Viewing Cells

A. Magnifying cells

1. Early microscopes—lenses made images _____ but not always clear.
2. Modern microscopes that use lenses to bend _____
 - a. A simple microscope has one lens while a _____ microscope has two sets of lenses.
 - b. A stereomicroscope, which has two eyepieces, creates a _____ image.
 - c. Powers of the eyepiece multiplied by objective lenses determine total _____.
3. Electron microscopes—more powerful than other microscopes
 - a. Use a _____ in a vacuum to bend electronic beams
 - b. _____ must be photographed or produced electronically.

B. Development of the cell theory

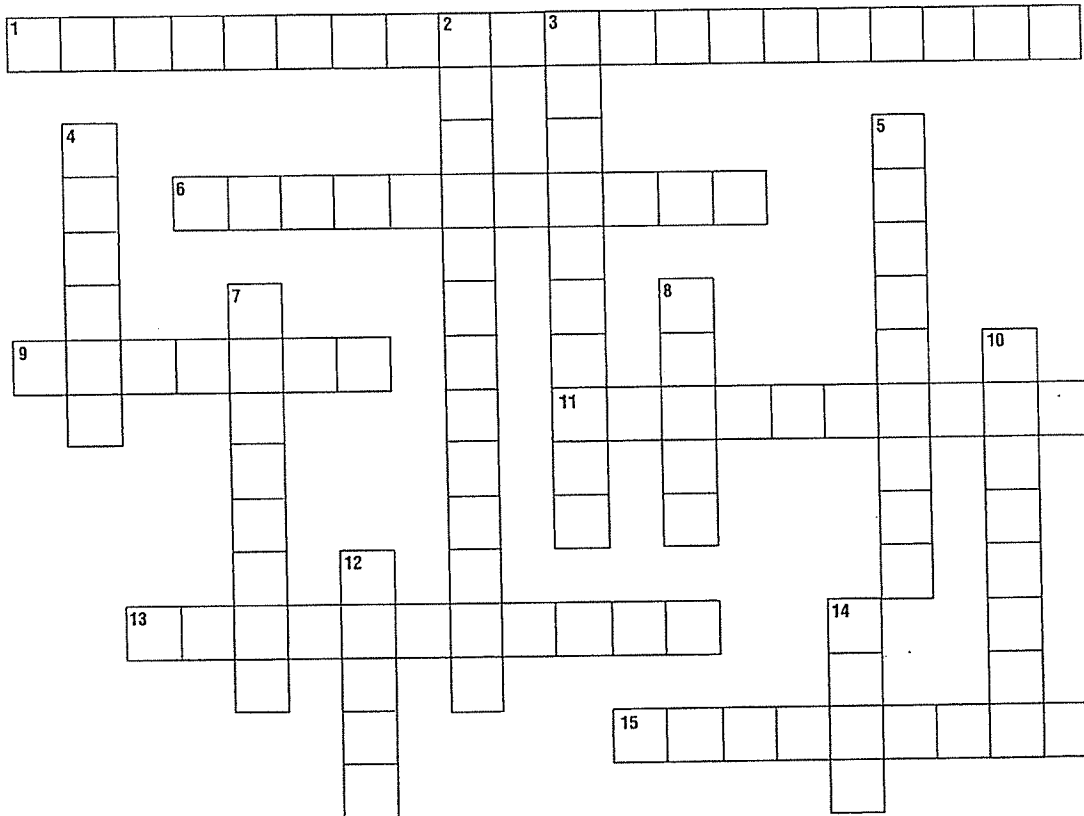
1. The _____ resulted from many scientists' observations and conclusions.
2. The basic _____ of organization is the cell.
3. All _____ are composed of one or more cells.
4. New cells come from old cells through cell _____.


**Chapter
Review**

Cells

Part A. Vocabulary Review

Directions: Use the clues below to complete the crossword puzzle.



Across

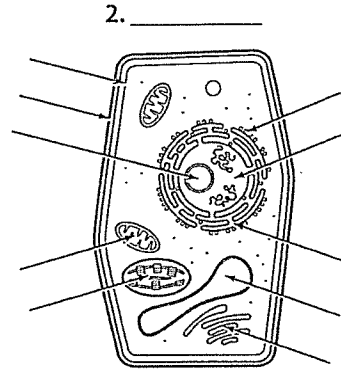
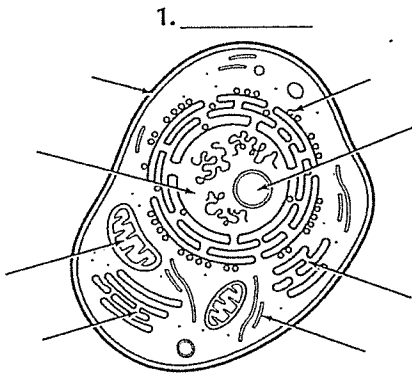
1. A series of folded membranes that move materials around in the cell
6. Green organelles in the cytoplasm of plant cells
9. Directs all the activities of the cell
11. Structures within the cytoplasm of eukaryotic cells
13. Flattened membranes that package cellular substances for export
15. Small, two-part structures in cells that make proteins

Down

2. Organelle where energy is released from broken-down food molecules
3. Summary of scientists' observations and conclusions about cells
4. A group of similar cells that work together to do one job
5. Gelatinlike mixture inside the cell membrane
7. Encloses the cells of plants, algae, fungi, and most bacteria
8. A structure made up of different types of tissues that work together
10. Protective outer covering around all cells
12. A strand of hereditary material surrounded by a protein coating
14. Cell in which a virus multiplies itself

Chapter Review (continued)**Part B. Concept Review**

Directions: Study the following diagrams. Write **P** above the plant cell and **A** above the animal cell. Then label the cells using the numbers of the correct terms from the list.



- | | | | |
|------------------|------------------|---------------------------|-----------------|
| 3. nucleus | 6. ribosomes | 9. cytoskeleton | 11. chloroplast |
| 4. cell membrane | 7. mitochondrion | 10. endoplasmic reticulum | 12. Golgi body |
| 5. vacuole | 8. cell wall | | 13. nucleolus |

14. Number the events in the correct historical order in the blanks provided.
- _____ a. Virchow hypothesized that cells divide to form new cells.
- _____ b. Hooke gave the name "cells" to the little boxes he saw under magnification.
- _____ c. The first microscope was invented.
- _____ d. Schleiden concluded that all plants are made up of cells, and Schwann concluded that all animals are made of cells.

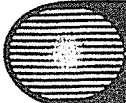
Directions: Answer the following questions on the lines provided.

15. List the three parts of the cell theory.

- a. _____
- b. _____
- c. _____

16. Explain the difference between one-celled organisms and many-celled organisms.

17. Explain the difference between prokaryotic and eukaryotic cells.


**Chapter
Test**

Cells

I. Testing Concepts

Directions: Match the description in the first column with the item in the second column by writing the correct letter in the space provided. Some items in the second column may not be used.

- | | |
|---|------------------------------|
| _____ 1. a strand of hereditary material surrounded by a protein coating | a. tissue |
| _____ 2. microscope that has two sets of lenses, objective lenses and eyepiece lenses | b. organ system |
| _____ 3. allows certain materials to move into and out of the cell | c. cell membrane |
| _____ 4. directs all cell activities | d. cell theory |
| _____ 5. a group of similar cells that work together to do one job | e. cell wall |
| _____ 6. organelles that digest food molecules and wastes inside the cell | f. compound light microscope |
| _____ 7. organelles where energy is released from food molecules | g. electron microscope |
| _____ 8. a group of organs working together to perform a certain function | h. endoplasmic reticulum |
| _____ 9. moves materials around in the cell | i. lysosomes |
| _____ 10. protects the plant cell | j. mitochondria |
| | k. nucleus |
| | l. virus |

Directions: Complete the following sentences by writing the letter of the correct answer in the blank at the left.

- _____ 11. A cell in which a virus multiplies itself is a(n) _____.
 a. host b. infection c. lysosome d. parasite
- _____ 12. Enclosing normal hereditary material in a virus and allowing it to move into cells to replace defective hereditary material in the treatment of genetic disorders is a form of _____.
 a. replication b. a vaccine c. gene therapy d. latent virus
- _____ 13. A(n) _____ enters a cell and becomes part of the cell's hereditary material without destroying the cell or replicating itself.
 a. active virus b. latent virus c. gene d. chloroplast
- _____ 14. A solution made from weakened virus particles that prevents viral diseases is a _____.
 a. vaccine b. gene therapy c. lysosome d. Golgi body
- _____ 15. The pigment in plants that captures light energy and produces sugar molecules for food is _____.
 a. chloroplasts b. cytoplasm c. chlorophyll d. cellulose

Chapter Test (continued)

- _____ 16. Objects that are too small to be seen with other microscopes can be observed with a(n) _____.
- a. compound light microscope c. stereomicroscope
b. electron microscope d. simple microscope
- _____ 17. The scientist who concluded that all animals are made up of cells was _____.
- a. Hooke b. Schleiden c. Schwann d. Virchow
- _____ 18. The cell theory is based mainly on the conclusions of _____.
- a. Schleiden, Schwann, and Virchow c. Van Leeuwenhoek and Hooke
b. Hooke and Schleiden d. Hooke, Schwann, and Virchow
- _____ 19. The _____ is the gelatinlike material inside the cell membrane.
- a. chromatin c. endoplasmic reticulum
b. mitochondria d. cytoplasm
- _____ 20. Proteins are made in small, two-part structures called _____.
- a. chloroplasts b. lysosomes c. Golgi bodies d. ribosomes
- _____ 21. Cells in a many-celled organism all _____.
- a. have similar shapes
b. work together to keep the organism alive
c. are about the same size
d. perform similar functions
- _____ 22. Structures made up of different types of tissues that work together are called _____.
- a. organelles b. organ systems c. organs d. organisms
- _____ 23. Structures that can store food, water, and waste products in cells are _____.
- a. chloroplasts b. mitochondria c. lysosomes d. vacuoles
- _____ 24. Organelles that package cellular substances for export are _____.
- a. Golgi bodies b. ribosomes c. lysosomes d. chloroplasts
- _____ 25. The chemical that contains the code for the cell's structure and activities is _____.
- a. chlorophyll b. RNA c. antiviral d. DNA

II. Understanding Concepts**Skill: Comparing and Contrasting**

Directions: Write the microscope name (simple, compound light, stereomicroscope, or electron) next to its description below.

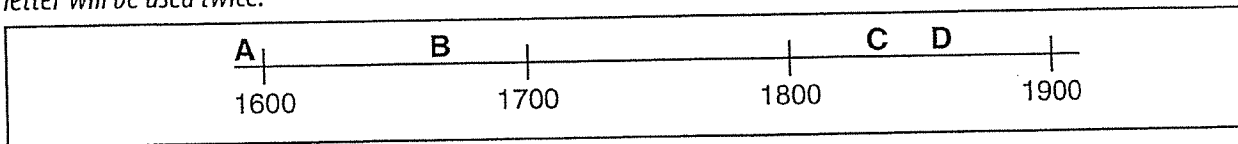
Kinds of Microscopes

Name	Characteristics
_____	1. uses a magnetic field; magnifies up to one million times
_____	2. uses light to magnify; uses two lenses
_____	3. uses light to magnify; gives a three-dimensional view
_____	4. uses light to magnify; uses one lens

Chapter Test (continued)

Skill: Sequencing

Directions: Write the letter of the correct time on the timeline in front of each of the events listed below. One letter will be used twice.



- _____ 5. Hooke named the little boxes he saw under his microscope.
- _____ 6. Virchow proposed that cells come from cells that already exist.
- _____ 7. Schleiden studied plant parts under a microscope.
- _____ 8. The first microscope was invented.
- _____ 9. Schwann observed many different animal cells and came to a conclusion.

Directions: Complete the paragraph by filling in the blanks.

The cell theory's three ideas are (a) that all organisms are made up of one or more

10. _____, (b) that cells are the basic units of structure and

11. _____ in all organisms, and (c) that all cells come from

12. _____. Unlike one-celled organisms, the cells in a many-celled

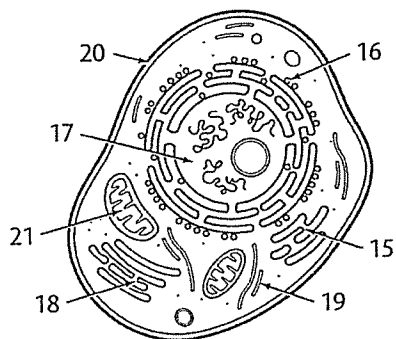
organism are organized into tissues, organs, and 13. _____.

The major difference between animal and a plant cells is that plant cells have 14. _____.

Skill: Interpreting Scientific Illustrations

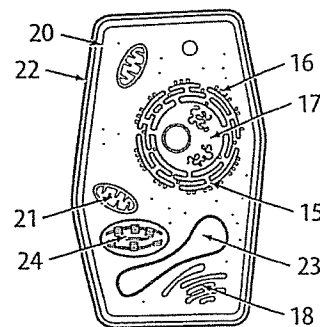
Directions: Study the following diagrams. Then identify each cell part by filling in each blank below.

Animal Cell



15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____

Plant Cell



Chapter Test (continued)**III. Applying Concepts**

Directions: *On the lines provided, list three ways that all living cells are alike.*

1. _____
2. _____
3. _____

Directions: *Identify the following as **single cell, tissue, organ, or organ system.***

- _____ 4. kidney
- _____ 5. heart, blood, and vessels
- _____ 6. bacteria
- _____ 7. the lining inside the mouth

Directions: *On the lines provided, describe the five steps of an active virus multiplying in a host cell.*

8. _____
9. _____
10. _____
11. _____
12. _____

IV. Writing Skills

Directions: *Answer the following question using complete sentences.*

13. What are some reasons a nucleus is important to a cell?

Plant Cell

3D Cell Parts

Name _____

- _____ Cell Wall
- _____ Cell membrane
- _____ Cytoplasm
- _____ cytoskeleton
- _____ Nucleus
- _____ nucleolus
- _____ Ribosomes
- _____ ER
- _____ Mitochondria
- _____ Chloroplasts
- _____ Golgi Complex
- _____ Vesicles
- _____ Vacuoles

Creativity 10 pts _____

Key 10 pts _____

Total _____

Animal Cell

3D Cell Parts

Name _____

- _____ Cell membrane
- _____ cytoskeleton
- _____ Nucleus
- _____ nucleolus
- _____ Ribosomes
- _____ ER
- _____ Mitochondria
- _____ Cytoplasm
- _____ Golgi Complex
- _____ Vesicles
- _____ Lysosomes

Creativity 10pts _____

Key 10 pts _____

Total _____

Name: _____ Date: _____

Student Exploration: Cell Structure

Vocabulary: cell wall, centriole, chloroplast, cytoplasm, endoplasmic reticulum, Golgi apparatus, lysosome, mitochondria, nuclear envelope, nucleolus, nucleus, organelle, plasma membrane, plastid, ribosome, vacuole, vesicle

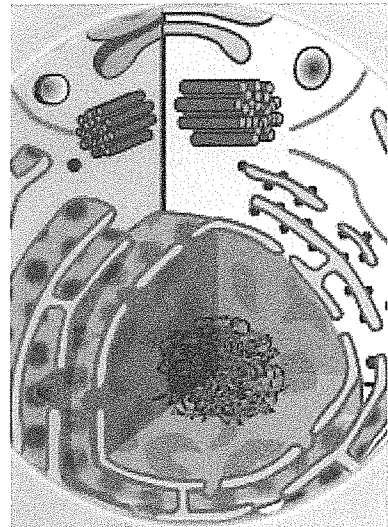
Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. What are some of the structures inside a cell that help it to live and perform its role in an organism? _____

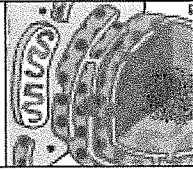
2. How do you think plant cells differ from animal cells? (Hint: What can plants do that animals cannot?) _____

Gizmo Warm-up

The *Cell Structure* Gizmo™ allows you to look at typical animal and plant cells under a microscope. To start, click **Sample** to take a sample of an animal cell. Use the **Zoom** slider to see the cell at a magnification of 1000x (1000 times larger than normal).

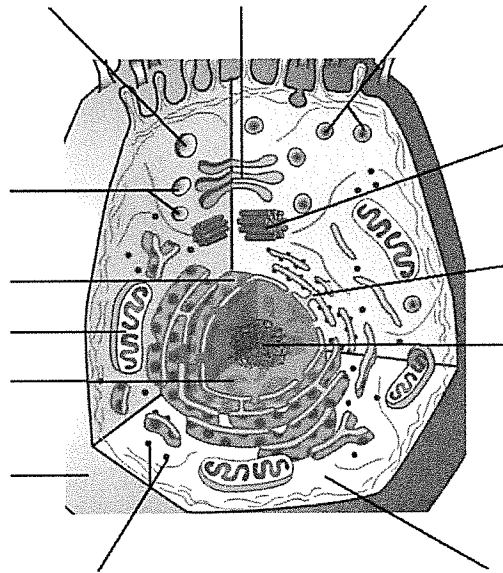


1. Use the up/down and left/right sliders to manipulate the cell. Find the red arrow pointing to the **centrioles**. Make a sketch of the centrioles in the space below.
2. Read the description of the centrioles. What is their function? _____

Activity A: Animal cells	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Check that an Animal cell is mounted on the microscope. • Set the Zoom to 500x. 	
---	--	---

Question: Organelles are specialized structures that perform various functions in the cell. What are the functions of the organelles in an animal cell?

1. Label: Locate each organelle in the animal cell. Label the organelles in the diagram below.



2. Match: Read about each organelle. Then match each organelle to its function/description.

___ **Cytoplasm**

___ **Lysosome**

___ **Mitochondria**

___ **Centriole**

___ **Endoplasmic reticulum**

___ **Vacuole**

___ **Plasma membrane**

___ **Nucleus**

___ **Ribosome**

___ **Nuclear envelope**

___ **Golgi apparatus**

___ **Vesicle**

___ **Nucleolus**

A. Structure that organizes motion of chromosomes.

B. Stack of membranes that packages chemicals.

C. Membrane that protects the nucleus.

D. Membrane that surrounds and protects the cell.

E. Sac filled with digestive chemicals.

F. Structures that converts nutrients to energy.

G. Passageways where chemicals are made.

H. Jelly-like substance within the plasma membrane.

I. Structure that manufactures ribosomes.

J. Structure that contains DNA and directs the cell.

K. Package created by the Golgi apparatus.

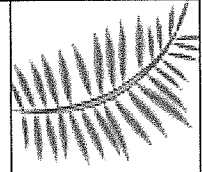
L. Small structure that synthesizes proteins.

M. Sac that stores water, nutrients, or waste products.

Activity B:
Plant cells

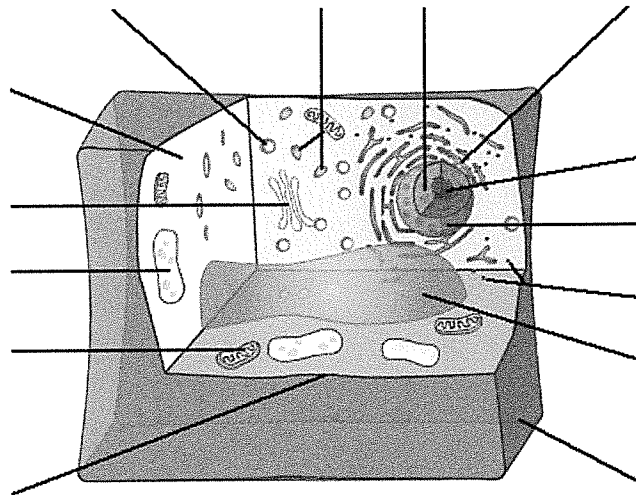
Get the Gizmo ready:

- Select **View plant cell**, and click **Sample**.
- Set the **Zoom** to 500x.



Question: What functions do the organelles in a plant cell perform?

1. Label: Locate each organelle in the plant cell. Label the organelles in the diagram below.



2. Compare: What structures are present in an animal cell, but not in a plant cell? _____

What structures are present in a plant cell, but not in an animal cell? _____

3. Fill in: Name the organelle or organelles that perform each of the following functions.

A. _____ convert sunlight to chemical energy.

B. The _____ and the _____ help to support the plant cell and help it to maintain its shape.

C. _____ store food or pigments.

D. The _____ converts food into energy. It is found in both plant cells and animal cells.

Cell Structure

as you read

What You'll Learn

- Identify names and functions of each part of a cell.
- Explain how important a nucleus is in a cell.
- Compare tissues, organs, and organ systems.

Why It's Important

If you know how organelles function, it's easier to understand how cells survive.

Review Vocabulary

photosynthesis: process by which most plants, some protists, and many types of bacteria make their own food

New Vocabulary

- cell membrane
- cytoplasm
- cell wall
- organelle
- nucleus
- chloroplast
- mitochondrion
- ribosome
- endoplasmic reticulum
- Golgi body
- tissue
- organ

Common Cell Traits

Living cells are dynamic and have several things in common. A cell is the smallest unit that is capable of performing life functions. All cells have an outer covering called a **cell membrane**. Inside every cell is a gelatinlike material called **cytoplasm** (SI tuh pla zum). In the cytoplasm of every cell is hereditary material that controls the life of the cell.

Comparing Cells Cells come in many sizes. A nerve cell in your leg could be a meter long. A human egg cell is no bigger than the dot on this *i*. A human red blood cell is about one-tenth the size of a human egg cell. A bacterium is even smaller—8,000 of the smallest bacteria can fit inside one of your red blood cells.

A cell's shape might tell you something about its function. The nerve cell in **Figure 1** has many fine extensions that send and receive impulses to and from other cells. Though a nerve cell cannot change shape, muscle cells and some blood cells can. In plant stems, some cells are long and hollow and have openings at their ends. These cells carry food and water throughout the plant.

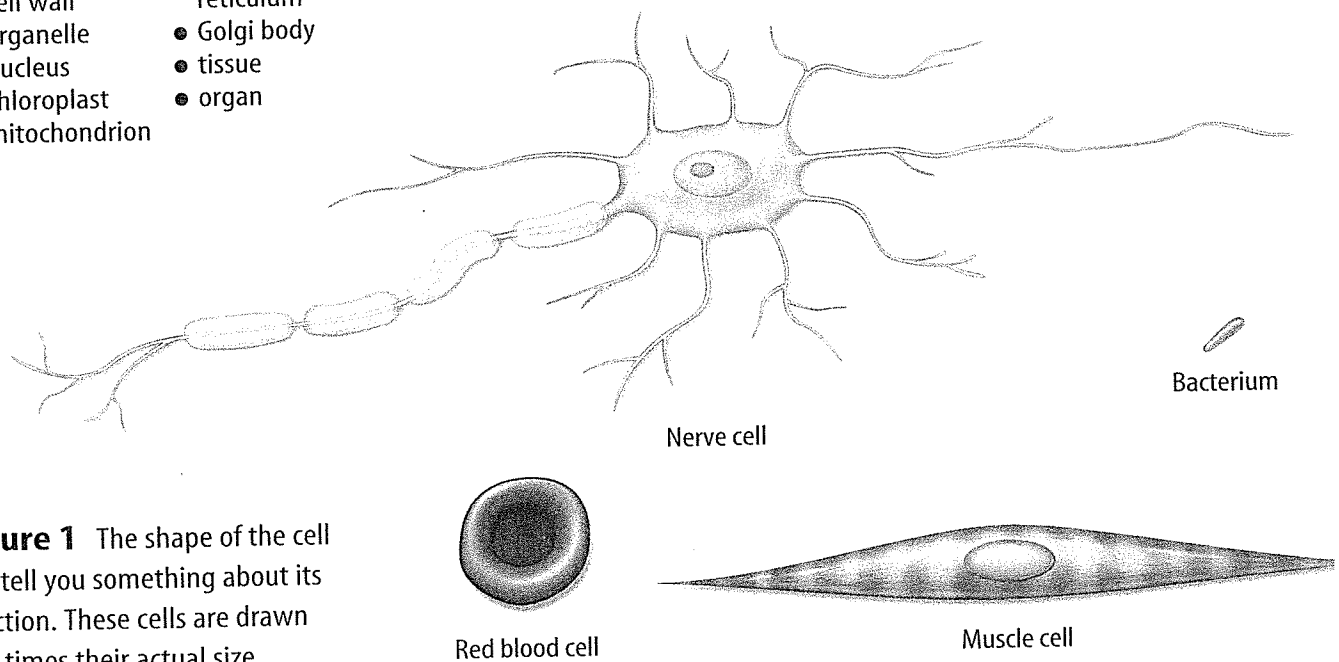
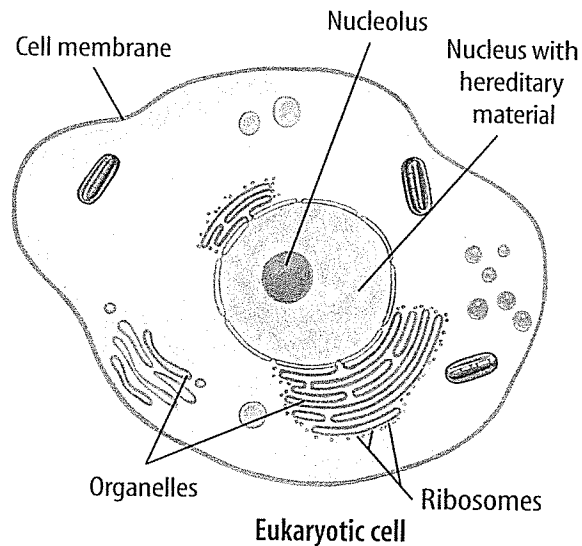
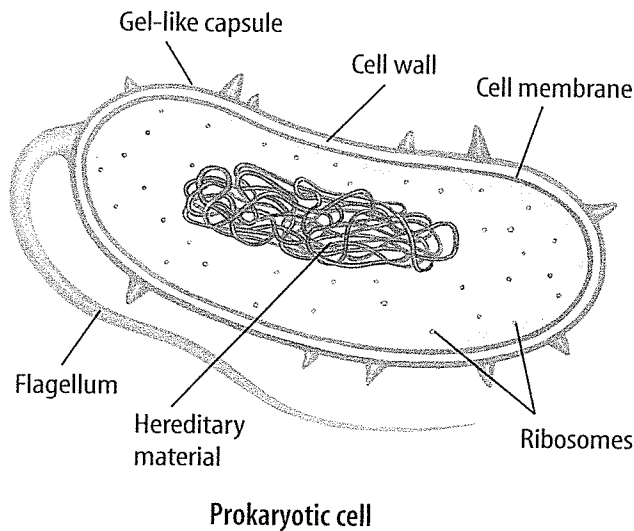


Figure 1 The shape of the cell can tell you something about its function. These cells are drawn 700 times their actual size.



Cell Types Scientists have found that cells can be separated into two groups. One group has no membrane-bound structures inside the cell and the other group does, as shown in **Figure 2**. Cells without membrane-bound structures are called prokaryotic (proh KAYR ee yah tihk) cells. Cells with membrane-bound structures are called eukaryotic (yew KAYR ee yah tihk) cells.

Reading Check Into what two groups can cells be separated?

Cell Organization

Each cell in your body has a specific function. You might compare a cell to a busy delicatessen that is open 24 hours every day. Raw materials for the sandwiches are brought in often. Some food is eaten in the store, and some customers take their food with them. Sometimes food is prepared ahead of time for quick sale. Wastes are put into trash bags for removal or recycling. Similarly, your cells are taking in nutrients, secreting and storing chemicals, and breaking down substances 24 hours every day.

Cell Wall Just like a deli that is located inside the walls of a building, some cells are enclosed in a cell wall. The cells of plants, algae, fungi, and most bacteria are enclosed in a cell wall. **Cell walls** are tough, rigid outer coverings that protect the cell and give it shape.

A plant cell wall, as shown in **Figure 3**, mostly is made up of a carbohydrate called cellulose. The long, threadlike fibers of cellulose form a thick mesh that allows water and dissolved materials to pass through it. Cell walls also can contain pectin, which is used in jam and jelly, and lignin, which is a compound that makes cell walls rigid. Plant cells responsible for support have a lot of lignin in their walls.

Figure 2 Examine these drawings of cells. Prokaryotic cells are only found in one-celled organisms, such as bacteria. Protists, fungi, plants, and animals are made of eukaryotic cells. **Describe** differences you see between them.

Figure 3 The protective cell wall of a plant cell is outside the cell membrane.

Color-enhanced TEM Magnification: 9000×

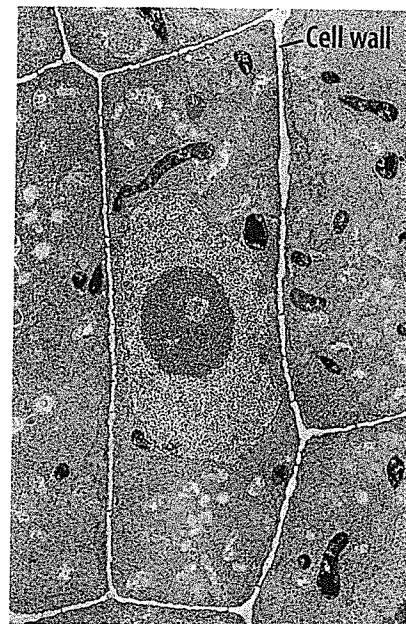
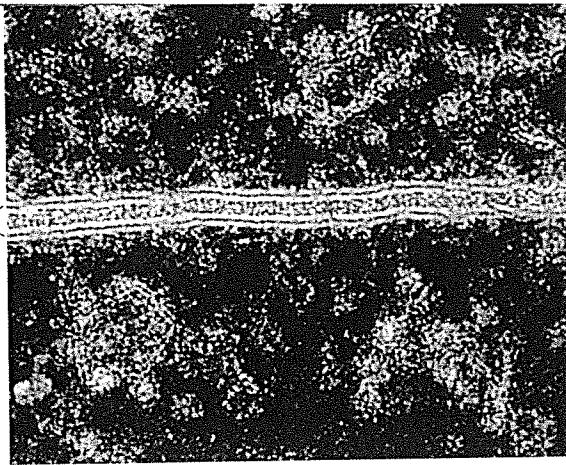


Figure 4 A cell membrane is made up of a double layer of fatlike molecules.

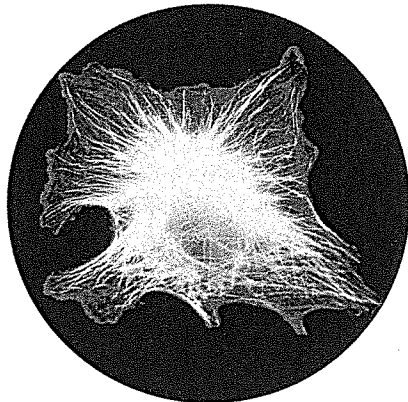
Cell membranes



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Cell Membrane The protective layer around all cells is the cell membrane, as shown in **Figure 4**. If cells have cell walls, the cell membrane is inside of it. The cell membrane regulates interactions between the cell and the environment. Water is able to move freely into and out of the cell

through the cell membrane. Food particles and some molecules enter and waste products leave through the cell membrane.



Stained LM Magnification: 700X

Figure 5 Cytoskeleton, a network of fibers in the cytoplasm, gives cells structure and helps them maintain shape.

Cytoskeleton Cells are filled with a gelatinlike substance called cytoplasm that constantly flows inside the cell membrane. Many important chemical reactions occur within the cytoplasm.

Throughout the cytoplasm is a framework called the cytoskeleton, which helps the cell maintain or change its shape. Cytoskeletons enable some cells to move. An amoeba, for example, moves by stretching and contracting its cytoskeleton. The cytoskeleton is made up of thin, hollow tubes of protein and thin, solid protein fibers, as shown in **Figure 5**. Proteins are organic molecules made up of amino acids.

Reading Check *What is the function of the cytoskeleton?*

Most of a cell's life processes occur in the cytoplasm. Within the cytoplasm of eukaryotic cells are structures called **organelles**. Some organelles process energy and others manufacture substances needed by the cell or other cells. Certain organelles move materials, while others act as storage sites. Most organelles are surrounded by membranes. The nucleus is usually the largest organelle in a cell.

Nucleus The nucleus is like the deli manager who directs the store's daily operations and passes on information to employees. The **nucleus**, shown in **Figure 6**, directs all cell activities and is separated from the cytoplasm by a membrane. Materials enter and leave the nucleus through openings in the membrane. The nucleus contains the instructions for everything the cell does. These instructions are found on long, threadlike, hereditary material made of DNA. DNA is the chemical that contains the code for the cell's structure and activities. During cell division, the hereditary material coils tightly around proteins to form structures called chromosomes. A structure called a nucleolus also is found in the nucleus.

Mini LAB

Modeling Cytoplasm

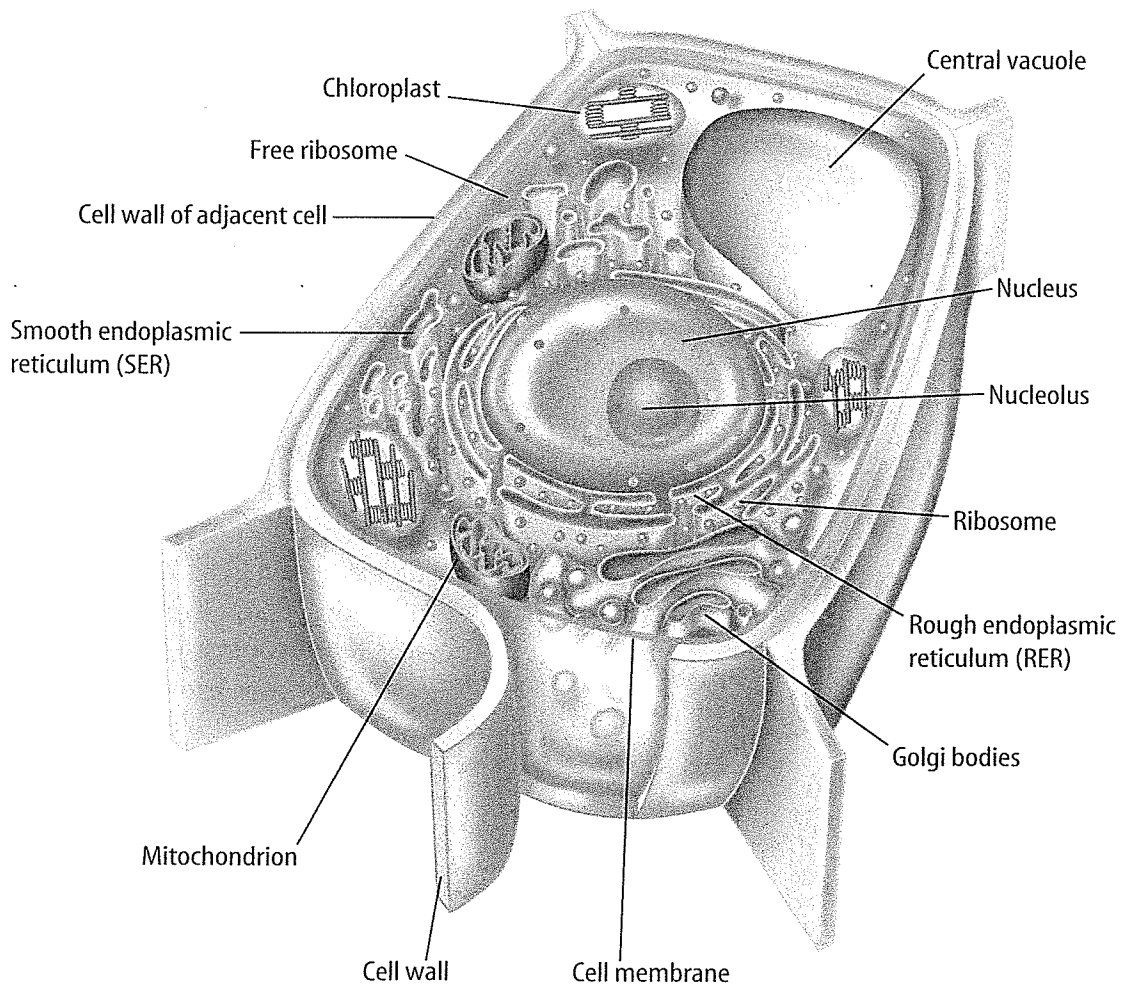
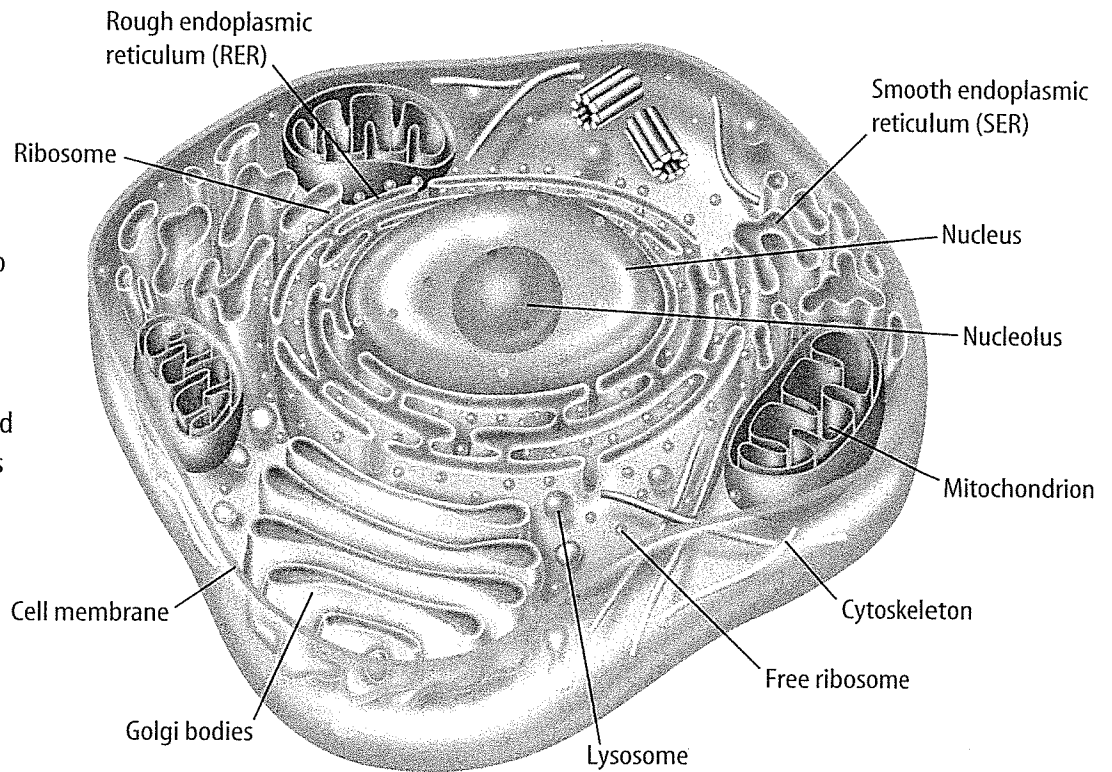
Procedure

1. Add 100 mL of water to a clear container.
2. Add unflavored gelatin and stir.
3. Shine a flashlight through the solution.

Analysis

1. Describe what you see.
2. How does a model help you understand what cytoplasm might be like?

Figure 6 Refer to these diagrams of a typical animal cell (top) and plant cell (bottom) as you read about cell structures and their functions. **Determine** which structures a plant cell has that are not found in animal cells.





Color-enhanced TEM Magnification: 37000×

Figure 7 Chloroplasts are organelles that use light energy to make sugar from carbon dioxide and water.

as chemical energy. Many cells, including animal cells, do not have chloroplasts for making food. They must get food from their environment.

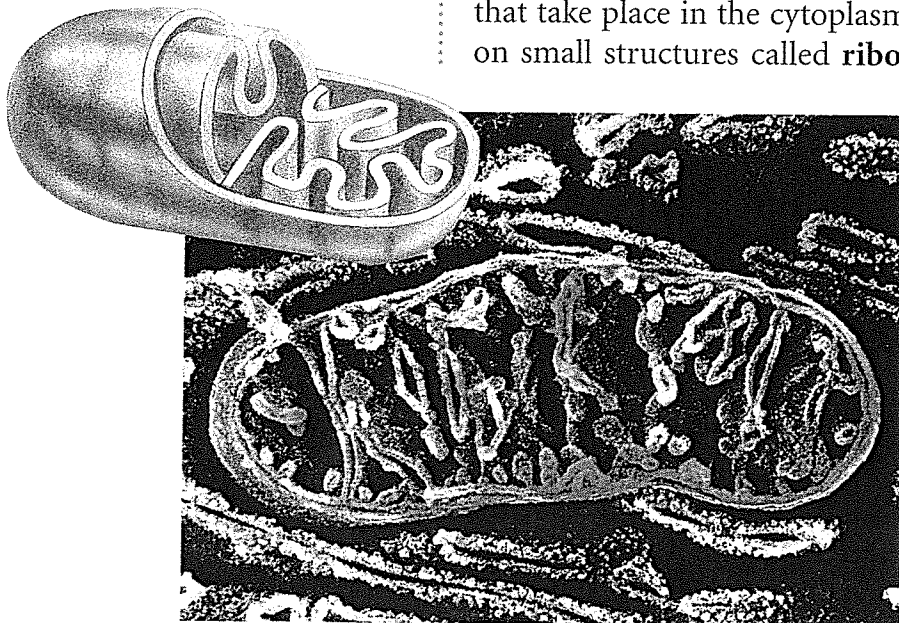
The energy in food is stored until it is released by the mitochondria. **Mitochondria** (mi tuh KAHN dree uh) (singular, *mitochondrion*), such as the one shown in **Figure 8**, are organelles where energy is released from breaking down food into carbon dioxide and water. Just as the gas or electric company supplies fuel for the deli, a mitochondrion releases energy for use by the cell. Some types of cells, such as muscle cells, are more active than other cells. These cells have large numbers of mitochondria. Why would active cells have more or larger mitochondria?

Figure 8 Mitochondria are known as the powerhouses of the cell because they release energy that is needed by the cell from food.

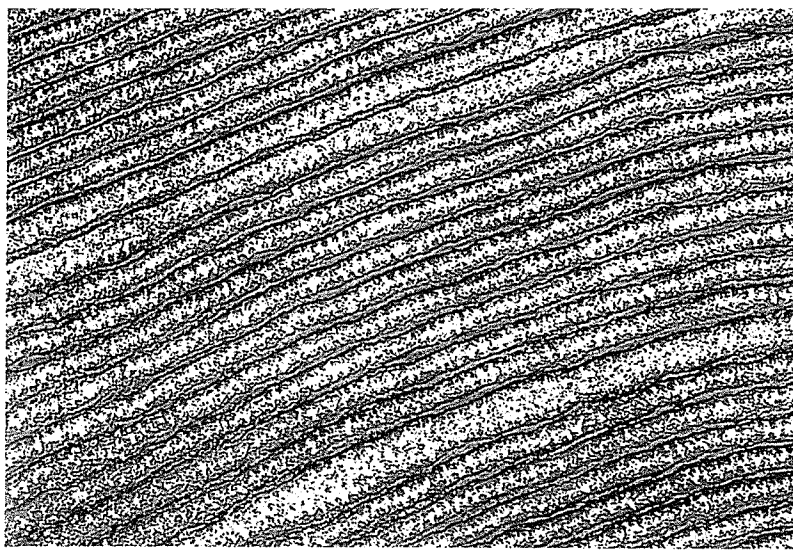
Name the cell types that might contain many mitochondria.

Manufacturing Organelles One substance that takes part in nearly every cell activity is protein. Proteins are part of cell membranes. Other proteins are needed for chemical reactions that take place in the cytoplasm. Cells make their own proteins on small structures called **ribosomes**. Even though ribosomes

are considered organelles, they are not membrane bound. Some ribosomes float freely in the cytoplasm; others are attached to the endoplasmic reticulum. Ribosomes are made in the nucleolus and move out into the cytoplasm. Ribosomes receive directions from the hereditary material in the nucleus on how, when, and in what order to make specific proteins.



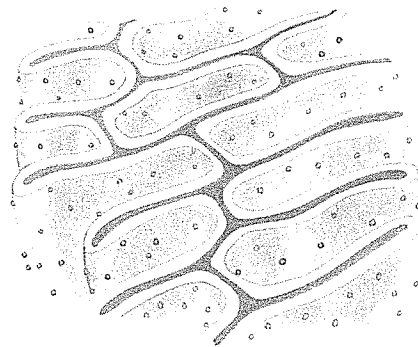
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Color-enhanced TEM Magnification: 65000×

Figure 9 Endoplasmic reticulum (ER) is a complex series of membranes in the cytoplasm of the cell.

Infer what smooth ER would look like.



Processing, Transporting, and Storing Organelles

The **endoplasmic reticulum** (en duh PLAZ mihk • rih TIHK yuh lum) or ER, as shown in **Figure 9**, extends from the nucleus to the cell membrane. It is a series of folded membranes in which materials can be processed and moved around inside of the cell. The ER takes up a lot of space in some cells.

The endoplasmic reticulum may be “rough” or “smooth.” ER that has no attached ribosomes is called smooth endoplasmic reticulum. This type of ER processes other cellular substances such as lipids that store energy. Ribosomes are attached to areas on the rough ER. There they carry out their job of making proteins that are moved out of the cell or used within the cell.

✓ Reading Check

What is the difference between rough ER and smooth ER?

After proteins are made in a cell, they are transferred to another type of cell organelle called the Golgi (GAWL jee) bodies. The **Golgi bodies**, as shown in **Figure 10**, are stacked, flattened membranes. The Golgi bodies sort proteins and other cellular substances and package them into membrane-bound structures called vesicles. The vesicles deliver cellular substances to areas inside the cell. They also carry cellular substances to the cell membrane where they are released to the outside of the cell.

Just as a deli has refrigerators for temporary storage of some of its foods and ingredients, cells have membrane-bound spaces called vacuoles for the temporary storage of materials. A vacuole can store water, waste products, food, and other cellular materials. In plant cells, the vacuole may make up most of the cell’s volume.

Figure 10 The Golgi body packages materials and moves them to the outside of the cell.

Explain why materials are removed from the cell.



Color-enhanced TEM Magnification: 28000×

