DISCOVERY
SCIENCE CENTER

4th GRADE

4th Grade Science Content Standard: Life Sciences

3. Living organisms depend on one another and on their environment for survival.

d. Students know that most microorganisms do not cause disease and that many are beneficial.

Teachers: Microorganisms

No matter where you go on this planet, you'll find bacteria. In the billions of years bacteria have lived on Earth, these tiny survivors have changed and adapted to every environment. You'll find bacteria in icy regions, deserts, and rain forests—even places without air. Some live in the extreme environments of active volcanoes and hydrothermal vents on the ocean floor. Bacteria also live in the human body. In fact, the average healthy person is home to a stunning 100 trillion bacteria! Many bacteria are beneficial.

To replenish the soil, farmers introduce bacteria by growing peanuts. Legumes, a group of plants that includes peanuts, peas, and beans, have nodules, or bumps, in their roots. Caused by the *Rhizobium* bacteria, the nodules absorb nitrogen from the soil. They convert it to nitrate and create an essential nutrient that plants can use. This process works so well that farmers often plant legumes in fields every few years to renew nitrogen-depleted soil where other crops have been grown.

Yogurt is a food produced by the growth of other beneficial bacteria, *Lactobacillus bulgaricus* and *Streptococcus thermophilus* in particular. To make yogurt, active cultures are needed.

Activity: Making Yogurt

Materials:

Plain yogurt (with active yogurt cultures)
Quart jar with a tight seal
Tablespoon
Sauce pan

Measuring cups
Cooking thermometer
Powdered milk
Heat source
Towels
Milk

Procedure:

1. Combine ½ cup of powdered milk with 3½ cups of milk in a sauce pan.

2. Heat the mixture to 180^0F (82^0C) and then allow it to cool to 113^0F (41^0C).

3. Mix one tablespoon of yogurt into a small amount of the cooled milk mixture. Combine this with the rest of the cooled milk mixture and pour it into a very clean jar. Seal it well.

4. Wrap the jar in several towels to keep it warm. Let it stand for 6-10 hours.

Yogurt tends to be very tangy. It can be sweetened with honey or fruit.

4th Grade Science Content Standard

1. Electricity and magnetism are related effects that have many useful applications in everyday life.

e. Students know that electrically charged objects attract or repel each other.

Teachers: Electrically charged objects

Static electricity is called such because it remains stationary (or static) on the surface of an object, as opposed to the familiar "current electricity" that flows in a wire. At the heart of both types of electricity is the negatively charged electron. The shock you get after shuffling your feet across a wool rug comes from a static electricity charge—a charge composed of electrons rubbed from the rug onto the soles of the shoes. The rug's atoms, with their electron deficiency, become positively charged, while those in the shoe—and one's body—are negatively charged. A spark made up of these excess negatively charged electrons will jump from the fingers to a grounded object such as a doorknob or a less charged human being. Any object electrically charged this way also tends to attract another object with an opposite charge and to repel one with a similar charge.

Activity: Attraction of Opposite Charges

Materials:

Wool sweater
Balloon

Tissue paper or Styrofoam “peanuts”
Fluorescent light bulb

Procedure:

Rub the wool sweater with the balloon. The electrons from the sweater are transferred onto the balloon, giving the balloon a negative charge. Now place the balloon near several pieces of tissue paper or Styrofoam “peanuts.” The balloon’s negative charge repels electrons from the paper’s (or Styrofoam) surface, giving the paper’s (or Styrofoam) surface a positive charge. Since unlike charges attract each other, the balloon picks up the paper (or Styrofoam). This demonstrates how opposite charges attract one another.

Also, rub the fluorescent bulb against the wool sweater. The static electricity produced is enough to cause the mercury gas atoms inside the bulb to emit photons, lighting the bulb.

4th Grade Science Content Standard: Earth Sciences

5. Waves, wind, water, and ice shape and reshape Earth’s land surface.

a. Students know some changes in the earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

c. Students know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

Teachers: Glaciers

A glacier is a large, thick ice mass that forms over hundreds or thousands of years and moves slowly down a slope, pushing rocks and sand as it travels, causing dramatic change. As they move, glaciers can cause scratches or grooves on bedrock by abrasion, or they can make a glacial trough by widening, deepening, and straightening a mountain valley. Glaciers are responsible for many new landforms.

Activity: Effects of Glaciers

Materials:

Paper and pencils
Newsprint (optional) and markers
Ice cube trays
Water

Sand
Two hard plastic cups for each group
Teaspoon
Paper towels

Note: Before beginning the lesson, prepare the ice trays for the student activity. Make enough ice so that each group has two clear ice cubes and two that have been frozen with sand on the bottom. Then put the other materials in a central place so students are ready to begin immediately following the opening discussion.

1. Begin the lesson by asking students if they know what a glacier is. Write their ideas on the newsprint or chalkboard. As a class, arrive at a definition of a glacier. Tell students that they will participate in an activity that will demonstrate how glaciers can cause dramatic changes. Divide students into small groups; tell them to select one person in each group who's responsible for collecting materials for the group.

2. Have the designated students gather the materials for their groups. At this point, retrieve the ice cube trays from the freezer. Put two clear ice cubes in one cup and two sandy ones in another for each group. Distribute the hard plastic cups, two for each group.

3. Tell students to use a paper towel to pick up one of the sandy ice cubes. Instruct them to hold this ice cube against the side of the plastic cup and rub the bottom of the cube back and forth several times. Make sure each student in the group has a chance to rub the ice cube.

4. Ask the students to carefully examine the surface of the cup where the ice cube was rubbed. Have the students record their observations.

5. Then have the students follow the same steps with the clear ice cube. Make sure they rub this ice cube with as much pressure and force as they used for the sandy one. Ask the students to record their observations.

6. Have the groups clean up their areas as they finish the activity. When all the groups have completed the activity, bring the class together for a discussion. Ask what happened after the students rubbed the sandy ice cube against the cup. Ask what happened after the students rubbed the clear ice cube against the cup. The students will probably observe that the sandy ice cube made a mark on the cup, while the clear one did not.

7. Discuss with the class what the results show. Help the students understand that the sandy particles in the ice cube are what caused the mark on the cup. This rubbing motion is similar to the way glaciers cut deep depressions in the Earth's surface.

8. Conclude the discussion by asking the students if they can think of other natural forces that cause changes on the Earth's surface. Possible ideas include flowing water, wind, and the movement of tectonic plates or

underground water. Record the students' ideas on a sheet of newsprint or the chalkboard.

4th Grade Science Content Standard: Physical Sciences

1. Electricity and magnetism are related effects that have many useful applications in everyday life.

b. Students know how to build a simple compass and use it to detect magnetic effects, including Earth's magnetic field.

Teachers: Magnetic Field

Magnetism is caused by the movement of electrons. In a magnet, the spin of electrons in orbit around the nucleus of each atom creates the magnetic effect. Although all matter has electrons in orbit around a nucleus, in magnetic objects the atoms are all lined up so that they point in the same direction. By rubbing a nonmagnetic needle against a magnet, you cause the atoms in the needle to line up in the same direction, and the needle becomes magnetic.

The Earth has a large magnetic field due to the movement of the molten magma—melted rock—in the Earth's core. This magnetic field can be detected on the Earth's surface with a magnet. The needle of a compass lines up automatically with the Earth's magnetic field.

Activity: Making a Compass

Materials:

Scissors	2 needles (1½ inches or longer)
Bowl	Styrofoam plate
Ruler	Strong magnet
Compass	Tap water
Marker	Transparent tape

Procedure:

1. Use the compass to determine north, south, east, and west. Write N, S, E, and W on pieces of tape, and stick the tape in the same locations on the bowl as they are on the compass. Fill the bowl with water.

2. Cut a 1-inch (2.5 cm.) disk from the Styrofoam plate.

3. Magnetize one of the needles by rubbing it against a strong magnet 30 or 40 times. This works best if you always rub in the same direction. You

can tell that the needle is magnetized when it attracts the other needle to it, just like a real magnet.

4. Insert the magnetized needle lengthwise through (and parallel to) the disk.

5. Place the disk in the labeled bowl of water. What happens? The needle should point north and south as it aligns itself with the Earth's magnetic field.