What are Cells?

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About Cells

A cell is the basic unit of life. All living organisms are composed of one (unicellular) or more (multicellular) cells. In unicellular organisms, like many protists and bacteria, specialized parts of the cell perform all of the organism's vital functions. In multicellular organisms, like humans, specific types of cells are bound to each other to create tissue, which makes up the organs of the vital body systems that together keep the entire organism alive. Cells of one tissue type can be completely different than cells of a different tissue type. Different organisms with different evolutionary histories show adaptations on the cellular level as well. Even within the same genus of a specific organism, cells of the same tissue type may show uniqueness on the species or even the individual level.

While cells show an amazing diversity of form and function, cells have unifying characteristics as well. Though a horse's muscle cells are very different from the cells in an earthworm's intestine, many of their basic parts and systems are the same.

Every cell is essentially an assortment of functional parts suspended in a liquid medium and enclosed in a slightly leaky bag. The functional parts are called **organelles**. The fluid inside the membrane is called **cytoplasm** and is composed of water, salts, and organic molecules. The enclosing material is called the **cell membrane**, which is semi-permeable to allow small molecules and dissolved gases to pass through (large molecules require special help from membrane-bound transport proteins). Plant, fungi, and bacteria cells have an extra structural layer outside their cell membranes called a **cell wall**. The cell wall protects against mechanical stress and keeps the cell from becoming over-filled with water.

Within the cell are the organelles, some of which can be seen with the aid of a compound microscope. The **nucleus** is a large, often rounded organelle. Most animal and plant cells have a nucleus, which contains a copy of the DNA of the organism (a notable exception would be mammalian red blood cells, which lack a nucleus). Chemically coded on the DNA are the instructions to produce every protein an organism needs to make new cells, digest foods, produce necessary chemicals, move, and all other cell-level life functions. The exact sequences are copied inside the nucleus by molecules of messenger RNA (mRNA), which pass out of the nucleus to **ribosomes** for production. Ribosomes are able to read the sequence of ingredients on the mRNA and attach amino acids together to form the new protein. Depending on the protein it is creating the ribosome will either stay suspended in the cytoplasm or will attach to another organelle, the **endoplasmic reticulum**. The endoplasmic reticulum functions to sort and transport proteins, and may have a studded (rough) appearance from attached ribosomes.

MOST*

VOCABULARY

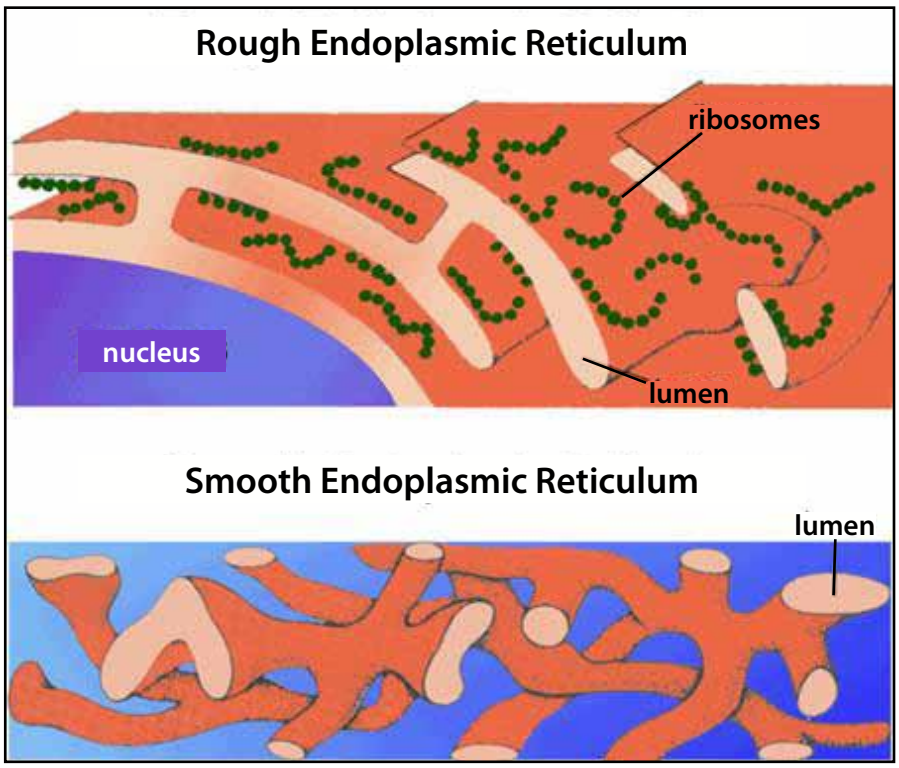
Animal cell
Cell membrane
Cell wall
Cytoplasm
Endoplasmic reticulum
Golgi bodies
Mitochondria
Nucleus
Organelles
Ribosomes
Vacuoles
Vesicles

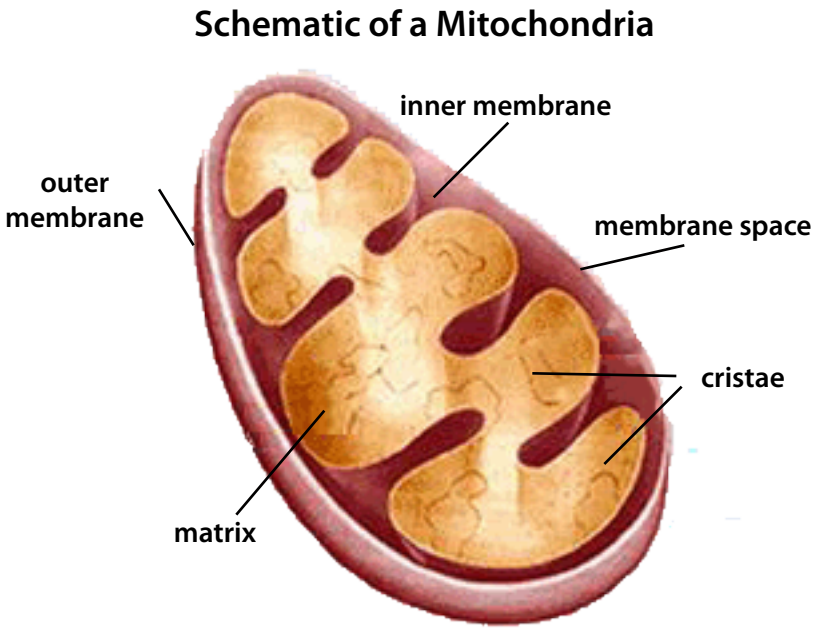
Inside This Packet

After proteins and other large molecules, such as lipids, are made, they are sent to the **golgi bodies**, where they are packaged into vesicles to be transported around the cell or outside of the cell (secretion). **Vesicles** and **vacuoles** are storage organelles; vesicles are found in animal cells and are smaller than vacuoles, a term more typically applied to plant cell components.

In order to function at all, cells need a constant supply of energy. Cellular energy, a molecule called Adenosine Tri-Phosphate (ATP), is primarily made in the inner membranes of the **mitochondria**. Mitochondria occur in plant and animal cells, and convert the chemical bond energy in sugar (glucose) into ATP. Plant cells contain an additional organelle, the **chloroplast**, which is the site of photosynthesis. Chloroplasts use the green pigment chlorophyll to convert sunlight, water, and carbon dioxide into the chemical energy stored in the sugar, glucose.

Together, these components keep a cell alive and functioning. The presence and proportions of these organelles inside cells will vary with the function of the cell, and while each cell contains a complete set of the DNA for an entire organism, cells that make up different body systems will express different parts of that DNA.





Activity: The Edible Cell

What Are We Working With?

Organelles are tiny structures within cells that perform specialized tasks and are often surrounded by their own membrane. These organelles perform the functions necessary to keep the cell alive. While there are many different types of cells making up an organism, most of these cells contain the same set of organelles:

The **cytoplasm** is a viscous liquid that surrounds the organelles and acts as a site for many important chemical reactions to take place.

The **cell membrane** is a semi-permeable film that holds the cell together, keeping the cytoplasm apart from the outside environment.

The **cell wall** is a rigid exterior of plant cells, and is made primarily of cellulose.

The **nucleus** holds all of the genetic information (DNA) of the cell in the form of protein recipes.

Ribosomes are abundant, small production organelles that make proteins using DNA.

The **endoplasmic reticulum**, a folded film sometimes studded with ribosomes, assists with the production and transport of proteins

Golgi bodies package newly synthesized proteins for distribution out of the cell (secretion).

Vacuoles are essentially membrane-enclosed compartments used for storage and regulation of internal pressure in plant cells.

Vesicles are the storage organ found in animal cells. These tend to be much smaller then plant vacuoles.

Mitochondria generate most of the cell's ATP, the energy currency of life.

Chloroplasts, only found in plant cells, are bright green because of the chlorophyll they use to generate sugar from light.

Activity: The Edible Cell

What to do:

1. For this activity, try not to touch uncovered surfaces or the floor in your science classroom. Make sure your hands are clean enough to handle food. If you need to, wash them now!

2. When your instructor tells you, collect the materials for your model. Make sure you collect only the materials for your cell type (animal or plant).

   Which cell type did you choose?_____

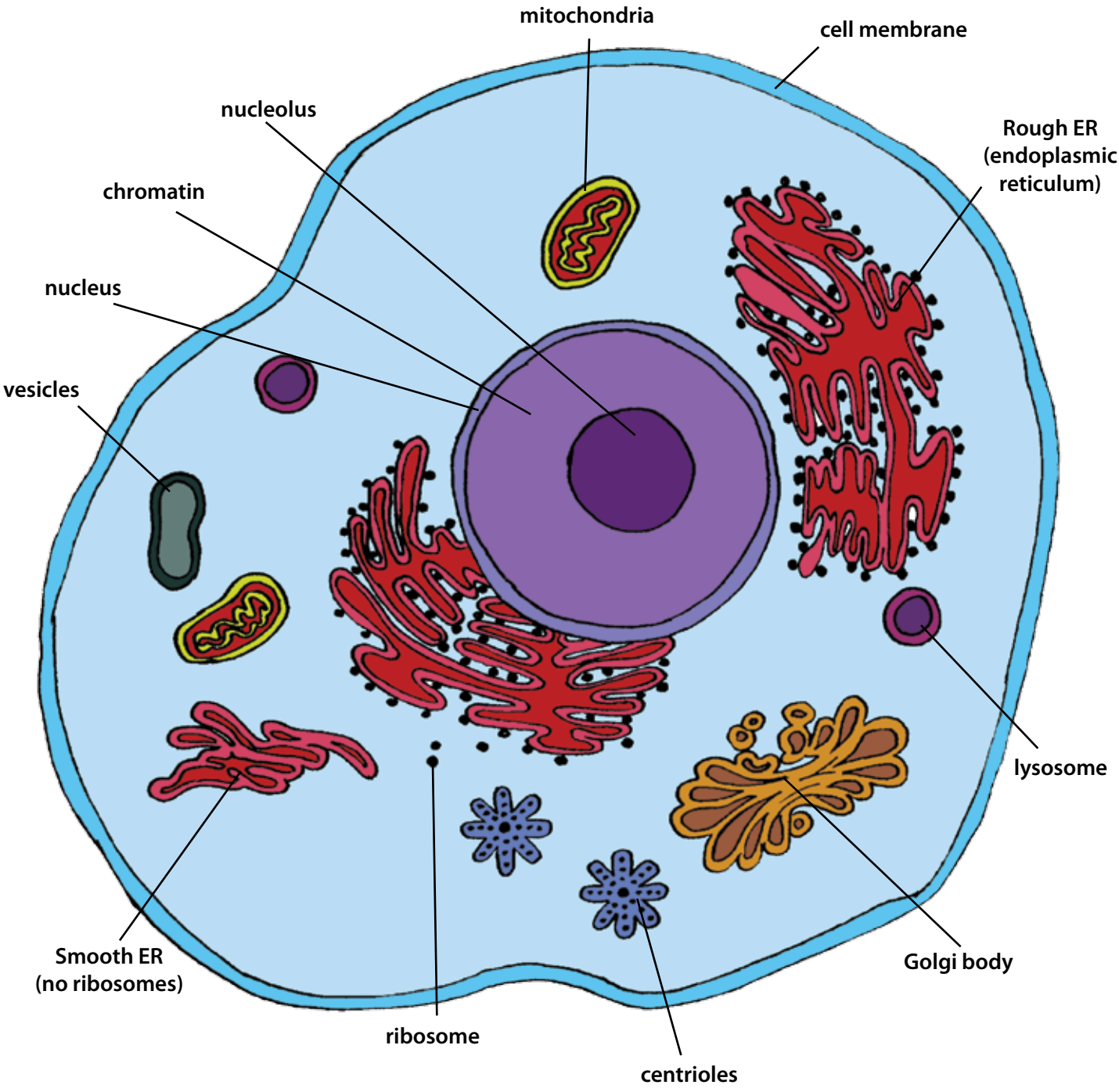
3. Your instructor will discuss the functions of each of the organelles in your model. When an organelle is discussed, add the candy representation of it to your model.

4. When your model is complete, wash your hands again.

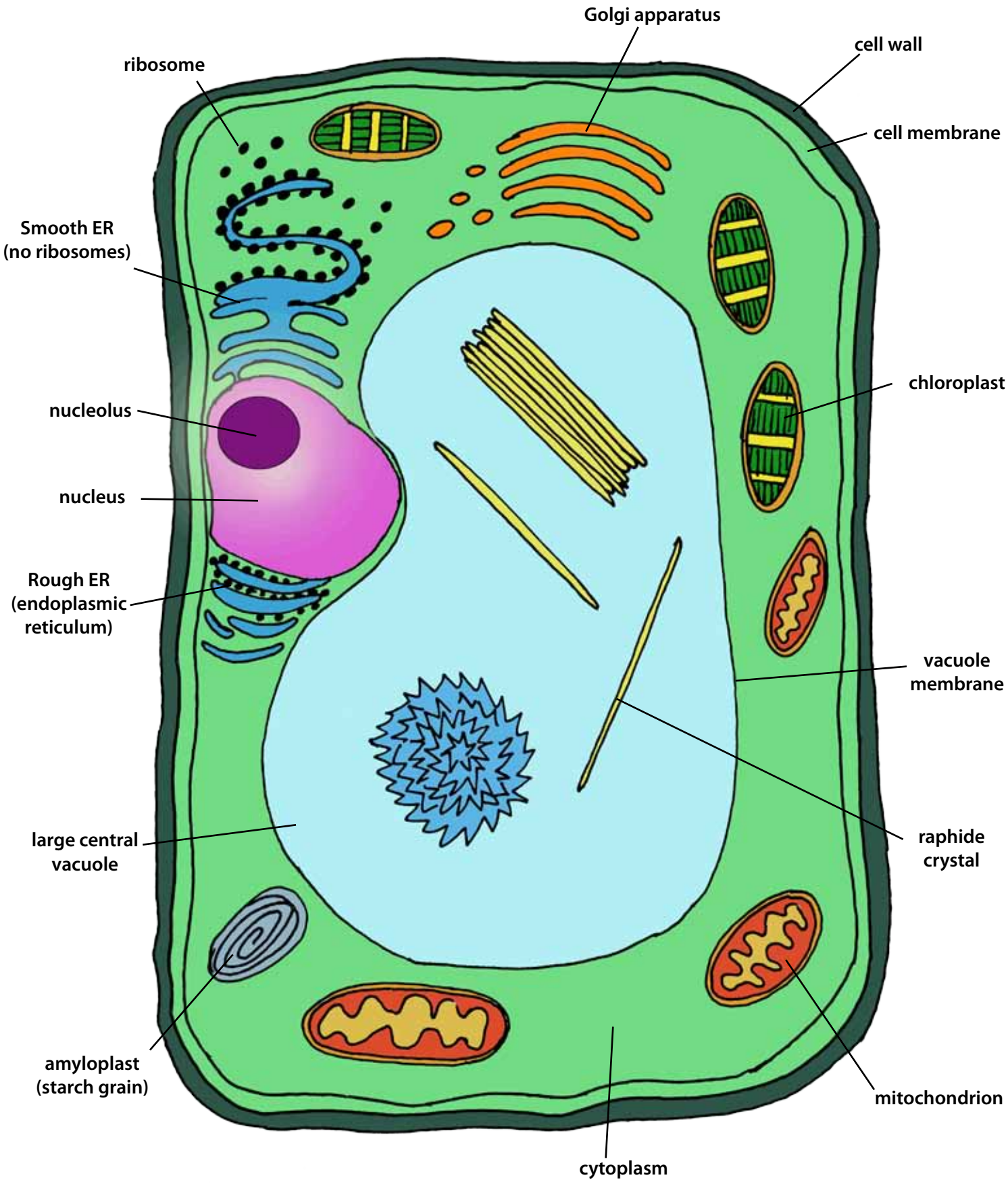
5. Draw a diagram of the cell you are building in the space at the bottom of this page. Make sure to draw all organelles you use in your model (including cytoplasm and cell membrane) and label them with their names and their representation in the model.
   example: Cell Wall
   (Plastic Cup)

6. When you have completed your activity, turn in your diagram and receive a spoon to eat your cell!

Animal Cell Diagram



Plant Cell Diagram



Cell Membrane

All Cells

Take 1

Cell Wall

Plant Cells Only

Take 1

Place cell membrane inside cell wall.

Cytoplasm - Animal

Animal Cells Only

Take 1 scoop

Place inside cell membrane.

Cytoplasm - Plant

Plant Cells Only

Take 1 scoop

Place inside cell membrane.

Nucleus

All Cells

Take 1

Endoplasmic Reticulum

All Cells

Take 1

Mitochondria

All Cells

Take 4

Ribosomes

All Cell

Take 1 spoonful

Golgi Body

All Cells

Take 4

Chloroplasts

Plant Cells Only

Take 5

Vacuoles

Plant Cells Only

Take 3

Vesicles

Animal Cells Only

Take 3

The Edible Cell Materials List

Students Should be Able to:

Create a model of a call.

Identify the parts to a cell.

State two differences between a plant and animal cell.

Materials Needed:

Pleated sandwich bags and clear plastic cups (cell membrane and wall)

2 packages unflavored gelatin (cytoplasm)

2 packages lime gelatin (plant cytoplasm)

2 packages lemon, strawberry, or peach gelatin (animal cytoplasm)

Large gumballs (nucleus)

Hot Tamales or bright colored jelly beans (mitochondria)

Fruit roll-ups, quartered (or smaller) (endoplasmic reticulum)

Colored sugar or cake sprinkles (ribosomes)

Green hard candies or jelly beans (chloroplasts)

Licorice slices (Golgi bodies)

Round hard candies (vesicles/vacuoles)

Hand sanitizer or antibacterial soap

Plastic spoons

Disposable plastic tablecloths

Bowls for candy

2 one-cup-sized measuring cups for scooping gelatin

Smallest size zip lock bags or small paper cups for holding candy

1 blank piece of paper and 1 photocopy of the activity sheet per student

Set of labels for candy distribution area

Information for the Teacher

Teacher Notes for Activity Prep:

Students can be surveyed the day before this activity to find out whether they will model a plant or animal cell. Alternatively half of the class can be randomly picked to model an animal cell or a plant cell.

Make a double batch of gelatin using the lime gelatin (two packages) and a package of plain gelatin. Make a second double batch of the lemon/strawberry/or pineapple gelatin (2 packages) and the second plain gelatin package. Allow the gelatin to set overnight. In the morning, whisk the gelatin to break it up into small pieces so it behaves less like a solid. Store the gelatin in the refrigerator until the activity begins.

Make sure the surfaces where students will work and where the materials are set up are cleaned and covered.

It might be helpful to set up two areas for students to get materials, the first with the gelatin, bags, and cups and a second with the rest of the ingredients in a long row. Place the bowls of candy and other materials on the corresponding printed labels.

Keep the spoons until the end of the activity period.

Activity Procedure:

I) Prior Discussion to Edible Cell:
What life functions of a cell must be performed to sustain life? (respiration, digestion, reproduction, excretion, protection, etc.) When possible relate these life functions to the cell as well as to the human body.

II) Look at the Cell Structure Activity sheet.
Make sure that the students know what each of the organelles is and what it's function is for the cell. Where possible relate this organelle to the human body organ that completes the similar function.

Activity Directions:

1. Have students wash their hands thoroughly.
2. Set up the supplies needed in an assembly-line style.
3. Follow instructions listed at each location
4. Have students collect organelles only for the type of cell they are assigned (animal or plant cell)
5. Have them return to their work station after collecting all materials.
6. Note as a class what type of candy denotes which organelle, what it's function is and then have the student place the organelle in their cell model
7. Once all organelles are identified and added to the cell, have the students draw a diagram of the cell and label the organelles and the candy that represents the organelle on their activity sheet.
8. Have the students turn in their finished worksheet
9. Once their paper has been returned, give them a spoon to enjoy their edible cell snack!

New York State Standards

Middle School

Standard 4
Key idea 1: 1.2a, 1.2c, 1.2e, .2f, 1.2g, 1.2h, 1.2i