# Lesson 2 | The Cell

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Why do eggs have shells?

Bird eggs have different structures, such as a shell, a membrane, and a yolk. Each structure has a different function that helps keep the egg safe and assists in development of the baby bird inside of it.

**Procedure**

1. Read and complete a lab safety form.
2. Place an uncooked egg in a bowl.
3. Feel the shell, and record your observations in your Science Journal.
4. Crack open the egg. Pour the contents into the bowl.
5. Observe the inside of the shell and the contents of the bowl. Record your observations in your Science Journal.

**Think About This**

1. What do you think is the role of the eggshell?

   

2. Are there any structures in the bowl that have the same function as the eggshell? Explain.

   

3. **Key Concept** What does the structure of the eggshell tell you about its function?
## Content Vocabulary

### The Cell

**Directions:** Use the clues and the terms listed below to complete the puzzle. NOTE: There is no empty square in the puzzle between the words of two-word terms.

<table>
<thead>
<tr>
<th>cell membrane</th>
<th>cell wall</th>
<th>chloroplast</th>
<th>cytoplasm</th>
<th>cytoskeleton</th>
<th>envelope function</th>
<th>nucleus</th>
<th>organelle</th>
</tr>
</thead>
</table>

### Clues

**Across**

4. organelle that contains DNA  
6. a flexible covering that surrounds a cell  
7. fluid inside the cell that contains salts and other molecules  
8. a membrane-surrounded component within a cell  
9. the action for which something is used

**Down**

1. stiff structure outside the cell membrane  
2. an outer covering  
3. a network of threadlike proteins within a cell  
5. organelle that conducts photosynthesis
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 ____________________.
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.
How do eukaryotic and prokaryotic cells compare?

With the use of better microscopes, scientists discovered that cells can be classified as one of two types—prokaryotic or eukaryotic.

**Procedure**

1. Read and complete a lab safety form.
2. Using different **craft items**, make a two-dimensional model of a eukaryotic cell.
3. In your cell model, include the number of cell structures assigned by your teacher.
4. Make each cell structure the correct shape, as shown in this lesson.
5. Make a label for each cell structure of your model.

**Data and Observations**

**Analyze and Conclude**

1. **Describe** the nucleus of your cell.

2. **Classify** your cell as either a plant cell or an animal cell, and support your classification with evidence.

3. **Key Concept** Compare and contrast a prokaryotic cell, as shown in Figure 8 in your textbook, with your eukaryotic cell model.
### 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
- proteins
- specific jobs
- transport substances
- waste material

<table>
<thead>
<tr>
<th>Cell Structure</th>
<th>Purpose of Cell Structure</th>
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</thead>
<tbody>
<tr>
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</tr>
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<td>3. Cell appendages are often used for ______________________.</td>
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<td>6. The nucleus is the part of a eukaryotic cell that directs all cell activity and contains ______________________.</td>
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<td>Ribosomes</td>
<td>7. Important molecules made by ribosomes are ______________________.</td>
</tr>
<tr>
<td>Endoplasmic reticulum</td>
<td>8. An endoplasmic reticulum that has ribosomes attached is a site of ______________________.</td>
</tr>
<tr>
<td>Mitochondria</td>
<td>9. Mitochondria are the sites of ______________________.</td>
</tr>
<tr>
<td>Chloroplasts</td>
<td>10. Chloroplasts process light energy, water, and carbon dioxide to make ______________________ and release oxygen.</td>
</tr>
<tr>
<td>Golgi apparatus</td>
<td>11. The Golgi apparatus prepares proteins for ______________________.</td>
</tr>
<tr>
<td>Vesicles</td>
<td>12. Vesicles ______________________ to other areas of a cell.</td>
</tr>
<tr>
<td>Vacuoles</td>
<td>13. Vacuoles store food, water, and ______________________.</td>
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</tbody>
</table>
## The Cell

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</tr>
</tbody>
</table>
Word-Meaning Activity: Sentence Completion

Directions: Study the terms and definitions below. Then circle the term that best completes each sentence.

**carbohydrate** *n.* made up of one sugar molecule, two sugar molecules, or a long chain of sugar molecules

**cell membrane** *n.* flexible covering that protects the inside of a cell

**chloroplast** *n.* membrane-bound organelles that use light energy and make food

**cytoplasm** *n.* fluid inside a cell that contains salts and other molecules

**organelle** *n.* membrane-surrounded components that have specialized functions

**nucleus** *n.* part of a eukaryotic cell that directs cell activities and contains genetic information

**protein** *n.* long chain of amino acid molecules that is necessary for nearly everything cells do

1. Plant cells, such as algae, contain (chloroplast/cytoplasm), which can make glucose.

2. (Organelles/Carbohydrates) enable cells to carry out different functions at the same time.

3. Bread, pasta, and fruit all contain (carbohydrates/organelles).

4. A (nucleus/cell membrane) protects a cell from its outside environment.

5. Some (proteins/chloroplasts) in saliva help break down nutrients in food.

6. Water is the main ingredient of a cell, and most of the water is in the (cell membrane/cytoplasm).

7. The number of chromosomes in a (nucleus/protein) varies for different species of organisms.
Word-Family Activity: Word Chart

A noun is a word that names a person, place, thing, or idea. Examples include *Archimedes*, *Europe*, *cylinder*, and *theory*. A verb is a word that is used to describe an action, experience, or state of being. Examples include *compel*, *anticipate*, and *was*. Sometimes the noun and verb forms of a word are the same.

**Directions:** Complete the chart below with the correct word forms. The first word has been completed for you.

<table>
<thead>
<tr>
<th>Noun</th>
<th>Verb</th>
</tr>
</thead>
<tbody>
<tr>
<td>attraction</td>
<td>attract</td>
</tr>
<tr>
<td>telescope</td>
<td>explain</td>
</tr>
<tr>
<td>protection</td>
<td>contain</td>
</tr>
<tr>
<td>structure</td>
<td>perform</td>
</tr>
<tr>
<td>movement</td>
<td>transport</td>
</tr>
<tr>
<td>reaction</td>
<td></td>
</tr>
</tbody>
</table>
The Cell

Directions: Use your textbook to answer each question or respond to each statement.

1. Write a clue that could be used to describe each of the following cell structures. Then share your clues with your learning partner to see whether he or she can guess each answer. The first clue is provided as an example.

a. Cell membrane: This is a flexible covering that surrounds all types of cells.

b. Cell wall:


c. Nucleus:


d. Ribosomes:


e. Mitochondria:


f. Chloroplasts:


2. Suppose a scientist has found a new type of cell. The scientist notes that the cell has a membrane, a nucleus, cytoplasm, and ribosomes. Is this new type of cell prokaryotic or eukaryotic? How do you know?
The Cell

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.

bacteria  cell parts  eukaryotic  genetic
membrane  membrane-surrounded  organelles  prokaryotes
protists  size  specialized  unicellular

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.
The Cell

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

Directions: Use the phrases below to complete the diagram. Write what is different about prokaryotic and eukaryotic cells in the top boxes. Write what is similar about them in the bottom box.

- are bacteria
- have a cell membrane
- have a cytoskeleton
- have cytoplasm
- some have a cell wall
- do not have many cell parts
- contain membrane surrounded organelles
- have genetic material not surrounded by a membrane
- have genetic material surrounded by a membrane
- make up plants, animals, fungi, and protists

1. ____________________________
   ____________________________
   ____________________________

2. ____________________________
   ____________________________
   ____________________________

3. ____________________________
   ____________________________
   ____________________________

4. ____________________________
   ____________________________
   ____________________________

5. ____________________________
   ____________________________
   ____________________________

6. ____________________________
   ____________________________
   ____________________________
Key Concept Builder

LESSON 2

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? _______________
The Cell

Key Concept  What do the structures in a cell do?

Directions: Work with a partner to describe the structure and function of each organelle. Add as much information as possible for each structure.

Nucleus

Rough endoplasmic reticulum

Mitochondrion

Chloroplast
Enrichment

From Simple to Complex: The Symbiotic Theory

Scientists theorize that the earliest life-forms on Earth were simple prokaryotes. Recall that prokaryotes are unicellular organisms. Prokaryotes include bacteria and archaea.

Eukaryotes evolved nearly 2 billion years after the first prokaryotes. As you have learned, eukaryotes include plants, animals, fungi, and protists. Scientists theorize that eukaryotes evolved from prokaryotes. The question is, how?

Symbiosis

Symbiosis is a close, natural relationship between two living things. A colony of ants, for example, might build a nest in the branches of a tree. They get food and shelter from the tree. In return, they protect the tree from parasites and predators. The ants and the tree have a symbiotic relationship.

In 1981, biologist Lynn Margulis published a theory explaining how symbiosis might account for the evolution of eukaryotes. According to Margulis’s theory, a host bacterium was ingested or invaded by an aerobic (oxygen-using) bacterium. The host reproduced in such a way that future generations of the host also contained this aerobic bacteria.

The aerobic bacterium survived using nutrients taken in by the host bacterium. In return, it began to perform certain functions for the host cell, such as using oxygen for cell metabolism. Eventually, neither the host nor the aerobic bacterium could function on its own. Aerobic bacteria evolved into the mitochondria found in eukaryotic cells. In plants, a similar process occurred between a host bacterium and a photosynthetic bacterium; the photosynthetic bacteria eventually evolved into chloroplasts. Eukaryotic organisms evolved from these early symbiotic cells.

Support for the Theory

Margulis’s theory was largely dismissed at first. In recent years, however, scientists have found that the DNA of mitochondria resembles the DNA of bacteria, rather than the DNA found in the nucleus of eukaryotic cells. In addition, the innermost membrane that surrounds a mitochondrion is similar to the membrane found in a prokaryotic cell. These and other factors have lent support to the symbiotic theory.

Applying Critical-Thinking Skills

Directions: Respond to each statement.

1. Identify one symbiotic relationship between you and another organism.
2. Relate what evidence indicates that mitochondria might have had a prokaryotic ancestor.
3. Summarize the process by which eukaryotic cells might have evolved.
**Organelles in Familiar Terms**

Use analogies to compare cell organelles to familiar objects or events. An analogy is a comparison that shows similarities between two seemingly different things. For example, you could say that a cell is like a football team because all its parts work together for a common goal.

- Begin by sketching a plant cell in the space below.
- Sketch and label these cell organelles in your diagram.

<table>
<thead>
<tr>
<th>chloroplast</th>
<th>Golgi apparatus</th>
<th>mitochondrion</th>
<th>nucleus</th>
</tr>
</thead>
<tbody>
<tr>
<td>ribosome</td>
<td>vacuole</td>
<td></td>
<td>vesicle</td>
</tr>
</tbody>
</table>

- Write an analogy next to each cell organelle. Include the word because in each analogy. Compare the characteristics or the functions of cell organelles to familiar objects or events.
How are plant cells and animal cells similar and how are they different?

A light microscope enables you to observe many of the structures in an object’s individual cells. Increasing the magnification causes you to see a smaller portion of the object, but lets you see the object in more detail. As you see more details, you can **compare and contrast** different cell types. How are they alike? How are they different?

**Learn It**

If you were to **compare and contrast** a maple tree and a cat, you would find them more unlike each other than alike. Are their cells different, too?

**Materials**

- microscope
- dropper
- microscope slide and coverslip
- *Elodea* plant
- forceps
- prepared slide of human cheek cells
- tap water

**Safety**

**Try It**

1. Read and complete a lab safety form.

2. Using forceps, make a wet-mount slide of a young leaf from the tip of an *Elodea* plant.

3. Use a microscope to observe the leaf on low power. Focus on the top layer of cells.

4. Switch to high power and focus on one cell. The large organelle in the center of the cell is the central vacuole. Moving around the central vacuole are green, disklike objects called chloroplasts. Try to find the nucleus. It looks like a clear ball.

5. Draw a diagram of the *Elodea* cell. Label the cell wall, central vacuole, chloroplasts, cytoplasm, and nucleus. Return to low power and remove the slide. Properly dispose of the slide.
Skill Practice continued

6. Observe the prepared slide of cheek cells under low power.

7. Switch to high power and focus on one cell. Draw a diagram of one cheek cell. Label the cell membrane, cytoplasm, and nucleus. Return to low power and remove the slide.

Apply It

8. Based on your diagrams, how do the shapes of the *Elodea* cell and cheek cell compare?

9. **Key Concept** Compare and contrast the cell structures in your two diagrams. Which structures did you observe in both cells? Which structures did you observe in only one of the cells?