# Chapter 3  Cell Structure and Function

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Chapter 3  Cell Structure and Function

Chapter Preview Questions

1. In a microscope, an image is focused by
   a. the eyepiece lens and the mirror.
   b. the objective lens and the mirror.
   c. the eyepiece lens and the objective lens.
   d. the objective lens and a concave lens.
Chapter 3  Cell Structure and Function

Chapter Preview Questions

1. In a microscope, an image is focused by
   a. the eyepiece lens and the mirror.
   b. the objective lens and the mirror.
   c. the eyepiece lens and the objective lens.
   d. the objective lens and a concave lens.

   ✔️ c. the eyepiece lens and the objective lens.
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Chapter Preview Questions

2. An electron microscope uses a beam of electrons instead of
   a. slides.
   b. lenses.
   c. mirrors.
   d. light.
2. An electron microscope uses a beam of electrons instead of
   a. slides.
   b. lenses.
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3. Cells break down carbohydrates to get ____ for life processes.
   a. energy
   b. food
   c. oxygen.
   d. carbon dioxide
3. Cells break down carbohydrates to get ____ for life processes.

a. energy  ✔

b. food

c. oxygen

d. carbon dioxide
4. Cells in green plants make
   a. food and carbon dioxide.
   b. water and carbon dioxide.
   c. food and oxygen.
   d. water and carbon dioxide.
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   a. food and carbon dioxide.
   b. water and carbon dioxide.
   c. food and oxygen.
   d. water and carbon dioxide.
What is the structure of a cell?

You hear that a pinch of soil may contain millions of organisms. What optical tools would you use to see these organisms and to study their structure?
### Prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Meaning</th>
<th>Example Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>chlor-</td>
<td>green</td>
<td>chloroplast</td>
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</tbody>
</table>

**chloroplast**
A cellular structure that captures energy from sunlight
### Prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Meaning</th>
<th>Example Word</th>
</tr>
</thead>
</table>
| cyto-  | cell    | cytoskeleton
The framework inside a cell |
### Prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Meaning</th>
<th>Example Word</th>
</tr>
</thead>
</table>
| **multi-** | many | **multicellular**  
Having many cells |
## Prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
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<tbody>
<tr>
<td>uni-</td>
<td>one</td>
<td>unicellular</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Having one cell</td>
</tr>
</tbody>
</table>
Apply It!

1. A **chloroplast** is a structure in plant cells. What color do you think a chloroplast is?

   green

2. What clue within the word **cytoplasm** lets you know that the word has something to do with cells?

   the prefix *cyto-*
End of Chapter Preview
Section 1: Discovering Cells

- What are cells?
- How did the invention of the microscope contribute to knowledge about living things?
- What is the cell theory?
- How are the cells of multicellular organisms organized?
Development of the Cell Theory

The cell theory states the following:
• All living things are composed of cells.
• Cells are the basic units of structure and function in living things.
• All cells are produced from other cells.
Unicellular, or single-celled, organisms include bacteria, the most numerous organisms on Earth. Multicellular organisms are composed of many cells.
Links on Cell Theory

Click the SciLinks button for links on the cell theory.
End of Section: Discovering Cells
Section 2: Looking Inside Cells

- What role do the cell wall and cell membrane play in the cell?
- What is the role of the nucleus in the cell?
- What organelles are found in the cytoplasm and what are their functions?
- How do cells differ?
Plant and Animal Cells

Cytoplasm
The cytoplasm includes a gel-like fluid in which many different organelles are found.

Ribosomes
These small structures function as factories to produce proteins. Ribosomes may be attached to the endoplasmic reticulum, or they may float in the cytoplasm.

Nucleus
The nucleus directs all of the cell’s activities, including reproduction.

Mitochondria
Most of the cell’s energy is produced within these rod-shaped organelles.

Endoplasmic Reticulum

Golgi Body
The Golgi bodies receive materials from the endoplasmic reticulum and send them to other parts of the cell. They also release materials outside the cell.

Lysosomes
These small organelles contain chemicals that break down food particles and worn-out cell parts.

Vacuole
Some animal cells have vacuoles that store food, water, waste, and other materials.

Cell Membrane
Since an animal cell does not have a cell wall, the cell membrane forms a barrier between the cytoplasm and the environment outside the cell.
Click the Active Art button to open a browser window and access Active Art about plant and animal cells.
The nucleus is the cell’s control center, directing all of the cell’s activities.
Mitochondrion

Mitochondria are known as the “powerhouses” of the cell because they convert energy in food molecules to energy the cell can use to carry out its functions.
Endoplasmic Reticulum

The endoplasmic reticulum is similar to the system of hallways in a building. Proteins and other materials move throughout the cell by way of the endoplasmic reticulum. The spots on this organelle are ribosomes, which produce proteins.
Golgi Body

The Golgi bodies receive proteins and other newly formed materials from the endoplasmic reticulum, package them, and distribute them to other parts of the cell.
The Cytoplasm and Organelles

Click the Video button to watch a movie about cytoplasm and organelles.
End of Section: Looking Inside Cells
Section 3: Chemical Compounds in Cells

- What are elements and compounds?
- How is water important to the function of cells?
- What are the functions of carbohydrates, lipids, proteins, and nucleic acids?
Elements and Compounds

Carbon dioxide, which is found in gas bubbles, is a chemical compound. So is water.

**Carbon Dioxide Molecule**
Air bubbles contain carbon dioxide. A carbon dioxide molecule has one atom of carbon and two atoms of oxygen.

**Water Molecule**
A water molecule is made up of one atom of oxygen and two atoms of hydrogen.
All cells contain carbohydrates, lipids, proteins, and nucleic acids, as well as water and other inorganic compounds. But do all cells contain the same percentages of these compounds? The graph compares the percentage of some compounds found in a bacterial cell and a cell from a mammal.
Compounds in Bacteria and Mammals

Reading Graphs:

Q. What do the red bars represent? What do the blue bars represent?

A. Red bars represent percentages of compounds in bacterial cells; blue bars represent percentages of compounds in mammalian cells.
Compounds in Bacteria and Mammals

Interpreting Data:

Q. What percentage of a mammalian cell is made up of water? How does this compare to the percentage of water in a bacterial cell?

A. About 70%; the percentages are the same.
Compounds in Bacteria and Mammals

**Interpreting Data:**

Q. Which kind of compound—proteins or nucleic acids—makes up the larger percentage of a mammalian cell?

A. Proteins
Compounds in Bacteria and Mammals

**Drawing Conclusions:**

**Q.** In general, how do a bacterial cell and mammalian cell compare in their chemical composition?

**A.** They are similar, though mammalian cells have a lower percentage of nucleic acids, and bacterial cells have a lower percentage of lipids and fewer proteins.
Links on Proteins

Click the SciLinks button for links on proteins.
Section 4: The Cell in Its Environment

- How do most small molecules cross the cell membrane?
- Why is osmosis important to cells?
- What is the difference between passive and active transport?
A Selective Barrier

The cell membrane protects the contents of the cell and helps control the materials that enter and leave.
Diffusion

In diffusion, molecules move from an area of higher concentration to an area of lower concentration.

Before Diffusion
There is a higher concentration of oxygen molecules outside the cell than inside the cell.

After Diffusion
The concentration of oxygen molecules is the same outside and inside the cell.
Ratios

The concentration of a solution can be expressed as a ratio. A ratio compares two numbers. It tells you how much you have of one item in comparison to another. For example, suppose you dissolve 5 g of sugar in 1 L of water. You can express the concentration of the solution in ratio form as 5 g:1 L, or 5 g/L.

Practice Problem

Q. Suppose you dissolve 7 g of salt in 1 L of water. Express the concentration of the solution as a ratio.

A. 7 g:1 L or 7 g/L
Osmosis

In osmosis, water diffuses through a selectively permeable membrane.

A Normal Red Blood Cell
Concentration of water inside the cell is the same as outside.

B Low Water Concentration
Outside Cell
Water moves out of the cell during osmosis.

C High Water Concentration
Outside Cell
During osmosis, water moves into the cell.
Passive and Active Transport

Passive and active transport are two processes by which materials pass through the cell membrane. Active transport requires the cell to use its own energy, while passive transport does not.
More on Cellular Transport

Click the PHSchool.com button for an activity about cellular transport.
End of Section: The Cell in Its Environment
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QuickTake Quiz

Click to start quiz.