Teacher Guide

Mystery Cell Model

Abstract

In this paper modeling activity, students figure out what kind of differentiated cell they've been assigned based on the parts that it has. They learn about the functions of cell structures and organelles—including some that help cells do specialized jobs. There are 5 different cell models to distribute to the class.

Learning Objectives

• Within cells, special structures carry out particular functions.

• All cells have many of the same basic structures, yet they also have differences that allow the cells to perform specialized roles.

Estimated time

• Prep time: 30 min (one time)

• Class time: 45 min

Materials

• Per student or pair of students:

   • One cell model (*Tips: Printing in color is best. Laminate the models for reuse.*)

   • Structure-Function Organizer

• Optional: One of the following

   • Computers with internet access, headphones

   • ***Most cells have these parts*** hand-out

   • Generic cell model with organelles labeled *(not provided)*

Instructions

1. Distribute cell models and Structure-Function worksheets. Be sure to distribute models of different cell types strategically across the class.

2. Have students complete Part 1 of their organizers, which focuses on structures and functions that are common to all (or at least most) the cell models. To guide students, do one of the following:

   a. Send students to the online interactive Inside a Cell [learn.genetics.utah.edu/content/cells/insideacell/] and have them explore the animal cell. As they learn about the cell structures there, they can identify the same structures in their cell models and fill in the table.

   b. Project or distribute print-outs of ***most cells have these parts***. The descriptions there include contextual clues designed to help students identify the parts in their models. Students with different models can compare to uncover more clues about the parts they share.

   c. Project or distribute copies of a generic cell model (not provided) with organelles labeled. Have students identify the same structures in their models.

Variations: If students need more guidance, you could do this step as a whole class. If students have already learned about organelles, they could first try this step without supporting materials.

Important Note: The cell parts are numbered differently on each cell model. Make sure students fill in the right information for their specific model!

3. Have students complete Parts 2 and 3, which focus on the structures and functions that are unique to their cell type (these are listed on the models themselves) and the structures that help cells carry out Essential Functions. They'll follow the instructions to guess the cell type of their Mystery Model.

Discuss

Have students with different cell types work in small groups to discuss the following:

- Compared to a different cell model, how are the parts in your cell the same? How are they different?

- How do different cells' specialized parts help them do their jobs?

Other Implementation Ideas

- **Discuss models**: Show students images and/or videos of real cells (one good source is cellimagelibrary.org). Have them compare/contrast the real cells with their cell models, focusing on the strengths and weaknesses of models.

   Example strengths: The models highlight features that aren't very visible in real cells. The models use color to help show different parts.

   Example weaknesses: Real cells have moving parts; the models are static. Real cells are 3-dimensional; the models show 2-dimensional cross-sections. The models leave a lot out.

- **Cell Model Fashion Show:** Have a few students "model" their models. Students in the audience can interview them by asking name, job, special features, favorite pastimes, etc. Or call out particular cell structures and students with those can walk the "catwalk" holding their cell models.

Hidden Features

The cell models include several features that you may choose to discuss with your students.

- **Color-coded molecules**: The models share a color scheme with other visualizations on Learn.Genetics. DNA is blue, lipids (including the phospholipids that make up cell membranes) are yellow, and functioning proteins are shades of green.

- **Protein production in progress**: One of the most important things a cell does is make proteins. The models show this process beginning in the ER, closest to the nucleus. Here, ribosomes begin building proteins out of amino blocks building blocks, loosely represented in pale purple. As they move through the Golgi and mature into functional proteins, their color shifts to green.

- Like real cells, the cell models are packed full of molecules and structures. Cells are busy places with very little empty space.

Key (specialized structures in **bold**)

Model A: Ciliated Epithelial Cell

1. Cell membrane
2. Nucleus
3. Ribosomes
4. Endoplasmic reticulum
5. Golgi apparatus
6. Mitochondria
7. Cytoskeleton
8. Lysosome
9. Vesicles
10. **Cilia**
11. **Cell junctions**
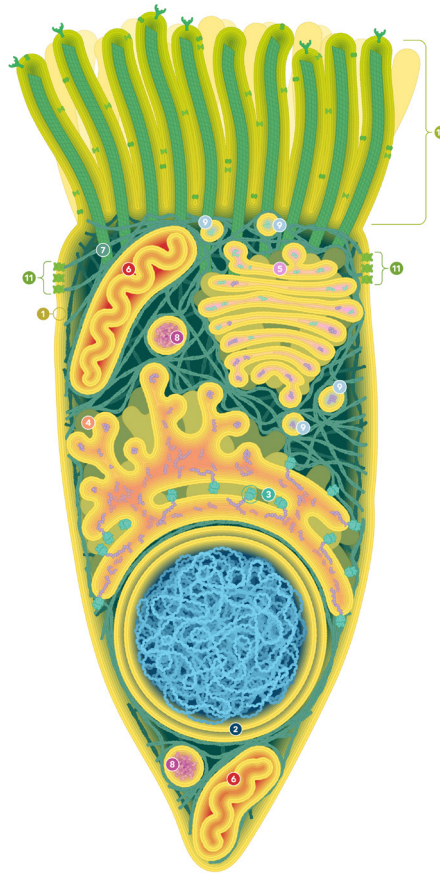
Model B: Intestinal Absorptive Cell

1. Endoplasmic reticulum
2. Ribosome
3. Golgi
4. Cytoskeleton
5. Mitochondria
6. Lysosomes
7. Nucleus
8. Cell membrane
9. Vesicles
10. **Cell junctions**
11. **Microvilli**
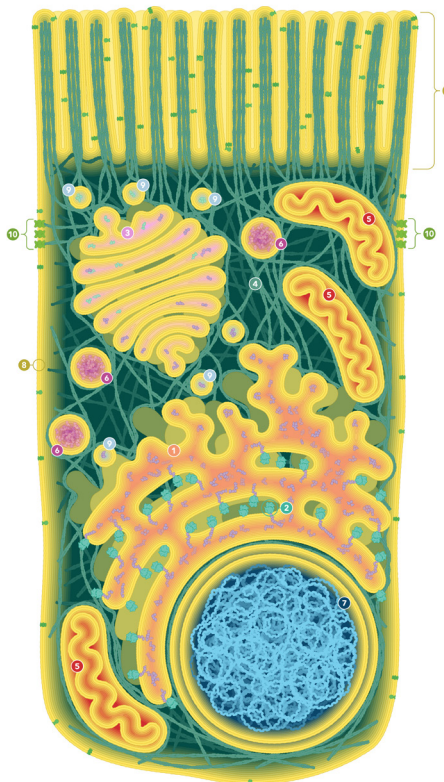
Model C: Spongy Parenchyma Cell

1. Ribosomes

2. Cytoskeleton

3. Cell membrane

4. Golgi apparatus

5. Endoplasmic reticulum

6. Nucleus

7. Mitochondria

8. *(There is no part #8)*

9. Vesicles

10. **Cell wall**

11. **Vacuole**

12. **Chloroplasts**
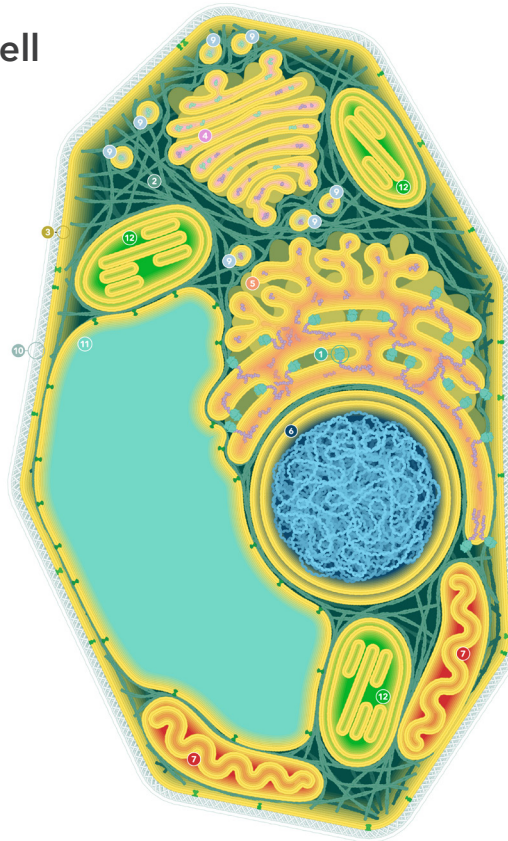
Model D: Motor Neuron

1. Nucleus

2. Mitochondria

3. Cytoskeleton

4. Cell membrane

5. Lysosome

6. Ribosomes

7. Golgi apparatus

8. Endoplasmic reticulum

9. Vesicles

10. **Axon**

11. **Dendrites**
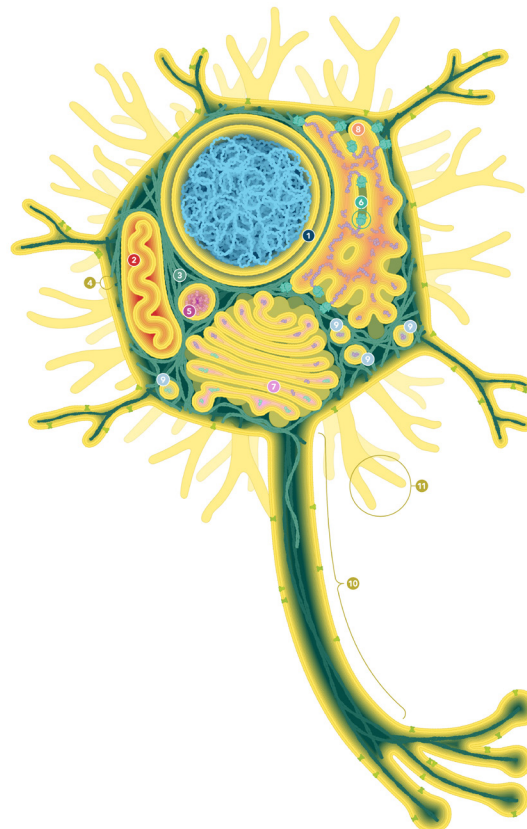
Model E: Root Hair Cell

1. Cytoskeleton

2. Cell membrane

3. Nucleus

4. Mitochondria

5. Ribosome

6. Golgi

7. Endoplasmic reticulum

8. *(There is no part #8)*

9. Vesicles

10. Root hair

11. Cell wall

12. Vacuole
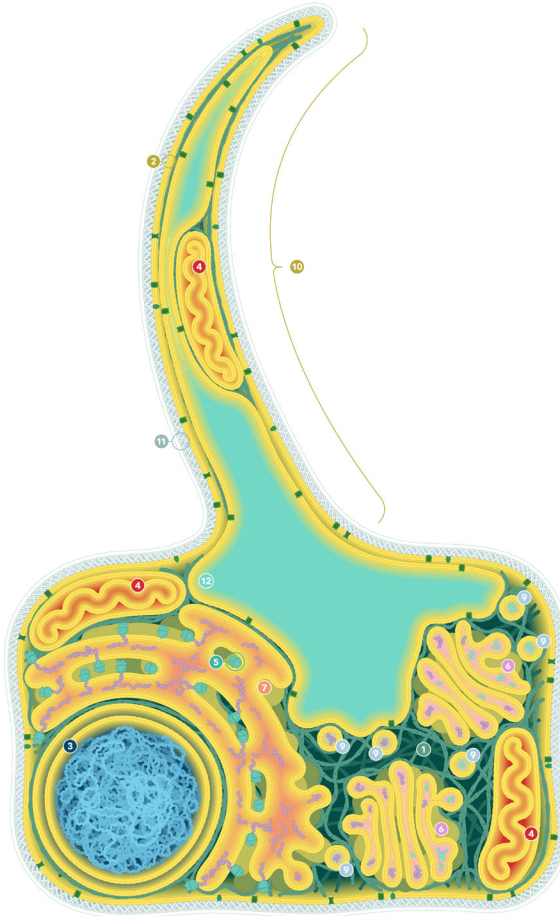
Part 3: Essential Life Functions

Stores & Reads Instructions

- Nucleus stores genetic material (DNA) and makes copies (messages)

- Ribosomes read copies to make proteins

- ER, vesicles & Golgi help with building proteins and moving them where they need to go *(students may or may not be able to connect this piece)*

Gets & Uses Energy

- Mitochondria break down food to get energy

- Proteins in the cell membrane take food molecules into the cell *(Only Model B shows this)*

- Some plant cells have chloroplasts, which use energy from sunlight to build sugars *(Model C)*

- Lysosomes recycle material inside the cell *(Models A, B & D; though you can also think of this as waste removal)*

Keeps Itself Within a Container

- Cell membrane wraps all the way around the outside of the cell.