### Chapter 2 Cell Structure and Function

#### Learning Guide

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</table>
Cells and Life

A. Understanding Cells

1. __________ enable us to see the tiny basic units of all living things.

2. Robert Hooke saw the openings in cork and called them __________.

3. Matthias Schleiden and Theodor Schwann realized that plant and animal cells have __________ features.

4. The cell theory has three parts: All living things are made of __________ cells. The cell is the smallest unit of __________. All new cells come from __________ cells.

B. Basic Cell Substances

1. __________ form when many small molecules join.

2. The main ingredient of any cell is __________.

3. The structure of a water molecule makes it ideal for __________ many other substances.

4. The four types of __________ in cells are nucleic acids, proteins, lipids, and carbohydrates.

5. Nucleic acids form when long chains of molecules called __________ join.

6. Nucleic acids are important in cells because they contain __________ information.

7. The macromolecules that are necessary for nearly everything cells do are __________.

8. Proteins are long chains of __________ molecules. Some proteins help break down __________ in food.

9. A(n) __________ is a large macromolecule that does not dissolve in water.

10. Macromolecules that do not mix with water play an important role as protective __________ in cells.
Lesson Outline continued

11. One sugar molecule, two sugar molecules, or long chains of sugar molecules make up ________________.

12. Carbohydrates store ________________ and provide structural support. They also are used for ________________ between cells.

Chapter 2, Lesson 1 Learning Targets

1. I can define and use these words: cell, carbohydrate, cell theory, lipid, macromolecule, nucleic acid, protein, theory

2. I can explain the benefits of using microscopes to view cells.

3. I can explain the 3 parts of the cell theory.

4. I can identify and describe the 4 types of macromolecules.

5. I can differentiate between the common and scientific uses of the word “theory.”
The Cell

A. Cell Shape and Movement

1. A cell is made of different ___________________________ that work together and keep a cell alive.

2. The ___________________________ is a flexible covering that protects the inside of a cell from the environment outside.

3. A cell membrane is mostly made of phospholipids and ___________________________.

4. A(n) ___________________________ is a stiff structure outside the cell membrane of some cells.

5. ___________________________, fungal cells, and some types of bacteria have cell walls.

6. Cell appendages are often used for ___________________________.
   a. Long, tail-like appendages called ___________________________ whip back and forth and move a cell.
   b. ___________________________ are short, hairlike structures that can move a cell or move molecules away from a cell.

7. Most water in a cell is in the ___________________________, a fluid that contains salts and other molecules.

8. The ___________________________ is made of a network of threadlike proteins that are joined to form a framework inside a cell.

B. Cell Types

1. With advanced microscopes, scientists discovered that all cells can be grouped into two types—prokaryotic and ___________________________.

2. The most important feature of a(n) ___________________________ cell is that the genetic material is not surrounded by a membrane.

3. Plants, ___________________________, fungi, and protists are made of one or more eukaryotic cells.

4. Every eukaryotic cell has membrane-surrounded components, called ___________________________, which have specialized functions.

C. Cell Organelles

1. The ___________________________ is the part of a eukaryotic cell that directs cell activities and contains genetic information stored in DNA.

2. Surrounding the nucleus are two membranes that form a structure called the nuclear ___________________________.

Cell Structure and Function
Lesson Outline continued

3. ________________ are made in small structures called ribosomes.

4. Ribosomes can be found in a cell’s ________________ or attached to a weblike organelle called the endoplasmic reticulum.

5. Energy is released during chemical reactions that occur in the ________________.

6. ________________ is the fuel for cellular processes such as growth, cell division, and material transport.

7. Chloroplasts are membrane-bound organelles that use ________________ energy and make glucose from water and carbon dioxide. This energy drives a process known as ________________.

8. The Golgi apparatus prepares ________________ and packages them into ball-like structures called ________________.

9. ________________ are organelles that help recycle cellular components.

10. Vacuoles are organelles that ________________ food, water, and waste material.

Chapter 2 Lesson 2 Learning Targets

1. I can differentiate between prokaryotic cells and eukaryotic cells.

2. I can describe the structure and function of the organelles within a cell.
Moving Cellular Material

A. Passive Transport
   1. A cell membrane is ________________, which means that it allows only certain substances to enter or leave a cell.
   2. Passive transport is the movement of substances through a cell membrane without using the cell’s _________________.

B. Diffusion
   1. Diffusion is the movement of substances from an area of ________________ concentration to an area of ________________ concentration.
   2. Usually diffusion continues through a membrane until the ________________ of a substance is the same on both sides of the membrane.

C. Osmosis—The Diffusion of Water
   1. Osmosis is the diffusion of ________________ molecules only through a membrane.
   2. If the concentration of water in the air surrounding a plant is less than the concentration of water inside the plant’s vacuoles, water will diffuse into the ________________ until the concentrations of water are equal.
   3. Facilitated diffusion allows molecules to pass through a cell membrane using ________________ proteins.
      a. Carrier proteins carry ________________ through the cell membrane.
      b. ________________ proteins allow ions to pass through the cell membrane.

D. Active Transport
   1. Active transport uses the cell’s ________________ to move substances through a cell membrane.
   2. Active transport moves substances from areas of ________________ concentration to areas of ________________ concentration.
Lesson Outline continued

3. A cell uses ________________ to take in a substance by surrounding it with the cell membrane.

4. A cell’s vesicles release their contents outside the cell during ________________.

E. Cell Size and Transport

1. For a cell to survive, its surface area must be large compared to its ________________.
2. As a cell ________________, its volume increases faster than its surface area.

Chapter 2, Lesson 3 Learning Targets

1. I can describe ways materials enter and leave cells.

2. I can explain how cell size affects the transport of materials.
Cells and Energy

A. Cellular Respiration

1. All ______________________ things need energy to survive.

2. ______________________ is a series of chemical reactions that convert the energy in food molecules into a usable form of energy called ATP.

3. The first step of cellular respiration, called glycolysis, occurs in the ______________________ of all cells.

4. During glycolysis ______________________, a sugar, is broken into smaller molecules.

5. The second step of cellular respiration occurs in the ______________________ of eukaryotic cells. This step requires ______________________.

6. During the second step of cellular respiration, the smaller molecules made during ______________________ are broken down. Large amounts of usable energy, called ______________________, are produced.

7. ______________________ and carbon dioxide (CO₂) are two waste products that are given off during the second step of cellular respiration.

B. Fermentation

1. Eukaryotic and prokaryotic cells use fermentation to obtain energy from food when ______________________ levels are low.

2. Fermentation occurs in a cell’s ______________________.

3. Lactic-acid fermentation converts ______________________ into ATP and a waste product called lactic acid.

4. Some types of bacteria and yeasts make ATP during ______________________ fermentation. This process produces ______________________ and CO₂.

C. Photosynthesis

1. Plants and some unicellular organisms obtain energy from ______________________.

2. Photosynthesis is a series of chemical reactions that convert light energy, water, and CO₂ into ______________________ and ______________________.

3. In plants, light energy is absorbed by ______________________ such as chlorophyll.
Lesson Outline continued

4. The chemical reactions of photosynthesis occur in ____________________, the organelles in plant cells that convert light energy into food.

5. Photosynthesis uses CO₂ that is released during ____________________ to make food energy and release oxygen.

6. When an organism eats plant material, it takes in ____________________ energy. An organism’s cells use ____________________ released during photosynthesis.

Chapter 2, Lesson 4 Learning Targets

1. I can explain how cells obtain energy.

2. I can describe the process of cellular respiration.

3. I can explain the importance of photosynthesis and cellular respiration.
Cell Structure and Function

Multiple Choice
Directions: On the line before each question, write the letter of the correct answer.

1. Which function pertains to a lipid molecule?
   A. transport
   B. energy storage
   C. structural support
   D. containing genetic information

2. Which statement explains a difference between a cell wall and a cell membrane?
   A. Plant cells have cell walls, and animal cells do not.
   B. Animal cells have cell walls, and plant cells do not.
   C. Cell walls protect a cell, and cell membranes do not.
   D. Cell membranes protect a cell, and cell walls do not.

3. Which substance moves by osmosis?
   A. ions
   B. water
   C. protein
   D. hormones

Completion
Directions: On each line, write the term that correctly completes each sentence.

4. Food, water, and waste materials are stored in a cell’s _________________.
5. A cell’s activities are directed by the _________________.
6. The ________________ is semipermeable, which means that only some substances can cross it.
7. ________________ is the movement of substances into cells by surrounding them with the cell membrane.
8. Cellular energy is needed to carry out ________________ transport.
9. ________________ is the movement of substances using transport proteins.
Interpreting a Diagram
Directions: Use the diagram to respond to each statement.

10. Label the diagram with the correct terms.

- a. ____________
- b. ____________
- c. ____________
- d. ____________
- e. ____________
- f. ____________

11. Describe the function of three organelles that you labeled.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Short Answer
Directions: Respond to each statement on the lines provided.

12. Judge whether scientists would have been able to develop cell theory without a microscope.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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13. **Analyze** the way the products of cellular respiration and photosynthesis are related. 

14. **State** why a plant deprived of light would die, despite having water and fertile soil. 

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**Concept Application**

**Directions:** Respond to each statement on the lines provided. Use complete sentences.

15. **Hypothesize** whether prokaryotic or eukaryotic cells evolved first. Use details about the structure of each cell type to support your hypothesis. 

16. The surface area of a cell’s membrane restricts how large the cell can grow. **Propose** one way that a cell membrane could be modified to allow a cell to grow larger than it normally would. Explain how this modification would facilitate the transport of greater amounts of substances across the cell membrane.
Chapter 2 Vocabulary

Lesson 1

**carbohydrate** one or more sugar molecules  
**cell** smallest structural and functional unit of an organism  
**cell theory** living things are made of one or more cells; the cell is the smallest unit of life; new cells come from preexisting cells  
**lipid** large macromolecule that does not dissolve in water  
**macromolecule** substance that forms by joining many small molecules  
**nucleic acid** macromolecule that forms when a long chain of nucleotides join together  
**protein** long chain of amino acid molecules  
**theory** an explanation or model based on observation, experimentation, and reasoning, especially one that has been tested and confirmed as a general principle helping to explain and predict natural phenomena; an explanation of an observed phenomenon.

Lesson 2

**cell membrane** protects the inside of a cell from the environment  
**cell wall** stiff structure outside the cell membrane  
**chloroplast** membrane-bound organelle that uses light energy and makes food  
**cytoplasm** fluid inside a cell that contains salts and other molecules  
**cytoskeleton** network of threadlike proteins inside a cell  
**envelope** outer covering  
**function** purpose for which something is used  
**nucleus** directs all cell activities and contains DNA  
**organelle** membrane-bound cell structure with a specialized function

Lesson 3

**active transport** movement of substances through a cell membrane using the cell’s energy  
**diffusion** movement from an area of higher concentration to an area of lower concentration  
**endocytosis** process during which a cell takes in a substance by surrounding it with the cell membrane  
**exocytosis** process during which a cell’s vesicles release their contents outside the cell  
**facilitated diffusion** when molecules pass through a cell membrane using transport proteins  
**osmosis** diffusion of water molecules only through a membrane  
**passive transport** movement of substances through a cell membrane without using energy

Lesson 4

**cellular respiration** series of chemical reactions that convert energy in food molecules into ATP  
**fermentation** reaction used to obtain energy from food when oxygen levels are low  
**glucose** a sugar C₆H₁₂O₆  
**glycolysis** process by which glucose is broken down  
**photosynthesis** series of reactions that convert light energy, water, and CO₂ into glucose and give off oxygen
Cells and Life

Directions: Use your textbook to respond to each statement.

1. List the three parts of the cell theory.
   a. ____________________________
   b. ____________________________
   c. ____________________________

2. Identify and describe the four types of macromolecules in cells by completing the table below.

<table>
<thead>
<tr>
<th>Macromolecule</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Nucleic acids</td>
<td>a.</td>
</tr>
<tr>
<td>b.</td>
<td>long chains of amino acid molecules</td>
</tr>
<tr>
<td>Lipids</td>
<td>c.</td>
</tr>
<tr>
<td>d.</td>
<td>long chains of sugar molecules</td>
</tr>
</tbody>
</table>

3. Have your learning partner guess the main ingredient of all cells. Write the correct response here.

Was your learning partner correct? Explain to your learning partner why this main ingredient is such an important molecule in cells.
The Cell

**Directions:** On each line, write the term from the word bank that correctly completes each sentence.

- energy processing
- fluid
- framework
- genetic material
- glucose
- harmful organisms
- movement
- outside
- production
- protein
- specific jobs
- transport substances
- waste material

<table>
<thead>
<tr>
<th>Cell Structure</th>
<th>Purpose of Cell Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell membrane</td>
<td>1. The cell membrane protects the inside of the cell from the environment ___________________________ the cell.</td>
</tr>
<tr>
<td>Cell wall</td>
<td>2. The cell wall protects a cell from attack by _____________________________________________</td>
</tr>
<tr>
<td>Cell appendages</td>
<td>3. Cell appendages are often used for _______________________________________________________</td>
</tr>
<tr>
<td>Cytoplasm</td>
<td>4. Cytoplasm is a(n) __________________________ inside the cell.</td>
</tr>
<tr>
<td>Cytoskeleton</td>
<td>5. The cytoskeleton forms a(n) __________________________ inside the cell.</td>
</tr>
<tr>
<td>Nucleus</td>
<td>6. The nucleus is the part of a eukaryotic cell that directs all cell activity and contains ________________________________</td>
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<tr>
<td>Ribosomes</td>
<td>7. Important molecules made by ribosomes are _______________________________________________</td>
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<tr>
<td>Endoplasmic reticulum</td>
<td>8. An endoplasmic reticulum that has ribosomes attached is a site of ____________________________</td>
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<tr>
<td>Mitochondria</td>
<td>9. Mitochondria are the sites of ___________________________________________________________</td>
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<tr>
<td>Chloroplasts</td>
<td>10. Chloroplasts process light energy, water, and carbon dioxide to make ________________________ and release oxygen.</td>
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<tr>
<td>Golgi apparatus</td>
<td>11. The Golgi apparatus prepares proteins for _____________________________________________</td>
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<tr>
<td>Vesicles</td>
<td>12. Vesicles __________________________________________ to other areas of a cell.</td>
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<tr>
<td>Vacuoles</td>
<td>13. Vacuoles store food, water, and _______________________________________________________</td>
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</tbody>
</table>
**Key Concept Builder**

**LESSON 2**

**The Cell**

Use reading pages 23-28 for help.

**Key Concept** How are prokaryotic cells and eukaryotic cells similar, and how are they different?

**Directions:** Complete the paragraphs by choosing terms from the word bank and writing them in the correct spaces. Terms may be used only once.

<table>
<thead>
<tr>
<th>bacteria</th>
<th>cell parts</th>
<th>eukaryotic</th>
<th>genetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>membrane</td>
<td>membrane-surrounded</td>
<td>organelles</td>
<td>prokaryotes</td>
</tr>
<tr>
<td>protists</td>
<td>size</td>
<td>specialized</td>
<td>unicellular</td>
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</tbody>
</table>

A defining feature of a prokaryotic cell is that the **(1.)** ________________ material is not surrounded by a(n) **(2.)** ________________. Another characteristic of prokaryotic cells is that they do not have all the **(3.)** ________________ found in eukaryotic cells. Most prokaryotic cells are one-celled, or **(4.)** ________________ organisms and are called **(5.)** ________________.

Another word for prokaryotes is **(6.)** ________________.

Eukaryotic cells make up plants, animals, fungi, and **(7.)** ________________. These organisms are called **(8.)** ________________. Almost all eukaryotic cells have genetic material that is contained in a nucleus. Another characteristic of eukaryotic cells is other **(9.)** ________________ components, called **(10.)** ________________, which have **(11.)** ________________ functions. Another difference between prokaryotic and eukaryotic cells is their **(12.)** _________________. Eukaryotic cells are usually larger than prokaryotic cells.
Key Concept Builder

LESSON 2

Use reading pages 23-28 for help.

The Cell

Key Concept: What do the structures in a cell do?

Directions: Write the correct organelle or cell structure on the lines provided.

Common to plant cells:
1. What is a stiff structure outside the cell membrane? __________
2. In which organelle does photosynthesis take place? __________
3. Which organelles store food, water, and waste material? __________

Common to plant and animal cells:
4. What is a flexible barrier that protects the inside of a cell? __________
5. What are short, hairlike structures that help move a cell? __________
6. What is the fluid that fills the inside of the cell? __________
7. What gives framework to a cell and helps it move? __________

Common to all eukaryotic cells (plants, animals, fungi, and protists):
8. Which organelle contains genetic information and controls the cell? __________
9. In which organelle are proteins made? __________
10. What removes harmful substances for a cell? __________
11. Which organelle releases energy in a cell? __________
12. Which organelle prepares proteins for specific jobs? __________
13. Which organelle carries substances to other parts of a cell? __________
14. Which vacuole-like structures break down and recycle cell parts? __________
### Moving Cellular Material

**Directions:** List a fact or term next to each bullet to complete the chart.

<table>
<thead>
<tr>
<th>Information to Find</th>
<th>Answers</th>
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<tbody>
<tr>
<td>1. What passes through a cell using passive transport?</td>
<td>•</td>
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<tr>
<td>2. What are three types of passive transport?</td>
<td>•</td>
</tr>
<tr>
<td>3. How do substances move in passive transport?</td>
<td>•</td>
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<tr>
<td>4. What is the diffusion of water molecules only?</td>
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<tr>
<td>5. What is used in facilitated diffusion to assist the transport of sugar and sodium molecules?</td>
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<tr>
<td>6. What is only used in active transport?</td>
<td>•</td>
</tr>
<tr>
<td>7. How do substances move in active transport?</td>
<td>•</td>
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<tr>
<td>8. Which proteins are used in active and passive transport?</td>
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<tr>
<td>9. What does a cell do to a substance in endocytosis?</td>
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<tr>
<td>10. What does a cell use to eliminate a substance that is too large to leave by diffusion?</td>
<td>•</td>
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<tr>
<td>11. Which structures join with the cell’s membrane during exocytosis?</td>
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Animal Cell Coloring

<table>
<thead>
<tr>
<th>A - Cell Membrane (Red)</th>
<th>D - Nucleolus (Orange)</th>
<th>G - Vacuoles (Dark Green)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B - Nucleus (Yellow)</td>
<td>E - Mitochondria (Blue)</td>
<td>H - Ribosomes (Pink)</td>
</tr>
<tr>
<td>C - DNA (Light Green)</td>
<td>F - Golgi Complex (Purple)</td>
<td>I - Endoplasmic Reticulum (Lt. Blue)</td>
</tr>
</tbody>
</table>
PLANT CELL COLORING

A - Cell Membrane (Red)  D - Cell Wall (Orange)  G - Vacuoles (Dark Green)
B - Nucleus (Yellow)     E - Mitochondria (Blue)   H - Ribosomes (Pink)
C - Chloroplast (Light Green)  F - Golgi Complex (Purple)  I - Endoplasmic Reticulum (Lt. Blue)