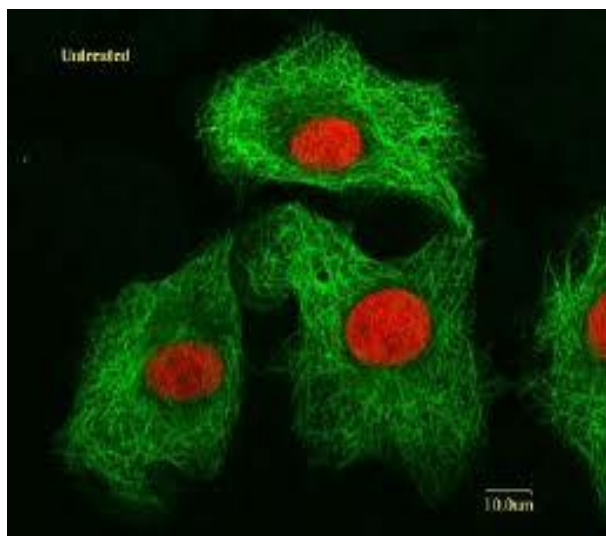




# Edible Cell



## KEY WORDS

Nucleus	Cell	DNA	Cytoplasm
Golgi Apparatus	Lysosome	Proteasome	Endoplasmic Reticulum
Cell Membrane	Cell Wall	Vacuole	Protein

## MATERIALS CHECK LIST

### Each student needs the following items:

- 1 Plastic spoon
- 1 Paper towel or napkin
- 1 Sugar cookies or other plain cookies enough for each child to have one (half the class gets round for animal cells, half the class gets square one for plant cells)
- 1 Piece of candy that is about 3/4 of an inch long (nucleus); the circus peanut candy works well

### Each group needs the following items to share:

- Vanilla or some other light colored frosting (cytoplasm)
- 3 different colors of gel tube icing (cell membrane, cell wall, and plant vacuoles) – rope licorice can be used for 1 color
- 2 boxes of Good and Plenty candies (mitochondria, Golgi apparatus)
- 2 boxes of Mike and Ike candies (endoplasmic reticulum, chloroplasts)
- 1 bag of m and m's for animal vacuoles

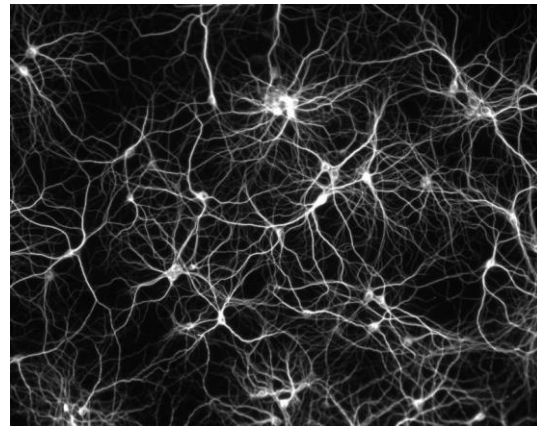


### Lesson Background & Concepts for Teachers

Cells are found throughout animals and plants. It is what makes us what we are. Without cells, we wouldn't be here. Today we are going to learn about the different parts of animal and plant cells.

#### I. Cell Theory

**\*Questions on student worksheet:** The human body has between \_\_\_\_\_ (50 and 75 trillion) cells. There are several different type of cells that have special functions. For example, neurons (brain cells) help us to think. Glia cells also found in the brain help to support the neurons. Cardiac cells make sure your heart functions and beats at the right rate. You can think of a cell as being like a city with all different type of components or organelles to make sure it functions correctly.



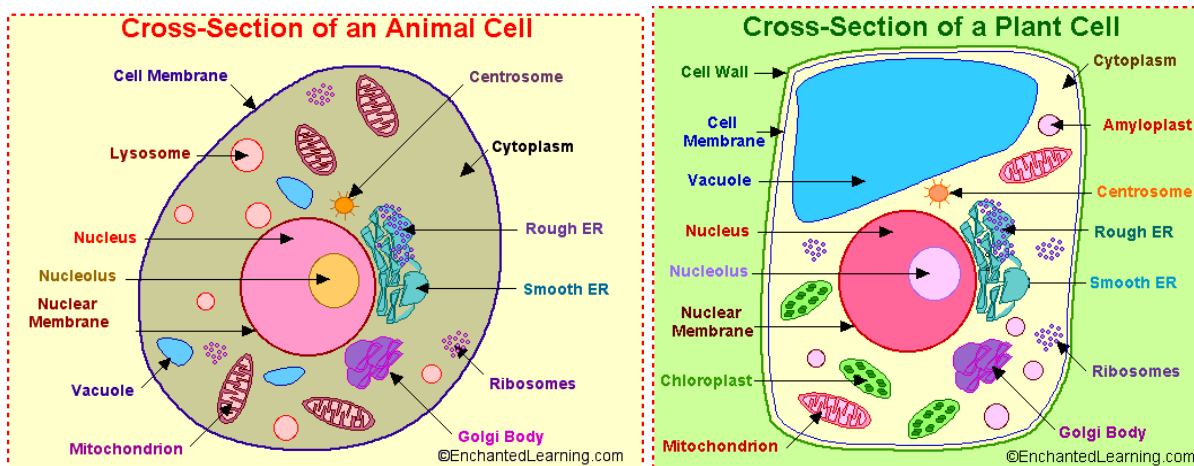
***Have the students name important parts of a city, write them on the whiteboard, and start drawing an example of a cell:***

- Nucleus -City hall or government
- Mitochondria and Chloroplasts - Electricity plant; energy transformation
- Proteins- People, animals, plants, all types of things that have a role to play
- Cytoplasm - A nice environment to keep the people healthy
- Cell Membrane (animal) or cell wall (plant)-Protection; wall around the city, the gateway
- Lysosome/Proteasome -Garbage pickup/Waste disposal
- Golgi Apparatus – post office or manufacturing plant (packages things and gets them ready)
- Endoplasmic Reticulum- hospital; things are made here; synthesize proteins, etc.
- DNA- life instruction book; laws
- Cytoskeleton – roadways, intracellular transport
- Vacuoles – storage containers

***Tell students that all these cells combine to make a tissue and all these tissues combine to make an organ. Organs then make up the body.***



If you think of cells like cities: Cities make up states, States make up our country the United States, and then countries combine to make up the world. When all the cities, states, and countries work together there is peace and balance.



## II. Animal and Plant Cells

1. Looking at the diagrams of animal and plant cells, what organelles do plant cells have that animal cells do not?
2. What could these different organelles do in a plant?
  - a. Amyloplasts - change starch into sugar for energy
  - b. Vacuole – contains water in plant cells
  - c. Cell Wall – made of cellulose, help keep plants shape.

## III. Making an Edible Cell

Adapted from Beacon Lesson Plan Library

### PROCEDURE

As you make the model of the cell, have students add each component in a step by step fashion right after you. As they add components, have them write down on their observation sheet each organelle, its corresponding candy and its function.



**1. Cell Shape:** Have students select a cookie. Tell students that the circular cookies represent animal cells while the square cookies represent the plant cells. Explain that the plant cell is more rigid due to the cell wall.

**2. Cytoplasm:** Spread some icing on the cookie and explain that the icing is the cytoplasm. Discuss what the cytoplasm is and what it does for the cell.

The cytoplasm consists of a jelly-like substance and is part of the cell between the cell membrane and nuclear envelope of the nucleus. It holds all the cellular organelles except the nucleus. Cell expansion, growth, metabolism including glycolysis, and replication are carried out in the cytoplasm.

**3. Cell wall and membrane:** Squeeze gel tube icing around the outside edges of the cookie. If this is a plant cell, the outside edge of the cookie represents the cell wall. Next have students add the cell membrane using another color of gel tube icing. The cell membrane would be on the inside edge of the cell wall of the plant cell. It would be on the outside edge of the cookie for an animal cell. Discuss what the cell wall and cell membrane are and the jobs they perform for the cell.

The cell wall of the plant is a thick, rigid membrane that surrounds a plant cell. It gives the plant cell most of its support and structure. It also bonds with other cell walls to form the structure of the plant. The cell wall is made up of cellulose that allows high pressure to build inside of the plant cell, without bursting. A plant cell has to be able to accept large amounts of liquid through osmosis, without being destroyed. An animal cell does not have this cell wall. If you start to fill the animal cell with too much distilled water or other fluid, it will eventually pop. Not having the cell wall, allows the animal cell to take on a variety of shapes although most are circular.

The cell membrane in animal cells physically separates the inside of the cell from the outside or extracellular environment. In both animal and plant cells it is selectively permeable to ions and organic molecules and controls what goes in and out of the cell. It is involved in cell adhesion, ion conductivity, and cell signaling.



**4. Nucleus:** The circus peanut candy is the nucleus. Place it somewhere in the "cytoplasm". Discuss what it is and the job it performs for the cell.

Both plant and animal cells have a nucleus. It contains most of the cell's genetic material organized as long linear DNA molecules that are joined (complexed) with proteins such as histones to form chromosomes. The nucleus regulates what genes are expressed and protects the DNA. It is the control center of the cell. It has its own membrane called the nuclear membrane that does not allow most molecules into it (impermeable). It does have special pores (nuclear pores) that allow some things to get out and in but it is carefully controlled.

**5. Mitochondria and Chloroplast:** Choose one color of the Good and Plenty's to be the mitochondria. Discuss what they are and the job they do in the cell. Students with plant cells can add in green Mike and Ike candies to represent the chloroplast where photosynthesis occurs.

Both plant and animal cells have mitochondria. These organelles also have their own membranes (an inner and outer one). They use oxygen and glucose to make adenosine triphosphate (ATP) for the energy the cell needs to function through a process called cellular respiration (includes Krebs' cycle). You can think of them as "cellular power plants". They are also involved in cell signaling, cell death, the cell cycle, and growth. The number of mitochondria in a cell varies greatly between tissues. Some will have single mitochondria while others need thousands. Neurons (brain cells) require a lot of energy to function so they have lots of mitochondria. Mitochondria are unique as it has its own DNA separate from the nucleus DNA.

Chloroplast is an organelle found only in the plant cells. It contains chlorophyll which is a molecule that uses light energy from the sun to turn water and carbon dioxide into glucose and oxygen (photosynthesis). The chlorophyll gives the plant its green color. These products (oxygen and glucose) can then be used by the mitochondria to make ATP.

Stress to students that chlorophyll containing plant cells go through both **photosynthesis** and **cellular respiration**, while animal cells only go through cellular respiration.



**6. Endoplasmic reticulum:** Place a non green Mike and Ike candy in the cytoplasm. This is the Endoplasmic Reticulum. Discuss what it is and the job it performs for the cell.

The endoplasmic reticulum, also known as the ER for short, functions as a packaging system. There are two types of ER, the rough and the smooth. The smooth ER creates and stores steroids and lipids. It also stores ions that the cell may need at later times. The rough ER plays a role in the synthesis and packaging of proteins. The ER works closely with the Golgi apparatus, ribosomes, RNA, mRNA, and tRNA. It creates a network of membranes found through the whole cell. The ER may also look different from cell to cell, depending on the cell's function. Both plants and animals have an ER.

**7. Golgi apparatus:** The other color of the Good and Plenty is the Golgi apparatus. The students can actually put this as a column of the candy to represent the series of cisternae. Discuss what it is and its job.

The Golgi apparatus (Golgi body) is found in both animal and plant cells. It consists of a series of five to eight cup-shaped, membrane-covered sacs called cisternae. It is pretty big and was one of the first organelles observed in 1897 by Camillo Golgi. It functions as the distribution and shipping department for the cells chemical products. Protein and lipids built in the ER bud off as tiny vesicles (bubbles) and move thru the cytoplasm to the Golgi apparatus. These vesicle fuse with the Golgi membranes and then once inside, the Golgi apparatus adds molecules or chops tiny pieces off the ends. When completed, the product is extruded from the GA in a vesicle and directed to its final destination inside or outside the cell. The exported products are secretions of proteins or glycoproteins that are part of the cell's function in the organism. Other products are returned to the endoplasmic reticulum or may undergo maturation to become lysosomes.



**8. Vacuoles:** For animal cells, place M and M's in the cytoplasm. This represents vacuoles. For the plant cell, take a gel icing of a different color and design a vacuole. It will be a single one that takes up a good amount of space in the cytoplasm. Discuss what it is and the job it performs for the cell.

The vacuole stores water and ions, and may be used for storage of toxins. It contains waste materials, water, and nutrients that can be used or secreted as necessary. Plant cells have a single vacuole that takes up most room in the cell. When a plant is well-watered, water collects in cell vacuoles producing rigidity in the plant. Without sufficient water, pressure in the vacuole is reduced and the plant wilts. Animal cells have small vacuoles and may have numerous ones. They never have the large single vacuole that takes up most of the space in plant cells.

**9.** Have two to three students show you their “cell” and have them explain the type of cell (plant or animal) and its different components in their own words.

**10.** Let students eat their cells. While they are eating review the cell parts, their jobs and how cells are organized to form tissues, organs, and systems.

### Troubleshooting Tips:

\* These words can be very new to students. Have them repeat them with you several times so they get comfortable with the words. Encourage them as they will have trouble trying to say them.

\* Depending on the class, you may not want to get into as much detail. Make sure the students understand the basic function of each organelle. Keep going back to the “cell is like a city” activity above.

\* Many students have missed the definition of an organelle. Make sure they understand that these are the organized parts of the cell... i.e. “organized” correlate to “organ” for them to remember

\* Students get confused over cellular respiration and photosynthesis. Stress the difference to them.

\* Clearly point out the similarities and differences between animal and plant cells.