

1. Grade 07: Structure, Function and Information Processing

Content Area: **Science**
Course(s):
Time Period: **Generic Time Period**
Length: **45 days**
Status: **Published**

Stage 1: Desired Results

Unit Overview/ Rationale

All living things are composed of cells, whose details are usually visible through a microscope. Within the cells many basic functions of organisms are carried out. Students demonstrate age appropriate abilities to plan and carry out investigations to develop *evidence* that living organisms are made of cells. Students gather information to support explanations of the relationship between structure and function in cells. They are able to communicate an understanding of cell theory and understand that all organisms are made of cells. Students understand that special structures are responsible for particular functions in organisms. They then are able to use their understanding of cell theory to develop and use physical and conceptual models of cells. The crosscutting concepts of *scale, proportion, and quantity* and *structure and function* provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in *planning and carrying out investigations, analyzing and interpreting data, and developing and using models*. Students are also expected to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Standards

Student Learning Objectives

Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between things, and understanding that living things may be made of one cell or many and varied cells.] ([MS-LS1-1](#))

Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function of the cell. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relations and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. As a result, the biochemical function of cells or cell parts.] ([MS-LS1-2](#))

SCI.MS-LS1-1

Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

SCI.MS-LS1-2

Develop and use a model to describe the function of a cell as a whole and ways

parts of cells contribute to the function.

Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

Big Ideas - Students will understand that...

1. All living things are made of cells, which is the smallest unit of life.
2. An organism can be unicellular or multicellular.
3. Special structures within the cell are responsible for particular functions.
4. The subsystems are groups of cells working to make tissue or organs that specialize in body functions.
5. Energy stored in food is broken down and used in cellular respiration.

This unit of study begins with students distinguishing between living and nonliving things. Students will conduct investigations examining both living and nonliving things and using the data they collect as evidence for making this distinction. During this investigation, students will study living things that are made of cells, either one cell or many different numbers and types of cells.

Students will also study nonliving things, some of which are made up of cells. Students will understand that life is a quality that distinguishes living things—composed of living cells—from once-living things that have died or things that never lived. Emphasis is on students beginning to understand the cell theory by developing evidence that living things are made of cells, distinguishing between living and nonliving things, and understanding that living things may be made of one cell or many and varied cells.

Students will pose a question drawn from their investigations and draw on several sources to generate additional related, focused questions that allow for multiple avenues of exploration. They will conduct a short research project to collect evidence to develop and support their answers to the questions they generate. The report created from their research will integrate multimedia and visual displays of cells and specific cell parts into a presentation that will clarify the answers to their questions. Students will include in their reports variables representing two quantities, such as the number of cells that makes up an organism and units representing the size or type of the organism, and their conclusion about the relationship between these two variables. They will write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Students will analyze the relationship between the dependent and independent variables using graphs and tables and relate the graphs and tables to the equation.

As a continuation of their study of the cell, students will study the structure of the cell. This study begins with thinking of the cell as a system that is made up of parts, each of which has a function that contributes to the overall function of the cell. Students will learn that within cells, special structures—such as the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall—are responsible for particular functions. It is important to remember that students are required only to study the functions of these organelles in terms of how they contribute to the overall function of the cell, not in terms of their biochemical functions.

As part of their learning about the structure of the cell, students use models as a way of visualizing and representing structures that are microscopic. Students will develop and use a model to describe the function of the cell as a whole and the ways parts of the cell contribute to the cell's function. Models can be made of a variety of materials, including student-generated drawings, digital representations, or 3-D structures.

Students will examine the structure and function relationship of the cell membrane and the cell wall. They will learn that the structure of the cell membrane makes it possible for it to form the boundary that controls what enters and leaves the cell. They

will also learn that the structure of the cell wall makes it possible for it to serve its function. This study of the relationship between structure and function will be limited to the cell wall and cell membrane. Students will use variables to represent two quantities that describe some attribute of at least one structure of the cell—for example, how the surface area of a cell changes in relation to a change in the volume cell's volume. Students will write an equation to express the dependent variable in terms of the independent variable, and they will analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation.

Throughout this unit, students will learn that some of the structures of the cell are visible when studied under certain magnification while others are not and that engineering discoveries are making many new industries possible.

Essential Questions - What provocative questions will foster inquiry and transfer of learning

How do the structures and processes of a cell enable it to survive?

How do prokaryotic and eukaryotic cells compare?

How is the mitochondrion similar to a factory?

Photosynthesis is the way plants make food. Why is photosynthesis important to humans?

Content - Students will know...

- All organisms are made of cells.
- Specialized cells perform specialized functions.
- Tissues, organs and organ systems are composed of cells and function to serve the needs of food, air and waste removal.
- Food is broken down to provide energy for work that cells do.
- Plants use light energy to complete photosynthesis.
- Cells reproduce through stages called mitosis which ensures that all genetic material is passed to offspring.
- Distinguish between living and nonliving things.
- Cells are the smallest unit of life that can be said to be alive.
- All living things are made up of cells, either one cell or many different numbers and types of cells.

- Organisms may consist of one single cell (unicellular).
- Nonliving things can be composed of cells.
- Organisms may consist of many different numbers and types of cells (multicellular).
- Cells that can be observed at one scale may not be observable at another scale.
- Engineering advances have led to important discoveries in the field of cell biology, and scientific discoveries have led to the development of entire industries and engineered systems
- The cell functions as a whole system.
- Identify parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.
- Within cells, special structures are responsible for particular functions.
- Within cells, the cell membrane forms the boundary that controls what enters and leaves the cell.
- Complex and microscopic structures and systems in cells can be visualized, modeled, and used to describe how the function of the cell depends on the relationships among its parts.

Skills - Students will be able to...

Compare benefits and limitations of unicellular and multicellular organisms

Relate the functions of cells, tissues organs and organ systems to their function in supporting life.

Describe the sources of the reactants of photosynthesis and trace the pathway to the products.

Represent and explain the relationships between structures and functions of organelles using a variety of models.

Design and construct a cell model

Design a flip chart poster illustrating and describing the cycle cycle

Conduct an investigation to produce data that provides evidence distinguishing between living and nonliving things.

Distinguish between living and nonliving things.

Observe different types of cells that can be found in the makeup of living things.

Develop and use a model to describe the function of a cell as a whole.

Develop and use a model to describe how parts of cells contribute to the cell's function.

Develop and use models to describe the relationship between the structure and function of the cell wall and cell

membrane.

Stage 2: Assessment Evidence

Assessment

Chapter 1,2, 3 assessments including tests and quizzes

Essential Question Responses

Build a Cell rubric

Lab activity worksheets

Cell Cycle Poster rubric

Using microscopes worksheets

Design Your Own Experiment Using a Microscope activity

Candy dichotomous key

Various cell puzzles

Stage 3: Learning Plan

Learning Activities

Accommodations for students with IEPs and learning difficulties:

- Model how to perform specific roles when conducting experiments
- visual sentence frames using academic vocabulary for discussion
- use science "Reading Essentials" packets in place of textbook sections
- print lesson vocabulary in premade flashcard fashion to be used as a study guide
- allow verbal responses in place of written responses
- provide graphic organizers for comparing and contrasting science concepts
- modify graphic organizers/worksheets to reduce choices
- Use visuals to show important vocabulary for students to make connections
- Vocabulary word banks and strategies
- Think alouds and Think-Pair-Share

For ELL students:

- visuals for vocabulary
- word wall
- additional word work such as illustrating vocabulary and playing vocabulary games
- partner reading
- choral reading
- color-coded sticky notes for close reading to identify which sticky notes pertain to vocabulary
- questions about text, etc.
- When students make an error in speaking, answer or restate what they said using the correct form without drawing attention to the mistake.

For gifted students:

-additional self-selected science resources to explore the characteristics of life

-offer bonus points for "Reaching Higher" critical thinking questions

Unit Reflections & Teacher Notes

This unit is an interesting one for the students because they get to use the microscopes. They loved looking at items, such as sugar, salt and sand, while a microscope. This year I had them investigate other items that they were curious about. Using the scientific method, the students then designed their own experiment related to the items they wanted to view with the microscope. The lesson was risky but well-worth it. By allowing the students to choose their experiment, they had ownership in the activity and learned a great deal.