SUCCESS ACADEMY EDUCATION INSTITUTE

Life Science:
Unit 1

The Secret Lives of Cells: Introduction

Purpose: The Why, What, and How of This Unit

Essential Question: What are living things made of?

Unit Storyline Synopsis: After stopping to consider that our bodies seem to miraculously heal themselves after we get a cut or a scrape, scholars realize there must be more to life than meets the eye. What are we really made of, and what differentiates organic material from other matter? To find out, scholars conduct research, learn to use an exciting new scientific tool (a microscope!), and develop and/or use several different models. By the end of the unit, scholars can identify cells as the smallest units of life on Earth and describe the functions of several important organelles.

Why This Unit? It is astounding to consider that the human body is built from trillions of cells. Zoom in down to a microscopic level on one finger, and thousands of unfathomably small, virtually identical systems operating in unison will be revealed. Cells are highly specialized to keep every part of an organism functioning. This concept of structure and function is *enormously* important in biology and across the sciences. But how does it all work? In this unit, scholars will unveil the secret lives of cells, the building blocks of life.

Through the use of texts, observations, models, and exploration, you'll guide scholars to understand the most basic structure of life on Earth. After this unit, scholars will understand the functions of several individual organelles. They will also be able to explain how cells come together in multicellular organisms to form tissue, organs, and organ systems. These understandings will lay the foundation for the remainder of the year and serve as prerequisites for exploration in subsequent units.

What Is the Bottom Line?

Big Idea 1: Cells are the structural units of life.

- All living things are made up of cells, and they are the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).

Big Idea 2: Cells contain substructures that support their functioning.

- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.

Big Idea 3: In multicellular organisms, the body is a system of multiple interacting subsystems.

- The subsystems are groups of cells that work together to form tissues and organs that are specialized for particular functions in the body.

How do Next Generation Science Standards practices and crosscutting concepts support mastery of the Big Ideas? Science and Engineering Practices highlighted in this unit:

- **Developing and Using Models**
    - Develop and/or use a model to predict and/or describe phenomena.
    - Develop a model to describe unobservable mechanisms.

Crosscutting Concepts highlighted in this unit:

- **Structure and Function**
    - Complex and microscopic structures and systems can be visualized, modeled, and used to show how their function depends on the shapes, composition, and relationships among their parts. In other words, complex natural structures and systems can be analyzed to determine how they function.
- **Systems and System Models**
    - Models can be used to represent systems and their interactionsâ€” such as inputs, processes, and outputsâ€” and energy and matter flows within systems.
    - Systems may interact with other systemsâ€— they may have subsystems and be a part of larger complex systems.

Safety

Plan carefully for safety in all lessons. The top safety risks in this unit include:

- In Lesson 1, scholars use different types of fruit. Be conscious of the allergies your scholars have whenever using food products in the classroom. If scholars have severe allergies to any of the fruits needed for Lesson 1, you will need to find an alternative. Ensure that scholars wear proper personal protective equipment (PPE) indicated for this lesson (gloves, goggles, and aprons).
- In Lesson 1, scholars will use plastic knives. Work with your manager to develop clear directions and to ensure that scholars are aware of all necessary safety precautions that must be taken before handling the knives.
- In lessons 2 and 3, scholars will conduct an experiment using glass slides and coverslips, which can break easily. Work with your manager to develop clear directions and to ensure that scholars are aware of all necessary safety precautions that must be taken. Prepare a plan for dealing with and cleaning up broken glass safely.
- Lesson 3 uses methylene blue. Review all safety information and the Safety Data Sheet for **methylene blue** to ensure proper safety precautions are taken before conducting this lesson. Ensure that scholars wear proper personal protective equipment (PPE) indicated for this lesson (gloves, goggles, and aprons).
- In Lesson 5, scholars will conduct an experiment with screwdrivers. Work with your manager to develop clear directions and ensure scholars are aware of all necessary safety precautions that must be taken before handling the screwdrivers.
- Lesson 7 uses Lugol's solution. Review all safety information and the Safety Data Sheet for **Lugol's solution** to ensure proper safety precautions are taken before conducting this lesson. Ensure that scholars wear proper personal protective equipment (PPE) indicated for this lesson (gloves, goggles, and aprons).
- Lesson 7 uses cornstarch. Review all safety information and the Safety Data Sheet for **cornstarch** to ensure proper safety precautions are taken before conducting this lesson. Ensure that scholars wear proper personal protective equipment (PPE) indicated for this lesson (gloves, goggles, and aprons).

Important Note: These lesson plans highlight some of the safety risks you should be aware of while teaching these lessons. These safety suggestions are not meant to take the place of a formal science safety training. Please be sure to follow all safety rules from your district, as well as all local, state, and federal science safety guidelines.

Unit Storyline

Engage: After observing scarred fruit and considering their own experiences with everything from paper cuts to scraped knees, scholars begin to wonder how it is possible that a body part can just *heal itself*. What exactly are our bodies made of, anyway? And what differentiates living things from nonliving things? Scholars share their ideas and compile questions, launching a unit-long investigation that will redefine life as they know it.

- **Lesson 1: The Stuff of Life** Why don't you bleed to death when you get a paper cut? What is a scar, and how does it get there? Why can you heal but a nonliving thing can't? Scholars

consider these questions as they study scarred fruits and their own bodies for clues as to what makes living things unique.

Explore: After identifying cells at the end of the Engage section, scholars take another look at the teeny-tiny structures that serve as the building blocks of all living things. Through observation and diagramming, scholars learn three important things: that cells contain *even smaller* parts, that cells from different sources have both similarities and differences, and that each cell is a miniature but fully operational system that performs essential functions.

- **Lesson 2: A Closer Look** Scholars study animal cells (although they do not yet know what they're looking at) through a microscope, diagram their observations, and consider the implications of their findings.
- **Lesson 3: Are All Cells the Same?** Scholars study plant cells through a microscope, diagram their observations, and compare them to the animal cells they observed in Lesson 2.

Explain: At this point, scholars recognize a cell when they see one and can even differentiate between plant and animal cells based on their shape. However, they lack the vocabulary to accurately describe the parts of a cell, and they don't have the big-picture understanding of how cells actually combine to create more complex organisms. How is it possible that an entire person can grow from one pair of cells? In these lessons, scholars will find out.

- **Lesson 4: The Parts of a Cell** Comparing their work to existing diagrams and research, scholars learn that there are even more parts in a cell than they originally thought! Scholars revise and update their work to include the names and functions of several common cell organelles.
- **Lesson 5: What Is a System?** Scholars take apart a radio to study its structures and their functions. As they work, they learn how each part of the system contributes to its overall performance and how some parts can make or break the functionality of the entire system. As they work, they apply this thinking to a cell, learning through this model that a cell is also a system of interconnected, interdependent parts.
- **Lesson 6: The Organization of Cells** Scholars know what individual cells do, but they do not yet know how cells combine to create complex organisms. In this lesson, scholars dissect an onion to study the levels of organization within.
- **Lesson 7: The Cell Membrane** Scholars model the semipermeable nature of a cell membrane and discuss the necessity of this organelle. Then they debate the prospects of survival for an organism whose cells have compromised membranes due to disease or damage.

Elaborate: Scholars will apply their knowledge of cell structures and functions in a new context as they envision the cell as a city.

- **Lesson 8: The Cell as a City** Scholars construct an analogy comparing a cell and its organelles to a city. First they identify and describe analogous relationships between organelles and parts of a city, then they construct a visual model to share their work with others.

Evaluate: Scholars get creative as they write poems to "show what they know" about cells! Then scholars revisit and answer the unit's Essential Question.

- **Lesson 9: Cell Poetry** To demonstrate their deep understanding of cellular functioning, scholars write their own poems about cell structures and functions!

Extra Resources

In addition to the resources linked throughout the guide, use the following materials to help you prepare to launch this unit with scholars:

- **Printable Exit Tickets**
- **Printable Lab Notebook**