

Grade 6

Basic Life Science

Oak Meadow

Coursebook

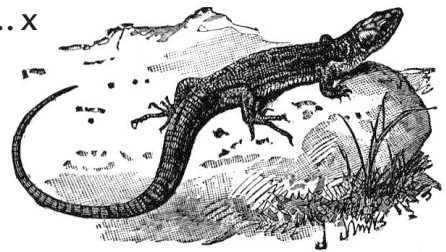
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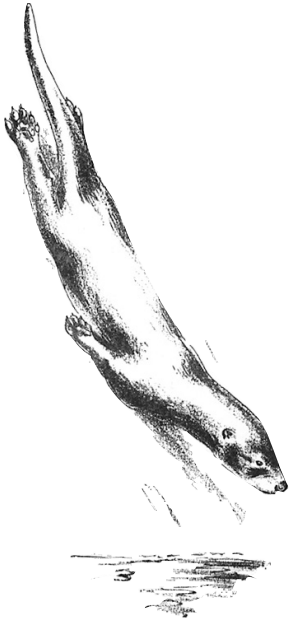
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What Is Biology?

People have always observed and studied the world. Two thousand years ago, ancient Greek and Roman experimenters asked excellent questions about the world around them. Today's science is still based on some of their observations and conclusions. Since then, experimenters have tested what these early thinkers decided, and have found that sometimes they were mistaken and sometimes they were correct. Either way, many of the words we use to describe the world are derived from the Greek and Latin languages.

Bios is a Greek word that means "life." Logos is the Greek word for "describing." We put these two words together and get *biology*, the study of living things. Hence, the study of life sciences is another definition of biology.

Your Thoughts

Before you read ahead, take a few minutes to think about the differences between living and nonliving things. How do we know something is alive? What characteristics do living things share? Is water living or nonliving? What about soil? Discuss your ideas with someone, and then continue reading to see how well your answers match up with the information in the next few sections.

ASSIGNMENT SUMMARY

- Make a list of requirements for survival.
- Describe characteristics that contribute to an organism's success.
- Choice assignment
- Complete lesson 3 test.

MATERIALS

Pencil and paper

Choice Assignment Living and Nonliving Things in Watery Environments:

Watery environment
Paper, pencil,
Poster making
materials
(posterboard and
crayons, paints, or
colored pencils)

Bean Plants:

4 beans for planting
(not treated with
any chemicals)
Nonfertilized soil
Fertilizer

Biology

the study of
living things.

Biology **Organisms**

(continued)

Organisms
any living thing.

Ecology
the study of how
living organisms
interact with their
environments.

Living things are called **organisms**. All plants and animals, including human beings, are organisms. Organisms have many needs to fill in order to stay alive. As organisms, we get everything we need from our environment in order to survive. If an organism cannot get what it needs from its environment, it will die. The study of organisms interacting with their environment is the science of **ecology**.

Life and Living Things

What is the difference between living and nonliving things? What determines whether something is alive or not? You may think it is easy to tell if something is a living thing, but it may be more difficult than you think. The standards used to judge whether something is a living thing or not have changed over time as scientists discover new organisms. The more scientists learn about the natural world, the harder it is to make a definitive list, but as far as we know these characteristics are shared by almost every living organism on the planet.

Living things:

- Are made of cells
- Are organized on different levels
- Use energy (metabolism)
- Reproduce
- Maintain stable internal conditions (homeostasis)
- Have inherited traits (heredity)

You may remember this list from fifth grade science. Let's take a quick look at what each one means.

- Made of cells: All living things are made up of one or more cells, and sometimes trillions of cells (like those inside your body!).
- Organized on different levels: The cell "organizes" life—that is the cell's number one job! Before you were born, the cells in your body developed into a brain, bones, muscles, skin, and every other part that makes up your body.

- Use energy (metabolism): All living things use energy to survive, transforming the sun’s energy, food, and water into life energy through a process called metabolism.
- Reproduce: Reproduction is the process by which organisms create new life, ensuring the species will continue long after an individual has died.
- Maintain stable internal conditions (homeostasis): Each living thing maintains its own internal environment. A fish in water doesn’t turn into water, but keeps its own shape. Mammals maintain their body temperature even when it is freezing cold outside.
- Have inherited traits (heredity): Living organisms produce offspring that look like their parents because they pass along their genetic material (you’ll learn more about that in lesson 20). A dog could never give birth to a baby giraffe! A dog can only have puppies and those puppies will share the same traits as its parents.

There are other things that living organisms do, but they don’t “define life.” There are many characteristics that living things share with nonliving things. For instance, most animals and plants move in some way. Animals and plants respond to things in their environment and many can adapt in order to survive. All living things grow and develop.

However, there are living organisms that do not move, such as coral, and there are many nonliving things that do move, such as a car and clouds. Also, there are many nonliving things that respond to things in the environment. A rock can change over time as the environment affects it, but it is not alive. A river changes in response to a rainstorm. Finally, there are nonliving things that can grow and develop, like an icicle, a crystal, or a fire.

This may seem confusing, so let’s look more closely at some of these characteristics, since they are shared by so many living organisms.

Movement

Both living and nonliving things move, but how they move is very different. Nonliving things move because an outside force or energy moves them, whether that force is gravity, wind, or a living thing, such as a person pushing a cart. Cars move because the energy released by the fuel causes the motor to run. Winds push clouds across the sky.

Biology

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Biology

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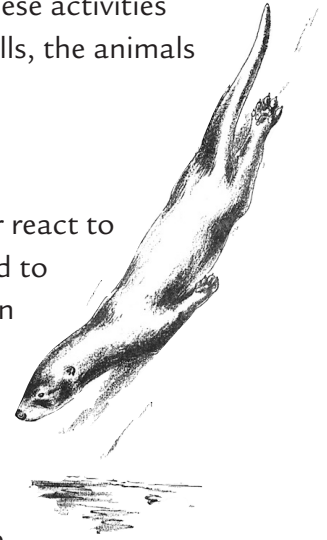
Leaf Cutter Ants

Living organisms move as a part of keeping their basic life support systems working. Hearts pump blood and lungs breathe air. Often living things will move to find or secure food or to capture the sun’s energy. Have you ever seen a snake basking in the sun? It moved into the sun because it needed the sun’s energy to warm itself.

Many animals seem to move because they enjoy movement. You probably know how good it feels to swing or swim or hike. Some animals, such as otters, horses, and dogs, appear to run, jump, and frolic simply because they want to. While these activities probably help the animal to practice survival skills, the animals also seem to revel in the freedom of movement.

Response to the Environment

There are many ways in which living things respond or react to changes in the environment. For example, you respond to being cold by getting “goose-pimples” or by putting on a jacket or coat. If you touch a hot stove, you quickly pull your hand away from it. If a bird swoops at your head, you duck. These are ways that you respond to your environment.



All living things respond to changes around them. The change that causes a response is called a stimulus. The reaction to the stimulus is called a response. In the previous examples, the cold air, the hot stove, and the swooping bird are all stimuli (more than one stimulus). In the realm of science, any and all changes can be interpreted in terms of a specific response to stimuli.

You are a living being and you have special organs that perceive stimuli from your environment. These stimuli can be compared to messages. Your sense organs receive these messages and help you perceive and respond to changes in your environment. Sense organs are called receptors because they can receive the messages of the stimuli in your environment. The sense organs are the eyes, nose, skin, ears and tongue; with them you see, smell, feel, hear, and taste. All your senses help you to respond to your environment so that you can adapt and survive.

Biology

(continued)



Assignments

1. You are a living organism. If you could not get all the things that you need from your environment, you would not survive. Make a list of at least six things that you require for your own survival. Discuss your ideas with your home teacher.
2. Some living organisms are more “successful” in meeting their needs than others. Usually these organisms are, therefore, present in great numbers. For example, rats are very common animals in many different environments all over the world. On the other hand, the Florida panther is nearly extinct. Think of an organism that is very common in your area, and write a paragraph describing the abilities and characteristics of that organism that might contribute to its “success.” Think of another organism that is rare, and write a second paragraph describing some of the possible reasons for the limited success of that organism.



Choice Assignment Choose **one** of the following projects.

- A. **Living and Nonliving Things in Watery Environments** If there is a pond, lake, ocean, swamp, brook, or other body of water near your home, spend at least a half hour observing it through the use of your sight, touch, hearing, and smell. What living things do you observe? What nonliving things are present? How are they dependent upon each other? Take notes and/or make sketches about your observations, and then create a poster-size drawing of the natural body of water that you studied. Label the living and nonliving parts with their names and note whether they are living or nonliving. Use paints, crayons, or colored pencils to color the drawing. Interestingly, some parts may be difficult to decide whether they are living or not. For example, water itself is nonliving but may be filled with tiny, living aquatic organisms as well as larger organisms such as fish.

- B. **Bean Plants** Plant four beans in four different pots with the same kind of nonfertilized soil. Do an experiment to test the requirements for survival for the bean plants. Be sure to follow the format for the scientific method that you learned in lesson 1. Include all five steps: question, hypothesis, procedure, observations, and conclusion.

For this experiment, you will give one plant fertilizer, light, and water, and another plant none of these things. For the other two pots, treat each of them with some of the things you think they need to grow, but omit one or two other things. Observe your plants for a week (this is your procedure). Write down what you think will happen (this is your hypothesis); make a chart about what actually does happen (these will be your observations). Record your observations for the next two weeks.

Make sketches of the pots and their contents before ending your experiment. Some examples of beans you can use are lima beans, pinto beans, kidney beans, string beans (if you have a garden, you may be able to use some leftover bean seeds), or any large bean seed that has not been treated with chemicals to prevent germination. Write up your conclusions based on your observations. Were you able to determine whether some things are more important than others in the survival of your particular bean plants? Write up your experiment into a report and discuss your findings with your parent or tutor.

Biology

(continued)

Biology

*(continued)***Lesson**
The graphic features a large, stylized number '3' in blue and white, set within a square frame with decorative, swirling patterns in shades of brown and gold.

Test Questions

1. Write a definition of biology in your own words.
2. List and describe the characteristics of all living organisms.
3. What is the difference between movement in a nonliving thing and movement in a living organism? Explain your answer and provide examples.
4. Can nonliving matter grow or reproduce? Explain your answer and provide examples.

FOR ENROLLED STUDENTS

At the end of the next lesson, you will be submitting work to your Oak Meadow teacher. Continue documenting your student's process with the assignment summary checklist, weekly planner, and the learning assessment form. Feel free to contact your teacher if you have any questions about the assignments or the learning process.

Learning Assessment

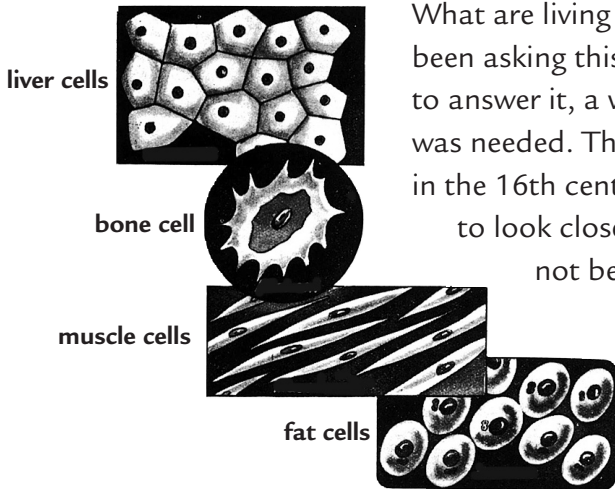
These assessment rubrics are intended to help track student progress throughout the year. Please remember that these skills continue to develop over time. Parents and teachers can use this space to make notes about the learning the student demonstrates or any skills that might need work.

SCIENCE	Not Yet Evident	Developing	Consistent	Notes
Identifies requirements for human survival				
Shows understanding of role of environment in survival				
Identifies characteristics that contribute to the success of an organism				
Differentiates between living and nonliving organisms				
Identifies characteristics of living organisms				

Grade 6

4

Cells



What are living organisms made of? Scientists have been asking this question for a long time. In order to answer it, a way to closely examine organisms was needed. That's why microscopes were invented in the 16th century. Scientists still use microscopes to look closely at very small organisms that cannot be seen with the eyes alone. We have

learned a great deal since the 16th century, and we continue to learn more as microscopes get stronger and new puzzles arise from what we see.

The **cell** is the remarkable basic structure found in all living things, from the tiniest **bacteria** to the largest redwood tree or blue whale. The human body is made of trillions of cells. Cells must be microscopic in order to function properly, so large creatures do not have bigger cells, they just have greater numbers of cells. With the aid of a microscope, some cells look like tiny ice cubes; others are long and thin. Some look like balls or rods; some are shaped like kites or tadpoles. Some cells have no fixed shape at all and act like blobs of jelly.

Organisms can consist of one cell or many cells. A one-celled organism carries out all life activities within the one cell. Bacteria and **protozoa** are examples of one-celled organisms. One-celled organisms are the most simple living things.

Cell

the microscopic basic structure found in all living things.

Bacteria

one type of single-celled organism.

Protozoa

one type of single-celled organism.

ASSIGNMENT SUMMARY

- Make a list of the levels of organization of a human organism.
- Choice assignment
- Complete lesson 4 test.
- Complete Unit I Review.

MATERIALS

Choice Assignment

Jell-O Cell Model:

Jell-O
Ziploc bag
Various fruits and nuts
Glass jar

Plant and Animal Cells:

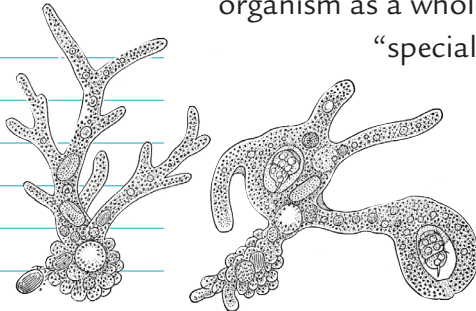
Microscope
Glass slide
Onion
Iodine
Eyedropper
Toothpick
Distilled water
Food coloring

Diagram of a Plant Cell and an Animal Cell:

Paints, crayons, or colored pencils

Cells

(continued)



A one-celled organism

Most plants and animals are made up of many cells joined together. In a many-celled organism, cells vary in shape and in function. Different types of cells carry out different functions or “jobs” for the benefit of the organism as a whole. Most of the cells of a many-celled organism are “specialized,” which means that in addition to basic life activities, they have special functions. Yet all the different cells in an organism depend on each other to stay alive. They all work together interdependently to perform the life activities of the whole organism.

Cells reproduce by dividing in two. (More on this in lesson 12.) By doing so, the organism grows.

Your body, for instance, is made up of over 100 trillion cells. But each of us began life as a single cell. That cell divided and grew, divided again, and again. Children grow because their cells are constantly dividing.

Cell Structure and Function

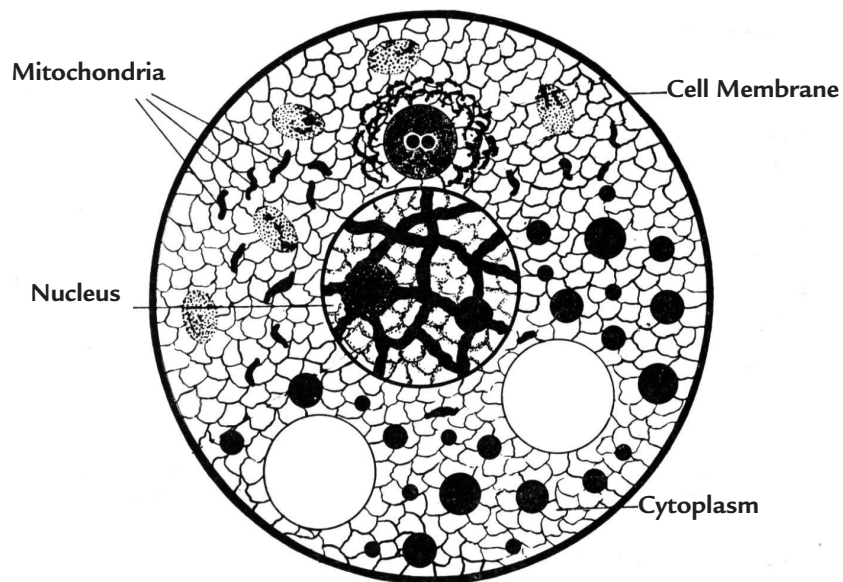
Nucleus
the central part of a cell that controls all the life functions of the cell.

Cell membrane
a twin layer that surrounds the cell and controls the movement of materials into and out of the cell.

Cytoplasm
all the material in a cell between the cell membrane and the nucleus.

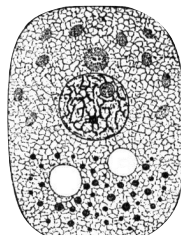
Every plant and animal cell has three main structures: the **nucleus**, the **cell membrane**, and the **cytoplasm**. (The only exceptions are bacteria cells, which have no organized nucleus.) The nucleus, which is usually round or egg-shaped, is located near the center of the cell. It controls all of the life functions of the cell, including cell reproduction.

Diagram of a cell



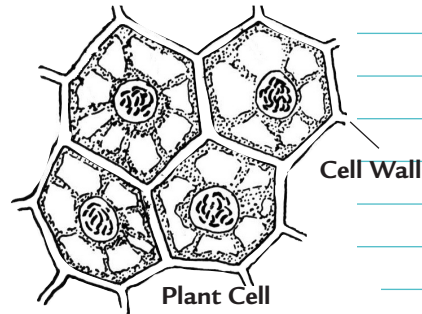
The nucleus has its own membrane, which separates it from the cytoplasm. The cell membrane surrounds the cell and controls the movement of materials into and out of the cell.

Single cells function much like large, many-celled organisms. In each cell are parts almost like all those that a whole organism needs. The nucleus acts as a control center and holds all essential information, similar to the function of a brain. Cells have a protective covering just like plants and animals. As stated before, animal cells have a cell membrane, which is flexible like skin. Plant cells also have a cell membrane, which is surrounded by a **cell wall**, which is stiff and provides support. Animal cells have no cell walls.



Animal Cell

Plant cells also have a cell membrane, which is surrounded by a **cell wall**, which is stiff and provides support. Animal cells have no cell walls.



Structure and support in animals is provided by either internal bone structure or a hard outer skeleton as in, for example, beetles and lobsters. Similar to the way in which our internal skeleton gives us shape and helps keep organs in the right place, individual cells make microscopic tubes and chains to keep the shape and their tiny machinery in place. Cells need to take in new raw materials, just as we eat food, and cells eliminate wastes and toxins, just as we must.

Along with their different sizes and shapes, different types of cells perform various functions. Their size and shape is influenced by the job they do. Plant cells have large spaces called **vacuoles** in which water, waste, and nutrients are stored. This helps the plant stay upright. Plants wilt when their vacuoles are drained. The cell wall of a plant is made of **cellulose**—a nonliving material that protects the cell and gives it shape. Wood is made up almost totally of cellulose. Only plant cells contain cellulose; animal cells do not contain any cellulose at all.

Groups of cells that are joined together work together like a team to do a particular job. A **tissue** is a group of cells that look similar and work together. Tissues are named for the jobs that they do. In an animal, for instance, muscles, skin, bones, blood, and nerves are different types of tissues, each of which is made up of different types of cells that work together to perform a particular function in the organism.

Cells

(continued)

Cell wall

the stiff outer coating of a plant cell that provides structure for the plant.

Vacuoles

the large spaces in plant cells that allow water, waste, and nutrients to be stored.

Cellulose

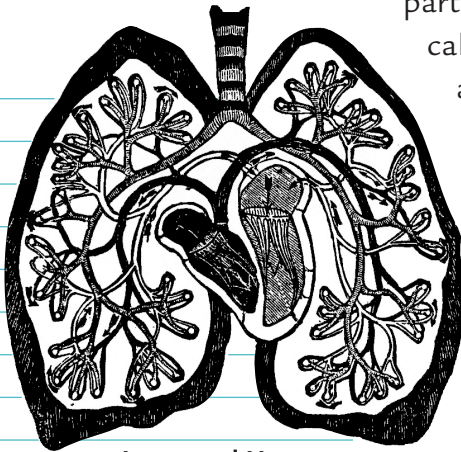
a nonliving material found in plant cells that protects the cell and gives it shape.

Tissue

a group of cells that look similar and are joined together to do a particular job.

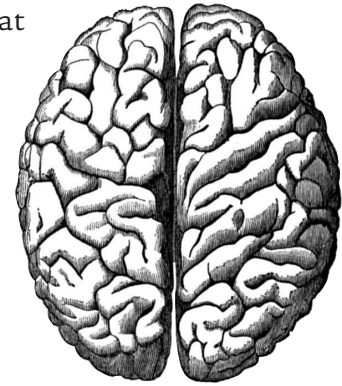
Cells

(continued)



Lungs and Heart

Tissues work together in much the same way that cells do. When tissues work together to do a particular job, this combination of tissues is called an organ. Your lungs, brain, eyes, and heart are all organs. Each organ has many different types of tissues working together to keep you alive. Your tissues work together to form organs, which also work together to form a complete organism. If they didn't work together, you would not be able to function normally.

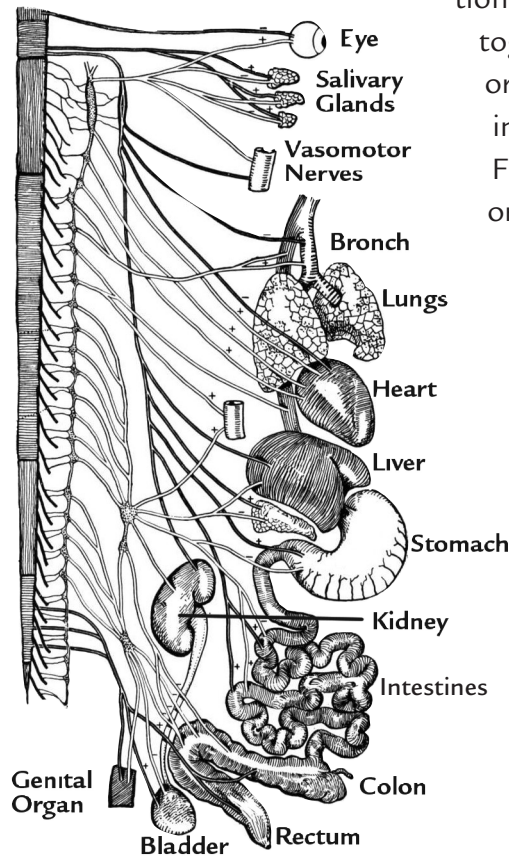


Brain

Levels of Organization

In studying living organisms, scientists study how different types of cells work together in different groups. Each group also works together to do certain things or to perform certain functions.

All of these functions combine together into all of the things that the organism itself does. Each grouping is called a level of organization. For example, the cell is one level of organization (just as people are one level of organization in a city). A tissue is a second level of organization (just as many cities make up a state). Tissues work together to form organs (another level of organization) and organs work together in particular organ systems. All of the organ systems together make up the organism itself, which is yet another level of organization.



Lesson

4

Assignments

Cells

(continued)

1. Make a list of the levels of organization of a human organism. Begin with the cellular level and continue as far as you can, including those levels mentioned here, moving into levels that are even larger. (Think BIG!)
2. Complete the unit review at the end of this lesson.



Choice Assignment Choose **one** of the following projects.

- A. **Jell-O Cell Model.** Make a food model of a cell. Make a gelatin dessert mix and allow it to cool, but don't let it completely gel. When cool, but still in liquid form, pour the gelatin dessert into a Ziploc bag. Then place the bag in the refrigerator and allow the gelatin dessert to gel. Once it is set, insert a plum into the center of it as the nucleus. Add any other cell parts, such as green grapes for chloroplasts or walnuts (in the shell) for mitochondria. Be creative and use your imagination. Mush the bag around to get a sense of the flexibility of the outer cell membrane. To represent a plant cell, put the bag in a glass jar to show the effect of the rigid cell wall.
- B. **Plant and Animal Cells.** (For those who have access to a microscope.) Prepare a slide of onion cells by taking a piece of the thin skin between the layers of an onion and placing it on a slide. With an eyedropper, drop a small amount of iodine stain or food coloring on the onion skin. If available, cover with a cover slip. Adjust your lens and slide to get a good view. Make a drawing of the onion cells, labeling all the parts you can recognize. Now prepare a slide of animal cells by gently scraping the inside of your cheek with the side of a toothpick. Gently smear the cells onto a slide and add a few drops of distilled water and a drop of food coloring. Cover with a cover slide and examine the cells. (You may have to try this more than once in order to see cells in which the cell membrane is unbroken.) Draw and label a picture of the animal cells. What differences can you see between the two types of cells?

Cells

(continued)

- C. **Draw a Diagram of a Plant Cell and an Animal Cell.** Label all the parts, and color the cells using paints, crayons, colored pencils, or a mixture of whatever artist’s materials you choose.

A vertical column of 24 horizontal blue lines, intended for students to draw and label a diagram of plant and animal cells.

Lesson
 **Test Questions**

1. Every cell has three main parts. List these parts and describe their functions.

2. Describe two ways in which plant and animal cells are different. Use terms from the reading in your description.

3. Multicellular organisms have their cells organized into tissues and organs. Name three tissues and three organs in a human being.

For Enrolled Students

At the end of this lesson, you will be sending your second batch of work to your Oak Meadow teacher along with your assignment summary checklist, the weekly planner, and the learning assessment form, or any alternate form of documentation. Include any additional notes or questions with your documentation—your teacher is eager to help. Please make sure your submission is organized and labeled well, and that complete lessons and assignments are submitted.

Cells

(continued)

Learning Assessment

Use assessment rubrics to track student progress and to make notes about the learning the student demonstrates or any skills that might need work.

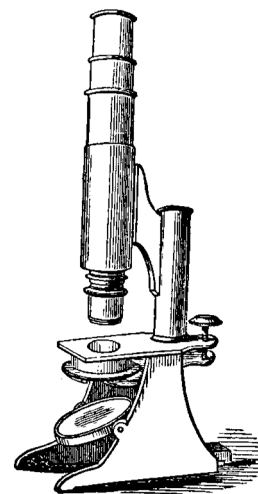
SCIENCE	Not Yet Evident	Developing	Consistent	Notes
Differentiates between plant and animal cells				
Differentiates between tissues and organs				
Identifies examples of tissues and organs in the human body				
Shows understanding of different levels of cellular organization				
Identifies cell structures and functions				

Unit I—The Basics

This ends the first unit of your science course. To review the material you have covered in this unit, please look over all of the test questions from the last five lessons. They have been listed below for your convenience. Looking over these questions will allow you to revisit the various topics in the unit and will give you an opportunity to see how all of the topics connect to each other. As you look over the questions, make sure you still know the answers. Circle the questions that you can't answer, and when you are through, go back and look up the answers in the appropriate lessons.

After you have finished looking over the test questions, choose **one** of the following activities to complete your unit review.

1. Quiz. Have your home teacher select eight questions from the test questions listed below and test you on them. See if you can answer the questions without returning to the coursebook. Discuss your answers with your home teacher when you are through and review any topics that gave you trouble.
2. Learning Reflection. Take some time to reflect on your learning from Unit I by answering the following questions. Please aim to write two to three sentences in response to each question.
 - a. What was your favorite topic? Why do you think you enjoyed learning about it?
 - b. Where do your strengths lie as a scientist? Do you enjoy making observations? Drawing? Writing up conclusions to experiments? Writing about research you have done? Please explain your answer.
 - c. What areas of science do you find the most challenging and why? Making observations? Drawing? Writing up conclusions? Doing research? Please explain your answer.
 - d. List five facts or ideas that you found especially interesting.



3. Artistic Choice. Choose a topic from Unit I that you found especially interesting and explore it further through art. You could create a poster, design a diorama, build a model, film a video, or come up with a project of your own choosing. Use this as an opportunity to learn more about the topic you've chosen by conducting research or making careful observations before you begin. Present your project to a friend or family member, explaining your interest in the topic, and allow time for questions and answers.

Test Questions from Unit 1

Scientific method

Controlled experiment

Variable

Hypothesis

Procedure

Observations

Conclusion

Lesson 1: Science and the Scientific Method

1. What is controlled in a controlled experiment? Provide an example.
2. Come up with three questions that could lead to a scientific experiment.
3. Come up with three hypotheses that you could test to help you answer the three questions you posed in the last question.
4. What are the five steps of the scientific method? Briefly explain each step.
5. Explain the difference between results and conclusion in a scientific experiment.

Lesson 2: The Environment

Environment

1. Write a definition of environment in your own words.
2. In what ways do YOU react to changes in your environment? List and describe at least three ways. (Example: How do changes in the weather affect you?)
3. Do all living things change? List changes that you have observed in three living things in your environment recently. (Example: If the season is changing, have you noticed animals around you losing or gaining their winter fur?)
4. Do nonliving things change? List changes that you have observed in three nonliving things in your environment recently? (Example: How has the sky changed today?)

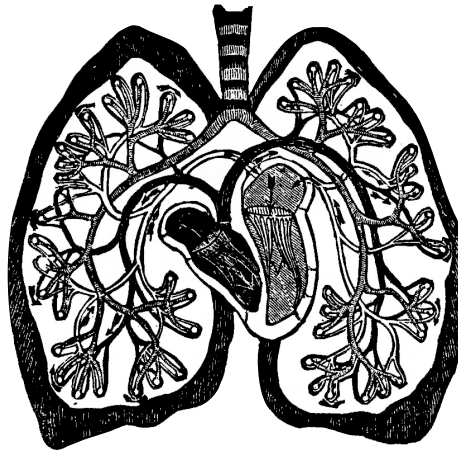
Lesson 3: Biology

1. Write a definition of biology in your own words.
2. List and describe the five characteristics of all living organisms.
3. What is the difference between movement in a nonliving thing and movement in a living organism? Explain your answer and provide examples.
4. Can nonliving matter grow or reproduce? Explain your answer and provide examples.

Biology
Organisms
Ecology
Stimulus/stimuli
Receptors
Natural selection

Lesson 4: Cells

1. Every cell has three main parts. List these parts and describe their functions.
2. Describe two ways in which plant and animal cells are different. Use terms from the reading in your description.
3. Multicellular organisms have their cells organized into tissues and organs. Name three examples of each in a human being.



Cell
Bacteria
Protozoa
Cell membrane
Cytoplasm
Cell wall
Vacuoles
Cellulose
Tissue

Ecology and the Environment

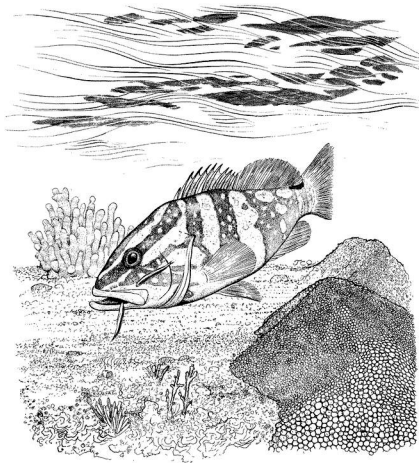
We learned in lesson 2 that the environment is made up of everything that is around us, both living and nonliving. The environment contains all the materials and energy needed for living organisms to carry out their life activities.

The environment of a fish, for example, consists of water, rocks, pebbles, sand, snails, various invertebrates, and other fish. The light that enters the water, the oxygen gas, and the carbon dioxide dissolved in water are also part of the fish's environment.

The study of living organisms and their environment is called *ecology*. In studying ecology, we learn how living things are affected by their environment. We also learn how those same living things have effects on their environment. Living things and their environment affect each other; in other words, organisms and their environment are *interrelated*.

The sciences are classified in much the same way that other topics are grouped. Biology is the study of living things. Geologists study the Earth, and astronomers study the skies. Physics is the study of matter and energy. Often, scientists are even more highly specialized, such as entomologists who study insects, botanists who study plant life, and quantum physicists who study the relationships between the tiniest subatomic particles.

Ecology is different from other sciences in that it deals primarily with how other sciences interconnect—how they are related. Ecology is the study of the areas where other sciences join together. It builds upon the knowledge in all other sciences, by placing the knowledge of other sciences in



A fish in its environment

ASSIGNMENT SUMMARY

- Choose an animal or plant and describe its habitat.
- Describe your own personal habitat.
- Choice assignment
- Complete lesson 23 test.

MATERIALS

Choice Assignment

Video Production:
Video camera

Nature Drawing:
Crayons or colored pencils

Ecology

the study of living organisms and their environment.

Interrelated

having a close connection with and affecting each other.

Ecology and the Environment

(continued)

Ecosystem

the interactions of living and non-living things within an environment.

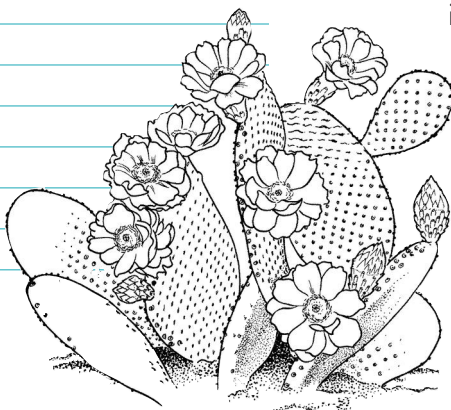
the context of the “real world.” Ecology examines how everything is connected. The discussion in the last lesson concerning the human element in adding complexity to natural food chains shows how information drawn from physics (energy), biology (agriculture), and Earth sciences (climate) all play a part in understanding how the world operates.

Ecosystems

The living and nonliving things in an environment, together with their interactions, are called an **ecosystem**. Food chains and food webs show some of the most obvious interactions between organisms in an ecosystem. There are many others that are just as important. Decomposers transform dead animals, animal wastes, and plant material into minerals and compounds that enrich the soil and allow grasses, trees, and other producers to grow better. Materials needed by organisms in an ecosystem are used over and over again. While a material is being used by one part of an ecosystem, it is reappearing in another part in a different form. This constant recycling of materials keeps an ecosystem in balance and keeps it and all of its parts healthy.

Habitat

No one organism can spread over all of the Earth. An organism can only live where conditions are right for it. A plant that needs a lot of moisture and warm air cannot live where it is cool and dry. Environmental factors like climate and geography will determine what organisms can live where. For this reason, temperature, moisture, sunlight, and soil types are examples of limiting factors that place limits on where certain organisms can live. For animals, these factors include temperature, water, food, and shelter. Limiting factors also determine the number of any one type of organism that can survive in a given **habitat**. In an ecosystem, every organism must be in balance with the other creatures that live there. The amount of nonliving resources available, such as water and soil, also must be able to support those living things. If one organism becomes out of balance, everything in the ecosystem is affected. For example, when natural predators such as wolves and coyotes are removed from an area, deer, rabbits, and mice (herbivores) quickly increase in population. This



Cacti live in dry habitats

puts stress on other forms of life, such as plant life. In an area with limited plant life, such as a small island, the vegetation can quickly be stripped. Then the deer, rabbits, and mice will have nothing to eat, and they will starve to death. The Earth and all its living organisms have evolved to be in balance with each other, at the same time that everything is moving and flowing and changing!

All animals have a home, an environment in which they can live. This home is called a habitat. The habitat is the area in which all of an animal's needs are met in order for it to live. There are certain types of water (fresh or salty) in which only certain types of organisms can live. Water can be shallow or deep, swiftly moving or stationary, warm or cold. Each provides a different habitat for different types of organisms.

Land also has many different types of habitats. Moles and worms live underground. Centipedes and moles live in holes in rotting trees. Rabbits, chipmunks, and deer live in meadows and woodlands. Some squirrels live their entire lives in the foliage of trees. Some birds nest on cliffs, others in trees. Some very adaptable kinds of birds even nest on man-made structures like bridges and skyscrapers, but this is not their natural habitat!

The area where a type of animal or plant is found is called its **range**. Some animals and plants have large ranges, like birds, bears, and rabbits. But the range of other animals is small. Kangaroos live only in certain parts of Australia. Some animals and plants can survive only in very specific areas. Spotted owls can live only in very old temperate forests with large trees. Many

Ecology and the Environment

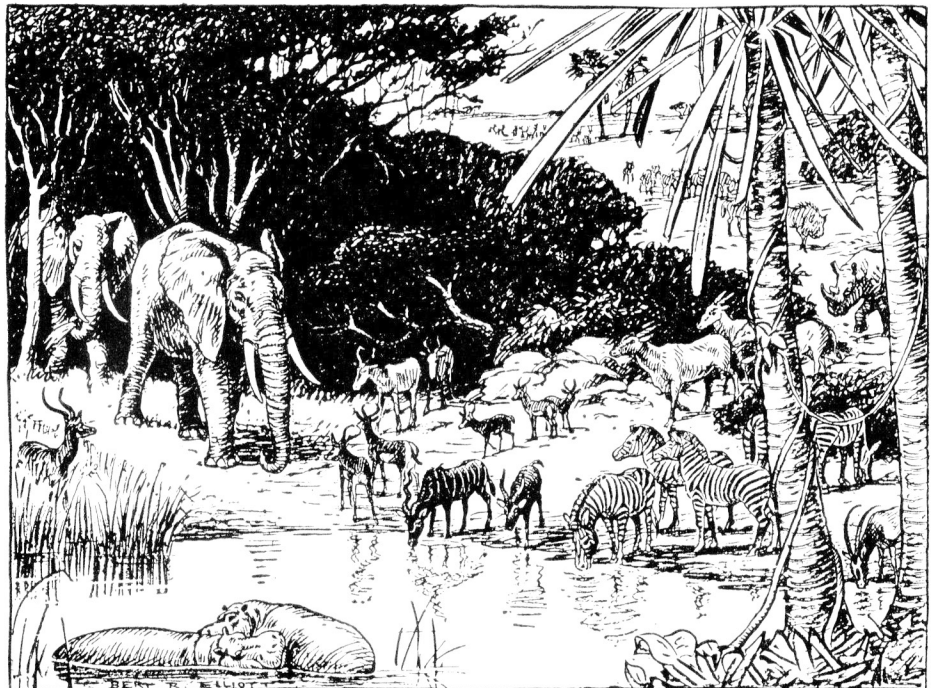
(continued)

Habitat

the environment in which all of an animal's needs are met in order for it to live.

Range

the area where a type of animal or plant is found.



Water is a valuable nonliving resource in the African Savanna ecosystem.

Ecology and the Environment

(continued)

species are endangered because of loss of their specific habitats to roads, buildings, and logging and industrial development. In the United States, many different land areas containing animal and plant habitats have been preserved as public lands.



A squirrel
in its habitat

Lesson 23

Assignments

1. Choose an animal or plant and describe its habitat. You can use your own knowledge, or you can conduct research using a book or the Internet. Aim to write two to three paragraphs.
2. Describe your own personal habitat. Include all of the elements described in the lesson including sources of food, water, other living organisms, climate, environment, etc.



Choice Assignment Choose **one** of the following projects.

- A. **Video Production.** You will need a video camera for this assignment. As film director for this ecological video, you will need to locate and explore four different habitats before filming. Notice the living and nonliving things in each of these habitats, taking special note of the relationships between different energy sources, the landscape, and the level of sunlight and moisture. Look for both large and small habitats, remembering that even the space under a mushroom cap is a separate mini-habitat.

After becoming familiar with these places, make your own ecological video with narration. You can put different scenes to music, take on a new voice, or add whatever nature-enhancing aspect you wish. Share the video with your family members and friends.

Ecology
and the
Environment

(continued)



Test Questions

1. What do we mean when we say that living and nonliving things in the environment are interrelated?

2. How is the study of ecology different from that of other sciences?

3. Describe, in your own words, what a habitat is.

4. Why does an ecosystem need to be in balance? Give an example of an ecosystem out of balance.

Ecology and the Environment

(continued)

5. An ecosystem needs a source of energy to keep it going. What is the source of energy for all ecosystems? (Hint: We learned this in lesson 22.)

For Enrolled Students

Please contact your teacher if any questions arise.

Learning Assessment

Use assessment rubrics to track student progress and to make notes about the learning the student demonstrates or any skills that might need work.

SCIENCE	Not Yet Evident	Developing	Consistent	Notes
Demonstrates knowledge of animal habitats				
Shows awareness of role and importance of a balanced ecosystem				
Identifies ways in which an ecosystem can be out of balance				
Shows understanding of relationship between living and nonliving things in an environment				



Populations

The work of research scientists sometimes involves determining the number of living organisms of a certain kind in a particular area. This is called a **population** study. For example, the number of people who are living in your home, in your city, or in the world can be counted. You can easily count how many fish are living in a fish tank in a pet store. It is more difficult to count how many of a certain type of butterfly are living in a 500-acre piece of land consisting of fields, woodlands, and wetlands. These are all populations, and scientists have devised some ways to count the more difficult ones when this knowledge is needed for research.

There are two different ways that populations can be computed. The first is to count all of the individuals in a particular area. This is called a **census**. For a small population in a small area, a census can be done easily. A large population in a large area is more difficult to count one by one. Where a census is not practical or possible, scientists try to estimate or guess what the population actually may be. The most common and easiest method of estimating a population is done by taking a **sample**. An area is first divided into small equal pieces. The population in one piece is counted and that number is then multiplied by the number of pieces in the entire area. Sampling works best with plants, because they don't move around. Animals that move around are very difficult to count accurately by a sampling method.

Populations can change in size in four different ways. Consider, for example, the moose population in Canada. Clearly, if some moose cross the border and move into the United States, the population of Canadian moose will decline. On the other hand, if moose from the United States decide to take a trip into Canada, the population of Canadian moose will increase. When moose are shot by hunters or die due to other causes, the population decreases. When moose mate and have offspring, the popula-

ASSIGNMENT SUMMARY

- Explain the difference between a census and a sample, and a population and a community.
- Compute a bird population using the sampling and census methods.
- Create a line graph showing population change over time.
- Choice assignment
- Complete lesson 24 test.

MATERIALS

Ruler

Choice Assignment

Life in a 3 x 3 Space:

String

Pencil

Populations

(continued)

Population

the number of living organisms of a certain kind in a particular area.

Census

the method of computing the population by counting all of the individuals in a particular area.

Sample

the method of computing the population by dividing an area into equal pieces, counting the population in one piece, and then multiplying that number by the number of pieces in the entire area.

tion increases. A population changes in size because of a change in birth rate, death rate, and movement into or out of an area.

Communities

In the picture of the African savanna in lesson 23, there are elephants, zebras, gazelles, wildebeests, and perhaps different types of birds. There are also different types of plants and grasses as well. All of the animal and plant populations living in a particular area make up a **community**. A community is a group of organisms that are related by some common element or by something that each member shares.

Communities can be big or small. For instance, everything in the world can be divided into two communities—things that are living and things that are not. The **biotic** community consists of all living things. The **abiotic** community is made up of all nonliving things (“a” in Greek means “not,” hence abiotic means “not living”). Usually communities refer to all of these organisms living in the same area or in the same particular place. The human community that you live in, for instance, consists of all of the people who live nearby in your city, county, or region.

Ecosystems are made up of communities interacting with their physical environment. Communities are made up of various populations of organisms inhabiting an area. Populations consist of the number of a particular species that live in that area. The organisms of a community



Animals that move around are very difficult to count.

interact with the nonliving parts of the environment (the abiotic factors). In the African savanna, for instance, wildebeests eat native grasses. The wastes from the wildebeest enrich and fertilize the soil, which helps the grasses grow. The grasses, in turn, take in carbon dioxide and give off oxygen in photosynthesis. The grasses also give small rodents both food and shelter. In this way, populations of plants and animals interact with each other in their communities within a particular ecosystem.

Human Communities and Population

We, too, live in communities. We have families and many families live in villages, towns, or cities. We have friends, coworkers, classmates, church members, merchants, and acquaintances with whom we come in contact regularly. All of those people with whom we interact make up our local community. We usually define our communities geographically, based on lines on a map that show the land where groups of people live. Communities can be defined by many different factors, including age, class, income level, race, gender, or religious belief.

The entire human population stretches across the planet Earth; our population is more than 7 billion, and this number is expected to reach 9 billion in about 30 years. No matter how we group or categorize ourselves, it is certain that how we choose to live together and interact with other living things and the environment is important. The Earth's resources are limited, and ecosystems must be healthy to support our growing population. We can learn from relationships among living things in the natural world (the study of ecology), and this may play a large part in determining what our future communities will look like.

Populations

(continued)

Community

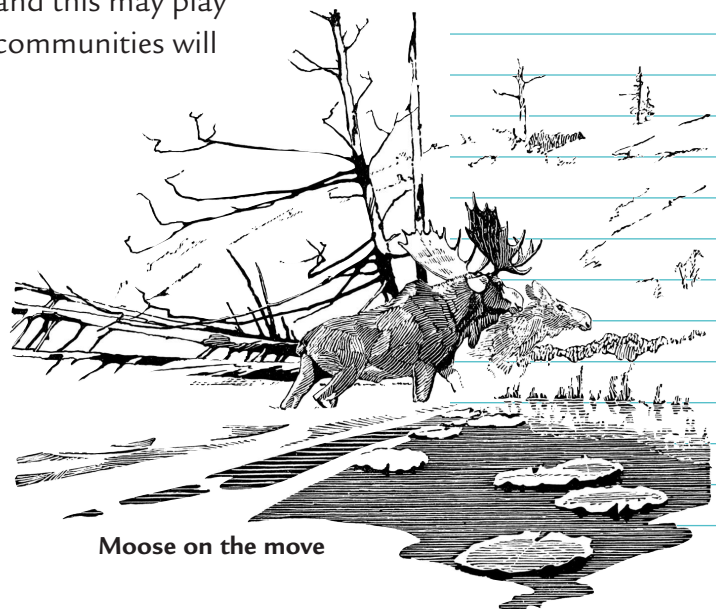
a group of organisms that are related by some common element or by something that each member shares.

Biotic

consisting of living things

Abiotic

consisting of nonliving things.



Moose on the move

Populations

(continued)

Lesson 24

Assignments

1. Explain the difference between a census and a sample. Then explain the difference between a population and a community.
2. Draw or copy a picture of a sky full of birds in flight. Using a ruler, divide the picture into four equally sized parts. Compute the population of birds in the picture by using two different methods:
 - a. Sampling: Count all the birds in one area of your picture and multiply that number by the number of areas in which you have divided the picture.
 - b. Census: Count each bird in the entire picture.

Which method was more accurate? Why? Please write a paragraph explaining your thinking.

3. What is the population of your hometown? What was the population about ten years ago? 50 years ago? One hundred years ago? Has the population increased or decreased? You may be able to find this information from your town clerk's office, your local library, or online. Draw a simple line graph that shows this data. Make sure to label the graph's axis (one will show the date and the other will show the population) and give your graph a title that indicates what it is (such as "Baltimore's Population Growth Over Time").



Choice Assignment Choose **one** of the following projects.

- A. **Life in a 3 x 3 Space.** Mark off an area that has four sides, each side being three yards in length. Your square can be marked off with string, boundary markers in the four corners, or ribbons around trees. (The boundary markers will be removed when you are through with this project.) Your area can be in the woods, a meadow, or your yard. Make a list of 20 different living and non-living things you find in your area. (This might require careful searching, but any spot this size should contain at

least 20 different living organisms and nonliving factors, such as soil, rocks, air, and water.) Organize and number your list in the order of things that are most plentiful to things that are least plentiful. After you have made your list, list several examples of ways that the living and nonliving parts of your space interact. Draw a map of your area that includes all of the things on your list. Your map can be a detailed pencil sketch or a colorful drawing.

- B. **Estimate Populations.** Imagine that you are a scientist who works with population studies. Your most recent assignment is to estimate the number of ten specific living and nonliving things within the forests. Your ten subjects are oak trees, chipmunks, trilliums (a kind of wildflower), pinecones, chickadees, slugs, worms, stones, mushrooms, and coyotes. The problem is, you can only get to one-tenth of the forest space you are investigating; the forest is actually nine times bigger than what you are able to walk around in. Therefore, you must estimate the population of the entire forest based upon the population of one-tenth of the forest.

Which of these ten things you are counting will give you the closest estimate of how many are in the entire forest? Write down the item that you think will give the most accurate estimate. Then go through your list and number the items, starting with the one that you can get the most accurate information about and ending with the one you will probably be able to get the least accurate information about. Next to each item, write why you think you will get an accurate or inaccurate count of its entire forest population.

- C. **Life in the Year 2050.** Our human population is currently over 6 billion. Our human species, as it exists today, has been living on Earth for over 200,000 years. If in just 30 years our population is expected to reach 9 billion, can you imagine how Earth will be changed? Pretend that it is the year is 2050 and write a story about what you see, hear, and smell around you.

Think about where you live, the town center, the schools, the grocery stores, and movie theaters. What changes do you think will come about with double the population? Your story can be descriptive about what you witness at this time, or it can reveal how

Populations

(continued)

Populations

(continued)

you are affected emotionally by the human population growth. Can you imagine any ways that we can make changes in our lifestyles and communities in order to improve the quality of our lives and our environment in such a densely populated world? Think of any benefits that could come about from such a large population as well.

Lesson



Test Questions

1. What is a population study?
2. A population of a given species in a given area can change in size. What four factors can cause changes in a population of, for example, moose in Canada?
3. Name several ways in which we define human communities (hint: geographically, by religion, etc.).

Learning Assessment

Use assessment rubrics to track student progress and to make notes about the learning the student demonstrates or any skills that might need work.

SCIENCE	Not Yet Evident	Developing	Consistent	Notes
Differentiates between a census and a sample of a population				
Differentiates between a population and a community				
Compares accuracy of different methods of measuring populations				