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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.
PROGRAM OVERVIEW

Inside a Cell provides a comprehensive look at this topic. Students will discover the various components of cells. They will view cell organelles and learn about their functions.

VIEWING OBJECTIVES

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

- Identify the main organelles in a cell
- List the major parts of a cell
- Describe the functions of the different parts of a cell
- Explain how organelles work together in a cell
- Explain the importance of cell functions

Objectives from the National Science Foundation Correlations:

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.
Every living thing on Earth is composed of cells.

Cytoplasm is the jelly-like substance that breaks down molecules to produce energy and builds up other molecules.

The cell membrane is the thin layer around the cell that holds organelles in place.

Cell membranes are semi-permeable, meaning that only certain particles are allowed to pass through them.

The cell membrane is the gatekeeper of the cell.

Lipids are organic compounds like fats and waxes that can pass easily through the cell membrane. They are required for the growth of cell membranes and organelles.

The cell membrane exports and imports nutrients and passes waste and unwanted particles outside of the cell.

A cell is matter in one of its smallest forms.

The cytoskeleton moves through the cytoplasm, providing support, strength, and shape for the cell. It is made of long, thin pieces of protein.

The endoplasmic reticulum synthesizes macromolecules, separates molecules, and transports proteins. Some contain ribosomes (rough) and some don’t (smooth).

Ribosomes synthesize protein. They are found on rough endoplasmic reticulum and in the cytoplasm.

The Golgi apparatus consists of interconnecting membranes. It connects, modifies, and packages substances manufactured by the cell (proteins, synthesized substances.)

The vesicle stores and transports substances from Golgi apparatus to other parts of the cell.

The lysosome uses digestive enzymes to break down worn-out organelles and particles.

If a lysosome breaks, the digestive enzymes would leak into the cell and digest it.

The mitochondria are considered the powerhouses of the cell. They have a double membrane. The inner layer is layered with complex folds called cristae. Mitochondria use sugars and fatty acids to generate energy. Mitochondria are self-replicating (they grow and divide). Mitochondria have their own DNA.

Cristae contain special enzymes that trap energy from broken down sugars.

The centriole is located next to the nucleus and helps organize the cytoskeleton. They also help with cell division.

The nucleus is the control center of the cell. It directs the organelles in the cell and monitors activities in the nucleolus. It controls protein synthesis.

DNA carries genetic messages.

Chromatin is a mass of DNA and protein. It condenses into chromosomes when the cell divides. The chromosomes carry the DNA to the new cell during division.

Mitosis is cell division. Body cells divide and replicate. Phases of mitosis are prophase, metaphase, anaphase, and telophase.
Inside a Cell

Complete the thinking map below using what you already know about cells.
Word Splash

Here you will find important vocabulary words related to this topic. On a separate piece of paper, write a paragraph, telling what you know about cells. Use as many of the words listed here as possible. Use a dictionary if necessary.

- cells
- nucleus
- membrane
- mitosis
- organism
- organelle
- chromosome
- DNA
- energy
Yes or No

Read each statement below. Decide whether you agree or disagree with the statement. Check the appropriate box in the Before Viewing column. After you’ve viewed the video/DVD, go through each statement again. Decide if you still agree or disagree with each statement. Check the appropriate box in the After Viewing column.

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<th>Before Viewing</th>
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<td>agree/disagree</td>
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<tr>
<td>Every living thing on Earth is composed of cells.</td>
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<tr>
<td>The cell membrane holds the cytoplasm and organelles in place.</td>
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<tr>
<td>A semi-permeable membrane does not allow anything to pass through it.</td>
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<tr>
<td>The cytoskeleton determines the size of the cell.</td>
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<tr>
<td>There are two kinds of endoplasmic reticulum.</td>
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<tr>
<td>Ribosomes are found only in cytoplasm.</td>
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<tr>
<td>Vesicles are attached to the Golgi apparatus.</td>
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<tr>
<td>The mitochondria are the powerhouses of a cell.</td>
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<tr>
<td>Mitochondria contain their own DNA.</td>
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<tr>
<td>Centrioles help in cell division.</td>
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<tr>
<td>The nucleus digests organelles.</td>
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<tr>
<td>The nucleolus makes ribosomes.</td>
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<tr>
<td>Cell division is called DNA.</td>
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<tr>
<td>The jelly-like stuff in a cell is called an organelle.</td>
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<tr>
<td>Lipids pass easily through the cell membrane.</td>
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Circling Cells

Listed below are several vocabulary words that are related to cells. Find the words in the puzzle and circle them.

CELL MEMBRANE
CENTRIOLE
CYTOPLASM
MITOCHONDRIA
ENDOPLASMIC RETICULUM
GOLGI APPARATUS

LYSOSOME
NUCLEOLUS
NUCLEUS
RIBOSOME

Y C Y W P C Z G L O H Y X G X E A Q D O
J E J N U E V R Z O M G X O Y F I Q J Y
E C C T T N L N U C L E O L U S R C W R
F L Z U R T W P U N V M L G K P D K P M
S W G M X R S S G C M K S I P K N E T H
M U L U C I T E R C I M S A L P O D N E
D P E U H O L V F L X U G P L S H N E W
B A D L A L T J E K B I S P K P C E Y J
Z B S V C E L L M E M B R A N E O H X U
B U M K M U E M O S O B I R X Y T T R D
V U M Q S I N T S Q R X U A K X I X Y C
V W Q G K Z R E O W L I M T L F M J I C
F M E E V D G F S Q Z S Z U A Y P L L J
Q V M G K K C K Y Z L T J S N W R G E M
M C H L X J A R L Z U W B K G R H X D W
What Do You Know?

Listed below are three columns. Before watching the video/DVD, write down everything you know about cells in the first column (What I know), then write down all of the questions you have about cells in the second column (What I want to know). After viewing the program, write down everything you learned in the third column (What I have learned). If some of your questions in the second column have not been answered, discuss them with your teammates.

<table>
<thead>
<tr>
<th>What I Know</th>
<th>What I Want to Know</th>
<th>What I Have Learned</th>
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Cell Diagram

Using the space below, draw a basic cell and label its parts. Use the words below to label your cell.

- cell membrane
- cytoplasm
- centrioles
- nucleus
- endoplasmic reticulum (smooth)
- endoplasmic reticulum (rough)
- lysosome
- mitochondria
- nucleolus
- vacuole
- ribosomes
- Golgi apparatus
Word Match

Match each definition with its term.

____ 1. the thin layer around the cell that holds the cytoplasm and organelles in place
____ 2. the jelly-like substance where molecules are broken down to produce energy
____ 3. a membrane that only allows certain particles to pass through it
____ 4. organic compounds like fats and waxes that easily pass through the cell membrane
____ 5. the control center of the cell
____ 6. provides support, strength, and shape to the cell
____ 7. gives strength to the cytoskeleton
____ 8. synthesizes macromolecules in the cell
____ 9. synthesizes protein in the cell
____ 10. forms on the ends of the top layer of the Golgi apparatus
____ 11. collects, modifies, and pockets substances manufactured by the cell
____ 12. breaks down worn out organelles, debris, and large ingested particles within the cell
____ 13. the powerhouse of the cell
____ 14. the folds on the mitochondria
____ 15. migrate to the poles of the cell to assist in division
____ 16. produces ribosomes in the nucleus
____ 17. cell division
____ 18. carries genetic messages
____ 19. a mass of DNA and protein

A. semi-permeable
B. endoplasmic reticulum
C. chromatin
D. cytoskeleton
E. vesicle
F. lysosome
G. DNA
H. nucleus
I. cristae
J. nucleolus
K. mitosis
L. centrioles
M. cell membrane
N. protein
O. mitochondria
P. cytoplasm
Q. Golgi apparatus
R. ribosome
S. lipid
Walking With Ryan

During the video/DVD, Ryan takes several steps to find his way out of the cell. As you watch and listen to the characters he meets, record their jobs below.
Walking With Ryan (cont.)

During the video/DVD, Ryan takes several steps to find his way out of the cell. As you watch and listen to the characters he meets, record their jobs below.
Take a Note

Listed below are some of the topics related to the video. Take notes about these topics as you watch and listen to the video/DVD. Write questions you still have about each topic so that you can discuss them.

<table>
<thead>
<tr>
<th>Organelle</th>
<th>Golgi apparatus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cytoplasm</td>
<td>Lysosome</td>
</tr>
<tr>
<td>Endoplasmic Reticulum</td>
<td>Centriole</td>
</tr>
<tr>
<td>Mitochondria</td>
<td>Nucleus</td>
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Lipid or Not?

The organelles keep thinking that Ryan is a lipid. Compare Ryan with a lipid by using the Venn diagram below.
The Big Guy

As Ryan makes his way through the cell, the organelles keep telling him that he needs to see the nucleus. They keep referring to the nucleus as an extremely important figure. As you listen to the video/DVD, write down the reasons why.
What Am I?

Use the clues to determine which cell organelle is being described. Write the name of the organelle after the question.

1. I feel like jelly, but my job is important. I am the place where molecules are broken down to produce energy and where other molecules are built up. What am I? ____________________

2. I am a thin layer that surrounds the cell. I hold all of the organelles in place. I let some things into the cell and keep others out. What am I? ____________________

3. I am strong like a bone. I provide support, strength, and shape to the cell. My long thin structures are made of protein. What am I? ____________________

4. I can be rough or smooth, but my job is to make macromolecules like proteins, lipids, and complex carbohydrates. I also separate molecules that go to the cytoplasm from those that go to other sites. What am I? ____________________

5. I am made in the nucleolus and found on rough endoplasmic reticulum. I synthesize protein and send it to different parts of the cell. What am I? ____________________

6. I hang out with vesicles and I collect, modify, and package substances manufactured by the cell. What am I? ____________________

7. I eat and eat debris, old organelles and large ingested particles within the cell. If I get too full and burst, my digestive enzymes will destroy the whole cell. What am I? ____________________

8. I am called the powerhouse of the cell. I have two membranes where I break down sugars and fatty acids to trap energy. I am self-replicating and have my own DNA. What am I? ____________________

9. I hang out near the nucleus. My job is to organize microtubules and migrate to the ends of the cell to assist in mitosis. What am I? ____________________

10. I am the brains of the operation. I direct all of the organelles and keep track of the DNA in my membrane. What am I? ____________________
Think It Over

Discuss each question with your team before writing your own answer.

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. Why do you think the organelles thought that Ryan was a lipid?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

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

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

5. What do you know about DNA?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
Fun With Microscopes

Follow the steps below to explore cells further with microscopes. Show your findings in words and in pictures.

1. Look at several prepared slides. This will help you to develop skill in using the microscope. Does your microscope reverse the image so that moving the slide one direction makes the image in the microscope move the opposite direction? If so, it takes a little more practice to become skilled at moving objects under the lens.

2. Practice drawing what you see in the microscope. Use a compass or a round object to make a circle on a piece of paper. Use this as the round area that you see in the microscope. Draw the object you are looking at so it fills as much of the circle as the object fills of the area you see in the microscope (called the field of view or field).

3. Most microscopes use a mirror or electric light underneath an object to light it up. The object must be thin enough that light can pass through it. Other microscopes, usually having lower magnification, use light from the top to shine down on objects viewed. These are called dissecting microscopes and are often used to look at larger objects such as flowers which are then taken apart or dissected. Remember to use a very small piece of any object you are looking at if the light source is below the object.

4. Scrape a wooden toothpick along the inside of your cheek and smear it on a slide. Look at the slide to see if you can find any cells from the inside of your cheek.

5. Get some water from a pond, a puddle or an aquarium. Can you find anything swimming in a drop of water when you look at it under the microscope? Put a handful of dead grass in a small jar of this water and leave it with the top off for a week. A peanut butter jar is good for this. Look at it again in a week to 10 days when it is starting to smell bad. Do you find things swimming in it now? This is called a hay infusion. See if you can identify some of the things you find in the hay infusion or make up your own names that describe them.

6. Get a piece of onion. Break it apart where one layer peels away from another. Use tweezers or your fingernails to pull a thin layer off the inside or outside surface of this onion layer. Look at it under the microscope. Can you see the cells that make up this onionskin layer? If you can, put a drop of iodine on it. Can you see the cells better now? Look at pieces of thread from different clothes. Compare the small fibers that make up the threads.

7. Dissolve different household powders in water (get permission first so you know it is safe) and leave them until the water evaporates away. You may find interesting crystals left behind. Try salt and sugar for example. Put some iodine on a slide, let it evaporate and look at what is left behind.
Cell Tour

Follow these steps to create a class tour of the cell.

1. With your team, choose two organelles that you will investigate.

2. Develop a list of questions with your team that you will answer through your research and presentation. List your questions here:

____________________________________________________________________________
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____________________________________________________________________________

3. Complete the research. You may need to change your questions as you work.
   Write your information on separate paper.

4. Create a poster or model showing each of the organelles and giving all of the information you have located.

5. Together, write a script that guides visitors through your organelles.

6. Have all teammates practice with the script so that they can say it clearly and loudly.

7. Arrange your organelle posters with others in the class and be prepared to participate in a class cell tour.
Cell Knowledge Quiz

Choose the best answer for each question.

1. The nucleus is sometimes called the _________________ of the cell.
   a. powerhouse
   b. gatekeeper
   c. control center
   d. transporter

2. Mitochondria are self-replicating which means they _________________
   a. divide and make copies of themselves
   b. provide support, strength, and shape to cells
   c. hold organelles in place
   d. transport digestive enzymes

3. Ribosomes can be found __________.
   a. in the cytoplasm
   b. on the endoplasmic reticulum
   c. in the centrioles
   d. A and B

4. Which of the following are organelles?
   a. Mitochondria
   b. Vesicle
   c. Golgi apparatus
   d. All of the above

5. Which of the following contains its own DNA?
   a. Golgi apparatus
   b. Mitochondria
   c. Endoplasmic reticulum
   d. Cytoplasm

6. Cell division is known as
   a. Mitosis
   b. Prophase
   c. Telophase
   d. Reproduction
Cell Knowledge Quiz (cont.)

Choose the best answer for each question.

7. Every living thing is composed of __________.
   a. cells
   b. organelles
   c. cytoskeleton
   d. DNA

8. The __________ has the job of exporting and importing nutrients as well as passing waste and
   unwanted particles outside the cell.
   a. mitochondria
   b. cell membrane
   c. cytoplasm
   d. All of the above

9. If a lysosome breaks, the __________ would leak into the cell and digest it.
   a. cytoskeleton
   b. digestive enzymes
   c. nuclear membrane
   d. cytoplasm

10. DNA carries __________ information.
    a. speed of cell division
    b. the stages of mitosis
    c. genetic
    d. centriole movement
Interdisciplinary Ideas

Language Arts

**Flash Cards** – Hand out index cards to students, provide enough so there is one card for each vocabulary word you want your students to make into a flashcard. On the front of each card have them draw a picture of an organelle and write the name of the organelle. On the back of the card, tell them to describe the function of that organelle. Then, ask them to use these flashcards with another classmate to practice their knowledge of cell functions.

**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?

Social Studies

**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.

Health/P.E.

Invite a specialist to talk to your class about cell disease and stem cell research.

Invite the school nurse to talk to your class about the importance of maintaining good health to keep your body’s cells healthy.
Interdisciplinary Ideas

Fine Arts

**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 a cell.

**Cell Museum** – A challenging project for older students would be to research and design a traveling Cell Museum. After conducting research on a particular type of cell, students can use self-hardening modeling clay to create 3-D models for specific cell structures. A museum guide should be developed to support the display.

**Name that Slide** – If you have access to compound microscopes in your school, set up a lab and let students sort several prepared slides similar to those in the Virtual Electron Microscope activity. Cover the labels on the prepared slides and have students identify each slide as a plant or animal cell or have them identify the object they observe from a list provided for them. Students could also diagram one of the specimens they observed. Be sure they draw only what they see under the microscope.

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 scientists use them in their work, and what has been discovered through 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 beautifully 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, record keeping, and formulating a 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. He is an inspiration to all budding scientists. Includes activities using a microscope or magnifying glass.
Internet Sites

http://micro.magnet.fsu.edu/primer/index.html
Teachers and older students might enjoy visiting Molecular Expression’s Primer on microscope use. Anyone interested in microscopes will enjoy a visit to their images page.

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 an 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 solid 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 provides a valuable 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.
## Yes or No

Read each statement below. Decide whether you agree or disagree with the statement. Check the appropriate box in the Before Viewing column. After you’ve viewed the video/DVD, go through each statement again. Decide if you still agree or disagree with each statement. Check the appropriate box in the After Viewing column.

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Circling Cells

Listed below are several vocabulary words that are related to cells.
Find the words in the puzzle and circle them.

CELL MEMBRANE
CENTROILE
CYTOPLASM
ENDOPLASMIC

RETICULUM
GOLGI APPARATUS
LYSOSOME
MITOCHONDRIA
NUCLEOLUS

NUCLEUS
RIBOSOME


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Inside a Cell
Cell Diagram

Using the space below, draw a basic cell and label its parts. Use the words below to label your cell.

- cell membrane
- cytoplasm
- centrioles
- nucleus
- endoplasmic reticulum (smooth)
- endoplasmic reticulum (rough)
- lysosome
- mitochondria
- nucleolus
- vacuole
- ribosomes
- Golgi apparatus
### Word Match

Match each definition with its term.

<table>
<thead>
<tr>
<th></th>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>M</td>
<td>semi-permeable</td>
<td>the thin layer around the cell that holds the cytoplasm and organelles in place</td>
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<tr>
<td>P</td>
<td>endoplasmic reticulum</td>
<td>the jelly like substance where molecules are broken down to produce energy</td>
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<tr>
<td>A</td>
<td>vesicle</td>
<td>a membrane that only allows certain particles to pass through it</td>
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<tr>
<td>S</td>
<td>lysosome</td>
<td>organic compounds like fats and waxes that easily pass through the cell membrane</td>
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<tr>
<td>H</td>
<td>nucleus</td>
<td>the control center of the cell</td>
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<tr>
<td>D</td>
<td>protein</td>
<td>provides support, strength, and shape to the cell</td>
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<tr>
<td>N</td>
<td>mitochondria</td>
<td>gives strength to the cytoskeleton</td>
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<tr>
<td>B</td>
<td>ribosome</td>
<td>synthesizes macromolecules in the cell</td>
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<tr>
<td>R</td>
<td>nucleolus</td>
<td>synthesizes protein in the cell</td>
</tr>
<tr>
<td>E</td>
<td>centrioles</td>
<td>forms on the ends of the top layer of the Golgi apparatus</td>
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<tr>
<td>Q</td>
<td>Golgi apparatus</td>
<td>collects, modifies, and pockets substances manufactured by the cell</td>
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<tr>
<td>F</td>
<td>lysosome</td>
<td>breaks down worn out organelles, debris, and large ingested particles within the cell</td>
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<tr>
<td>O</td>
<td>cell membrane</td>
<td>the powerhouse of the cell</td>
</tr>
<tr>
<td>I</td>
<td>cristae</td>
<td>the folds on the mitochondria</td>
</tr>
<tr>
<td>L</td>
<td>mitosis</td>
<td>migrate to the poles of the cell to assist in division</td>
</tr>
<tr>
<td>J</td>
<td>nucleolus</td>
<td>produces ribosomes in the nucleus</td>
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<td>K</td>
<td>ribosome</td>
<td>cell division</td>
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<tr>
<td>G</td>
<td>DNA</td>
<td>carries genetic messages</td>
</tr>
<tr>
<td>C</td>
<td>chromatin</td>
<td>a mass of DNA and protein</td>
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Walking With Ryan

During the video/DVD, Ryan takes several steps to find his way out of the cell. As you watch and listen to the characters he meets, record their jobs below.

- **cell membrane** – Ryan passes through it to get into the cell, semi-permeable, holds cytoplasm and organelles in place (gatekeeper), exports nutrients, lets waste pass through.

- **cytoskeleton** – long, thin tubes, helps the cell, moves through the cytoplasm, provides support, strength, and shape to the cell, made of protein.

- **endoplasmic reticulum** – smooth or rough (with ribosomes), synthesizes macromolecules, separates molecules, and transports proteins.

- **Golgi apparatus** – flattened, curved sac, collects, modifies, and packages proteins and synthesized substances, works with vesicle to transport substances elsewhere.

- **vesicle** – stores and transports substances from Golgi apparatus to other parts of the cell.
Walking With Ryan (cont.)

During the video/DVD, Ryan takes several steps to find his way out of the cell. As you watch and listen to the characters he meets, record their jobs below.

**lysosome** – breaks down worn-out organelles and debris, digests with enzymes, keeps cell clean

**mitochondria** – called the powerhouse of the cell, it has two membranes - inner layer is layered with complex folds called cristae, uses sugars and fatty acids to generate energy, mitochondria are self-replicating (they grow and divide)

**centriole** – located next to the nucleus and helps organize the cytoskeleton, also helps with cell division

**nucleus** – the control center of the cell, directs the organelles and monitors activities in the nucleolus, controls protein synthesis
Lipid or Not?
The organelles keep thinking that Ryan is a lipid. Compare Ryan with a lipid by using the Venn diagram below.
The Big Guy

As Ryan makes his way through the cell, the organelles keep telling him that he needs to see the nucleus. They keep referring to the nucleus as an extremely important figure. As you listen to the video/DVD, write down the reasons why.

**The Nucleus**

- **the big man – the boss, tells what can come and go**
- **the big boss – tells gatekeeper what can come in and go out**
- **very busy – manages cell division**
- **control freak of the cell – controls all cell activities**
- **OTHER IDEAS??????**
What Am I?

Use the clues to determine which cell organelle is being described. Write the name of the organelle after the question.

1. I feel like jelly, but my job is important. I am the place where molecules are broken down to produce energy and where other molecules are built up. What am I? _______ Cytoplasm _______

2. I am a thin layer that surrounds the cell. I hold all of the organelles in place. I let some things into the cell and keep others out. What am I? _______ Cell Membrane _______

3. I am strong like a bone. I provide support, strength and shape to the cell. My long thin structures are made of protein. What am I? _______ Cytoskeleton _______

4. I can be rough or smooth, but my job is to make macromolecules like proteins, lipids, and complex carbohydrates. I also separate molecules that go to the cytoplasm from those that go to other sites. What am I? _______ Endoplasmic Reticulum _______

5. I am made in the nucleolus and found on rough endoplasmic reticulum. I synthesize protein and send it to different parts of the cell. What am I? _______ Ribosome _______

6. I hang out with vesicles and I collect, modify, and package substances manufactured by the cell. What am I? _______ Golgi Apparatus _______

7. I eat and eat debris, old organelles and large ingested particles within the cell. If I get too full and burst, my digestive enzymes will destroy the whole cell. What am I? _______ Lysosome _______

8. I am called the powerhouse of the cell. I have two membranes where I break down sugars and fatty acids to trap energy. I am self-replicating and have my own DNA. What am I? _______ Mitochondria _______

9. I hang out near the nucleus. My job is to organize microtubules and migrate to the ends of the cell to assist in mitosis. What am I? _______ Centriole _______

10. I am the brains of the operation. I direct all of the organelles and keep track of the DNA in my membrane. What am I? _______ Nucleus _______
Think It Over

Discuss each question with your team before writing your own answer.

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? **Answers may vary. Some ideas may include the mayor or principal is the nucleus. The teacher is the powerhouse (mitochondria). The bricks holding up the buildings are the cytoskeleton, etc. Encourage students to be creative but to back up their arguments.**

2. Why do you think the organelles thought that Ryan was a lipid? **Answers may vary. They may assume that Ryan was not waste because he was able to permeate into the cell. Perhaps his body fat accounts for the mistake. Again, encourage students to be creative.**

3. In your opinion, which organelle has the most important job? The toughest job? The easiest job? Explain your answer. **Answers may vary. They should be supported by evidence from the video.**

4. What kind of relationship does the vesicle have with the Golgi apparatus? **Answers may vary. Students should recognize that these two organelles work together in storing and transporting substances.**

5. What do you know about DNA? **Answers may vary. Students should be encouraged to listen to news programs, or read the newspaper to learn about cloning, medical research, and other issues related to DNA.**
Cell Knowledge Quiz

Choose the best answer for each question.

1. The nucleus is sometimes called the _________________ of the cell.
   a. powerhouse  
   b. gatekeeper  
   c. control center  
   d. transporter

2. Mitochondria are self-replicating which means they _________________
   a. divide and make copies of themselves  
   b. provide support, strength, and shape to cells  
   c. hold organelles in place  
   d. transport digestive enzymes

3. Ribosomes can be found __________.
   a. in the cytoplasm  
   b. on the endoplasmic reticulum  
   c. in the centrioles  
   d. A and B

4. Which of the following are organelles?
   a. Mitochondria  
   b. Vesicle  
   c. Golgi apparatus  
   d. All of the above

5. Which of the following contains its own DNA?
   a. Golgi apparatus  
   b. Mitochondria  
   c. Endoplasmic reticulum  
   d. Cytoplasm
Cell Knowledge Quiz (cont.)

Choose the best answer for each question.

6. Cell division is known as
   a. Mitosis
   b. Prophase
   c. Telophase
   d. Reproduction

7. Every living thing is composed of __________.
   a. cells
   b. organelles
   c. cytoskeleton
   d. DNA

8. The __________ has the job of exporting and importing nutrients as well as passing waste and unwanted particles outside the cell.
   a. mitochondria
   b. cell membrane
   c. cytoplasm
   d. All of the above

9. If a lysosome breaks, the __________ would leak into the cell and digest it.
   a. cytoskeleton
   b. digestive enzymes
   c. nuclear membrane
   d. cytoplasm

10. DNA carries __________ information.
    a. speed of cell division
    b. the stages of mitosis
    c. genetic
    d. centriole movement


**SCENE ONE — IN THE CLASSROOM**

**MRS. CURRY**
Good morning class. Today we are going to look at eukaryote cells but before we begin let me explain the assignment and the directions.

**RYAN**
Eureka cells. What are those?

**JENNY**
Not eureka, eukaryotes. They’re cells that have a nucleus and organelles and are surrounded by a membrane.

**RYAN**
Do you mean like plant and animal cells? Oh, I get it.

**MRS. CURRY**
Very good. Now look through your microscopes at the slides of the animal cells.

After you have studied each cell, draw a picture of the cell as you see it.

**JENNY**
Do we have to label our pictures too?

**MRS. CURRY**
Excellent question Jenny. Yes, after you have drawn the picture of your cell please label each part of the cell and describe the functions of each part. Are there any questions? Then you may begin.

**RYAN**
Man this is going to be a lot of work. Draw this, label that, write this. Next thing you know we’re going to be doing full-blown dissections next week.

**MRS. CURRY**
Oh and by the way next week we will be dissecting frogs. So be prepared.
RYAN
Frogs. I don’t think I understand much of this cell stuff at all.

JENNY
Oh give me a break. This stuff isn’t that bad. Actually cells are pretty cool.

STEVEN
Yeah, if it weren’t for cells you wouldn’t be here.

RYAN
How do you figure?

STEVEN
Because every living thing on Earth is composed of cells.

MRS. CURRY
Ryan, Jenny, Steven… are we making progress?

STUDENTS
Yes.

MRS. CURRY
Good. Then you’d better get busy or you’re going to run out of time.

JENNY
Come on you guys, let’s get to work.

RYAN
I’ve got to get my book; I’ll be right back.

JENNY
Wow, you’ve got to see this cell. It looks so cool!

RYAN
I want to see, I want to see.

(Ryan falls)

SCENE TWO — GOING INSIDE!

RYAN
I’ve got to get to the cell. See the cell. Be the cell. Help somebody! Help me please!

STEVEN
Did you hear something?

JENNY
Yeah, or I thought I did.

STEVEN
Wait. Shh…

RYAN
Help! Somebody help me! Please!

STEVEN
Did you hear that?

JENNY
Yeah, but where’s it coming from?

STEVEN
I don’t know

RYAN
Jenny, Steven, I’m in here. Look in the microscope.

JENNY
Ryan, what are you doing in there?

RYAN
Somebody help me please.

STEVEN
Hey Ryan, that’s really neat! How did you get in there, man?
RYAN
I don't know, but all I want to do is get out of here before one of these meat eaters knock me over.

JENNY
Yeah, what are those things?

RYAN
I don't know and I don't want to find out. Get me out of here.

STEVEN
Here let me see. Oh, wait, I know what those are. Those are cells.

RYAN
You mean to say I've got cells flying at me.

STEVEN
Yeah actually you do. I can't believe this. This is so cool. Maybe I should go and get Mrs. Curry.

JENNY
No we might get into trouble. Let's just keep this among us.

RYAN
Yeah, yeah, don't tell anyone. I know I'm not going to be able to live this down.

JENNY
You may not live through this at all if you don't watch out for those cells. Ryan look out! It's coming straight at you. Move! Move!

Scene Three — Cell Membrane

STEVEN
Can you see him?

JENNY
Where'd he go?

RYAN
I'm in here guys. How did I get in here? The cell just kind of sucked me in.

STEVEN
Well, I think you just passed through the cell membrane.

RYAN
Cell membrane? Is that the stuff I'm stepping in?

JENNY
No, no, that sticky stuff is the cytoplasm. The cytoplasm is the jelly like substance where molecules are broken down to produce energy and other molecules are built up.

STEVEN
Yeah the cell membrane is a thin layer around the cell, which holds the cytoplasm and all the organelles in place.

RYAN
Well I'm obviously not an organelle. How did I pass through the membrane without ripping it?

JENNY
Well according to my book it's because cell membranes are semi-permeable.

RYAN
Semi-permanent? Oh great I'm going to be in here forever.

JENNY
No, semi-permeable.
RYAN
Perm? No I don’t need a perm, my hair’s just fine thanks.

JENNY
Not a perm. A semi-permeable membrane. It’s a membrane that only allows certain particles to pass through it.

RYAN
Good, because if I got in with no problems then I should be able to get back out.

CELL MEMBRANE
Yo watch it there buddy.

RYAN
Who’s that?

CELL MEMBRANE
It’s me, the cell membrane. But you can call me The Gatekeeper.

RYAN
The Gatekeeper? Ok. If you’re the gatekeeper, then tell me why I’m in here?

CELL MEMBRANE
I thought you were a lipid.

RYAN
Lip? I didn’t give you any lip.

CELL MEMBRANE
Lip? Not lip. Lipid. Lipids are organic compounds like fats and waxes that can pass easily through me.

RYAN
So all you do is let nutrients pass through you to get into the cell?

CELL MEMBRANE
No I export nutrients to other parts of the body and let waste and unwanted particles pass through me to leave the cell as well.

RYAN
Well then in that case, don’t call me Ryan, call me Mr. Waste so I can get out of here.

CELL MEMBRANE
Not so fast. The big man says that you’re not going anywhere yet.

RYAN
The big man? Who’s that?

CELL MEMBRANE
The nucleus. He’s the boss… well, of our world.

RYAN
The nucleus? Well I don’t care who he is.

CELL MEMBRANE
You better care kid because he’s the big man.

RYAN
Sort of like mind over matter.

CELL MEMBRANE
In a sense. Hey speaking of matter, you are matter at the moment.

RYAN
Matter?

CELL MEMBRANE
Yep, in one of it’s smallest forms.
RYAN
Well you see that’s my problem, outside this cell I’ve got a life. I hang out with friends, play sports, you know just basically live.

CELL MEMBRANE
Good, good. You can live with us a little then.

RYAN
Un huh no, no, no, no, no way. I’ve got to find this nucleus guy so I can leave. Show me the way to him.

CELL MEMBRANE
Well that’s easy, just pass by the cytoskeleton, hang a left at the endoplasmic reticulum and ribosomes, turn right at the Golgi apparatus and vesicle, then straight past the endoplasmic reticulum and centrosome. You can’t miss it.

RYAN
Yeah, right. That was “a lot of help”.

JENNY
Don’t worry Ryan. We’ll help you get there.

STEVEN
Yeah, we’ll get you out of there. Don’t worry.

SCENE FOUR —
CYTOSKELETON

RYAN
Well I hope so. I have to get to the nucleus. Where am I headed? I can’t see where I’m going very well.

JENNY
Watch out… You’re going to run into those long thin tubes.

RYAN
Where? Where?

STEVEN
Straight ahead, don’t get tangled up in them.

RYAN
What are they?

JENNY
I don’t know. I’m looking. I’m looking.

RYAN
Well hurry up. They’re all around me now.

CYTOSKELETON
Relax, do you think I’m going to bite you or something? Give me a break.

RYAN
What? I mean you can talk too? What’s your name again?

CYTOSKELETON
My full name is cytoskeleton, it rhymes with sight of skeleton. But since the sight of a skeleton can sometimes be scary, well, I usually go by the name of Cy.

RYAN
Okay Cy, can you help me get to the nucleus?

CYTOSKELETON
You want my help?

RYAN
Umm, yeah.

CYTOSKELETON
All I ever do is help, help you, help the cell and no one appreciates me.
RYAN
Okay, okay, sorry. I’d really appreciate it if you’d help me get out of here.

CYTOSKELETON
I was. How many organelles do you know that would move through the cytoplasm and not complain like I did? Huh, tell me? Well, I’ll tell you. None!

JENNY
I guess you really upset her, Ryan.

RYAN
Oh, you finally noticed! What should I do? I don’t want to upset her even more?

STEVEN
Ask her what her job in the cell is. Try and make her feel important.

RYAN
Oh okay. So Cy, I realize that you help out the cell. What exactly do you do?

CYTOSKELETON
Finally, someone who cares. As a cytoskeleton I provide support, strength and shape to the cell.

RYAN
Wow, you must be pretty strong then, huh?

CYTOSKELETON
Yes, very strong. My long thin structures are made out of a special substance. Do you want to guess what it is?

RYAN
Is this some kind of a joke?

CYTOSKELETON
Of course! What else would you expect from a girl known as a cytoskeleton. Here’s a clue, I believe in young people.

RYAN
Huh?

CYTOSKELETON
That makes me pro-teen, protein. Get it?

RYAN
Oh very funny. As you were saying?

CYTOSKELETON
Ah, yes. As I was saying, our long thin structures are made of protein. Protein gives us the strength that we need to support and maintain the shape of the cell.

RYAN
Protein? Well, how about using some of that protein to help me get to the nucleus?

CYTOSKELETON
You’re going where?

RYAN
I told you, the nucleus. The cell membrane won’t let me out until the big guy says so.

CYTOSKELETON
Oh! That could be a problem.

RYAN
What do you mean?

CYTOSKELETON
Sometimes he’s not so friendly. He has this reputation for being the control freak of the cell. Not a pleasant organelle, if I must say so. But, being the helpful organelle that I am, I guess I’ll help you.

JENNY
That’s okay Ryan, we’ll deal with the nucleus when we get there.

STEVEN
Yeah don’t sweat it. Let’s just see what’s coming up next.
Scene Five — Quick Quiz

Quick Quiz
Here’s Quick Quiz. It looks like Ryan has quite a journey ahead of him, but before we continue let’s take a quick breather. Okay, now let’s see if you understand everything that we’ve covered so far. I’m going to ask you a question and give you 3 choices for answers. You pick the one that you feel best answers the question. Are you ready? All right here it goes.

The cytoskeleton aids the cell in the following areas except __________.

a) size  
b) support  
c) shape

Take a second to think about. Do you think you’ve got an answer? Well, we know that the cytoskeleton provides support, shape and strength to the cell. Therefore the answer is A, the cytoskeleton does not determine the size of the cell. Okay guys, let’s go back and see how Ryan’s doing.

Scene Six — Endoplasmic Reticulum

Steven
Okay Ryan, you’re almost there.

Ryan
Almost where? Do you mean those big blob things ahead?

Jenny
Well, they’re not exactly blob things. I think it’s the endoplasmic reticulum.

Ryan
The endoplasmic ridiculous?

Endoplasmic Reticulum
No, no, no, the endoplasmic reticulum. Please don’t insult me. There’s nothing plastic or ridiculous about me.

Ryan
Wow, this is too cool. Listen, I’m sorry. I’m not trying to offend anyone or anything in your case. I’m just trying to get out of here.

Endoplasmic Reticulum
Well, I’m sorry, I can’t help you there.

Ryan
Figures. Good for nothing.

Endoplasmic Reticulum
Hey, hey, hey. Good for nothing, is that what you said? I’ll have you know that I’m good for a lot of things. Actually I’m pretty important.

Ryan
How do you?

Jenny
Hang on Ryan, let her finish.

Steven
Yeah.

Endoplasmic Reticulum
Well, at least your friends have some manners.

Ryan
Sorry. I guess this whole trip is just stressing me out a bit.

Endoplasmic Reticulum
Stress? You think you have stress? You don’t know stress. Let me tell you about stress.

Ryan
So do you think she’s a little stressed? So your job’s pretty tough, huh?
ENDOPLASMIC RETICULUM
Tough? You don’t know the half of it. I’m responsible for synthesizing macromolecules in the cell like proteins, lipids and complex carbohydrates. I also have to separate molecules destined for the cytoplasm from those intended for transport to other sites. And, I have to transport proteins to various places in the cell. You know, all this work can really wear an endoplasmic reticulum out.

RYAN
I’m sorry. Ouch, what are all those bumps on you?

ENDOPLASMIC RETICULUM
Oh, those things? Guess.

RYAN
I haven’t got a clue.

JENNY
I know, I found it in the book. They’re called ribosomes.

RYAN
Oh, okay ribosomes. What do they do?

ENDOPLASMIC RETICULUM
The ribosomes synthesize protein in the cell.

RYAN
So what do they do with it after it’s been synthesized?

ENDOPLASMIC RETICULUM
Well, after the ribosomes synthesize the protein, the protein enters my channels and goes to various locations in the cell that need it. Or, it’s exported to other parts of the body.

RYAN
So all endoplasmic reticula have ribosomes that cover them?

ENDOPLASMIC RETICULUM
No. Do you see my cousin over there?

RYAN
Yeah, but I don’t see any ribosomes on her.

ENDOPLASMIC RETICULUM
Exactly! We call her smoothie because her skin’s so smooth. So you see there are two types of endoplasmic reticula. There are rough endoplasmic reticula, like me, and smooth endoplasmic reticula, like my cousin. Smooth endoplasmic reticula do not have ribosomes on their surface.

RYAN
So what do they do then?

ENDOPLASMIC RETICULUM
The smooth endoplasmic reticula synthesize lipids, which are organic compounds like fats and waxes while ribosomes break down proteins. Speaking of which, I’m surprised she’s not over here trying to synthesize you. You kind of look like a lipid.

RYAN
That’s what the cell membrane said too. Why do you all think I’m a lipid?

ENDOPLASMIC RETICULUM
Don’t be upset. It’s actually a compliment in our world. Lipids are required for the growth of cell membranes and for the membranes of organelles in the cell.
RYAN
In that case, I guess it’s okay. So ribosomes are only located on rough endoplasmic reticula right?

ENDOPLASMIC RETICULUM
Not quite. While ribosomes are found on rough endoplasmic reticula, they can also be found in the cytoplasm.

RYAN
Oh cool, there are ribosomes in the cytoplasm. But what good are they?

ENDOPLASMIC RETICULUM
They synthesize protein and pass the protein directly into the cytoplasm.

RYAN
Okay, so let me see if I’ve got this right. Ribosomes synthesize proteins, which are then transported to various parts of the cell. They are found in the cytoplasm or on the outside of the rough endoplasmic reticula right?

ENDOPLASMIC RETICULUM
Yeah, very good.

RYAN
And the smooth endoplasmic reticula do not have ribosomes on them and their job is to synthesize lipids?

ENDOPLASMIC RETICULUM
Excellent Ryan. But really I must get back to work. Good luck on your voyage to see Mr. Nucleus, and by the way, when or if you get to meet him, be very very humble. He can be quite irritable at times. But anyway, I have to go now. So many molecules to process and so little time. Bye.

RYAN
But wait, where do I go? What do I do? Great, now which way do I go?

SCENE SEVEN —
GOLGI APPARATUS

JENNY
Hold on a second it looks like you’re heading towards another endoplasmic reticulum.

RYAN
Not another one.

STEVEN
Here let me see. No it’s not an endoplasmic reticulum. It’s a… here, I’ll spell it, G-O-L-G-I A-P-P-A-R-A-T-U-S.

RYAN
A gold guy apparatus. Awesome, I’m going to get rich in this cell.

JENNY
Not a gold guy apparatus, a Golgi apparatus.

RYAN
What’s that?

JENNY
Well, it says that they’re sets of flattened slightly curved sacs that look similar to endoplasmic reticulum.

RYAN
Yep, this must be it.

GOLGI APPARATUS
Who are you calling a flattened, slightly curved sac?

VESICLE
What are you doing here? We don’t get much company in this neck of the cell.

GOLGI APPARATUS
Are you a lipid? Because, if you’re a lipid, you don’t belong here. You belong...
**RYAN**
I am not a lipid. Does everybody in this cell hear me? I am not a lipid!

**VESICLE**
Easy there, she was just kidding. See what you did? We hardly ever get any company and you almost scared him off.

**RYAN**
Oh, that’s okay. Besides, who are you? You’re not the Golgi apparatus. Jenny, Steven, I thought you said that this was a Golgi apparatus?

**JENNY**
That’s what the book said.

**GOLGI APPARATUS**
I’m a Golgi apparatus, he’s a vesicle.

**RYAN**
But, why are you guys together, if you’re separate organelles?

**VESICLE**
I guess that you could say that we kind of hang out together. We’re buddies.

**RYAN**
What do you mean?

**GOLGI APPARATUS**
As the Golgi apparatus in the cell it is my responsibility to collect, modify and pocket substances manufactured by the cell.

**RYAN**
What kind of substances?
Don’t say lipids.

**GOLGI APPARATUS**
No. I mostly deal with proteins and other newly synthesized substances in the cell.

**VESICLE**
And that’s where I come in.

**RYAN**
What do you mean?
VESICLE
It’s my job to store and transport these substances from the Golgi apparatus to various locations within the cell including the cell membrane, where the nutrients are exported to other cells. It seems like I’m always on the move. Hey, want to hear a poem I wrote?

RYAN
Okay sure.

VESICLE
Okay ready?

We’re vesicles, we’re vehicles. We serve our Golgi, she’s a great Golgi. We’re movers and shakers. We’re truly not fakers. We’re here, we’re there, we’re everywhere. Got lots of nerve and we’re here to serve. Ain’t no bore, just got to store. More and more and more and more. I’m not mystical, just a plain old vesicle.

RYAN
Cool poem. Maybe I can hitch a ride with you to the membrane and you can get me out of here.

VESICLE
Sorry, I’d like to help you out. But as you can see, I don’t have any room. I’m full of synthesized proteins.

RYAN
Oh come on. You can fit me in there somewhere and then you can sneak me out of the cell.

VESICLE
Sorry, I’d like to help you out. But as you can see, I don’t have any room. I’m full of synthesized proteins.

RYAN
Oh come on. You can fit me in there somewhere and then you can sneak me out of the cell.

VESICLE
Not past “The Gatekeeper”, I can’t. He may be semi-permeable, but he’s strict.

GOLGI APPARATUS
Oh lad, you don’t mess with The Gatekeeper...

He does whatever the big boss wants.

VESICLE
Yeah, you know, the...

RYAN
Oh, I know the nucleus. Yeah I already heard about him. Let me see if I understand all this. You collect, modify and package substances that are manufactured by the cell.

GOLGI APPARATUS
You are correct.

RYAN
And you form at the ends of the top layer of the Golgi apparatus and you transport substances to the cell membrane and other parts of the cell.

VESICLE
You got it! By the way though, I’m late. I must get going or I’m not going to make it to the gate in time to drop off these synthesized proteins and The Gatekeeper hates it when I’m late. He can get mean. He might mess me up if you know what I mean and then I’d be a “messicle” instead of a vesicle.

RYAN
You guys are all jokers around here, huh?

VESICLE
After all the work we do, we deserve to have some fun.

GOLGI APPARATUS
Speaking of that, I’ve got some substances waiting to be packaged so I must leave you now, Ryan. Good luck and cheers. I hope for your sake that the
Inside a Cell

nucleus is in a good mood today. He can be awfully scary when he’s in a bad mood.

VESICLE
See ya Ryan.

RYAN
Gosh these organelles are really busy today.

JENNY
Yeah, could you imagine if they just stopped doing their work? It would affect our whole body, I can’t even think about it.

RYAN
Hey you two, I’ve got other things on my mind like getting out of here, and besides, I think I’m almost to the nucleus. What do you guys see coming up next?

SCENE EIGHT — QUICK QUIZ

QUICK QUIZ
Quick Quiz is back. Hi guys it’s me, Quick Quiz. Let’s take a quick brain break. You know how it works, here comes the question and you pick the best answer. Here it goes.

Which of the following organelles is responsible for collecting, modifying, and packaging substances manufactured by the cell?
   a) the cytoplasm
   b) the Golgi apparatus
   c) the endoplasmic reticulum

Take a second to think about it. You think you’ve got an answer? Let’s see. The cytoplasm is the jelly-like substance where molecules are broken down to produce energy and where other molecules are built up. Endoplasmic reticulum synthesizes macromolecules and transports proteins to various places in the cell. So therefore the answer is B, the Golgi apparatus. The Golgi apparatus is responsible for collecting, modifying, and packaging substances manufactured by the cell. So did you get it right? Great! So, let’s get back to Ryan, Jenny, and Steven and see what’s coming up next.
SCENE NINE — LYSOSOMES

RYAN
You guys see anything?

JENNY
Yeah... oh yuck.

STEVEN
What? What? Let me take a look.
Wow, whatever it is, it’s eating one of the other organelles.

RYAN
What? Oh great! An eating organelle, that’s just what I need. I hope it’s not a man-eating organelle!

LYSOSOME
What are you? If you need to be digested you’re going to have to wait until I finish this worn out mitochondria.

RYAN
No, no, no, no, I’m not waiting to be digested! I’m just trying to get to the nucleus.

LYSOSOME
Good, because for a minute there, I thought you were a lipid that didn’t get synthesized by the smooth endoplasmic reticulum.

RYAN
Not quite. Besides, what are you?

LYSOSOME
I’m a lysosome.

RYAN
Lysosome?

LYSOSOME
I digest things.

RYAN
Like what, and how?

LYSOSOME
Well, inside of my membrane are digestive enzymes. I use these digestive enzymes to break down worn out organelles, debris, and large ingested particles from within the cell.

RYAN
You digest old organelles? Gross!

LYSOSOME
Oh contraire. Organelles are a delectable treat, sort of like caviar. Hey, if it wasn’t for me, the organelles; debris; and particles would just float around in the cell and take up space. The cell would be a mess.

RYAN
Well I can understand that, but it’s still kind of weird.

LYSOSOME
Yes, it can be. When the worn out organelles see me coming, they know it’s the end of the line for them and that can be unpleasant. Some of them don’t want to go without a fight.

RYAN
I can’t say that I blame them.

LYSOSOME
Well, sometimes it’s not a very good job, but some organelle’s got to do it. Just imagine if someone didn’t collect your garbage. Well, I’m nothing more than a garbage person; difference is, I eat the stuff. Yum, yum.

RYAN
So, all you do, is travel around the cell and digest worn out organelles; debris; and ingested particles. Hmm, you must get full eventually though.
LYSOSOME
Yeah, I do get very full. Sometimes
I feel like I’m going to burst. It’s okay, you can
all calm down, I’m not going
to burst it was a false alarm.

RYAN
Whoa, what happened?
Why’d they all freak out?

LYSOSOME
Because I said the magic word.

RYAN
What word?

LYSOSOME
Burst. See what I mean? It’s okay, please go
back to work. I’m fine, nothing’s going to
happen, really.
They get into such an uproar
whenever I say that.

RYAN
Why?

LYSOSOME
You remember when I said I have digestive
enzymes in my membrane?

RYAN
Yeah, but what does that have
to do with anything?

LYSOSOME
It has everything to do with it. You
see if my membrane were to break,
all of the digestive enzymes
would leak out into the cell.

RYAN
Hmm and that would be pretty bad, huh?

LYSOSOME
Yeah. Really bad. The digestive enzymes
could destroy the whole cell.

RYAN
Destroy the whole cell?

LYSOSOME
Yep, that’s right! Destroy it all and life
in the cell as we know it. Kaboom, the show’s
over, the end of..

RYAN
Okay I get it. So if you’re membrane were to
burst?

LYSOSOME
False alarm again folks, sorry.
He did it this time, not me.

RYAN
Sorry, let me rephrase that. If your membrane
were to break then all the digestive enzymes
would leak out and digest the whole cell.

LYSOSOME
Yes, exactly! Hey what is that over there? Is
that a worn out organelle
I see, trying to sneak past me?

He’s toast, that is, toast with caviar. Sorry,
Ryan I’ve got to go.

RYAN
Wait, wait, wait, wait!
What am I supposed to do?
Where am I supposed to go?

STEVEN
Relax Ryan. You’re on the right track, you’re
almost there.

JENNY
Yeah, just hang a right and keep going.

RYAN
I’m going. I wonder what kind of weirdo I’m
going to meet next?
SCENE TEN — QUICK QUIZ

QUICK QUIZ
Quick quiz. Hello there let’s take a quick break. Okay I’ll give the question and you give the answer. Here’t goes:

Sacs filled with digestive enzymes that travel around the cell and eliminate worn out organelles are called?
a) vesicles  
b) ribosomes  
 or c) lysosomes.

Take a second to think about it. You think you’ve got the answer? Well let’s see. Vesicles transport and store substances like proteins. Ribosomes synthesize protein. The answer is C, lysosomes contain digestive enzymes and eliminate worn out organelles, debris, and ingested particles. Did you get it right? Well great!

SCENE ELEVEN — MITOCHONDRIA

STEVEN  
Is that a red flashing sign, I see?

RYAN  
Oh, you see it too? I thought I was imagining things.

JENNY  
Let me see. What does it say Ryan?

RYAN  
Powerhouse. Oh no, not another organelle that thinks he’s all that.

JENNY  
Well, wait a second, I think I saw something in my book about that. Here it is, it says that the mitochondria is also called the powerhouse of the cell.

RYAN  
Hypochondria? What does this guy think he’s sick all the time or something?

JENNY  
No mito, mitochondria.

RYAN  
It kind of looks like a big sausage. It doesn’t feel like a sausage though. It actually feels pretty strong.

MITOCHONDRIA  
Well, that’s because I have two membranes.

RYAN  
Whoa, you startled me.

MITOCHONDRIA  
Oops, sorry.

RYAN  
You have two membranes?

MITOCHONDRIA  
Yes I have a double-layered membrane. The inner layer, as you can see, is arranged into complex folds called crista. These folds increase my surface area.

RYAN  
Are those folds used for something special?

MITOCHONDRIA  
Special? Yeah, actually they’re special. You see, inside of these folds are specialized enzymes that trap energies from sugars that are broken down.
RYAN
Sugars? Man, you’re my kind of organelle. I love candy bars, especially ones with the caramel and the peanuts.

MITOCHONDRIA
Hang on now. Before you get carried away, let me explain. You know, I don’t sit around all day eating candy bars.

RYAN
You said that you use sugars, right?

MITOCHONDRIA
Oh I do, but I use fatty acids also.

RYAN
Fatty acids? For what?

MITOCHONDRIA
I use sugar and fatty acids to generate energy for the cell. Because I generate energy they call me the powerhouse of the cell, just think of me as the mighty chondria. Get it?

RYAN
Got it.

MITOCHONDRIA
I’m beginning to feel a little bit strange, as if, I’m about to become another me.

RYAN
What? Another you? Jenny, Steven what’s going on?

STEVEN
I don’t know. Oh wait it’s splitting apart.

JENNY
Yeah, it is splitting apart. Let me see if I can find something in the book about this.

RYAN
Well hurry up. It may look really interesting from up there, but from down here, it’s not.
MITOCHONDRIA
Yeah, because we use our own DNA. Because we have our own DNA, we do not rely on the cell for division, we can divide ourself.

RYAN
Man I wish I could do that. I’d go out and hang out with friends; while I left the other me at home to do homework and maybe some chores.

NEW MITOCHONDRIA
Hey there, don’t get carried away. We really have serious work to do, energy to make, organelles to see and places to go.

RYAN
Okay, okay, you organelles can be so touchy sometimes. So let me see if I got all this. As the mitochondria, it’s your job to generate energy for the cell from sugars and fatty acids.

BOTH MITOCHONDRIA
Oh yes, very good.

RYAN
And, you can also self-replicate because you have your own DNA.

MITOCHONDRIA
Excellent. See, that wasn’t hard to remember.

RYAN
Yeah. I guess, I have learned a lot throughout my trip in the cell so far. Who’s that over there?

NEW MITOCHONDRIA
Oh, that organelle? That’s the centriole.

RYAN
Centriole?

MITOCHONDRIA
Yes, the centriole. We don’t really care for the centriole; she’s pretty close to the nucleus if you know what I mean.

NEW MITOCHONDRIA
Yeah, all she does, is hang out next to him all day long.

RYAN
She hangs out with nucleus? Oh man, I have to go see her. Maybe she can help me talk to the nucleus, so I can get out of here. I’ll see you guys later.

MITOCHONDRIA
See you Ryan. I guess we’ve got to split too, huh?

JENNY
It’s straight ahead, Ryan. You can’t miss it.
**Scene Twelve — Centrioles**

**Ryann**
Excuse me, Miss Centriole.
Are you there?

**Centriole**
Of course, I’m here.
Where am I going to go to?

**Ryann**
Yeah, I guess you guys don’t get out of the cell much.

**Centriole**
No, we don’t. Was that you over there talking to the mitochondrion?

**Ryann**
Yeah, that was me.

**Centriole**
Oh, I thought you were a lost lipid. Hey, now what were you doing over there talking to them? They’re always picking on me and my sister. They don’t like us because we hang out here with the nucleus.

**Ryann**
Hey, hey don’t cry. It’s okay, don’t let them bother you.

**Centriole**
I’m just tired of all picking on us. They think that we get special treatment because we’re located next to the nucleus.

**Ryann**
I can barely understand you. It’s okay, just calm down.

**Centriole**
They don’t understand that we’re here because this is where we do our job.

**Ryann**
What job is that?

**Centriole**
It’s our job to organize specific cytoskeleton, called microtubules, in the cell.

**Ryann**
You organize the cytoskeleton?
Hmm, that doesn’t sound too hard.

**Centriole**
Well, that isn’t all, that we do. We also play an important part in cell division.

**Ryann**
Cell division? Oh, don’t tell me, you’re going to split apart like the mitochondria did.

**Centriole**
No, I don’t split apart. You see, when the cell divides, it’s our job to migrate to the poles of the cell to assist in division.

**Ryann**
So you don’t split apart then, you just move to opposite ends of the cell right?

**Centriole**
You got it!

**Nucleus**
Organelles prepare for division.

**Centriole**
Oh Ryan, I’ve got to start migrating so I really must go. If you all need to see the nucleus, you better get on it like mud on a pig because he’s going to be very busy.
RYAN
Busy, why?

CENTROFILE
Ask the nucleus.

RYAN
Ask the nucleus what?

CENTROFILE
Ask him about the big “M” word.

RYAN
The big “M” word? Oh thanks. Great, that’s perfect. That’s all I need, more complications in my life right now. Okay guys, the nucleus is just up ahead. I’m kind of nervous.

JENNY
It will be okay, think positive.

STEVEN
Yeah, he can’t be that bad.

RYAN
We’ll see, soon enough.

SCENE THIRTEEN — QUICK QUIZ

QUICK QUIZ
Here’s Quick Quiz. Before we meet the nucleus let’s do one last quick question. Okay, the final question is...

Centrioles:
a) are located next to the nucleus in the cell, b) organize cytoskeleton called microtubules or c) migrate to opposite ends of the cell during division.

Take a second to think about it. You think you got an answer? In this case, all 3 answers are correct. How’d you guys do? Excellent, well that’s all for me. So, now let’s go back to see how Ryan’s going to get out of this cell.

SCENE FOURTEEN — NUCLEUS

RYAN
This, must be it.

NUCLEUS
Who goes there?

RYAN
It’s me. It’s Ryan. I just want to get out of here, if it’s no bother to you.

NUCLEUS
You don’t leave here until I say so.

RYAN
But sir, I really couldn’t.

NUCLEUS
Come a bit closer; let me have a good look at you. Are you a lipid?

RYAN
I am not a lipid.
NUCLEUS
Hey, I know who you are. You’re the one that’s been wandering around this cell, getting all the organelles in an uproar. Before long, the organelles will be rebelling. Just what do you think you are, getting my organelles so worked up like that?

RYAN
Uh, no one, sir. As I said, I’m just trying to get out of here. Hey, how’d you know I was talking to all the other organelles?

NUCLEUS
Well, you have a lot to learn about me. I know everything that goes on in this cell. I’m the boss, that’s why they call me the control center of the cell.

RYAN
Control center? I heard you were the control freak.

NUCLEUS
Control freak? Which organelle said that? If I find out, I’ll send a lysosome over to digest them. I am not a control freak.

RYAN
Easy there, I was just kidding. None of the other organelles said that about you.

NUCLEUS
What did they say, then?

RYAN
Oh, they just told me what they do and they told me a few jokes.

NUCLEUS
Jokes? I hate jokes. Life in this cell is a serious matter you know. Ooh matter, matter, matter, get it? As in, what’s the matter.

RYAN
He’s nuts, too.

NUCLEUS
I heard that. Buddy, do you know who I am or not?

RYAN
You’re the nucleus; you’re the control center of the cell, what else is there to know.

NUCLEUS
Well, it’s much more complex than that. Not only do I have to direct the organelles in the cell. I’m also responsible for the activities that take place inside of my nucleolus.

RYAN
Nucleolus, what’s that?

NUCLEUS
Do you see that smaller structure on the side of me?

RYAN
Yeah. What is it?

NUCLEUS
That’s the nucleolus.

RYAN
Nucleolus? That produces ribosomes. Is that all you do?

NUCLEUS
I wish. I also have to control protein synthesis in the cytoplasm and keep track of the DNA inside of my membrane. Those DNA, little rascals, they’ve gotten swelled heads lately. They think they’re so special. They’re in the news all the time you know, all this hoopla about cloning and duplication. What’s the big deal, one sheep, two sheep, three sheep, baaa.
RYAN
It is a big deal. What if they clone people?

NUCLEUS
They better not. If I have more than one of you to deal with, I’ll go out of my nucleus head. Hey, here’s a clone joke. How come two of you would make a yummy sandwich?

RYAN
I don’t know.

NUCLEUS
Because two Ryan’s, would be a Rye on Rye, a rye bread sandwich.

RYAN
Very funny.

NUCLEUS
Anyway, what do you know about DNA?

RYAN
Uh, a little bit. It’s the stuff that carries genetic messages right?

NUCLEUS
Yes exactly. I see that you’ve learned a lot. The DNA, inside of my membrane, is organized along with proteins into a mass called chromatin.

RYAN
Chromatin? So, chromatin is a mass of DNA and protein.

NUCLEUS
Yes. However, when the cell divides, the chromatin condenses and forms thick structures that are called chromosomes. These chromosomes carry the genetic code to the new cells during division. Speaking of which, hold on a second, Ryan. Attention organelles, mitosis will begin in 1, I repeat, 1 minute.

RYAN
Mitosis, what’s that?

NUCLEUS
Mitosis. Cell division. The big M.

RYAN
Oh, one of the organelles told me to ask you about that.

NUCLEUS
Good. Mitosis is when body cells divide and replicate. In mitosis, there are many different phases.

RYAN
Different phases uh like what?

NUCLEUS
Let’s see, there’s prophase, metaphase, anaphase, and telophase. I’m so excited.

RYAN
Prophase, anaphase, telephone what?

NUCLEUS
Not telephone, telophase! 45 seconds, I repeat, 45 seconds.

RYAN
45 seconds till mitosis, cell division right?

NUCLEUS
40 seconds.

RYAN
What exactly happens when you split?

NUCLEUS
Well it’s a bit complex, but basically everything in the cell splits in two. Me, you.
RYAN
Me split?

NUCLEUS
Yes sounds exciting, huh?

RYAN
Exciting. Jenny, Steven, get me out of here now, I’m about to split.

NUCLEUS
20 seconds.

RYAN
Wait!

NUCLEUS
I’d love to Ryan, but mitosis waits for no one. I mean no cell. But hey, I’m really not such a bad guy. I’ve just got this reputation for being mean.

RYAN
You’re not mean. You’re kind and you’re generous and you’re caring and you’re sweet and and...

NUCLEUS
Gee really? No one’s told me that before. So I guess if you want to split not in two, then you can split, now.

RYAN
Are you serious, I can leave?

NUCLEUS
Yes, of course. What did you think? I was going to keep you here? Now if you were a lipid, maybe.

RYAN
Okay, okay, okay. Don’t get on this lipid thing. How do I get out of here?
SCENE FIFTEEN — THE RETURN TO CLASS

STEVEN
Mrs. Curry, the nurse is on her way.

MRS. CURRY
Thank you. Let’s just try to keep him calm.

STEVEN
Ryan, wake up.

JENNY
Come on Ryan, say something and stop trying to kick me.

RYAN
Jenny, Steven, you’re here. Thank you guys for your help. I wouldn’t have been able to get out of the cell if it wasn’t for you guys.

STEVEN
Out from where? What are you talking about?

RYAN
Jenny, you remember the organelle-eating lysosome and the centriole that was crying.

JENNY
Ryan, I don’t know what you’re talking about.

MRS. CURRY
Ryan, the nurse is here. She’ll take care of you.

NURSE
Well it appears as though you’ve hit your head pretty hard.

RYAN
But I was there, I promise I was. You guys believe me, right?

JENNY
Sure you were, in the cell, right? Where else would you have gone? Ryan, what’s that in your hand?

RYAN
You see, I was in the cell.

MRS. CURRY
Ryan, I’m so glad you’re okay. I’ll take that pass if you don’t mind, as far as I know we have only one hall pass around here.

RYAN
It was a cell pass, a cell pass.

NURSE
Good work out there, Ryan. Have fun with your science studies. By the way next time you visit us, be sure to bring two of you, for the mitosis adventure. See ya.