

Lab 4. Cell Structure: What Type of Cell Is on the Unknown Slides?

Introduction

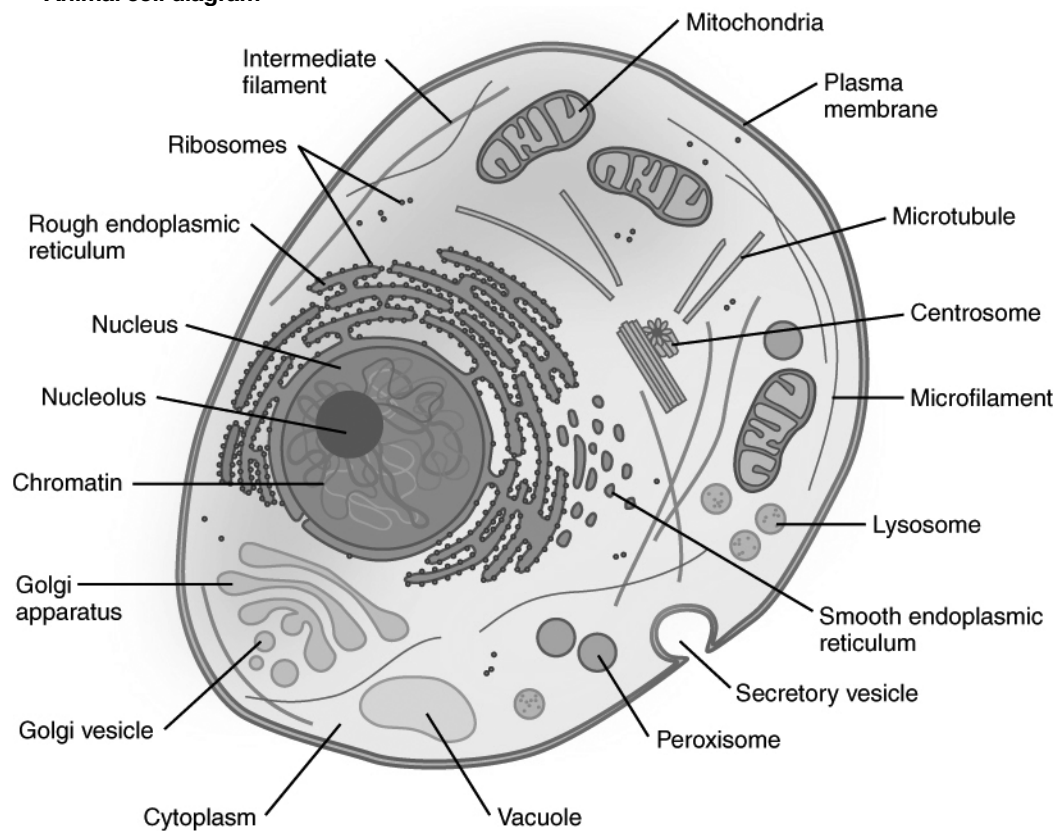
Scientists who study living organisms deal with a lot of different types of life forms, from trees to tadpoles and bacteria to birds. As they investigate how life happens on the planet, they rely on several scientific theories that have developed over time. These theories combine different types of evidence to support a big idea that explains some aspect of life or the natural world. One of the major theories that scientists rely on when studying living things is the *cell theory*. This theory includes three major ideas that have been supported over the years as new life forms continue to be discovered:

1. All living organisms are made up of one or more cells.
2. The cell is the basic unit of life.
3. All new cells come from cells that are already alive.

Just as there are many types of organisms, including plants and animals, there are also many types of cells. However, there are several features found in all cells. The most common features are the presence of DNA and the presence of a *cell membrane*. DNA is a molecule that contains information that cells need to live. The cell membrane is the sheet of molecules that separates the inside of the cell from the rest of the environment. You can think of the cell membrane as a cell's "skin." More complex cells, like those found in animals and plants, have other structures in common, known as *organelles*. Organelles are special structures found inside cells that serve different functions. Those functions include helping the cell get energy, making the materials it needs to continue growing, and storing the information (like DNA) to make new cells. The organelles present in a cell will also influence what activities that cell can perform.

FIGURE L4.1

Animal cell diagram



Plant and animal cells have many organelles in common, including the nucleus, the endoplasmic reticulum, Golgi bodies, ribosomes, the cell membrane, and mitochondria (Figure L4.1). Some organelles found in plant cells, however, are not found in animal cells, and vice versa. For example, animal cells have

centrioles (which help organize cell division in animal cells), but plant cells do not. Plant cells have an extra layer surrounding them called a cell wall. Cell walls are stiff membranes that sit outside of the cell membrane and help keep plant cells in a specific shape. The differences in types of organelles can be used to distinguish between cells that come from a plant and cells that come from an animal. However, not all organelles can be seen using microscopes we use in school.

Your Task

Using what you learn from observations of several slides of cells using a microscope, with some slides labeled as plant cells and others as animal cells, determine what types of cells are on the slides labeled as “unknown.”

The guiding question of this investigation is, **What type of cell is on the unknown slides?**

Materials

You may use any of the following materials during your investigation:

- Known slide A (plant cells)
- Known slide B (plant cells)
- Known slide C (animal cells)
- Known slide D (animal cells)
- Unknown slide E
- Unknown slide F
- Unknown slide G
- Unknown slide H
- Compound light microscope
- Slide wipes
- Sanitized indirectly vented chemical-splash goggles
- Chemical-resistant apron
- Gloves

Safety Precautions

Follow all normal lab safety rules. In addition, take the following safety precautions:

1. Put on sanitized indirectly vented chemical-splash goggles and laboratory apron and gloves before starting the lab activity.
2. Handle all glassware with care to avoid breakage. Sharp edges can cut skin!
3. Follow all safety rules that apply when working with electrical equipment, and use only GFCI-protected electrical receptacles.
4. Wash hands with soap and water after completing the lab activity.

Investigation Proposal Required? Yes No

Getting Started

To determine the difference between a plant cell and animal cell, you and your group will need to explore what cell structures you can see with a compound light microscope. To answer the guiding question, you must first determine what type of data you need to collect, how you will collect it, and how you will analyze it. To determine *what type of data you need to collect*, think about the following questions:

- What type of measurements or observations will you need to make during your investigation?
- How will you quantify any differences or similarities you observe in the different cells?

To determine *how you will collect your data*, think about the following questions:

- How will you make sure that your data are of high quality (i.e., how will you reduce error)?
- How will you keep track of the data you collect and how will you organize it?

To determine *how you will analyze your data*, think about the following question:

- How will you define the different categories of cells (e.g., what makes a plant cell a plant cell, what makes an animal cell an animal cell)?

Connections to Crosscutting Concepts, the Nature of Science, and the Nature of Scientific Inquiry

As you work through your investigation, be sure to think about

- how scientists look for patterns across different living things,
- how the structure of an organelle or cell is related to the function it performs,
- the difference between observations and inferences, and

- how science knowledge changes over time as new evidence is discovered and technology is created.

Initial Argument

Once your group has finished collecting and analyzing your data, you will need to develop an initial argument. Your argument must include a claim, evidence to support your claim, and a justification of the evidence. The claim is your group's answer to the guiding question. The evidence is an analysis and interpretation of your data. Finally, the justification of the evidence is why your group thinks the evidence matters. The justification of the evidence is important because scientists can use different kinds of evidence to support their claims. Your group will create your initial argument on a whiteboard. Your whiteboard should include all the information shown in Figure L4.2.

FIGURE L4.2

Argument presentation on a whiteboard

The Guiding Question:	
Our Claim:	
Our Evidence:	Our Justification of the Evidence:

Argumentation Session

The argumentation session allows all of the groups to share their arguments. One member of each group will stay at the lab station to share that group's argument, while the other members of the group go to the other lab stations one at a time to listen to and critique the arguments developed by their classmates. This is similar to how scientists present their arguments to other scientists at conferences. If you are responsible for critiquing your classmates' arguments, your goal is to look for mistakes so these mistakes can be fixed and they can make their argument better. The argumentation session is also a good time to think about ways you can make your initial argument better. Scientists must share and critique arguments like this to develop new ideas.

- What did your group do to collect the data? Why do you think that way is the best way to do it?
- What did your group do to analyze the data? Why did your group decide to analyze it that way?
- What other ways of analyzing and interpreting the data did your group talk about?
- What did your group do to make sure that these calculations are correct?
- Why did your group decide to present your evidence in that way?
- What other claims did your group discuss before you decided on that one? Why did your group abandon those other ideas?
- How sure are you that your group's claim is accurate? What could you do to be more certain?

Once the argumentation session is complete, you will have a chance to meet with your group and revise your initial argument. Your group might need to gather more data or design a way to test one or more alternative claims as part of this process. Remember, your goal at this stage of the investigation is to develop the most valid or acceptable answer to the research question!

Report

Once you have completed your research, you will need to prepare an investigation report that consists of three sections that provide answers to the following questions:

1. What question were you trying to answer and why?
2. What did you do during your investigation and why did you conduct your investigation in this way?
3. What is your argument?

Your report should answer these questions in two pages or less. The report must be typed and any diagrams, figures, or tables should be embedded into the document. Be sure to write in a persuasive style; you are trying to convince others that your claim is acceptable or valid!