

Name: _____

Date: _____

Guided Learning: Cells—the Basic Unit of Life

Learning goals

After completing this activity, you will be able to ...

- Recognize levels of organization in plants and animals.
- Diagram the levels of organization within an organism.
- Understand that all organisms are composed of one or more cells.
- Recognize that cells carry on similar functions.

Vocabulary: cell, cell theory, multicellular, organ, organism, organ system, spontaneous generation, tissue, unicellular

Warm-up questions:

Have you ever read a good story in a book? You may have never thought about it, but books are organized in a certain way to help you make sense of the story. Books are broken down into chapters. Chapters are made up of paragraphs. Paragraphs are made up of sentences.



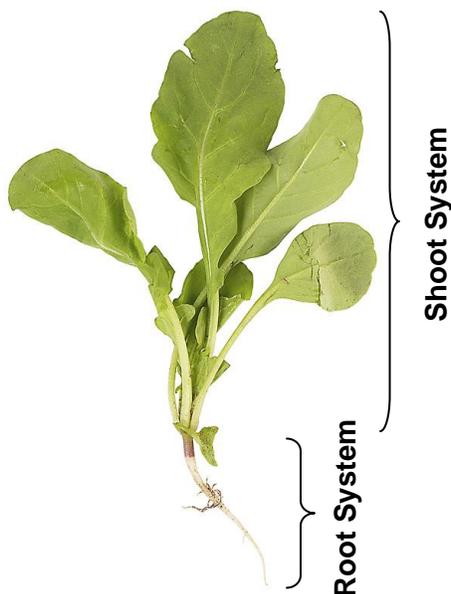
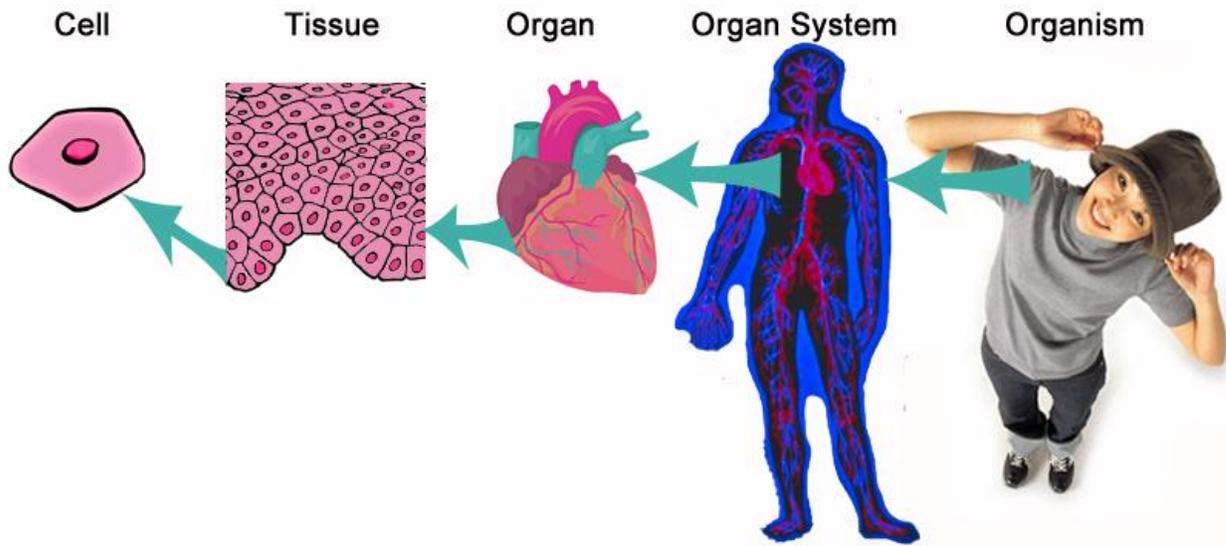
1. What are sentences made up of?

2. Can the things that sentences are made of be broken down into even smaller units? Explain.

Activity A: Levels of organization

Just as sentences are made up of words and words are composed of letters, you are also made up of smaller and smaller units. Your body is made up of many different **organ systems** that work together to keep your body functioning and healthy. These organ systems are made up of many individual **organs**. In return, organs are made up of different kinds of **tissues**. Tissues are composed of tiny units known as **cells**. A cell is the basic unit of life. Every single **organism**, or living thing, is made up of at least one cell. You are made up of trillions!

On the next page, you can see the levels of organization of the human body.



Humans aren't the only organisms that have these levels of organization. Many other organisms have organ systems, organs, tissues, and cells. For example, look at the plant shown at left. Plants have two main organ systems: a root system and a shoot system.

Each one of these systems is made up of organs. The organs are composed of tissues, and the tissues are made up of cells. Can you guess what one type of organ is in the stem system?

Leaves, buds, stems, flowers, and fruits are all common organs found in a plant's stem system. If you look at a leaf through a microscope, you can see that it is made up of various tissues, such as tissues that convert light energy into food and tissues that carry water to the leaf. Each one of these tissues is made up of thousands and thousands of cells.



1. Draw a diagram placing the following levels of biological organization in the correct order from largest to smallest: organ system, cell, organism, tissue, and organ.

2. Pick a type of cell found in the human body, such as a red blood cell, and describe the levels of organization the cell belongs to. _____

3. The tips of most plant roots are covered in a root cap, which protects the root as it grows through the soil. Suppose you saw a root cap cell under a microscope. Predict what type of tissue, organ, organ system, and organism the cell belongs to.
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Activity B: Cell theory

You've learned that you are made of trillions of cells. But your cells are so tiny that you can't see them with the naked eye. Because of how tiny cells are, cells weren't discovered until the 1600s when the first true microscope was invented.

In 1665, British scientist Robert Hooke used a microscope to look at a thin slice of plant material. What he saw closely resembles the image you see at right. The plant material seemed to be made up of hundreds of tiny chambers, or "cells."

Around this same time, Dutch scientist Anton van Leeuwenhoek was also making good use of his microscope. But unlike Hooke, who was studying **multicellular** organisms such as plants and animals, van Leeuwenhoek used his microscope to discover a whole new group of organisms.



Plant cells

Leeuwenhoek used his microscope to view a sample of pond water. To his astonishment, he saw hundreds of tiny little organisms flitting around in the water. These organisms weren't made up of connected cells. Instead, they were each made up of a single cell. These organisms are now known as **unicellular** organisms. Bacteria and most protists are unicellular organisms.

At the time of Hooke and Leeuwenhoek, many people believed that organisms could arise from non-living matter. For example, people believed that mice could arise from dirty clothes and grain, and that maggots could grow from rotting meat. This idea is known as **spontaneous generation**.



Pasteur's flask

A series of experiments gradually disproved the idea of spontaneous generation. In 1668, Francesco Redi demonstrated that maggots would only appear in meat that was exposed to flies. No maggots appeared in meat that was stored in jars covered in cheesecloth to keep flies away.

In 1859, Louis Pasteur boiled broth in a flask to kill any bacteria in the broth. He used a flask with a long, curved neck. The long neck of the flask prevented outside particles from entering the broth but did allow the flow of air. The flask remained bacteria-free for an extended period of time. This experiment convinced most that spontaneous generation could not happen.

The debate about spontaneous generation led to a very important idea in biology: Life can only come from life. Every living organism and every cell comes from another organisms or cell.

As scientists learned more about cells, they began to determine how cells work. Many of the functions of a cell mirror the functions of an organism. For example, animals breathe in oxygen and breathe out carbon dioxide and water. They also eat food for energy. Inside a cell, oxygen and food are used to produce energy, carbon dioxide, and water. Just as organisms must get rid of waste products, cells need to remove waste products. Animals have a skin that protects them from their environment, and bones that help support them. Cells have membranes and cell walls that perform similar functions. Animals grow and reproduce, and so do cells.

The observations of Hooke, van Leeuwenhoek, and many other scientists eventually helped form one of the fundamental concepts of biology: the **cell theory**. According to the cell theory:

- All living things are made up of cells.
- Cells are the basic units of structure and function in living things.
- All cells carry out similar functions.
- New cells are only produced from existing cells.



1. According to cell theory, what are all organisms composed of? _____

2. How are you similar to a bacterium? _____

3. What is the importance of Redi and Pasteur's experiments to cell theory? _____

4. Describe three functions that all cells share. _____
