Table of Contents

Guide Information ................................................. 05
Fast Facts .......................................................... 07
Before Viewing Activities ................................. 08
During Viewing Activities ................................. 13
After Viewing Activities ................................. 20
After Viewing Quizzes ........................................ 25
Additional Resources ........................................ 27
Answer Keys .......................................................... 31
Script .............................................................. 46
About This Guide

Providing students with visual media is an excellent way to take them out of the classroom and into the real world. Our programs offer real-world footage, dynamic graphics, engaging dramatizations, and first-person testimonials that keep students interested and help them visualize difficult concepts. More importantly, they reinforce critical learning objectives shaped by state and national educational standards. However, the learning doesn’t begin and end when the program does. You can make the learning experience even more effective by using the materials provided in this Teacher’s Guide.

This guide is divided into the following sections:

• **Fast Facts** are designed to give your students a quick overview of the information presented within the video.

• **Before Viewing Activities** help identify what students already know about the subject, what they are curious about, and what they hope to learn.

• **During Viewing Activities** may be used during viewing to enhance students’ understanding of the video.

• **After Viewing Activities** help students summarize and draw conclusions from the information that was presented.

• **After Viewing Quizzes** test students’ retention of the information presented in the program and activity sheets.

• **Additional Resources** are designed to help you extend the information presented in the program into other areas of your curriculum.

• **Answer Keys** are provided for relevant activities or reproducible pages.

• **Script** content is provided in an unabridged version for future reference.
Simply Cells: Parts & Functions provides a comprehensive look at this topic. Students will see historic contributions made to the study of cells. They will explore the structure of both plant and animal cells and learn about the organelles of each.

**Program Overview**

Objectives from the National Science Foundation:
All students should develop an understanding of the characteristics of organisms. Each plant or animal has different structures that serve different functions in growth, survival, and reproduction.

**Viewing Objectives**

By viewing the video and engaging in the activities provided, students will be able to:

- Identify the basic parts of an animal cell and a plant cell
- List the functions of the structures of a cell
- Know how to build a 3-D model of a cell
Cell Fast Facts

- All living things are made of cells.
- Robert Hooke, an English physicist in the 1600’s, was the first person to use the term “cell” to describe the smallest unit of life.
- Cell theory states that all living things are made up of one or more cells.
- Cells are the basic units of living organisms and carry on all life processes.
- Cells only develop from other living cells.
- Organelles are tiny structures in our bodies that have jobs to do which help the cell grow, move, and live.
- Organelles are the cell membrane, cytoskeleton, nucleus, nucleolus, centrioles, endoplasmic reticulum, ribosomes, mitochondrion, Golgi apparatus, vesicles, lysosomes, peroxisomes, and vacuoles.
- The cell membrane regulates what comes in and what goes out of a cell.
- A cell that has a nucleus is an eukaryote.
- A cell that doesn’t have a nucleus is a prokaryote.
- The nucleus is the control center for everything that happens inside a cell.
- DNA, inside the nucleus, contains information that the cell needs to function.
- The nucleus has its own membrane called the nuclear envelope.
- The nucleolus helps build ribosomes, the cell’s protein producers.
- Centrioles, found inside the centrosome, help in cell division.
- A cell gets its energy from food, mainly from carbohydrates, protein, and lipids, which are fats.
- The endoplasmic reticulum processes many of the proteins, lipids, and carbohydrates made by the cell.
- Ribosomes are the protein builders of the cell.
- Vesicles transport complex molecules from the Golgi apparatus to various locations, including the cell membrane where nutrients can then be released.
- A mitochondrion breaks down substances like sugars for energy and water for oxygen. This process is called cellular respiration.
- Lysosomes break down worn out organelles, debris, and large ingested particles.
- Peroxisomes have enzymes inside and their job is to rid the body of toxic substances, especially hydrogen peroxide.
- Vacuoles are pockets that store different molecules like food or oil, which the cell may need to survive.
- Plants have a cell wall in addition to a cell membrane.
- A plant’s cell wall is made of cellulose, a substance made in the cytoplasm.
- The chloroplast is an organelle found only in plant cells.
- Chlorophyll, which gives plants their green color, is found inside a chloroplast.
Anticipatory Questions

Use what you already know about cells to answer the following questions. If you don’t know an answer, take your best guess. This guide is designed to help you start thinking about cell parts and their functions.

1. Think about how plants and animals are alike and different. Would you think that animal cells are more alike or more different than plant cells? Why?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

2. When you hear the sentence “cells are the building blocks of life,” what does it make you think of? What do you think it means?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

3. You have probably heard of DNA? What have you heard about it? What do you think it is?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

4. Mitochondria are called the “powerhouses” of the cell. What does that make you think of? Why do you think they are called that?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

5. The nucleus is the control center of the cell. What other things are “control centers” in life? What do they do? Based on what you know, what do you think the nucleus does?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________
Word Sort

Below is a list of vocabulary words related to cells. Sort the words into the categories listed below. You may want to use a dictionary to help you. Check back after watching the video to see if you would change any of your answers.

**Hint:** Some of the words belong to both categories.

<table>
<thead>
<tr>
<th>organelle</th>
<th>nucleus</th>
<th>chloroplast</th>
</tr>
</thead>
<tbody>
<tr>
<td>cell membrane</td>
<td>centriole</td>
<td>cell wall</td>
</tr>
<tr>
<td>vesicle</td>
<td>lysosome</td>
<td>endoplasmic</td>
</tr>
<tr>
<td>ribosome</td>
<td>vacuole</td>
<td>reticulum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ANIMAL CELL</strong></th>
<th><strong>PLANT CELL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fact or Fiction?

Read the following statements carefully. Some are facts and some are fiction. Circle the statements that you believe to be facts.

Cells are the building blocks of life.

Organs help the cell grow, move, and live.

Animal cells have cell walls.

Plant and animals cells are the same.

Many of the cell’s life processes happen in the cytoplasm.

A cell with a nucleus is a prokaryote.

The nucleus is the control center of the cell.

Centrioles help the cell divide.

There are two kinds of endoplasmic reticulum.

Ribosomes process waste in the cell.

Vesicles are found only in cytoplasm.

Mitochondria are the powerhouses of the cell.

Mitochondria have their own RNA.

Peroxisomes can self replicate.

Vacuoles store things that help the cell survive.

Only plant cells have a cell wall.

Both plant and animal cells have chloroplasts.
Cell Research
Read the information and follow the directions given.

Information:
At one time, people could not see the one-celled organisms that live on the Earth. Then, a man named Anton van Leeuwenhoek invented a scientific tool that helped people learn about such organisms. Look in an encyclopedia or online to find out about van Leeuwenhoek’s invention. Write a paragraph about it below. Include an illustration at the bottom of the page.

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

![Illustration of a scientific tool]
Cell Thoughts

Next to each letter below, write a phrase that comes to mind when you think about cells and what you know about them. Each phrase must start with the letter given.

C
E
L
L
S
Drawing Cells (Plants)

Using the space below, draw a plant cell. Label the parts. Use the words below to label your cell.

- cell membrane
- cell wall
- cytoplasm
- nucleus
- endoplasmic reticulum (smooth)
- endoplasmic reticulum (rough)
- mitochondria
- centrosome
- nucleolus
- vacuole
- chloroplast
- ribosomes
Drawing Cells (Animals)

Using the space below, draw an animal cell. Label the parts. Use the words below to label your cell.

- cell membrane
- cytoplasm
- nucleus
- endoplasmic reticulum (smooth)
- endoplasmic reticulum (rough)
- lysosome
- mitochondria
- nucleolus
- vacuole
- ribosome
**Vocabulary Match**

Write the number of the word in the left column next to its correct definition.

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. organelles</td>
<td>the basic units of living organisms</td>
</tr>
<tr>
<td>2. eukaryote</td>
<td>play a role in cell division</td>
</tr>
<tr>
<td>3. prokaryote</td>
<td>cells that don’t have a nucleus</td>
</tr>
<tr>
<td>4. vacuole</td>
<td>the tiny structures that help the cell grow, move, and live</td>
</tr>
<tr>
<td>5. cell wall</td>
<td>directs organelles and makes sure that everything functions correctly</td>
</tr>
<tr>
<td>6. cytoplasm</td>
<td>includes everything in the cell, except the nucleus</td>
</tr>
<tr>
<td>7. cells</td>
<td>processes many of the proteins, lipids, and carbohydrates</td>
</tr>
<tr>
<td>8. mitochondria</td>
<td>transports cargo from the Golgi apparatus</td>
</tr>
<tr>
<td>9. nucleus</td>
<td>in charge of packaging, modifying and moving proteins and other recently made substances from the cell</td>
</tr>
<tr>
<td>10. chloroplast</td>
<td>a cell that has a nucleus</td>
</tr>
<tr>
<td>11. centrioles</td>
<td>the powerhouses of the cell</td>
</tr>
<tr>
<td>12. semi-permeable</td>
<td>helps plant cells maintain shape</td>
</tr>
<tr>
<td>13. lysosomes</td>
<td>the protein builders of the cell</td>
</tr>
<tr>
<td>14. peroxisomes</td>
<td>the organelle that gives plants their green color</td>
</tr>
<tr>
<td>15. Golgi apparatus</td>
<td>a membrane that can control the rate at which a substance enters or leaves</td>
</tr>
<tr>
<td>16. vesicles</td>
<td>self-replicating organelle that breaks down substances</td>
</tr>
<tr>
<td>17. ribosomes</td>
<td>pockets that store different molecules like food or oil</td>
</tr>
<tr>
<td>18. endoplasmic reticulum</td>
<td>break down worn out organelles, debris, and large particles</td>
</tr>
</tbody>
</table>
Cells in Context

As you watch the video, complete each sentence below with the correct word.

1. Robert ___________________ was a 17th century English physicist who gave cells their name.

2. Cell ___________________ states that all living things are made up of one or more cells.

3. A cell is like a non-stop _____________.

4. A cell’s small organs are called ___________________.

5. The cell ___________________ regulates what comes in and what goes out of a cell.

6. The cell membrane is made of a double layer of ___________________, a fatty substance, and protein.

7. The cell membrane holds the ___________________ and protects all the organelles.

8. The ___________________ is a gel-like fluid made up mostly of water, proteins, and some chemicals.

9. Many of the cell’s life processes, such as making proteins and dissolving waste, take place in the ___________________.

10. Within the cytoplasm is a scaffold or “skeleton” called the ___________________.
What am I?

Answer each of the following riddles with the appropriate word from the video.

1. I process many of the proteins, lipids, and carbohydrates made by the cell. I also separate molecules that belong in the cytoplasm from those being transported to other areas in the cell. I come in two varieties.

2. I am the control center for the cell. I direct organelles and make sure everything functions properly.

3. I am the powerhouse of the cell. I break down sugars and other substances for energy. My folds, called cristae, increase my surface area and help break down molecules. I can also self-replicate.

4. I am found in the cytoplasm and next to the Golgi apparatus. It is my job to transport cargo from the Golgi apparatus to various locations, including the cell membrane where the nutrients are then released from the cell.

5. I am found only in a plant cell. I provide structure for the cell membrane.

6. I am a pocket-like organelle that stores molecules like food and oil that the cell needs to survive. When I am in a plant cell, I store water.

7. We are the protein builders of the cell. We can be attached to the endoplasmic reticulum or can float around in the cytoplasm.
What am I? (cont.)
Answer each of the following riddles with the appropriate word from the video.

8. I include everything inside the cell, except the nucleus. I am filled with cytosol and many of the cell’s life processes take place in me.
   __________________________

10. I provide the pretty green color of plants. I am found only in plant cells.
    ________________________

11. We are located in the centrosome, just outside the nucleus. We are important for cell division.
    _________________________

9. I eat debris, large ingested particles, and other organelles.
   __________________

13. I live inside the nucleus. I help build ribosomes, which provide protein for the cell.
    ________________________

12. I hold in cytoplasm and protect all of the organelles. I am made up of a double layer of phospholipids and protein.
    _________________________

14. I am made of long, thin fibers and microtubules. I provide strength, support, and shape for the cell. I also anchor the organelles and help the cell move.
    __________________________

15. I am the cell’s distribution center. I package, modify and move proteins and other recently made substances from the cell.
    __________________________
Venn Cells

Use the Venn diagram below to show similarities and differences among and between plant cells and animal cells.

Now write a sentence telling the basic difference between a plant cell and an animal cell.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Cell Thinking

Discuss the questions below with your teammates. Then write your own responses, in the spaces provided, in complete sentences.

1. You now know more about what happens in a cell. Can you compare the functions of organelles to the functions of your school or a city? What roles might be similar? What might be different?

2. In your opinion, which organelle has the most important job? The toughest job? The easiest job? Explain your answer.

3. What kind of relationship does the vesicle have with the Golgi apparatus?

4. You now know that plant and animal cells are different. In your own words, describe how they are different and why they need to be different.

5. What do you know about DNA?
Cell Building

With your team, complete the steps below to create your own cell models.

1. Gather materials: quart-sized baggies, disposable plastic storage containers, one box Jell-O® gelatin mix, one packet Knox® gelatin mix, boiling water, mixing bowls, spoons, miscellaneous fruits to represent cell organelles.

2. With your team, review the diagrams of the cells you have drawn. Be sure to discuss the differences between plant cells and animal cells.

3. Prepare the Jell-O® as directed on the box, arriving only at the liquid state. Then, add the Knox® gelatin packet, but no additional water. (This helps make a firmer gelatin.)

4. Place one baggie inside the plastic container and one open on the desk. The plastic baggie represents the cell membrane. The plastic container represents the cell wall of a plant cell. Fill the baggies with the liquid gelatin mixture.

5. Place fruits in the baggies to represent cell organelles. Do not place any fruit organelle in the cells unless your team agrees on what it represents. You might want to use grapes for chloroplasts, mandarin orange slices for mitochondria, plums for nuclei, etc.

6. Close the bags and refrigerate to set.

7. After the cells are set, study the two cells and take note of the structural differences between your plant cell and your animal cell. Discuss these differences with your team. What are the shapes of the cells? What effect does the cell wall have on a plant cell? Why do you think plant cells have sturdy walls? How does this help them survive? How does this influence the structure of the plant itself? Why don’t animals need cell walls?

8. Next, form a plant “tissue” by stacking a few of the plant cells created by the class. Compare the structural and overall shape differences.

9. On a separate piece of paper, show (in words and in pictures), what you have discovered about plant and animal cells. Be sure to include labeled diagrams and complete sentences in your explanation.

10. Enjoy a cell snack!
# Cell-ing at the Mall

What does a cell have in common with a shopping mall? Find out! Read the functions of the cell structures below. Then, read the list of mall structures and their functions at the bottom of the page. Next to each cell structure, write the mall structure that has a similar job.

<table>
<thead>
<tr>
<th>Cell Structure</th>
<th>Cell Function</th>
<th>Mall Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>cell wall</td>
<td>outermost, support, protection</td>
<td>outside walls (provide shape, protection, support)</td>
</tr>
<tr>
<td>cell membrane</td>
<td>protects, controls movement</td>
<td>mall food court (produces food)</td>
</tr>
<tr>
<td>cytoplasm</td>
<td>area of movement</td>
<td>water tank and pipes (store water)</td>
</tr>
<tr>
<td>nucleus</td>
<td>regulates and controls activities</td>
<td>mall office (regulates and controls activities)</td>
</tr>
<tr>
<td>nuclear membrane</td>
<td>protects nucleus, lets materials in</td>
<td>supply carts (transport merchandise)</td>
</tr>
<tr>
<td>chromosomes</td>
<td>direct activities of cell</td>
<td>mall office director (directs activities)</td>
</tr>
<tr>
<td>endoplasmic reticulum</td>
<td>transportation</td>
<td>mall entrance (provides passage into and out of mall)</td>
</tr>
<tr>
<td>ribosomes</td>
<td>produce proteins</td>
<td>mall office walls and door (protect office, let workers in and out)</td>
</tr>
<tr>
<td>mitochondria</td>
<td>supply energy</td>
<td>electrical system (supplies electrical energy)</td>
</tr>
<tr>
<td>vacuole</td>
<td>stores water and food</td>
<td>vendors (produce supplies, goods)</td>
</tr>
<tr>
<td>chloroplasts</td>
<td>produce food</td>
<td>hallways (areas for moving people and supplies)</td>
</tr>
</tbody>
</table>

eoutside walls (provide shape, protection, support)
mall food court (produces food)
water tank and pipes (store water)
mall office (regulates and controls activities)
supply carts (transport merchandise)
mall office director (directs activities)
mall entrance (provides passage into and out of mall)
mall office walls and door (protect office, let workers in and out)
electrical system (supplies electrical energy)
vendors (produce supplies, goods)
hallways (areas for moving people and supplies)
Plant Cell Math

Read the clues concerning the parts of a plant cell in the boxes below. Then, select the correct term from the word list that applies to each clue, and write the number for that term in the box. By recording all the correct numbers, you will produce a magic square. When you add the numbers across, diagonally, or down, you will get the same answer.

1. cell membrane 2. nucleus 3. chromosomes
4. mitochondria 5. chloroplasts 6. cytoplasm
7. cell wall 8. nucleolus 9. vacuoles

The membrane-enclosed command center of the plant cell
The rigid layer that supports and protects the cell
The gel-like substance in which most of the cell’s life processes take place
Places where cells store water, food, and other materials
Places where cells convert energy into food
Controls what goes in and what comes out
These supply energy needed by the cell to do work
These contain complex chemical information that direct the cell’s hereditary-related activities
A region in the nucleus that produces tiny cell particles needed in protein synthesis

The magic number is:
Cell-e-bration

Use the words below to complete the following sentences. Then, use the numbered letters to answer the riddle at the bottom of the page.

1. Robert Hooke was a ___ ___ ___ ___ ___ ___ ___ ___ ___ who used a microscope to identify and name cells.
2. Cells are the basic units of all ___ ___ ___ ___ ___ ___ things.
3. Cells perform important life ___ ___ ___ ___ ___ ___ ___ ___ ___ ___.
4. One life process that cells perform is releasing ___ ___ ___ ___ ___ ___ from food.
5. Cells come in different shapes and ___ ___ ___ ___ ___ ___.
6. The ___ ___ ___ ___ ___ ___ ___ ___ of a cell determines its shape and size.
7. Some ___ ___ ___ ___ ___ ___ ___ ___ ___ are made of only one cell. Others have many.
8. ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ are smaller structures within the cell that perform specific jobs.
9. Almost every cell has a ___ ___ ___ ___ ___ ___ ___ ___ ___ ___, the control center of the cell.
10. The parts of a cell are surrounded by cell ___ ___ ___ ___ ___ ___ ___ ___.
11. Filling the space between the membrane and nucleus is a ___ ___ ___ ___ ___ ___ ___ ___ substance called cytoplasm.
12. Humans are made up of ___ ___ ___ ___ ___ ___ ___ ___ of cells.
13. All organisms begin as a ___ ___ ___ ___ ___ ___ cell.
14. Most materials move in and out of cells through the process of ___ ___ ___ ___ ___ ___ ___ ___ ___ ___.
15. All cells divide and grow. When cells divide, it is called ___ ___ ___ ___ ___ ___.

**What did two cells say to each other during mitosis?**

''
Cells Quiz

Choose the best answer for each question.

1. Cell Theory states that:
   a. All living things are made up of one or more cells.
   b. Cells are the basic units of living organisms.
   c. Cells only develop from other living cells.

2. The cell membrane is also called the ___________.
   a. cell wall
   b. plasma membrane
   c. nucleus

3. Organelles and their membranes are composed of two layers of _______.
   a. lysosomes and peroxisomes
   b. cytoplasm
   c. phospholipids and protein

4. Which of the following types of cells do NOT have a nucleus?
   a. Animal cell
   b. Prokaryote
   c. Eukaryote

5. The nucleus is semi-permeable, allowing ____ to enter or leave the nucleus.
   a. RNA
   b. DNA
   c. Nucleolus

6. Many of the organelles in a cell spend their time making or processing ______.
   a. DNA
   b. macromolecules
   c. All of the above

7. The folds inside the mitochondrion that increase its surface area are called ____.
   a. vesicles
   b. ribosomes
   c. cristae

8. What organelle breaks down worn out organelles, debris, and large ingested particles?
   a. Lysosome
   b. Vacuole
   c. Ribosome
Cells Quiz (cont.)
Choose the best answer for each question.

9. Which of the following organelles are missing in an animal cell?
   a. Lysosomes and peroxisomes
   b. Cell wall and chloroplasts
   c. Vacuoles and ribosomes

10. When you water a plant, where does the water go?
    a. Into the nucleus
    b. Into the chloroplasts
    c. Into the vacuoles
Extensions

**Picture Dictionary**
Draw pictures of each organelle and describe its function. Research the roots of each word, and determine if there are other meanings to each word. Staple the dictionary together and share it with a classmate.

**Comic Strip**
Write a comic strip or comic book about one or more organelles in a cell. Be creative but make sure to include factual information about the functions of the organelle you are writing about.

**Creative Writing**
Write a story from the point of view of one of the organelles. Describe what your job is and how it affects you and the other organelles in your cell.

**Analogy**
Compare the functions of a cell to that of your town or school. How are the organelles and their functions similar to or different from the people and structures of your school or town?

**Poetry**
Using the names and functions of each organelle, write a poem or song that might help you remember their importance.

**Make A Map**
Draw a map of a cell. Make a key and label your map so that anyone who looks at it knows what the organelles are and where they are found.

**Timeline**
Use your library or the Internet to discover how cell research began and how it has evolved over time. Prepare a timeline showing how far we have come in this area of science.

**Travel Brochure**
Pretend you are a travel agent trying to get people to visit a cell. Create a travel brochure encouraging people to visit each of the organelles. Be sure to include all of the positive attributes of each destination.

**Research Project**
Using the library or Internet, research and present to the class information about cell disease and cell research.

**Count Your Cells**
Look at some cells under a microscope. Using what you know about scale and the size of cells, try to calculate how many cells there are in a blade of grass, a piece of meat, or the human body.
Extensions

**Guest Speaker**
Invite a specialist to talk to your class about cell disease and stem cell research or have the school nurse come and talk to your class about the importance of maintaining good health to keep your body’s cells healthy.

**Animal Versus Plant**
Make a chart showing the differences between plants and animals and the differences between their cell structures. Explain why our cells are different from plant cells.

**Game Show**
With a group of students, create a game quiz show to practice your knowledge of cell parts and their functions. Fashion the game after your favorite TV game show or be creative and make up your own format.

**Board Game**
Create a board game for other students. The game should include factual information about cells and organelles. Test it out on your classmates to see if it is fun and educational.

**Drama**
Create a play with your classmates. Each role represents an organelle in a cell. Write the parts so that they interact the way the parts of a cell do.

**3-D Cell**
Using clay, create a three-dimensional model of both a plant and an animal cell. Use toothpicks to hold up the names of each cell organelle.

Kramer, Stephen. *Hidden Worlds: Looking Through a Scientist’s Microscope*. Houghton Mifflin. Stunning photos of microscopic images invite the reader to investigate the amazing, hidden world that comes to life under a microscope. This captivating book discusses how a scientist becomes interested in microscopes, how he uses them in his work, and what he has discovered in his research.

Ruiz, Andres Llamas. *The Life of a Cell*. Sterling, 1997. From single-celled organisms to the complexity of the human body, the cell is the basic unit of life. This highly illustrated book takes a look at the various parts that make up a cell, how a cell functions, and how cells adopt a specialty as they gather together to form tissues.

Young, John K. *Cells: Amazing Forms and Functions*. Franklin Watts, 1990. Along with basic information about the structure and function of cells, this book provides details about the variety of strange and wonderful types of cells that make up the human body. It also includes a brief history of our understanding of DNA, the “code of life.”

Yount, Lisa. *Antoni van Leeuwenhoek: First To See Microscopic Life*. Enslow. Not a scientist but a fabric seller, Antoni van Leeuwenhoek’s life teaches us much about the scientific processes of observation, persistence, record keeping, and hypothesis. He improved upon a tool of his trade, the magnifying glass, to create quality microscopes. For his entire 91 years, he was curious, meticulous, and thrilled with his discoveries and successes becoming an inspiration to all budding scientists. Includes activities using a microscope or magnifying glass.
Internet Sites

Below is a list of sites that you may use to find more information about cells. Due to routine web maintenance, not all of the links will be accurate at the time of access. If the link is not available, try to conduct a search on that topic from the main site or from a search engine.

http://www.howe.k12.ok.us/~jimaskew/bcell1.htm
This site explores cell theory. Historical information and related terminology are given. There are also links to other sources.

www.cell.com
Diagrams and illustrations clarify the components of cells. Functions of cell parts are also investigated.

http://www.jcb.org/
This site, from the Journal of Cell Biology, provides up-to-date information about cell research. Information about cell processes is provided. There are also many links to additional information.

http://www.plantcell.org/
This site is from the American Society of Plant Biologists. There is a good deal of information here about plant cells. Effective illustrations add to the clarity of the information provided.

http://www.cellsalive.com/
This site is called Cells Alive! It provides a very interactive look at cells and the functions of cell organelles. This site includes a few QuickTime® movies and animations of microscopic organisms.

http://www.life.uiuc.edu/plantbio/cell/
This is a site for a virtual tour of a cell. Students will gain a good understanding of cells and the functions of the organelles as they travel through the cell.

www.ascb.org
The American Society for Cell Biology provides this site. While some of the information included is geared toward older students, it does provide a good source of diagrams and definitions that might be useful at all levels.

www.biology4kids.com
This site provides detailed and factual information in a format that is easy to understand and can be used by even young students. It is a good source of information and is very comprehensive.
Word Sort

Below is a list of vocabulary words related to cells. Sort the words into the categories listed below. You may want to use a dictionary to help you. Check back after watching the video to see if you would change any of your answers.

**Hint:** Some of the words belong to both categories.

<table>
<thead>
<tr>
<th>ANIMAL CELL</th>
<th>PLANT CELL</th>
</tr>
</thead>
<tbody>
<tr>
<td>organelle</td>
<td>organelle</td>
</tr>
<tr>
<td>nucleus</td>
<td>nucleus</td>
</tr>
<tr>
<td>vacuole</td>
<td>vacuole</td>
</tr>
<tr>
<td>cell membrane</td>
<td>cell membrane</td>
</tr>
<tr>
<td>endoplasmic reticulum</td>
<td>endoplasmic reticulum</td>
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<tr>
<td></td>
<td>chloroplast</td>
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<tr>
<td></td>
<td>cell wall</td>
</tr>
<tr>
<td></td>
<td>lysosome</td>
</tr>
<tr>
<td></td>
<td>centriole</td>
</tr>
<tr>
<td></td>
<td>vesicle</td>
</tr>
<tr>
<td></td>
<td>ribosome</td>
</tr>
<tr>
<td></td>
<td>vacuole</td>
</tr>
</tbody>
</table>
Fact or Fiction?

Read the following statements carefully. Some are facts and some are fiction. Circle the statements that you believe to be facts.

- Cells are the building blocks of life.
- Organs help the cell grow, move, and live.
- Animal cells have cell walls.
- Plant and animal cells are the same.
- Many of the cell’s life processes happen in the cytoplasm.
- A cell with a nucleus is a prokaryote.
- The nucleus is the control center of the cell.
- Centrioles help the cell divide.
- There are two kinds of endoplasmic reticulum.
- Ribosomes process waste in the cell.
- Vesicles are found only in cytoplasm.
- Mitochondria are the powerhouses of the cell.
- Mitochondria have their own RNA.
- Peroxisomes can self replicate.
- Vacuoles store things that help the cell survive.
- Only plant cells have a cell wall.
- Both plant and animal cells have chloroplasts.
Drawing Cells (Plants)

Using the space below, draw a plant cell. Label the parts. Use the words below to label your cell.

- cell membrane
- cell wall
- cytoplasm
- nucleus
- endoplasmic reticulum (smooth)
- endoplasmic reticulum (rough)
- mitochondria
- centrosome
- nucleolus
- vacuole
- chloroplast
- ribosomes
Drawing Cells (Animals)

Using the space below, draw an animal cell. Label the parts. Use the words below to label your cell.

- cell membrane
- cytoplasm
- nucleus
- endoplasmic reticulum (smooth)
- endoplasmic reticulum (rough)
- lysosome
- mitochondria
- nucleolus
- vacuole
- ribosome
Vocabulary Match
Write the number of the word in the left column next to its correct definition.

1. organelles
   - the basic units of living organisms

2. eukaryote
   - play a role in cell division

3. prokaryote
   - cells that don’t have a nucleus

4. vacuole
   - the tiny structures that help the cell grow, move, and live

5. cell wall
   - directs organelles and makes sure that everything functions correctly

6. cytoplasm
   - includes everything in the cell, except the nucleus

7. cells
   - processes many of the proteins, lipids, and carbohydrates

8. mitochondria
   - transports cargo from the Golgi apparatus

9. nucleus
   - in charge of packaging, modifying and moving proteins and other recently made substances from the cell

10. chloroplast
    - a cell that has a nucleus

11. centrioles
    - the powerhouse of the cell

12. semi-permeable
    - helps plant cells maintain shape

13. lysosomes
    - the protein builders of the cell

14. peroxisomes
    - the organelle that gives plants their green color

15. Golgi apparatus
    - a membrane that can control the rate at which a substance enters or leaves

16. vesicles
    - self-replicating organelle that breaks down substances

17. ribosomes
    - pockets that store different molecules like food or oil

18. endoplasmic reticulum
    - break down worn out organelles, debris, and large particles
Cells in Context

As you watch the video, complete each sentence below with the correct word.

1. Robert ___________________ was a 17th century English physicist who gave cells their name.

2. Cell ___________________ states that all living things are made up of one or more cells.

3. A cell is like a non-stop _________ factory ________.

4. A cell’s small organs are called _________ organelles ________.

5. The cell _________ membrane ________ regulates what comes in and what goes out of a cell.

6. The cell membrane is made of a double layer of _________ phospholipids ________, a fatty substance, and protein.

7. The cell membrane holds the _________ cytoplasm ________ and protects all the organelles.

8. The _________ cytosol ________ is a gel-like fluid made up mostly of water, proteins, and some chemicals.

9. Many of the cell’s life processes, such as making proteins and dissolving waste, take place in the _________ cytoplasm ________.

10. Within the cytoplasm is a scaffold or “skeleton” called the _________ cytoskeleton ________.
What am I?

Answer each of the following riddles with the appropriate word from the video.

1. I process many of the proteins, lipids, and carbohydrates made by the cell. I also separate molecules that belong in the cytoplasm from those being transported to other areas in the cell. I come in two varieties.

   **endoplasmic reticulum**

2. I am the control center for the cell. I direct organelles and make sure everything functions properly.

   **nucleus**

3. I am the powerhouse of the cell. I break down sugars and other substances for energy. My folds, called cristae, increase my surface area and help break down molecules. I can also self-replicate.

   **mitochondria**

4. I am found in the cytoplasm and next to the Golgi apparatus. It is my job to transport cargo from the Golgi apparatus to various locations, including the cell membrane where the nutrients are then released from the cell.

   **vesicles**

5. I am found only in a plant cell. I provide structure for the cell membrane.

   **cell wall**

6. I am a pocket-like organelle that stores molecules like food and oil that the cell needs to survive. When I am in a plant cell, I store water.

   **vacuoles**

7. We are the protein builders of the cell. We can be attached to the endoplasmic reticulum or can float around in the cytoplasm.

   **ribosomes**
What am I? (cont.)
Answer each of the following riddles with the appropriate word from the video.

8. I include everything inside the cell, except the nucleus. I am filled with cytosol and many of the cell’s life processes take place in me.
   ______________________
   **cytoplasm**

9. I eat debris, large ingested particles, and other organelles.
   ______________________
   **lysosome**

10. I provide the pretty green color of plants. I am found only in plant cells.
    ______________________
    **chlorophyll**

11. We are located in the centrosome, just outside the nucleus. We are important for cell division.
    ______________________
    **centrioles**

12. I hold in cytoplasm and protect all of the organelles. I am made up of a double layer of phospholipids and protein.
    ______________________
    **cell membrane**

13. I live inside the nucleus. I help build ribosomes, which provide protein for the cell.
    ______________________
    **nucleolus**

14. I am made of long, thin fibers and microtubules. I provide strength, support, and shape for the cell. I also anchor the organelles and help the cell move.
    ______________________
    **cytoskeleton**

15. I am the cell’s distribution center. I package, modify and move proteins and other recently made substances from the cell.
    ______________________
    **Golgi apparatus**
Venn Cells

Use the Venn diagram below to show similarities and differences among and between plant cells and animal cells.

- **Plant Cell**
  - cell wall
  - chloroplast
  - chlorophyll
  - larger vacuoles
  - cell membrane
  - cytoplasm
  - nucleus
  - nucleolus
  - cytoskeleton
  - mitochondria
  - centrosome
  - ribosomes
  - Golgi apparatus
  - vesicles
  - endoplasmic reticulum
  - lysosomes (rarely found in plant cells)

- **Animal Cell**
  - smaller vacuoles
  - centrioles

Now write a sentence telling the basic difference between a plant cell and an animal cell.

**Animal cells do not have a cell wall, chloroplasts, or chlorophyll because they do not conduct photosynthesis.**
Cell Thinking

Discuss the questions below with your teammates. Then write your own responses, in the spaces provided, in complete sentences.

Some answers will vary, but should reflect an accurate understanding of the topics presented in the program.

1. You now know more about what happens in a cell. Can you compare the functions of organelles to the functions of your school or a city? What roles might be similar? What might be different?

2. In your opinion, which organelle has the most important job? The toughest job? The easiest job? Explain your answer.

3. What kind of relationship does the vesicle have with the Golgi apparatus?

   The Golgi apparatus packs, modifies, and moves proteins and other recently made substances from the cell, placing them inside the vesicles for transport to other locations.

4. You now know that plant and animal cells are different. In your own words, describe how they are different and why they need to be different.

5. What do you know about DNA?
Cell-ing at the Mall

What does a cell have in common with a shopping mall? Find out! Read the functions of the cell structures below. Then, read the list of mall structures and their functions at the bottom of the page. Next to each cell structure, write the mall structure that has a similar job.

<table>
<thead>
<tr>
<th>Cell Structure</th>
<th>Cell Function</th>
<th>Mall Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>cell wall</td>
<td>outermost, support, protection</td>
<td>outside walls</td>
</tr>
<tr>
<td>cell membrane</td>
<td>protects, controls movement</td>
<td>hallways</td>
</tr>
<tr>
<td>cytoplasm</td>
<td>area of movement</td>
<td>mall entrance</td>
</tr>
<tr>
<td>nucleus</td>
<td>regulates and controls activities</td>
<td>mall office</td>
</tr>
<tr>
<td>nuclear membrane</td>
<td>protects nucleus, lets materials in</td>
<td>mall office walls and door</td>
</tr>
<tr>
<td>chromosomes</td>
<td>direct activities of cell</td>
<td>mall office director</td>
</tr>
<tr>
<td>endoplasmic reticulum</td>
<td>transportation</td>
<td>supply carts</td>
</tr>
<tr>
<td>ribosomes</td>
<td>produce proteins</td>
<td>vendors</td>
</tr>
<tr>
<td>mitochondria</td>
<td>supply energy</td>
<td>electrical system</td>
</tr>
<tr>
<td>vacuole</td>
<td>stores water and food</td>
<td>water tank and pipes</td>
</tr>
<tr>
<td>chloroplasts</td>
<td>produce food</td>
<td>mall food court</td>
</tr>
</tbody>
</table>

outside walls (provide shape, protection, support)
mall food court (produces food)
water tank and pipes (store water)
mall office (regulates and controls activities)
supply carts (transport merchandise)
mall office director (directs activities)
mall entrance (provides passage into and out of mall)
mall office walls and door (protect office, let workers in and out)
electrical system (supplies electrical energy)
vendors (produce supplies, goods)
hallways (areas for moving people and supplies)
Plant Cell Math

Read the clues concerning the parts of a plant cell in the boxes below. Then, select the correct term from the word list that applies to each clue, and write the number for that term in the box. By recording all the correct numbers, you will produce a magic square. When you add the numbers across, diagonally, or down, you will get the same answer.

1. cell membrane
2. nucleus
3. chromosomes
4. mitochondria
5. chloroplasts
6. cytoplasm
7. cell wall
8. nucleolus
9. vacuoles

The membrane-enclosed command center of the plant cell
The rigid layer that supports and protects the cell
The gel-like substance in which most of the cell’s life processes take place
Places where cells store water, food, and other materials
Places where cells convert energy into food
Controls what goes in and what comes out
These supply energy needed by the cell to do work
These contain complex chemical information that direct the cell’s hereditary-related activities
A region in the nucleus that produces tiny cell particles needed in protein synthesis

The magic number is: 15
Cell-e-bration

Use the words below to complete the following sentences. Then, use the numbered letters to answer the riddle at the bottom of the page.

- nucleus
- sizes
- biologist
- energy
- living
- mitosis
- trillions
- diffusion
- organelles
- function
- organisms
- single
- processes
- membrane
- jellylike

1. Robert Hooke was a ___________ who used a microscope to identify and name cells.  

2. Cells are the basic units of all ___________ things.

3. Cells perform important life ___________.

4. One life process that cells perform is releasing ___________ from food.

5. Cells come in different shapes and ___________.

6. The ___________ of a cell determines its shape and size.

7. Some ___________ are made of only one cell. Others have many.

8. ___________ are smaller structures within the cell that perform specific jobs.

9. Almost every cell has a ___________, the control center of the cell.

10. The parts of a cell are surrounded by cell ___________.

11. Filling the space between the membrane and nucleus is a ___________ substance called cytoplasm.

12. Humans are made up of ___________ of cells.

13. All organisms begin as a ___________ cell.

14. Most materials move in and out of cells through the process of ___________.

15. All cells divide and grow. When cells divide, it is called ___________.

**What did two cells say to each other during mitosis? 

___ ___ ___ ‘ ___ ___ ___ ___ ___ ___  

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Simply Cells: Parts & Functions
Cells Quiz

Choose the best answer for each question.

1. Cell Theory states that:
   - a. All living things are made up of one or more cells.
   - b. Cells are the basic units of living organisms.
   - c. Cells only develop from other living cells.

2. The cell membrane is also called the _________.
   - a. cell wall
   - b. plasma membrane
   - c. nucleus

3. Organelles and their membranes are composed of two layers of _____.
   - a. lysosomes and peroxisomes
   - b. cytoplasm
   - c. phospholipids and protein

4. Which of the following types of cells do NOT have a nucleus?
   - a. Animal cell
   - b. Prokaryote
   - c. Eukaryote

5. The nucleus is semi-permeable, allowing ____ to enter or leave the nucleus.
   - a. RNA
   - b. DNA
   - c. Nucleolus

6. Many of the organelles in a cell spend their time making or processing _____.
   - a. DNA
   - b. macromolecules
   - c. All of the above

7. The folds inside the mitochondrion that increase its surface area are called _____.
   - a. vesicles
   - b. ribosomes
   - c. cristae

8. What organelle breaks down worn out organelles, debris, and large ingested particles?
   - a. Lysosome
   - b. Vacuole
   - c. Ribosome
Cells Quiz (cont.)
Choose the best answer for each question.

9. Which of the following organelles are missing in an animal cell?
   a. Lysosomes and peroxisomes
   b. Cell wall and chloroplasts
   c. Vacuoles and ribosomes

10. When you water a plant, where does the water go?
    a. Into the nucleus
    b. Into the chloroplasts
    c. Into the vacuoles
Script

SCENE ONE - INTRODUCTION

HOST
The friends you talk to…
The pets you play with…
The flowers you see…
The bees by a fountain…
The trees that give you shade…

ALL living things are made of cells.

When we look inside this microscopic world, all we see is simply…cells!

Hi, I’m Kimberly Morgan and today we’re going to take an in-depth look at the building blocks of life-cells.

At the end of this program, you’ll be able to identify the basic parts of an animal cell and a plant cell. You’ll also be able to list the functions of those structures in the cell.

We’re also going to show you how to build a cell model. It’s a great way to see that cells are three-dimensional structures. They certainly don’t look that way through a microscope. And they didn’t look three-dimensional when Robert Hooke, an English physicist in the 1600s, saw them. He coined the term cells after observing cork through a compound microscope. He thought the small boxes looked like the rooms or cells in a monastery. And ever since then we’ve been using that term to describe the smallest unit of life.

After nearly two centuries of research on cells, scientists had gathered enough information to form a cell theory. It states that: All living things
are made up of one or more cells. Cells are the basic units of living organisms and carry on all life processes. And cells only develop from other living cells.

Now that we know a little history about cells, let’s take a closer look at what they actually do. A cell spends its day working, moving, processing, growing. It’s like a non-stop factory.

Every moment of it’s life, this cell factory processes water, proteins, carbohydrates, fats and chemicals. In order to maintain productivity, a cell needs the help of it’s organelles, or small organs.

Now these organelles don’t look like the organs in our bodies, but these tiny structures do have jobs which help the cell grow, move and live.

You can think of them as an assembly line; each part has a role to play to make the final product.

Cells have many organelles in common – the cell membrane, cytoskeleton, nucleus, nucleolus, centrioles, endoplasmic reticulum, ribosomes, mitochondrion, Golgi apparatus, vesicles, lysosomes, peroxisomes, and vacuoles.

Keep in mind that some cells have ALL of these parts while other cells may only have a few. But it’s still important to know each one.

Let’s begin with the cell membrane. The cell membrane, or plasma membrane, regulates what comes in and what goes out of a cell. It plays an active role in what the cell takes in, like nutrients, or removes, like waste.

It’s semi-permeable, which means it can control the rate at which substances enter or leave depending on the needs of the cell.

The cell membrane is made of a double layer of phospholipids, a fatty substance and protein. Proteins are located throughout the membrane and help move molecules, chemicals and nutrients in and out of the cell. The cell membrane also holds in the cytoplasm and protects all the organelles.
Keep in mind as we talk about the other organelles that their membranes are also composed of two layers of phospholipids and protein.

It’s time to begin our cell model. Jaquan is going to help me out by building it. Let’s head over to the lab and see what he’s picked to represent the cell membrane.

**Scene Two - Starting the Cell Model**

**Jaquan**

Hi everyone. I’m going to make a 3D cell model using different things to represent the organelles.

I’m going to start with a plastic bag which will be the cell membrane. If you’re going to make your own cell model, remember that the membrane needs to be flexible enough to allow the cell to move and thin enough to show that it’s semi-permeable; you know, it controls what goes in and out of the cell.

I’ll be back in a little while to show the other organelles after Mrs. Morgan introduces them.

**Scene Three - Cell Organelles**

**Host**

Thanks, Jaquan. We’ll check back with you in a few minutes.

Now let’s look at the organelles inside the cell membrane. The cytoplasm includes everything inside the cell membrane, except the nucleus. Also part of the cytoplasm is cytosol, a gel-like fluid made up mostly of water, proteins and some chemicals.

Take a look at the inside of this egg. This liquid is like cytosol.

But the jelly-like area in a cell doesn’t just sit there. There’s a lot going on in the gooey space outside the nucleus. Many of the cell’s life processes, such as making proteins and dissolving waste, take
place in the cytoplasm. It also keeps the organelles moving in a process called cytoplasmic streaming.

Within the cytoplasm is a scaffold or “skeleton” called the cytoskeleton. It’s made of long, thin protein fibers and microtubules. It provides strength, support and shape for the cell. It also anchors the organelles and helps the cell move.

When you look at a cell through a microscope, the first part you may see, mainly because it’s the largest part, is the nucleus.

A cell that has a nucleus is a EUKARYOTE. Most multi-cellular organisms, like humans, are eukaryotic. Cells that don’t have a nucleus are called PROKARYOTES. Bacteria fall into this category.

The nucleus is the control center for everything that happens inside a cell. The nucleus directs the organelles to make sure everything functions properly.

Just like you use instructions to build something, the nucleus contains all the instructions to tell the cell what to do. Those instructions are in the form of deoxyribonucleic acid or DNA. DNA is the hereditary information that cells need to function. The nucleus sends those instructions to each organelle, builds proteins, and keeps track of the DNA.

The nucleus has its own membrane called the nuclear envelope. It’s also semi-permeable, allowing proteins and ribonucleic acid, or RNA, to enter or leave the nucleus. RNA is chemically similar to DNA and provides a copy of the instructions for building proteins needed by the cell.

Inside the nucleus is the nucleolus, shown here as a small, round, dark area. Cells may have one or more nucleoli, or none at all. The nucleolus helps build ribosomes, the cell’s protein producers.

An organelle located just outside the nucleus is the centrosome. Inside the centrosome are a pair of smaller organelles called centrioles. They lie perpendicular to each other near the nucleus and are composed of microtubules.
The centrioles play a role in cell division. When a cell divides using mitosis or meiosis, the centrioles migrate to the poles of the cell and create the spindles. The spindles act like cables that pull the cell apart.

Now that I’ve reviewed the cytoplasm, the cytoskeleton, the nucleus, the nuclear membrane, the nucleolus and centrioles, it’s time to head back to Jaquan’s lab to see these organelles in his 3D cell. Take it away Jaquan!

**Scene Four - Continue The Cell Model**

**Jaquan**

Thanks, Mrs. Morgan. I’m going to use this gel to represent the cytoplasm. We’ll have to imagine that it’s full of chemicals, water and proteins. I’m going to use this bowl for some support as I pour in the cytoplasm.

The cytoskeleton will be these thin straws to represent the microtubules and this thin spaghetti will be the filaments.

The nucleus will be the largest organelle. I’m going to use this plastic sphere as the nucleus. Inside I’m going to put in the DNA which are pipe cleaners twisted into a double helix and the nucleolus, this dark marble. The DNA contains all the instructions for the cell and the nucleolus helps make ribosomes. The nuclear envelope will be the plastic shell. For the centrioles, I’m going to use these noodles. They work during mitosis. What happens is the centrioles replicate, or copy themselves and create spindles that pull the cell apart. I’m going to place the centrioles perpendicular to each other near the nucleus.

It’s looking pretty good so far. Let’s head back to Mrs. Morgan’s lab to find out about the other organelles.

**Scene Five - More Organelles**

**Host**

Great job, Jaquan.
In order for an animal cell to handle moving, growing and reproducing, it needs energy. It gets its energy from food, mainly from carbohydrates, protein and lipids, which are fats.

These large molecules, or macromolecules, are very important to a cell. Many of the organelles spend their time making or processing them.

The endoplasmic reticulum processes many of the proteins, lipids, and carbohydrates made by the cell.

The endoplasmic reticulum is attached to the nucleus and loops back and forth to provide a larger surface area for processing those nutrients.

It also separates molecules that belong in the cytoplasm from those being transported to other areas in the cell.

If we were able to get close enough to the endoplasmic reticulum, we would notice some parts look bumpy while others look smooth. There are actually two types of endoplasmic reticulum—rough and smooth.

The smooth endoplasmic reticulum synthesizes lipids, or fats and carbohydrates. Lipids are required for growing the cell membrane and membranes of the organelles. Smooth endoplasmic reticulum also works to detoxify the cell of poisonous substances.

The rough endoplasmic reticulum builds proteins with the help of ribosomes. The ribosomes are attached to the endoplasmic reticulum giving it that bumpy or “rough” look.

Ribosomes are the protein builders of the cell. They can be found floating in the cytoplasm or attached to the endoplasmic reticulum.

Ribosomes may look round, but if you look closely they are actually made of two subunits, a larger one and a smaller one.

The ribosomes attached to the endoplasmic reticulum make the proteins that are sent outside the cell.
After the ribosome creates protein, the protein continues through the endoplasmic reticulum and goes to the area of the cell where it is needed.

These floating ribosomes synthesize proteins that will be used inside the cell. After the ribosomes build proteins, the proteins move to the Golgi apparatus. As the cell’s distribution center, this organelle is in charge of packaging, modifying and moving proteins and other recently made substances from the cell. It basically takes simple molecules, combines them into more complex molecules, then distributes them.

These complex molecules are placed into vesicles, which transport their cargo from the Golgi apparatus to various locations, including the cell membrane where the nutrients can then be released from the cell. Vesicles are also found in the cytoplasm. They transport substances from one place to another.

Let’s take a minute and see how all these organelles would look in our 3D cell.

**SCENE SIX - CELL MODEL**

**JAQUAN**

OK, so now we have to put in the smooth endoplasmic reticulum, rough endoplasmic reticulum, ribosomes, the Golgi apparatus and vesicles.

I’m going to use these ribbons to represent the endoplasmic reticulum. For the rough endoplasmic reticulum, I’ve attached these beads to represent the ribosomes.

I’m going to start with the smooth endoplasmic reticulum. I’ll fold it up. Now I’ll fold the rough endoplasmic reticulum. I’m going to put them pretty close to the nucleus since endoplasmic reticula are part of the nuclear envelope.
The rough endoplasmic reticulum has ribosomes, but remember there are free-floating ribosomes too. And since they are made of two subunits, one large and the other one small, I’ll use these beads for the ribosomes in the cytoplasm.

I’ve made the Golgi apparatus, the cell’s distribution center, out of modeling clay. The proteins move through and once they are made they get put into vesicles. So if we pinch off a part of the Golgi apparatus, we’ll get a vesicle. Like that.

That all goes in the cell.

It’s getting pretty full, but there’s still more organelles to add! Back to you, Mrs. Morgan.

**SCENE SEVEN - MORE ORGANELLES**

**HOST**
Thanks, Jaquan. Earlier I said that cells need energy to move and grow. They have their own energy generator called the mitochondrion. In fact, a mitochondrion is often called the powerhouse of a cell.

A mitochondrion breaks down substances like sugars for energy and water for oxygen. This process is called cellular respiration. Inside the mitochondrion are folds called cristae that increase its surface area and help with the break down of molecules.

The plural for a mitochondrion is mitochondria. You may have heard that term before. It’s important to know it because these organelles can multiply quickly.

Since they have their own DNA, they can self-replicate. That means they can copy themselves over and over depending on how much energy the cell needs. So if the cell needs lots of power, it will have several mitochondria.

When a mitochondrion stops functioning, it needs to be removed from the cell. Luckily, the cell has lysosomes to do just that. Lysosomes break down worn out organelles, debris, and large ingested particles. Inside
the membrane of a lysosome are digestive enzymes, which take care of cleaning out all the unwanted, useless, and unnecessary substances.

We can compare lysosomes to a trash collector who picks up the garbage. We couldn’t function properly with all our trash around us and neither can our cells.

Other organelles that break down substances are the peroxisomes. They have enzymes inside and their job is to rid the body of toxic substances, especially hydrogen peroxide. Peroxisomes are self-replicating, so they can reproduce depending on how many are needed.

Sometimes you may see bubbles floating in the cell. They are called vacuoles. These pockets store different molecules, like food or oil, which the cell may need to survive. Some of them even hold waste products to protect the cell from contamination.

OK, Jaquan, it’s time to head back to you. Do you have all of the organelles I mentioned?

**SCENE EIGHT - FINISH THE CELL MODEL**

**JAQUAN**

Mitochondria, lysosomes, peroxisomes and vacuoles. I’ve got them all right here.

I’m going to use these jelly oranges to represent the mitochondria, the powerhouses of the cell. We’ll put a couple of them to begin with, but if the cell needs more energy, remember mitochondria can self-replicate because they have their own DNA.

The lysosomes will be these marbles and the peroxisomes will be these darker ones. Each one has different enzymes to break down different substances.

And finally, I’ll use these for the vacuoles. In an actual cell, the vacuoles would be filled with water, oil, chemicals or substances that can contaminate the cell. They’re pretty handy to have around.
Well, I think that just about does it. See, cells are 3 dimensional structures. The shape of a cell is different depending on what the cell does in the organism, but cells have pretty much the same basic parts in common.

Now that we’re done with the animal cell, let’s go back to Mrs. Morgan to learn about plant cells. I know they have a couple structures that aren’t found in animal cells.

**SCENE NINE- PLANT CELLS**

**HOST**
That’s right, Jaquan. In fact, there are two structures found ONLY in plant cells.

Plants have a cell wall in addition to a cell membrane.

The cell wall helps the plant maintain its shape. Instead of being flexible, the cell wall is rigid. It’s made of cellulose, a substance made in the cytoplasm.

The chloroplast is the other organelle found only in plant cells.

Inside a chloroplast is a substance called chlorophyll, which gives plants their green color.

Chloroplasts take the sun’s energy and convert it to sugars creating power for the plant in a process called photosynthesis.

Plant cells also have many of the same structures found in an animal cell- cytoplasm, nucleus, mitochondria, ribosomes, Golgi apparatus, endoplasmic reticulum, and vesicles.

They also have vacuoles, which are usually larger than the ones found in animal cells. When you water your plants, the water is kept in the vacuoles. So if you over water, those vacuoles will get very full, but they’ll never go beyond the cell wall because it’s so rigid.
Jaquan, do you have a three dimensional plant cell you can show us?

**SCENE TEN - PLANT CELL MODEL**

**JAQUAN**
Yes, actually I’ve already made a plant cell with most of the same parts as the animal cell.

I used green gelatin for the cytoplasm and put in most of the same basic structures.

In my completed plant cell I have – the cell membrane, the nucleus, the endoplasmic reticula, rough and smooth, the Golgi apparatus, vesicles, mitochondria, ribosomes, vacuoles, the cytoskeleton and the centrosome.

Oh, you won’t see centrioles in my plant cell model. That’s because plants don’t have centrioles. Now, they DO have a centrosome that works during cell division. They just don’t have the centrioles inside like an animal cell. Interesting…

The cell wall in our plant model is a rectangular glass dish. We can see that the cell wall is sturdy enough to keep plants tall and straight.

Looks like this plant just got watered because here’s the central vacuole with water inside.

Remember, it won’t ever get past the cell wall. In flowers and other more complex plants, the central vacuole takes on the job of the lysosome, you know the trash collector in an animal cell. It’s pretty RARE to find lysosomes in plants, except maybe for some algae.

I used these for chloroplasts. Inside is the chlorophyll, which helps in photosynthesis and gives plants their green color.

Well, looks like I’m all done here. These models were a great way to show all the cell structures. They were fun to make. Thanks, Mrs. Morgan for asking me to help out.
SCENE ELEVEN - CONCLUSION

HOST
You’re welcome, Jaquan. You did a great job.

In their tiny world, all these organelles work together to create life. It’s that team effort that keeps all living things moving, growing, and reproducing.

Thanks for joining us today. Have fun trying to make your own cell models! And remember, the smallest units that represent life are simply…cells!