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Catalog No. FB1612

Publication No. 10415

Make Your Own Cell Kit

Introduction

Cells are usually viewed using a microscope. We see them one plane at a time. It is easy to lose sight of the fact that cells are three-dimensional. Building a 3-D model of a cell can reinforce this concept.

Concepts

- Cell structure/function
- Cell organelles

Background

In the 17th century Robert Hooke used a microscope to examine shreds of cork. He marveled when he saw an internal structure within the cork pieces—little box-like units that appeared to be empty. At the thinnest areas of the cork he could see right through the box-like units. He called these structures cells.

Since Robert Hooke, many people have marveled at the "little boxes" when looking through a microscope. The size, shape, and variety of living cells is mind-boggling. Cells, though very small, are very complex. They have mechanisms for obtaining and using energy, reproducing, transporting materials, as well as a myriad of cellular processes.

Living cells can be separated into two groups—prokaryotes and eukaryotes—based upon their distinctive cellular structure. Prokaryotes—the bacteria—represent the simplest of living cells. Eukaryotic cells are larger, more complex, and more specialized than prokaryotic cells. Plants, animals, and other multicellular organisms are composed of eukaryotic cells. A eukaryotic cell will be modeled in this activity.

A key feature of eukaryotic cells is the structural division of the cell into smaller functional parts called *organelles*. Any part of a cell that has its own structure and function can be considered to be an organelle. Consult a cell model and/or your biology text and learn the general structural appearance of each of the following organelles as well as more details about their functions.

1. *Plasma Membrane*—Outer membrane of the cell; controls passage of materials into and out of the cell.
2. *Cell Wall*—Found in plant cells, outside the plasma membrane; provides rigidity for plants.
3. *Cytosol*—Semi-fluid materials surrounding the organelles.
4. *Cytoplasm*—All materials outside the nucleus but inside the plasma membrane, including the cytosol and the organelles.
5. *Nucleus*—Contains most of the cell's genetic information in DNA—the control center of the cell. Surrounded by nuclear membrane.
6. *Nucleoli*—One or more found in the nucleus, the site of synthesis and assembly of rRNA and tRNA.
7. *Lysosome*—The site of intracellular digestion.
8. *Centrioles*—Tubular structures that form organizing centers for mitotic spindle materials during mitosis.
9. *Mitochondria*—Site of cellular respiration in the cell; there may be several hundred in a cell.
10. *Endoplasmic Reticulum*—Tubular membrane system that compartmentalizes the cytosol and contains the ribosomes; the site of protein synthesis.
11. *Golgi Apparatus*—Flattened sac-like organelle that assists in delivery of materials to other organelles.
12. *Chloroplast*—Contains the light-absorbing pigments in photosynthetic cells, the site of photosynthesis.
13. *Vacuole*—Variable in size, may be large in plant cells; stores nutrients and waste products.

Materials

Flinn Cellgel,™ 250 mL	Heat-resistant gloves
Cell-making mold	Hot plate
Cell organelle model materials	Pot (beaker)
Dissecting needle/forceps	Zipper-lock bag

Safety Precautions

The melted Cellgel™ material is extremely hot and can cause severe burns. Be extremely careful when pouring the gel and while it is cooling. Wash hands before leaving the laboratory. Wear chemical splash goggles, heat-resistant gloves, and a chemical-resistant apron.

Procedure

1. Be sure cell structures and their functions have been studied and reviewed before building a model. Your teacher will review these topics prior to the model building.
2. As a cell-building team, collect possible materials to represent the organelles in your cell model. Your cell will only be about 250 mL in volume, so small items will be needed to represent the organelles. Examine all of the materials and discuss the relative merits of each item for representing a specific organelle. The Cellgel™ will be extremely hot when poured into the cell mold, so items that melt at low temperatures cannot be used. Food items will probably not work. Do not use items that contain rubber.
3. When the model is made, the Cellgel™ representing the cytosol of the cell, must be melted. Your instructor will provide directions on how to melt and handle your gel. *Be very careful at this stage of the activity since the melted gel can cause severe burns.*
4. Pour the melted gel into your cell mold and let it cool. As it cools, it will become thick and less liquid-like. Place your nucleus and other organelles into the gel, where appropriate, using forceps. If an organelle-object floats to the top instead of staying lower in the cell, wait until the gel cools to a thick consistency, and then "sink" the object by pushing it down into the gel with a dissecting needle. Items can be maneuvered in the gel until it sets completely. Avoid moving items quickly and creating air bubbles in the gel.
5. Allow the entire gel to cool until the gel hardens completely and then let it sit undisturbed overnight.
6. Take the cell out of the mold. How does the cell look? Draw a picture of your cell model and label each part of the cell.
7. Store your cell model in the mold or in a plastic zipper-lock bag as directed by your instructor.

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Teacher's Notes
Make Your Own Cell Kit

Materials Included in Kit

Flinn Cellgel™, 250 mL in cell-making mold, 8

Zipper-lock bags, 8

Additional Materials Needed (for each lab group)

Hot plate or microwave

Pot (beakers)

Dissecting needles/forceps

Cell organelle materials

Heat-resistant gloves

Safety Precautions

The melted gel in this activity is extremely hot and can cause severe burns. Use extreme caution during this part of the activity. Wear chemical splash goggles, heat-resistant gloves, and a chemical-resistant apron. The Cellgell™ contains an oil base and students should wash their hands before leaving the laboratory. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Pre-Lab Preparation

1. Try melting and pouring the gel prior to student use to determine the best way to melt and handle eight containers of gel in your laboratory. Pots with handles can be very helpful when preparing the melted gel. The gel can be melted in a microwave, but it requires full power and a relatively long time setting. Melting the gel in a pot on top of a stove can speed up the process. The Flinn Cellgel™ can simply be lifted from its plastic container and placed into a pot or beaker for melting. Heat the Flinn Cellgel™ just long enough for it to totally liquify. Then remove it from the heat source. It will remain hot enough to pour for some time. If it inadvertently hardens, simply heat again.
2. Review cell structure and functions. Show students the volume of gel material available for their model and brainstorm possible organelle materials. Have students bring items from home well in advance of the actual model making. Discuss the pros and cons of various types of materials.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Flinn Cellgel™ can be reused and remelted many times and cell models can be kept in sealed zipper-lock bags for long periods of time. The materials can be disposed of according to Flinn Suggested Disposal Method #26a.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Systems, order, and organization
Evidence, models, and explanation

Content Standards: Grades 5–8
Content Standard C: Life Science, structure and function in living systems.
Content Standard G: History and Nature of Science

Content Standards: Grades 9–12
Content Standard C: Life Science, the cell, matter, energy, and organization in living systems.
Content Standard G: History and Nature of Science

Teacher's Notes *continued*

Tips

- Enough materials are provided in this kit for 32 students working in groups of four (eight teams). Once organelle materials have been collected, the activity can be completed in one 50-minute class period. If smaller teams are desired, additional Flinn Cellgel™ material (FB1613) can be purchased separately.
- The shape of the final cell model depends on the shape of the mold. Any container that can withstand boiling water may be used. The container provided with the gel material makes an excellent mold. A mold with slanted sides works well for removing the model from the mold.
- Organelle materials can include any materials that do not melt easily. String, thread, marbles, seeds, sand, rocks, straws, baggies, toothpicks, buttons, beads, etc.—all can become good representations of organelles.
- Items can be moved within the cell model while the gel is still warm and fluid. Use a dissecting needle or forceps to move items around. Do not use hands as the gel will be too hot and can cause burns. Move slowly to avoid creating air bubbles, although air bubbles can also represent items in a cell!
- It is possible to remelt the gel materials many times. This must be done very carefully depending upon what container it is in or what is in the gel (avoid metal in a microwave, etc.)
- If any gel is spilled on a hard surface, simply let it cool. Do not attempt to wipe it up. When cooled, the gel should peel off most hard surfaces.
- Flinn Cellgel™ is oily to the touch and will leave an oily residue on soft surfaces. Store the cell models in non-porous containers.

Materials for *Make Your Own Cell Kit* are available from Flinn Scientific, Inc.

Catalog No.	Description
FB1612	Make Your Own Cell Kit
FB1613	Flinn Cellgel,™ 250 mL

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.