

## Unit Essential Question

*How do body systems interact with each other to communicate and collaborate?*

## Introduction

Now students are going to look inside cells. By looking inside cells, students can see the organelles and better understand how the cells work in relation to their environment.

## Objectives

Students will be able to

### Content

- Identify the cell membrane, cell wall, mitochondria, chloroplast, and nucleus.

### Science and Engineering Practices

- Develop and use a model to describe how cells work.

### Equity and Groupwork

- Collaboratively plan and present a drama (skit) about cells.

### Language

- Identify main facts from a reading about cells.

## Assessment

- Have students independently complete the Learning Task 2 section of the Individual Project Organizer as homework or in class, depending on students' needs and/or class scheduling.
- Collect Individual Project Organizers and assess them using these criteria:
  - "Developing and Using Models" row of the Science and Engineering Practices Rubric
  - "Obtaining, Evaluating, and Communicating Information" row of the Science and Engineering Practices Rubric
- Return the Individual Project Organizers, and give students time to make revisions. ELLs may need additional time.

## Academic Vocabulary

- |                  |                          |
|------------------|--------------------------|
| • carbon dioxide | • multicellular organism |
| • cell membrane  | • nucleus                |
| • cell wall      | • organ                  |
| • chloroplast    | • organelle              |
| • energy         | • oxygen                 |
| • mitochondria   | • unicellular organism   |

## Language of Instruction

- drama



### LANGUAGE SUPPORT STRATEGIES

Add the new vocabulary terms to the poster currently displayed in the classroom.

## Timing

This task can be completed in 4 class periods (based on 45-minute periods).

- Part I • Read a Short Article about Cells (1 class period)
- Part II • Model How a Cell Works (2 class periods)
- Part III • Optional: How Plant and Animal Cells Work Together Model
- Part IV • Connect to the Culminating Project and Assessment (1 class period)

## Student Materials

- Introduction to Cells video (2:54): <https://youtu.be/gFuEo2ccTPA>
- Bill Nye the Science Guy—Cells video (6:10):  
<http://www.schooltube.com/video/f7c3e5bb9bc0881ba287/Bill%20Nye%20the%20Science%20Guy%20-%20Cells>
- Cardstock for plant cell and animal cell “part” signs (enough to make signs for each group—see preparation)
- Pieces of string or yarn to attach to the signs to make the lanyards (enough pieces to attach one per sign)
- Manila envelopes for signs (1 envelope per group)
- Pieces of string or yarn to mark the cell membrane on the ground (the stage) (1 per group)
- Pieces of ribbon to mark the cell wall on the ground (the stage) (1 per plant cell group)
- Sticky notes (1 per student)

## Cell Drama Preparation



### NOTE

The word *parts* is in quotes below because the cell “parts” include actual cell parts such as mitochondria as well as materials that go in and out of the cell like oxygen.

- Write the animal cell “parts” on cardstock: mitochondria, nucleus, oxygen, carbon dioxide, food (sugar), energy.
- Write the plant cell “parts” on cardstock: mitochondria, chloroplast, nucleus, oxygen, carbon dioxide, food (sugar), sun, water, energy.
- Attach the “parts” signs to string or yarn to make a lanyard that will fit around a student’s neck.
- Mark the two large manila envelopes “Plant Cell” and “Animal Cell.” Put the signs in the appropriate manila envelopes.
- Put a long piece of string or yarn to represent the cell membrane in each manila envelope.
- Put a long piece of ribbon to represent the cell wall in each “Plant Cell” manila envelope.

## Background Knowledge

Although Task 2 and the Performance Expectation associated with it only focus on a few cell parts, these cell parts play an integral role in the communication and collaboration between cells and within cells. The table below summarizes the communication and collaboration connections. Some of the information is beyond the scope of the information that students need to know, but it may be useful for teachers so that they can give a simple but conceptually correct explanation if any students have questions.

Cell Part	Function	Collaborate	Communicate
Cell Membrane	The cell membrane controls what goes in and out of the cell. It also sends messages collected from the outside of the cell into the cell.	<p>The membrane</p> <ul style="list-style-type: none"> <li>Lets oxygen and food in and carbon dioxide and water out for the <b>mitochondria</b>.</li> <li>Lets carbon dioxide and water in and oxygen out for the <b>chloroplast</b>.</li> <li>Lets protein (signaling) molecules out, which are coded by the DNA in the nucleus, but made on ribosomes (not a part addressed yet).</li> </ul>	<p>The messaging system is a complicated process called <i>signal transduction pathway</i> and is currently a deeply researched process in the world of cellular biology. The signals (often proteins) enable cells to communicate with each other throughout the body. The signals attach to receptors on the outside of the cell membrane, initiating a complex series of reactions that send a signal into the cell.</p> <p>An example of an external cell signal is a hormone such as insulin. Insulin tells liver cells to take in sugar from the blood.</p> <p>An example of an internal cell signal is CDK, which tells the cell when it is time to divide into two cells.</p>
Nucleus	The nucleus stores the blueprints (DNA) for all the proteins that a cell makes and uses.	<p>Some of the proteins are used to facilitate chemical reactions. Proteins break down sugar into carbon dioxide, water, and energy in the <b>mitochondria</b>. Proteins put together carbon dioxide and water into food (sugar) in the <b>chloroplast</b>.</p> <p>The <b>cell membrane</b> lets in the raw materials (RNA nucleotides) to make copies of the DNA blueprint and lets in the raw materials to make proteins on the ribosomes.</p>	<p>The information in the nucleus controls what proteins will be made and thus tells the cell what it will do and look like and gives the cell a specific function.</p> <p>Because the nucleus sends out the messages for when and how the cell makes proteins, it can be said that the nucleus controls the cell parts and the cell's activities. Without the blueprints for the proteins, the cell could not make proteins and therefore could not function.</p>
Mitochondria	With the help of oxygen, the mitochondria break down food (sugar) into carbon dioxide (a waste), water (a waste), and energy (the important product of mitochondrial action).	<p>Food and oxygen are made by a <b>chloroplast</b> in a plant cell and move to the mitochondria or out through the <b>cell membrane</b>.</p> <p>Carbon dioxide is used by the <b>chloroplast</b> in a plant cell and moves in the cell through the <b>cell membrane</b>.</p> <p>The <b>nucleus</b> uses the energy to copy the blueprints for the ribosome in order to make proteins.</p>	The mitochondria get protein messages and protein enzymes for chemical reactions coded by the DNA in the nucleus and made by the ribosomes.

Cell Part	Function	Collaborate	Communicate
Chloroplast	A chloroplast makes food (sugar or glucose) by putting together carbon dioxide and water using the energy from the sun. In the end, animal cells need this food (sugar) to make energy—that's why animals eat plants. One major misconception is that the chloroplast creates energy for the plant cell. The chloroplast only creates food (sugar) and then the food (sugar) moves to the mitochondria in a plant cell to actually make useable energy (ATP). Plants can not order a pizza and eat, so they must make their own food. Animals can move and eat, so they eat and use the food that plants make to make energy.	Carbon dioxide comes from the <b>mitochondria</b> of an animal cell and plant cell or moves from the outside of the cell into the cell through the <b>cell membrane</b> . Food (sugar) and oxygen made by the <b>chloroplast</b> are used by the <b>mitochondria</b> in the animal and plant cell. Oxygen also moves out of the cell through the <b>cell membrane</b> .	The chloroplast gets protein messages and protein enzymes (made by the ribosomes) for chemical reactions coded by the DNA in the nucleus.
Cell Wall	The cell wall is only for protection and shape. A plant does not have bones, so one of the ways that plants have structure and shape is through their strong cell walls around their cells. If you kick a tree, it is hard because of the cell walls. If you poke your arm (animal cells) you "indent" because your body only has cell membranes.	The cell walls of plants must maintain the shape of plant cells and resist water pressure. When all plant cells work together to do this, it supports and strengthens plants' structure as a whole.	Proteins on the outside of the cell membrane identify the cell and allow communication between cells.

## Part I • Read a Short Article about Cells

1. Ask groups to assign Reader and Recorder roles. These roles will rotate as students read.
2. Have students read “All Living Things Are Made of Cells” out loud to their group and fill in the Cell Part and Function Table.
  - Have the first Reader read one paragraph as the rest of the group determines what they should record in the table.
  - The Recorder should fill in the table.
  - After reading each paragraph, have students rotate the Reader and Recorder roles. Everyone should read and record at least once.
3. Discuss the Cell Part and Function Table with the class. See the Cell Part and Function Table below.

**Cell Part and Function Table (with Answers)**

Cell Parts/ Organelle	Found in Animal Cell? (Yes/No)	Found in Plant Cell? (Yes/No)	Function of Cell Part (What does each cell part do?)
cell membrane	Yes	Yes	The cell membrane holds the cell together and lets particles into and out of the cell. These particles may be oxygen, carbon dioxide, water, and food (sugar). Not everything can pass through the membrane; it depends on the size of the particle trying to get in and the size of the opening in the membrane.
nucleus	Yes	Yes	The nucleus is the cell’s control center, which contains information (DNA) needed to make messenger particles. These tell the cell what to look like, what the cell parts should do, and when the cell should reproduce.
mitochondria	Yes	Yes	The mitochondria take in oxygen and food (sugar) and change them into carbon dioxide, water, and energy. The cell uses the energy, but the carbon dioxide and water are waste that then leave the cell.
chloroplast	No	Yes	Chloroplasts, only in plant cells, trap the sun’s energy and put it together with carbon dioxide and water to make their own food (sugar). Chloroplasts also release oxygen as a waste product.
cell wall	No	Yes	The cell wall is only in plant cells and serves to give the cell support.

## Part II • Model How a Cell Works

1. Have students watch the videos about cells. There are two recommended videos in the materials list. It is difficult to find simple videos about cells—most of the videos simply list all the parts of the cell and give functions, or they are too complicated for a sixth grade curriculum. The two recommended videos are simple and fun. The first one is a computer animated 2 minute video about different types of cells in the body. The second one is an oldie but goodie—a 6 minute video by Bill Nye the “Science Guy.” The main concepts that Bill Nye concentrates on about cells (cell membrane, cell [plasma] membrane, mitochondria, chloroplasts, nucleus, and different cells for different functions) are all appropriate for this unit. The Bill Nye video also has a short section in which two students sing a song about cells. This part might inspire creativity in students’ skits about cells.
2. Have students assign groupwork roles and review the Behavior Norms.
3. Tell students that they will perform a cell drama (skit) that shows how animal cells and plant cells work.
  - Students will each be a cell “part” and talk out loud about who they are and what they are doing. They can talk about such things as where they are, where they are going, how they move, what their job is for a cell, what they need, what they make. The script can be as creative as students want, as long as it incorporates facts. Thus, the skit can be similar to a fiction novel based on facts.
  - Option: As groups create their cell drama, students can write their script in their science notebook.
  - Option: Students can draw their cell “part” on their sign.
4. Ask each group to decide whether they want to perform a skit about a plant cell or an animal cell.



### NOTE

Depending on group size, there may be more roles than there are group members. Students may double up and play two roles or you can make larger groups.

5. Hand out the “Animal Cell” or “Plant Cell” manila envelopes according to the groups’ choices above.
6. Students should decide which “part” they will play and what they will say. Give them time to practice their drama a few times. Ask students to make their part/role title visible on their person during the skit.



### LANGUAGE SUPPORT STRATEGIES

Some ELLs may have a raised affective filter (anxiety over performance with science vocabulary in front of others). Offer time for them to orally practice some of the terms they will use. (Offer help with pronunciation as needed.)

7. Have students share their skits.
  - Hand out one sticky note to each student. Tell students to write comments on their sticky note about each skit. Students should write one positive comment, one constructive comment, and their initials on the sticky note.
  - Ask the groups to perform their skit. Watch and listen as students write comments on their sticky note. Share out a few comments. Pick up the sticky notes to give to each presenting group for feedback.



### LANGUAGE SUPPORT STRATEGIES

Offer the following sentence frames for support on the comments:

- Positive: I enjoyed when \_\_\_\_ because it showed me \_\_\_\_.
- Constructive: I did not understand when \_\_\_\_, but it might have been clearer if \_\_\_\_.

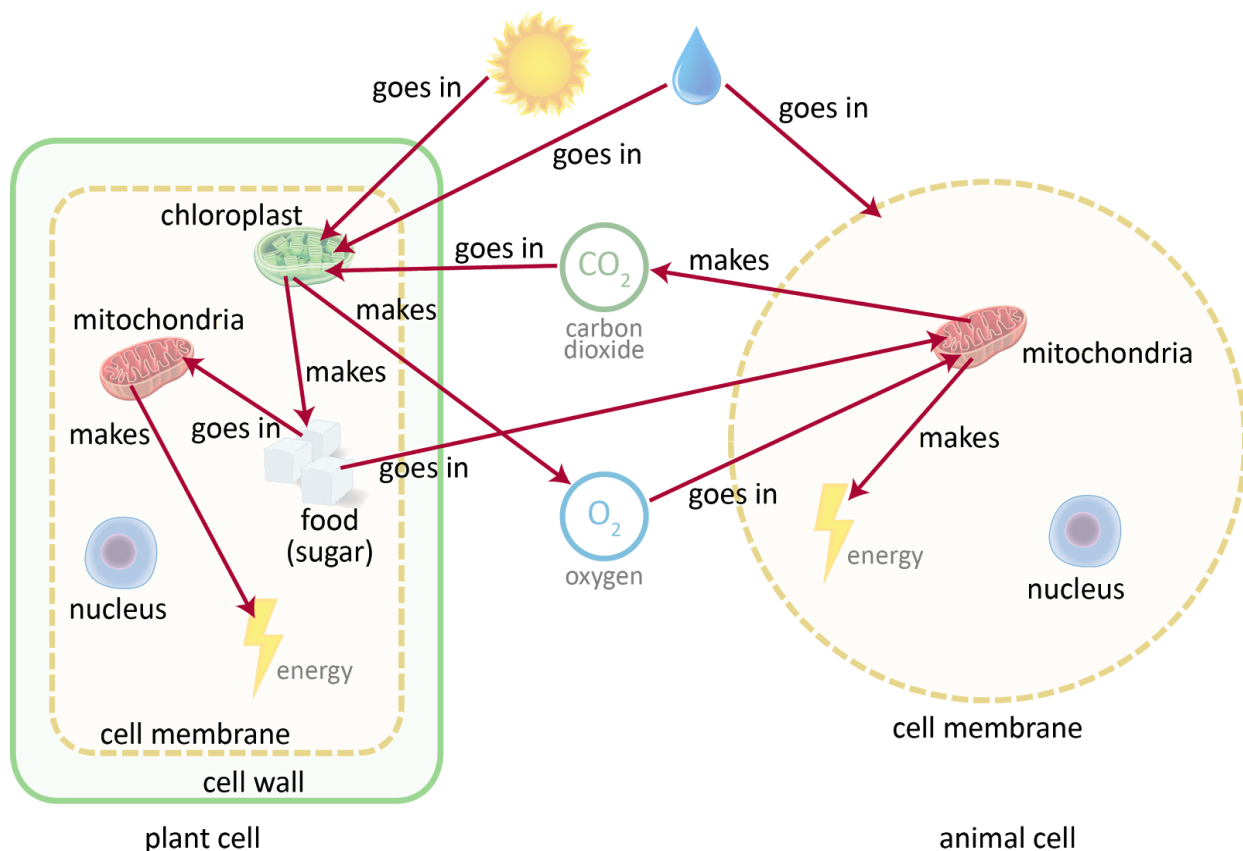
**OPTIONAL:** Ask for one plant cell group and one animal cell group to volunteer to perform a combined drama. Help the groups put on a drama that combines the animal and plant cell activities and shows the important collaboration between plant and animal cells. Additionally, you can use Part III • Optional: How Plant and Animal Cells Work Together Model which shows this collaboration.

8. Have students return to their groups to work on step 3 in the Student Edition (Apply your knowledge).
9. Debrief students' work in the previous step.

### Part III • Optional: How Plant and Animal Cells Work Together Model

Have students follow the instructions to complete the cell model. An answer key follows.

Step 1	Step 2	Step 3
<p>Use the following words to label the parts in both cells, where applicable:</p> <p>mitochondria      cell membrane</p> <p>chloroplast      cell wall</p> <p>nucleus      food (sugar)</p>	<p>Draw in arrow lines:</p> <ul style="list-style-type: none"> <li>Sunlight, water, carbon dioxide, and oxygen are drawn outside the cell.</li> <li>Draw arrows to show which of these enter and leave each type of cell.</li> <li>Make sure your arrows point to or from the correct cell parts!</li> </ul>	<p>On the arrows write:</p> <p><b>goes in</b>      and/or      <b>makes</b></p>



NOTE: The parts are not in proportion or drawn to scale.

## Part IV • Connect to the Culminating Project and Assessment

1. Have students independently complete the Task 2 section of the Individual Project Organizer as homework or in class, depending on students' needs and/or class scheduling.
2. Collect the Individual Project Organizers and assess them using these criteria:
  - The "Developing and Using Models" row of the Science and Engineering Practices Rubric
  - The "Obtaining, Evaluating, and Communicating Information" row of the Science and Engineering Practices Rubric
  - A criterion of your choice
3. Return the Individual Project Organizers and give students time to make revisions.