Lesson 1

WHAT ARE LIVING THINGS MADE OF?

WORDS TO KNOW

cell

unicellular

multicellular

THE BIG IDEA

- All living things are made up of cells, the smallest units of life.
- An organism may consist of one single cell (unicellular) or many types of cells (multicellular).

THINK ABOUT IT

What are examples of unicellular organisms?

WHAT I NEED TO KNOW

Have you ever looked at a drop of pond water under a microscope? Before you looked more closely under the microscope, the water drop may have looked clear, with nothing in it. When you see the drop magnified, a whole new world appears. You may see small, green objects float into view. A strange creature with a whiplike tail might race across the drop. You might even see a moving blob that looks like jelly.

Not everything in the drop of water is living, of course. You might see specks of dust, the decayed remains of once-living things and, of course, the water itself. In order to classify it as a living thing, an organism must meet all of the following criteria.

- It must be made of cells.
- It uses energy to live.
  (This includes respiration, consuming food, and excretion.)
- It grows and develops.
- It reproduces.
- It responds to its surroundings.
  (This includes movement, adaptations, and stimuli.)

Once-living things may meet some of these criteria. For example, a dead plant will still have cells, and recently-dead things may be hard to differentiate from living things. Once-living things will decompose until they break down completely, eventually becoming part of soil or the muddy bottom of the pond.

TURN AND TALK

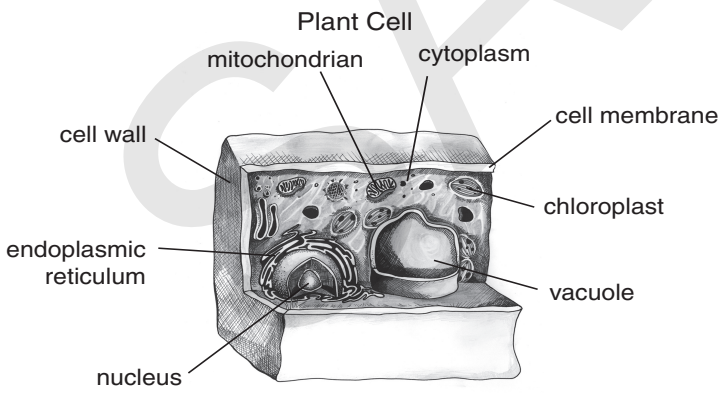
Discuss with a partner. What happens to the cells of once-living things?

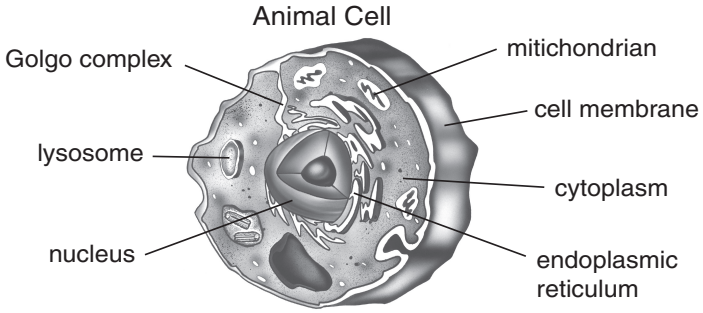
Every organism in the water drop is made of one or more cells, whereas the non-living things in the drop—like the water itself—are not made of cells. A cell is the basic unit of life. Cells give an organism structure and separate it from the outside world. Cells process food in order to provide energy and nutrition to the organism. Cells remove any waste the organism creates. They also allow the organism to grow and reproduce. In other words, cells perform all the functions necessary for life.

Organisms are made of one or more cells. Most of the pond organisms, and other organisms of the world's ecosystems, are unicellular, which means they consist of only one cell. Unicellular organisms are a diverse group, ranging from bacteria, which do not have a nucleus, to protists, such as amoeba and euglena, which do have a nucleus. Some algae also consist of single cells. In each unicellular organism, all life functions are performed by different structures within the cell.

Most organisms are single cells, while some are multicellular. Multicellular organisms consist of more than one cell. Multicellular organisms can range from algae, which may be made of a few cells, to humans, who consist of billions of cells. All plants and animals are multicellular organisms. Multicellular organisms often develop specialized cells. In the human body, for instance, cells in the stomach are specialized to help the organ perform digestion, while cells in the nose are specialized to help the body sense smells. This cell specialization allows multicellular organisms to be amazingly diverse and complex.

Cells in most organisms have similar structures. The images below show a typical plant and animal cell, with important structures labeled.





WHAT I HAVE LEARNED

1. A student is planning an investigation in which he will examine a slide of unknown material under a microscope. What evidence must he collect to determine that the material on the slide came from a living thing?

   Ⓐ The material must be multicellular.

   Ⓑ The material must be made of cells.

   Ⓒ The material must be made of atoms.

   Ⓓ The material must be able to move independently.

HINT, HINT

Consider the list of criteria for what is a living thing.

2. In the 1600s, an amateur Dutch scientist observed simple cells called protists through a simple microscope. His observations led to the development of Cell Theory, the idea that all living things are made of cells. What does this incident illustrate about the scientific process?

   Ⓐ An understanding of complex ideas can take several hundred years.

   Ⓑ Tools such as microscopes are required to make scientific breakthroughs.

   Ⓒ Human understanding of science is often linked to engineering advances.

   Ⓓ Most discoveries do not come from trained scientists, but from curious people.

3. A student is examining a drop of river water under a microscope. She observes something float by that is made of cells, but she cannot discern if it moved of its own accord or was simply responding to the recent movement of the glass slide. What conclusion can the student make about this thing?

   Ⓐ It is living.

   Ⓑ It is non-living.

   Ⓒ It was once-living.

   Ⓓ There is not enough information to form a conclusion.

4. Students are given two glass slides to investigate. The slides may contain cheek cells or a nonliving substance. Which choice describes the process the students should take, and the data they should record, to determine what the slides contain?

Ⓐ Look carefully at one slide under magnification and determine whether or not it contains cells. Looking at both slides is not necessary.

Ⓑ Start at the highest magnification level. Molecules should be visible in both slides. Then, reduce the magnification level until a nucleus can be seen on only one of the slides.

Ⓒ The microscope is not necessary for this investigation because the swab of cheek cells will be recognizable as cells without magnification. The students should look at both slides and draw quick sketches of each.

Ⓓ Increase the magnification until the material becomes visible on both slides. Carefully observe, then draw diagrams to display what is seen on each slide. The slide with the cheek cells should have cells with visible nuclei.

5. Why are microscopes important for studying cells?

Ⓐ They help keep the cells in place.

Ⓑ Most cells cannot be seen with the human eye.

Ⓒ Microscopes display the cells in full color.

Ⓓ Different types of cells look the same without magnification.

6. A student planning an investigation to look at cells under magnification believes that a sample from a piece of old, unprocessed cotton will look very different from a sample taken from a living sunflower plant. Which answer best explains what the student can expect to find during the investigation?

Ⓐ The cells will look very different because they are different types of cells.

Ⓑ The cells will look very similar because they are both from unicellular organisms.

Ⓒ The cells will look very different because the cotton is no longer living but the sunflower is.

Ⓓ The cells will look similar, even though the cotton is no longer living, because they are both plant cells.

HINT, HINT

Consider the features or structures of the cells you can use for comparison.

7. Why are cells described as the functional units of living things?

Ⓐ Cells are living units that carry out all life processes.

Ⓑ Cells are nonliving units that only sustain life when combined with other cells.

Ⓒ Cells are unable to reproduce on their own.

Ⓓ Cells carry out most life processes, but cannot reproduce.

TEACHER NOTES

STANDARDS MS-LS1-1

Performance Expectation

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

Displinary Core Idea LS1.A: Structure and Function

All living things are made up of cells, which is 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).

Science and Engineering Practices Planning and Carrying Out Investigations

Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.

Cross Cutting Concepts

Scale, Proportion, and Quantity. Phenomena that can be observed at one scale may not be observable at another scale.

Interdependence of Science, Engineering, and Technology. Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.

Prerequisite Knowledge & Standards LS1.A: Structure and Function

Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

Math Connection

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; 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. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

TEACHER NOTES

ELA Connection

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Misconceptions

- All cells are the same size and shape, i.e., there is a generic cell.
- There are no single-celled organisms.
- Some living parts of organisms are not made of cells.
- Plants are not made of cells.

TIPS FOR THE STRUGGLING LEARNER

- Some students may struggle with the concept of cells as they are not visible to the naked eye. Work to differentiate instruction by setting up stations around the room that appeal to different styles of learning. For example, one station can play a video of a cell being viewed under magnification; another station can have a tangible model that students can touch and manipulate, and another station can provide students with a paragraph of text about the cell and then challenge students to write a haiku based on that paragraph. Have students circulate in small groups through the stations after they have read the lesson text.

TIPS FOR THE ENGLISH LANGUAGE LEARNER

- Challenge advanced learners to complete a self-directed assignment in place of the independent practice. Students can generate an idea based on their own curiosity, but be prepared with several that can help guide them. Examples include the life of Henrietta Lacks and how she contributed to our knowledge of cells, the development of Cell Theory, early microscopes and how they advanced, and the fascinating unicellular organisms called extremophiles.

ACTIVITIES FOR THE ADVANCED LEARNER

- Make sure English language learners have the opportunity, if needed, to use both their home language and English to discuss the science terms in this lesson. Consider creating a model or drawing of a cell and creating separate bilingual labels that can adhere to the drawing (with the terms in both Spanish and English, for example), and then allow students to place the labels in the correct location. Refer students back to the visuals associated in this lesson to help them comprehend key terms.