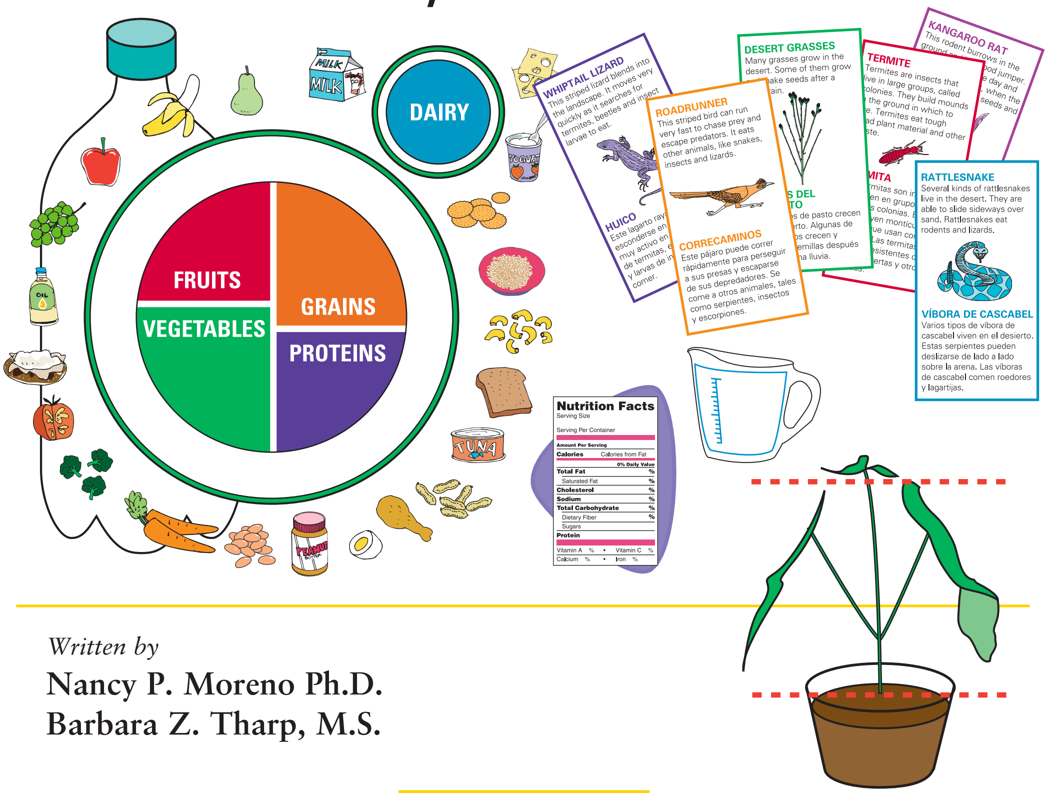
THE SCIENCE OF **Food**

TEACHER'S GUIDE

From Ecosystems to Nutrition



Written by
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BCM
Baylor College *of* Medicine

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Contents

THE SCIENCE OF FOOD

The Science of Food Teacher's Guide may be used alone. It also is integrated with the following unit components.

- ***The Mysterious Marching Vegetables*** (illustrated adventure story)
- ***Explorations*** (magazine for use in class or at home)
- ***The Reading Link*** (black-line masters for reading and language arts connections)
- ***The Math Link*** (black-line masters for mathematics connections)

TEACHER RESOURCES

Downloadable lessons and supplemental materials in PDF format, annotated slide sets for classroom use, streaming video lesson demonstrations, and other useful resources are available free at K8 Science (www.k8science.org).

Where Do I Begin?

WHERE DO I BEGIN?

The Science of Food Teacher's Guide may be used as a stand-alone set of science lessons. However, the other unit components are designed to be used with the guide. To begin the unit, some teachers prefer to generate student interest by reading part or all of the student story. Others use the cover of the magazine to build student enthusiasm. Still others begin with the pre-assessment lesson in this guide.

You may find it helpful to use the Sequence Guide on the following page to integrate the unit components into your schedule. When teaching for 45 to 60 minutes daily, most teachers will complete an entire unit with their students in two to three weeks. If you use the unit every other day or once per week, it will take three to nine weeks to teach, depending on the amount of time spent on each session.

The Science of Food Teacher's Guide provides background information for you, the teacher, at the beginning of each activity. In addition, a listing of required materials, estimates of time needed to conduct activities, and links to other components of the unit are given as aids for planning. Questioning strategies, follow-up activities and appropriate treatments for student-generated data also are included. Student pages are provided in English and in Spanish. The first and final activities in this guide are appropriate for assessing student mastery of concepts.

ABOUT THIS UNIT

The Science of Food activities, explorations and adventures provide students, teachers and parents with science educational materials that are integrated across several subjects of the curriculum. Prepared by teams of educators, scientists and health specialists, this unit focuses on a variety of physical and life science themes. The inquiry-based, discovery-oriented approach of the materials is aligned with National Science Education Standards and National Health Education Standards.

The Science of Food's integrated components help students understand important science, health and environmental concepts related to food and food safety.

- ***The Science of Food Teacher's Guide*** provides inquiry-based lessons that entice students to discover concepts in science, mathematics and health through hands-on activities.
- ***The Mysterious Marching Vegetables,*** an illustrated storybook, presents an engaging mystery adventure about cousins Riff and Rosie in an illustrated format that also teaches science and health concepts.
- ***Explorations*** is a colorful mini-magazine full of activities, information, and fun things for children and adults to try in class or at home.
- ***The Reading Link*** provides language arts activities related to the story.
- ***The Math Link*** extends each unit by connecting the story and hands-on science activities to mathematics skill-building and critical thinking exercises.

The Science of Food unit offer flexibility and versatility, and are adaptable to a variety of grade levels and teaching and learning styles.

USING THE UNIT AT THE K-1 LEVEL

The Science of Food unit easily can be adapted for use with younger students. To begin, introduce students to the main characters in the storybook, *The Mysterious Marching Vegetables*. Then read the beginning of the story to students. Demonstrate the activity in the back of the storybook and help students do it themselves.

Each story session should cover only about five pages of the book, accompanied by science concepts. The *Explorations* magazine also is an appropriate teaching tool. With very young children, it may be more fitting to conduct some of the activities as teacher demonstrations, unless you have several helpers to assist with the hands-on activities.

Sequence Guide

The Science of Food unit components can be used together in many ways. The chart below may help you coordinate the activities in this guide with the unit's student storybook, *The Mysterious Marching Vegetables*, and the *Explorations* magazine. Similar information is provided in the "Unit Links" section of each activity in this book.

Additional classroom materials for this unit, including *The Math Link* and *The Reading Link* (PDF format), annotated slide sets for classroom use, streaming video lesson demonstrations, and other useful resources, are available free at K8 Science (k8science.org).

The Science of Food activities are designed to be conducted by students working in collaborative groups. Assign the following roles to group members.

- **Principal Investigator:** Asks others to help, asks questions
- **Materials Manager:** Collects materials, helps the Principal Investigator
- **Recorder:** Writes or draws results, tells teacher when the group is done
- **Safety Scientist:** Follows the safety rules, directs clean-up

ACTIVITY	CONCEPTS	CLASS PERIODS TO COMPLETE	LINKS TO OTHER UNIT COMPONENTS	
			The Mysterious Marching Vegetables	*Explorations*
1. **What's That Food?** Pre-assessment	Six groups of foods are important for health.	1	Story, p. 1–5	Cover activity
2. **What Is Soil Made Of?**	Soil is a combination of living and non-living things.	2	Story, p. 6–8; Science box, p. 8	
3. **Do Plants Need Light?**	Plants need light for photosynthesis.	4+	Story, p. 8–10; Science box, p. 10	Let's Talk About the Food We Eat, p. 2–3
4. **Plant Parts You Eat**	People use many plant parts as food.	1	Story, p. 11–17; Science boxes p. 11–12	Food for You! p. 6
5. **Food Webs**	Producers use solar energy to make food. Consumers depend on producers.	1–2	Story, p. 18–21; Science boxes, p. 14–15, 19–20	"Sun Power" section of Let's Talk About the Food We Eat, p. 2
6. **Digestion**	Chemicals break food down during digestion.	1	Story, p. 21–25	Chew on This, p. 8; Neat Teeth, p. 8
7. **Bio Build-up**	Pollutants build up in the bodies of animals.	1	Story, p. 25–26; Science box, p. 25	
8. **They're Everywhere: Bacteria**	Bacteria can make food unsafe to eat.	2+	Story, p. 27–31; Science boxes, p. 15 and 34 (top)	Tips for Healthy Living, p. 3; Not Such a New Issue, p. 6
9. **Using Food Labels**	Food labels tell about nutritional value of foods.	1	Story, p. 34–35; Science boxes, p. 3 and 34 (bottom)	From the Label to the Table, p. 4; Marta Fiorotto, p. 7
10. **Safe Food Preparation**	Safe food preparation is easy.	1	Science boxes, p. 32–33	How Much Fat..., p. 6
11. **Healthy Snacks** Post-assessment	Post-assessment using mock food labels.	1	Review Science boxes throughout	We Can Make a Difference!, p. 5

Materials

You will need the following materials and consumable supplies to teach this unit with 24 students working in six cooperative groups. See Setup sections within each activity for alternatives or specifics.

ACTIVITY 1 (p. 1)
24 brown paper lunch bags
24 hand lenses (magnifiers)
6 or more sheets of white construction or chart paper, 9 in. x 12 in.
4 pieces each of food from the six major food groups (see Setup): dairy (cheese); fruit (any fresh or canned); vegetables (non-starchy, i.e., green beans, celery, cabbage, lettuce, spinach, etc.); meats/proteins (beef jerky, peanuts, dried peas or beans); grains/breads (rice, whole-grain bread, cereal or pasta); oils/sweets (candy or cookies)

ACTIVITY 2 (p. 5)
24 craft sticks, toothpicks or coffee stirrers
24 hand lenses (magnifiers)
12 cups of natural soil
12 paper plates
6 clear soft drink bottles with screw-on caps, 2-liter size
6 measuring cups
6 metric rulers
3 tsps of alum (1/2 tsp per group)
Newspapers to cover work areas

ACTIVITY 3 (p. 11)
24 hand lenses (magnifiers)
24 peat pots, 3-in. (or disposable cups)
24 sheets of paper towels or paper plates
12 cups of soil (see Setup)
6 dispensing bottles (2-oz size), or droppers
6 metric rulers
4 pieces of string or yarn (each approx. 6-in. in length)
1/4 lb of bean seeds (see Setup)

ACTIVITY 4 (p. 18)
6 crayons or markers
6 pieces of whole fresh fruits, vegetables or grains (see Setup)
6 plastic, serrated knives
6 sheets of white construction or drawing paper, 9 in. x 12 in.

ACTIVITY 5 (p. 21)
6 sets of crayons: one each of blue, green, red and yellow
6 sets of Ecosystem Cards (each set represents one ecosystem, see Setup)
6 sheets of white construction or drawing paper, 9 in. x 12 in.

ACTIVITY 6 (p. 29)
12 clear, resealable plastic bags, sandwich size
6 plastic, serrated knives
3 slices of turkey luncheon meat
3 tsps of meat tenderizer (1/2 tsp per group), or papaya enzymes (available at health food stores)

ACTIVITY 7 (p. 32)
24 pairs of scissors
3 pkgs of 1/4-in. round color coding labels (dots), asst. colors (760 per box; approx. 80 dots per student)
Crayons or colored markers

ACTIVITY 8 (p. 36)
24 cotton swabs
18 sterilized petri dishes (see Setup)
Distilled or boiled water (for swabs)
Masking tape for labeling and sealing petri dishes
Nutrient agar
Pens or markers

ACTIVITY 9 (p. 39)
6 cups of white sugar
6 measuring cups
6 measuring spoons

ACTIVITY 10 (p. 45)
24 clear resealable plastic bags, freezer weight, 4 in. x 6 in.
24 plastic spoons
24 tbs of sugar
12 clear resealable plastic bags, freezer weight, 1-gal size (12 in. x 15 in.)
12 cups of milk
12 tsps of unflavored gelatin
6 cups of orange juice
6 gal of ice
6 measuring cups
6 measuring spoons
5 cups of rock salt
Clean-up supplies

Safety Recommendations: Always follow all district and school science laboratory safety procedures. It is good practice to have students wash hands before and after any laboratory activity. Clean work areas with disinfectant.

What's That Food?

1

Pre-assessment

Food gives your body the fuel and raw materials it needs each day. Just like a car needs gasoline, your body needs energy to move, think and grow. The usable energy you get from food is measured in calories. The more calories a food has, the more energy it can supply. The amount of calories a person needs depends on his or her activities. The body stores extra calories as fat.

However, food provides more than just energy. It supplies the building materials, such as proteins and minerals (like calcium), for muscles, bones and other body parts. Food also has small amounts of other minerals and vitamins that help make energy available for muscles and the brain, and make other body functions possible.

No matter what your age or lifestyle, eating the right foods can contribute to good health. The U.S. Department of Agriculture (USDA) recommends that people select a diet that includes a variety of foods in the proporations indicated on the student page. In addition, it is important to balance the food you eat with physical activity; consume plenty of grain products, vegetables and fruits; choose a diet low in fat, saturated fat and cholesterol; and moderate your intake of sugars and salt.

This activity can be used as a pre-assessment of students' knowledge about nutrition and food needs.

Unit Links

The Mysterious Marching Vegetables
Story, p. 1–5

Explorations
Cover (answers p. 8)

SETUP

Each group of students will observe and describe a different food item. To prevent students from identifying the foods assigned to other groups, all of the food items should be kept inside brown paper bags. You will need to create a set of four identical bags for each group of four students (to allow each student to make his or her own observations). For example, each student in Group 1 will

Sample Setup

Student Group	**Six Basic Food Types: One Food Type per Student Group**	**Set of Four Bags** (1 piece per bag)
Group 1	**Grains:** Rice, whole-grain bread, cereals or pasta	macaroni
Group 2	**Vegetable:** Any non-starchy vegetable (green beans, celery, cabbage, lettuce, or spinach, etc.)	spinach leaves
Group 3	**Fruit:** Any dried fruit (raisins or prunes, etc.) or fresh fruit (apples, grapes, oranges or bananas)	dried prunes
Group 4	**Dairy:** Cheese	swiss cheese
Group 5	**Protein:** Dried beans, nuts or beef jerky	beef jerky
Group 6	**Oils, Fats and Empty Calories:** Candy or cookie	sandwich cookies

CONCEPTS

- Food comes in many forms.
- We need a minimum number of servings of certain foods and very little of others.
- There is a lot to know about healthy eating.

OVERVIEW

Students observe and describe samples of different food groups.

SCIENCE, HEALTH & MATH SKILLS

- Observing
- Recording observations
- Predicting
- Inferring
- Drawing conclusions

TIME

Preparation: 20 minutes
Class: 45 minutes

MATERIALS

- Food items representing five basic food groups and group of oils, fats and sweets (4 pieces of each item—see Setup)

Each group will need:

- Sheet of white construction or chart paper, 9 in. x 12 in.
- 4 brown paper lunch bags with food item (see Setup)

Each student will need:

- Hand lens (or magnifier)
- Copy of "Healthy Eating" sheet

ROOT OR STEM?

The part of the potato we eat is a specialized underground stem used for the storage of starches.

Photo © Adam Hart-Davis.

OPTIONAL PRE-/POST-ASSESSMENT

PICK A FOOD

Select a favorite food and answer the following questions.

- Where does this food come from?
- What other kinds of organisms might eat this food?
- To which food group or food groups does the food belong?
- How many servings a day should someone eat of this food?
- What would you do before cooking or eating this food?
- Where would you store this food?

Draw and write a Nutrition Facts label for your food.

receive a bag with one piece of macaroni. Select a different food type for each student group (see "Sample Setup" chart, page 1).

PROCEDURE

1. Divide students into groups of four. Explain that each group will be responsible for examining and reporting on a specific food item.
2. Distribute a set of bags to each group, explaining that although students may recognize the food, they should not call the name out loud. It will be a mystery food for other groups to identify, based on their observations and prior knowledge.
3. Ask students to observe the food in their bags, using all their senses except taste. Encourage use of the hand lens for closer observation. Questions to ask students include: *How does it feel, sound, look, and smell? Do you recognize this food? Do you eat this food? Do you think it is good for you? How much of this type of food would you need to eat daily? Where does it come from?*
4. Have each student write down his or her observations and anything specific that he or she knows about the food being observed. However, students should not name the food.
5. Students should share their observations within their groups. The groups' Reporters should make a list of the observations on construction paper. A good way for the group to share responsibilities is to have the members take turns giving one observation at a time for the Reporter to record. Once an observation has been shared, any other group member with the same observation should check it off his or her list. This will continue until all, or at least most, of the observations are listed.
6. Have the Materials Managers place their charts on the wall where all students can view them.
7. Student groups should view each of the charts and decide, based on the recorded observations, what food is being described and whether or not they have additional observations or information about that food.
8. Lead a discussion, based on the information on the charts, with the entire group. Explain that all the foods observed and discussed are necessary, but that different amounts of each are recommended for optimum health.
9. Conclude by using the "Healthy Eating page." Ask students to identify the group to which each of the foods examined belongs. Have students work in their groups to create a menu for one day that includes appropriate numbers of servings from each of the food groups.

Healthy Eating

Comiendo Saludablemente

Follow the recommendations below to design a menu for one day. Write the foods for each meal in the spaces below. Use the “My Plate” picture as a guide for each meal. (Hint: The small dairy “dish” can be a cup, bowl or saucer.)

Sigue las recomendaciones para diseñar un menú para un día. Escribe los alimentos para cada comida en los espacios que ves a continuación. Usa el diagrama “Mi Plato” coma guía para cada comida. (Sugerencia: el lugar para productos lácteos puede ser un plato o un vaso.)

My Plate/Mi plato

Oils are not a food group. Get your oils from fish, nuts and liquid oils, like corn oil, soybean oil or canola oil.

Los aceites no se consideran como grupo de alimentos. Se debe comer aceites de pescado, nueces, y en forma líquida, como los aceites de maíz, soya o canola.

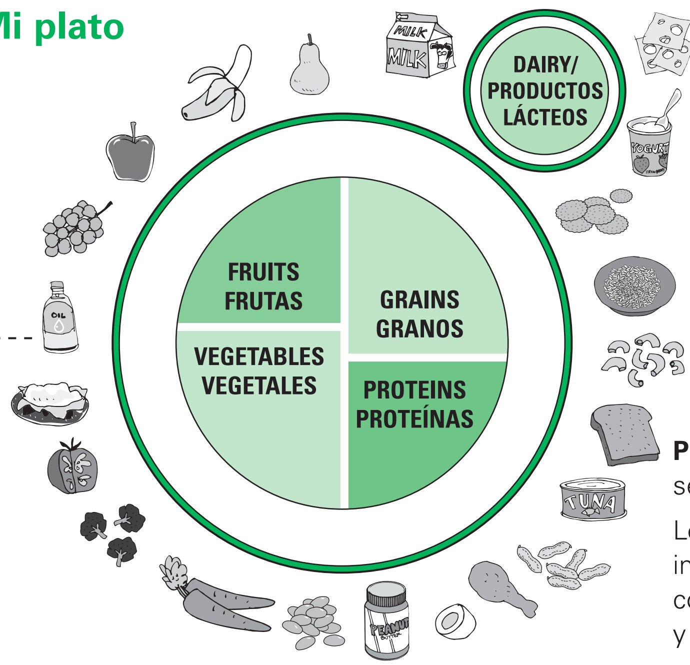


Illustration from the USDA.

Be active! Walk, dance, bike–it all counts. Aim for 60 minutes every day.

¡Se activo! Camina, baila, anda en biclicleta–todo cuenta. Trata de alcanzar 60 minutos todos los días.

Proteins include meats, poultry, seafood, dried beans and nuts.

Los alimentos ricos en **proteínas** incluyen las carnes, las aves de corral, los pescados, los frijoles, y las nueces.

Breakfast
Desayuno

Lunch
Almuerzo

Dinner
Cena

Snacks
Merienda

Building Blocks for Food

Physical Science Basics

THERMIC REACTIONS

Endothermic reactions (endo = inside; thermic = heat) require energy to be added. During photosynthesis, for example, light energy is used to power the manufacturing of sugars. In fact, photosynthesis involves a series of endothermic reactions.

Reactions that release heat are known as exothermic (exo = outside; thermic = heat). The breakdown of sugars inside our bodies to release energy is an example of an exothermic reaction. Excess energy released as heat helps keep us warm.

A chemical reaction takes place any time substances come together and are transformed into new substances. The rising of a cake in the oven, the powering of an automobile by gasoline and digestion of food within our bodies all are examples of chemical reactions.

Did you know that heat energy is measured in calories? One calorie represents the amount of heat that it takes to raise the temperature of one cubic centimeter of water (10 milliliters) one degree. The Calories reported on food labels are kiloCalories (1,000 calories).

All the food on our planet depends on the sun and on nutrients in soil and water. You never may have thought about it in this way, but the food that we and all other animals eat ultimately comes from very simple raw materials put together by green plants and their relatives.

LEAVES **use sunlight for photosynthesis.**

ROOTS **anchor the plant and take in water and nutrients from soil.**

STEMS **provide support and transport materials up to leaves and down to roots.**

The healthy root system of this melon seedling shows it is ready for transplant into a larger container. Photo © Martyn Garrett, ossettweather.blogspot.com.

All living things need energy and nutrients to grow, move and stay warm. Some are able to capture energy directly from the sun through a process known as photosynthesis. Green plants, algae, "seaweeds" and some bacteria are examples of organisms that use energy directly from the sun to make their own food. The trapped energy is stored in food molecules, such as sugars and starches. Photosynthesis relies on carbon dioxide from air and water from soil. Soil also provides other essential minerals and nutrients for plants.

Soil consists of bits of mineral rock; pieces of animal and plant material; living things, such as bacteria, fungi, plant roots, insects and other animals; air spaces; and water. Soils develop slowly over time from weathered rock and sand.

The following activity introduces students to soil, which provides two of the three building blocks for photosynthesis. The role of light, another requirement for plant growth, is explored in Activity 3 of this guide. Additional activities on light and light energy can be found in The Science of Global Atmospheric Change unit. Activities on water are the focus of the The Science of Water unit.

What is Soil Made Of?

2

Physical Science

Carbon, oxygen and hydrogen are the building blocks of the molecules that make up our bodies, our foods and even the fuels we burn. These elements are combined during photosynthesis to make energy-rich materials, such as sugars and other carbohydrates (starches). Plants obtain hydrogen from liquid water (H_2O). They obtain carbon from carbon dioxide (CO_2) gas in air. Oxygen is part of both water and carbon dioxide, and is present as oxygen gas (O_2) in air. However, all living things, including plants, require additional materials to carry out the chemical processes necessary for life.

Where do these other materials come from? Most of them are released into water from soil. Plants and plant-like organisms, such as algae, absorb nutrients dissolved in water. Examples of these nutrients include nitrogen, phosphorous and potassium. Non-photosynthetic organisms obtain the minerals and more complex molecules that they need by consuming plants and other living things. Thus, the nutrients in soil are important not only for supporting plant growth, but also for assuring that other organisms are able to grow and survive.

Unit Links

The Mysterious Marching Vegetables
Story, p. 6–8;
Science box, p. 8

Soil has both living and non-living components. It constantly changes through the action of weather, water and organisms. Soil formation takes a very long time—up to 20,000 years to make 2.5 cm of topsoil! This is only as deep as a quarter standing on its side!

The non-living parts of soil originated as rocks in the Earth's crust. Over time, wind, water, intense heat or cold, and chemicals gradually break rocks into smaller pieces, a process known as weathering. The size and mineral composition of the tiny rock particles determine many of the properties of soil.

Most soils are enriched by decomposed plant and animal material. Soil is home to many kinds of organisms: bacteria; fungi; algae (plant-like organisms that live in water or moist environments); earthworms; insect larvae; and plant roots, to name a few. Soil also contains many tiny air spaces. Typical garden soil is 25% water, 45% minerals, 5% material from living organisms and 25% air.

SETUP

This activity works best with a recently dug sample of natural soil (from a field, yard, garden or the playground). About one large shovelful will be enough for the entire class. Collect the soil 24 hours or less before conducting the activity and store it in a large plastic bag (do not seal completely). Read "Safety," page 3.

Have students work in groups of 2–4 to conduct the activity.

CONCEPTS

- Soil is a combination of many different living and non-living things.
- Soil provides raw materials needed by all living things.

OVERVIEW

Students explore a sample of natural soil by identifying and separating its different components.

SCIENCE, HEALTH & MATH SKILLS

- Observing
- Measuring
- Recording observations
- Drawing conclusions

TIME

Preparation: 10 minutes for each session

Class: 30 minutes for each of 2 sessions

MATERIALS

Each group will need:

- 2 cups of natural soil
- 2 paper plates
- 1/2 tsp of alum
- Clear soft drink bottle with screw-on cap, 2-liter size
- Measuring cup
- Metric ruler
- Newspapers to cover work area
- Copy of "Soil Observations" sheet

Each student will need:

- Craft stick, toothpick or coffee stirrer
- Hand lens (magnifier)

SOIL LAYERS

Soils usually are layered. This layering can be observed along the sides of new roadways or in a recently dug hole. The top layer of soil consists of partially broken down plant and animal material, called humus. Immediately below is a layer of soil, enriched with tiny particles of dead plant and animal material. Below that is the first layer of mineral soil. It consists of 50–70% mineral particles, combined with plant and animal (organic) material. Even further down, there may be several more layers, made up of mineral soils with progressively less organic material. The deepest soil layers are similar to the original mineral rocks from which the soil was formed.

SAFETY

You may want to sterilize soil by baking it at 375°C for 30–40 minutes. Or microwave loosely covered damp soil at full power for seven minutes. You also can create your own soil mix for students by combining packaged top soil and sand with a small amount of mulch.

PROCEDURE

Session 1: Looking at soil

1. Direct students to cover their work areas with newspapers. Have the Materials Manager from each group measure about 2 cups of soil onto a paper plate and bring the soil back to their group.
2. Have students place about 1/2 of their group's soil in the center of their work area. Have them take turns describing the soil, using all of their senses, except taste. Ask, *What does the soil look like? How does it smell? How does it feel?*
3. Ask each student to write three words that describe some aspect of the soil sample on his or her student sheet.
4. Next, direct students to spread out the sample (using toothpicks, popsicle sticks, etc.) and to observe the different components of the soil sample. Ask, *What are some of the things that you can see in the soil?* Possibilities include twigs, pieces of leaves, plant roots, insects, worms, small rocks and particles of sand. Ask, *What are some things in soil that we can't see?* Answers may include air, water and microorganisms.
5. Have students list or draw the different things they find in their soil samples. Suggest that they think about and classify the different components of soil as coming from living or non-living sources.

Session 2: Soil texture

1. Each group will need a soft drink bottle (with cap) and the other half of its soil sample.
2. Ask students to describe the different components of the soil they investigated during the previous session. Tell them that now they are going to observe the make-up of soil in a different way.
3. Have each group add about 1/2 cup of soil and 1/2 teaspoon of alum to the soft drink bottle, then add water until the bottle is 3/4 full. If students have difficulty pouring soil into the bottle, have them make a paper funnel by rolling a sheet of paper into a cone shape.
4. Direct students to cap the bottles tightly and shake the bottles for about one minute.
5. Next, have students place the bottles in the centers of the groups' work areas and observe how quickly or slowly the different types of particles settle.
6. When layers are visible at the bottom of the bottle, have students measure and mark the layers and draw their observed

results on their student sheets. To facilitate accurate measuring, you may want to instruct students to fold a sheet of paper lengthwise, hold it against the side of the bottle, and mark the boundaries of each layer on the paper.

7. After students have completed their observations, invite the groups to share their observations. Ask, *How many different layers did you find? What was on the bottom? What was on the top?* The heaviest particles, such as sand and rocks, usually will make up the bottom layer, followed by fine sand and silt. Some clay particles are so tiny that they will remain suspended in the water. Plant and animal material also may remain floating at the top of the water. You also might ask, *Of what do you think soil is mostly made?*

VARIATIONS

- Create unique soil samples for each group by mixing varying amounts of soil and sand from different sites. Have students compare their results and discuss which samples might be the best to use in a vegetable garden. Have them test their predictions by putting the different kinds of soils in pots or cups and planting flower or vegetable seeds in each one.
- Provide samples of pure sand and pure dry clay for students =to examine with their magnifiers. Have them write about the difference between the samples.
- Try making your own pH paper to test soil acidity. Place about 1 cup of sliced purple cabbage into a sealable bag filled with warm distilled water. When the water is dark blue or purple, pour it into a container. Cut white coffee filters into 1-inch wide by 6-inch long strips. Dip the strips into the cabbage water and allow them to dry on a hard surface. Test the pH strips in vinegar (weak acid) and water with baking soda (weak base) to see how they change color. Measure 1/2 cup of soil into 2 cups of distilled water. Test the water using the pH strips. Compare several soils from different locations.

QUESTIONS FOR STUDENTS TO THINK ABOUT

Nitrogen is very important for living organisms. It is found in proteins and in DNA (hereditary material in cells). Surprisingly, however, only a few organisms can use the abundant free nitrogen present in air. Most of these nitrogen-trapping organisms are bacteria that live in soil or in water. All other living things, including plants, depend on forms of nitrogen produced by nitrogen-trapping bacteria. Some nitrogen-trapping bacteria even work as partners with plants. They form special swellings or nodules in the roots of certain plants. This is especially common among members of the bean family (also known as legumes). See what you can find out about the partnership of these kinds of plants with bacteria OR have students create drawings of what they discover about the nitrogen cycle.

CLASSIFYING SOIL

The non-living part of soil is made up of rocks and minerals, which are classified according to size. The classification names refer only to the size of the particle, not the composition of the sediment (e.g., a clay-sized particle might not be composed of a clay mineral).

- **SAND** (2–0.2 mm in diameter) is the largest size particle. Soil with a lot of sand feels gritty.
- **FINE SAND** (0.2–0.02 mm in diameter) feels less gritty than sand, but still can be seen without a magnifier.
- **SILT** (0.02–0.002 mm in diameter) feels powdery. You need a magnifier to see individual particles.
- **CLAY** (less than 0.002 mm in diameter) particles are so tiny that they cannot be observed, even with a low power microscope. A large percentage of clay in soil makes the soil feel sticky. Sometimes, you even can shape or mold it!

The best soils for growing plants have a mix of particle sizes and considerable amounts of dead plant and animal material. These soils have many nutrients and help hold water for plants.

Water in soil is present primarily as a film on the surfaces of soil particles.

2 Soil Observations

Plants get water and nutrients from soil. Soil is important for people because we depend on plants that grow in soil.

Do you know what's in soil? To find out, you will need a clear soft drink bottle, soil, alum, water, a measuring cup, markers or crayons and a ruler.

Looking at Soil

1. Put about 1 cup of soil in the middle of your table. Write three words to describe the soil.

   ____________________ ____________________ ____________________

2. Find as many different kinds of things as you can in your soil. Make a list or draw all of the different things you observe. Use the back of this page for your list.
3. Put a star by all of the things on your list that are living or came from something living.

Soil Texture

1. Measure $\frac{1}{2}$ cup of soil and pour it into the bottle.
2. Measure one half teaspoon of alum and add it to the bottle.
3. Add water until the bottle is $\frac{3}{4}$ full.
4. Screw on the lid and shake the bottle.
5. What do you predict will happen to the soil? ____________________

   ____

6. Set the bottle down and let the soil settle. Watch what happens.
7. How many layers can you see in the soil? ____________________
8. What does the bottom layer look like?

   ____

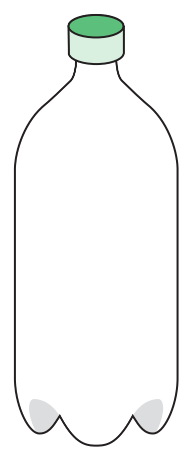
   ____

9. What does the top layer look like?

   ____

   ____

10. Draw lines on the bottle to the right to show each layer that formed in your bottle.
11. Measure each real layer in centimeters. Record your measurements below.



Observaciones sobre el Suelo

2

Casi todas las plantas crecen en el suelo, de donde éstas obtienen agua y nutrientes. El suelo es importante para nosotros porque necesitamos las plantas que crecen ahí.

¿Sabes qué hay en el suelo? Para investigar esto, vas a necesitar una botella transparente de plástico, suelo, alumbre, agua, una taza de medir, marcadores o crayolas y una regla.

Observando el Suelo

1. Vacía una taza de suelo en medio de la mesa. Escribe tres palabras descriptivas acerca del suelo.

   ______________ ______________ ______________

2. Busca tantas cosas diferentes como sea possible en el suelo. Haz una lista o dibuja las cosas que observas. Usa el otro lado de la página si necesitas más espacio.
3. Senãla con una estrella los objetos que observaste que provienen de algo viviente.

Observando el Suelo

1. Mide una taza de suelo y viértelo en la botella
2. Mide $\frac{1}{2}$ cucharadita de alumbre y añádelo a la botella.
3. Añade agua para llena $\frac{3}{4}$ r partes de la botella.
4. Tapa la botella y agítala.
5. ¿Qué predices que pasará al suelo? ______________

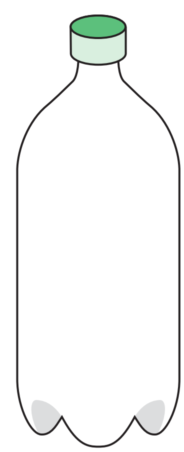
   ____
6. Pon la botella en la mesa y observa lo que pasa.
7. ¿Cuántas capas de suelo ves en el fondo de la botella? ______________
8. Describe la capa inferior.

   ____

   ____
9. Describe la capa superior.

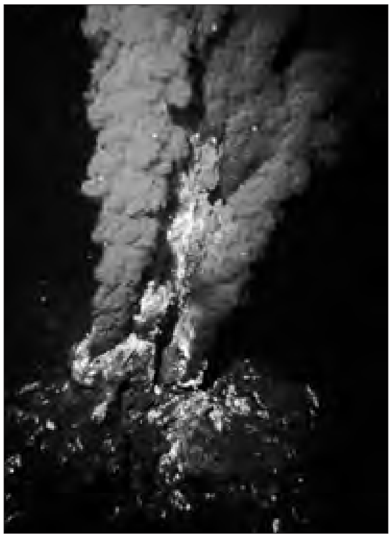
   ____

   ____
10. En la botella que ves al lado, marca una línea para cada capa de suelo que observaste.
11. Mide cada capa que ves dentro de la botella. Escribe tus medidas en el espacio abajo.



Food and Energy in Living Things

Life Science Basics



Some specialized bacteria make the molecules they need without sunlight. Bacteria that live in hot deep-sea vents obtain energy through the chemical breakdown of hydrogen sulfide in a process known as chemosynthesis. The bacteria are the primary producers in this environment.

In soil, some bacteria combine nitrogen- or iron-containing compounds with oxygen and capture the energy produced by these reactions.

Photo courtesy of NOAA.

Living things often are classified as producers or consumers, depending on how they obtain energy and nutrients. Producers typically are able to use solar energy to make the molecules they need from relatively few substances present in the air, water and soil. On land, green plants are the primary producers. In water, some plants and many varieties of algae, bacteria and other one- to many-celled organisms (Protists) are producers. All other organisms are consumers, which live directly or indirectly on food provided by producers.

Almost all producers make the molecules they need through photosynthesis. During photosynthesis, producers absorb energy from the sun and use it to combine carbon from carbon dioxide with water to make sugars and other carbohydrates. Thanks to this amazing process, light energy from the sun is converted into chemical energy stored in the bonds between atoms that hold molecules together. Plants use the energy stored in these molecules to build other compounds necessary for life. Likewise, consumers, who cannot trap energy directly from sun, must rely on molecules manufactured by plants for food.

The general sequence of who eats whom in an ecosystem is known as a food chain. Energy is passed from one organism to another at each step in the chain. Along the way, much energy is given off as heat. In fact, about 85–90% of the total usable energy is released as heat at every step in a food chain. Most organisms have more than one source of food. The relationship among all the energy flow interactions that happen in an ecosystem usually are described as a food web.

PRODUCERS AND CONSUMERS

- **HERBIVORES**, such as giraffes and caterpillars, are primary consumers. They feed on plants and other producers.
- **CARNIVORES**, such as anteaters and spiders, are secondary consumers. They feed on primary consumers. Most secondary consumers are animals, but a few are plants, like the pitcher plant.
- **OMNIVORES** eat plants and animals. Humans, pigs, dogs and cockroaches all are omnivores.
- **DECOMPOSERS** live off waste products and dead organisms. Many kinds of bacteria and fungi (molds and mushrooms) are decomposers. The decomposers themselves are important food sources for other organisms in soil, such as worms and insects. Litterfeeders, such as termites and earthworms, feed on partially broken down bits of plant and animal matter.
- **SCAVENGERS** feed on dead organisms that have been killed by another animal or that have died naturally. Vultures, flies and crows are examples of scavengers.

Do Plants Need Light?

3

Life Science

Only producers, such as green plants, are able to make the molecules needed for life from simple compounds in the air, soil and water. Almost all producers use energy from the sun to make food through photosynthesis. During photosynthesis, light energy is trapped and transformed into chemical energy that can be used by cells. Very few raw materials are required. Green plants need only water (H_2O) and carbon dioxide (CO_2) in the presence of light to manufacture sugar molecules and other carbohydrates, such as starch. Plants use the energy held in carbohydrates to fuel chemical reactions and to make other molecules necessary for life. Other needed materials (such as nitrogen, phosphorous or potassium) are taken in through plant roots. This activity allows students to learn about the needs of plants and the role of light in plant growth.

Growing plants in the classroom can be a simple and rewarding process for students. Elaborate equipment is not necessary for growing plants indoors. If you do not have a window with bright light, place plants under a fluorescent lamp. Allow only about five inches from the tops of the pots or growing plants to the light source. Inexpensive fluorescent lamps appropriate for growing plants often are sold in hardware stores as "shop lights."

Unit Links

The Mysterious Marching Vegetables
Story, p. 8–10;
Science box, p. 10

Explorations
Let's Talk About the Food We Eat, p. 2–3

SETUP

Soak enough bean seeds overnight in a container of water to give at least 12 soaked seeds to each group of students (4 seeds for observation). Each group also will need at least 4 dry bean seeds.

Moisten the soil before use. Place the soil in a plastic bag or container and add water until it is damp. Let the moistened soil in the unsealed bag sit for at least 1/2 hour before using.

As an alternative to peat pots, use disposable plastic or foam cups (punch one or more drainage holes in the bottom of each cup). Once students have planted their seeds, set the pots on plastic or foil trays near a light source.

SAFETY

Have students wash hands before and after the activity. Clean work areas with disinfectant.

PROCEDURE

Session 1: Observing dry seeds

1. Give each student a dry bean and a magnifier. Have students use their magnifiers to observe the bean seeds. Each student

CONCEPTS

- Plants require light, water, air and soil to grow.
- Light is necessary for the production of new plant material.

OVERVIEW

Students learn about plant growth and development by conducting an experiment that demonstrates the importance of light to plants.

SCIENCE, HEALTH & MATH SKILLS

- Observing
- Recording observations
- Measuring in centimeters
- Comparing measurements
- Graphing measurements
- Interpreting results
- Drawing conclusions

TIME

Preparation: 10 minutes per session
Class: 30 minutes for each session; 10–20 minutes each day for 1–2 weeks;

MATERIALS

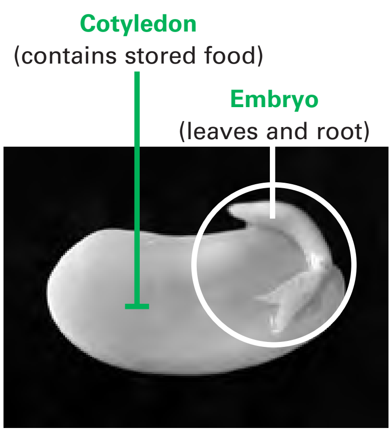
Each group will need:

- 12 soaked bean seeds
- 4 dry bean seeds
- 4 hand lenses (magnifiers)
- 4 peat pots (3-in. size), or disposable cups
- 4 pieces of string or yarn (each approx. 6-in. in length)
- 4 sheets of paper towels or paper plates
- 2 cups of moistened soil
- Dispensing bottle (2-oz size), or dropper
- Metric ruler
- Copies of student sheets (p. 14–17)

COTYLEDONS

As shown by the Mung bean seedling (above), the cotyledons have expanded, thrown off the seed shell, and now are located just beneath the seedling's first true leaves. The green pea seedling's cotyledons remained encased in its seed coat to act as an underground storage organ.

Photo © Annkatrin Rose, Ph.D.



Bean seed embryo without its seed coat.

Photo © Rhonda Clark.

> ### ETIOLATION
> Plants growing in dark conditions sometimes will develop tall spindly stems. This process, called etiolation, is a result of plants using their energy to grow upward in search of light.

should draw a seed on his or her "Seeds and Seedlings" sheet. Make sure that each student is able to observe the seed coat and the dark indentation on one side of the seed, corresponding to where the new plant will emerge.

Session 2: Observing and planting soaked seeds

1. Before proceeding with planting, give each student a soaked seed (on a paper towel) for observation. The students should compare the soaked seed to a dry seed. Ask, *How is the soaked seed similar to the dry seed? How is it different?* Have students remove the "skin" (seed coat) and spread apart the pieces of the tiny plant inside. They will be able to identify the cotyledons (seed leaves), other tiny leaves and the beginnings of what will become the plant root.
2. Have Materials Managers pick up 4 pots and 8 soaked seeds from a central location in the classroom. Direct the members of each group to pick a name for their group and to write it on the pots. They should number their pots: 1, 2, 3 and 4.
3. Have groups fill their pots about 3/4 full of soil.
4. Direct the students to make two indentations (about 1/2 cm deep) in the surface of the soil and to place one seed in each hole. Have them cover the seeds lightly with soil. Each group will have four pots, with two seeds in each pot.
5. Have students place the pots on trays near a bright, sunny window or under a fluorescent light.

   Over the next several days . . .
   - Once the seeds sprout, have students "mark" one of the two plants within each pot by loosely tying a piece of string around its base. *If a plant dies, students should continue to measure the remaining plant.*
   - Have students measure both plants in each pot every day or every other day and record the length of the stems in cm on their "Seeds and Seedlings" sheets.
   - Let students water the plants every day or two with a squirt bottle. The soil should be moist but not wet.

Session 3: Light experiment

1. When most of the seedlings are approximately 10 cm tall, explain to the students that they will now investigate the effect of light on the growth of the bean plants. Ask, *What do you think will happen if we give some of the plants less light?*
2. Have each group move pots 3 and 4 to a new location that you have selected (in the back of the classroom or in a dark corner away from the windows or light source). Ask, *Do you think that the plants in the new place will have as much light as the others? Why or why not? What do you think will happen to the plants receiving less light?* Have students discuss possible outcomes and make predictions.

3. Students should continue to measure the plants for another 3–5 days and record their measurements on their "Just Growing Up" student sheets.

Session 4: Looking at data

1. After making their final observations, have students complete the remaining questions on the "Just Growing Up" sheet.
2. Discuss students' results in class. They should be able to conclude that the difference in available light led to any observed differences between the two groups of plants. Ask, *Were the plants all about the same size before you moved pots 3 and 4 out of the bright light? Are all the plants still the same size? Why do you think that is so? Are there any differences other than size?* Help students to conclude that the differences in growth (the plants with less light will have grown less or will have developed tall, narrow stems) and in color (the plants with less light will be lighter green) were caused by the differences in the availability of light. *What is the only thing that was different about the two sets of pots?* (Only the amount of light changed; all other aspects of the experiment—water, soil, seedlings, pots, planting method—were unchanged for both groups.)
3. Ask, *Where do you think the plants in pots 1 and 2 got the materials and energy to produce more stems and leaves? What were the plants in pots 3 and 4 missing? What do you think would happen if we put the plants in pots 3 and 4 back in the light?*

VARIATIONS

- Have students rinse away the soil and compare the final masses in gm of the plants in pots 1–2 vs. pots 3–4.
- Conduct the same activity with corn seeds (a monocot), and compare the results.
- Help students "see" chlorophyll, the pigments essential for converting light energy into chemical energy (food molecules), by placing a handful of crushed fresh leaves (any kind) into a clear container filled up to about 2 cm with rubbing alcohol. Stir the mixture briefly and insert the tip of a strip of coffee filter paper into the alcohol. The pigments will travel up the paper strip and form a green band that will be visible after about 1/2 hour. This method of separating chemicals in solution is known as paper chromatography. **Safety Note.** Make certain the area is well ventilated and have students wear protective eyewear. Do not use alcohol near an open flame.

QUESTIONS FOR STUDENTS TO THINK ABOUT

How might you change this experiment to observe the effects of different amounts of water on plant growth, or of the addition of fertilizers to plants? Which parts of the experiment would you change? Which parts of the experiment would you leave the same?

DICOT OR MONOCOT?

Flowering plants are divided into two groups, based partially on the structure of their seeds. Plants with two cotyledons in the seed are called dicotyledonous plants or "dicots." Beans, roses, daisies and oaks all are examples of dicots. Monocotyledonous plants or "monocots" have seedlings with one initial leaf. Grasses, sedges, lilies and orchids all are monocots.

PHOTOSYNTHETIC ORGANISMS

In addition to plants, green algae, blue-green algae (relatives of bacteria) and other single and multicelled protists carry out photosynthesis. Scientists have found evidence of photosynthetic organisms in rocks more than 3.4 billion years old!

CHLOROPLASTS

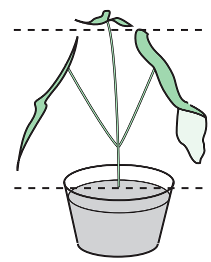
Within plant cells, photosynthesis takes place in specialized structures known as chloroplasts. Scientists believe that chloroplasts originated as free-living photosynthetic bacteria that became introduced into the cells of other organisms. A square millimeter of leaf may contain as many as 500,000 chloroplasts!

3 Seeds and Seedlings

Use this sheet to record your plant observations.

Draw a picture of a dry bean seed.	Draw a picture of a bean seed after soaking.	Draw a picture of the insides of the soaked bean seed.

1. Plant two bean seeds in each of four pots. Label the pots with the numbers 1, 2, 3 and 4.
2. Once the plants are growing, tie a string loosely around the base of one plant in each pot. Measure the length of the stems of both plants in each pot every day or every other day using a ruler. Record your measurements in mm below.



Measure stems from the soil to the bottom of the tallest leaf.

Date	Pot 1		Pot 2		Pot 3		Pot 4	
	Marked Plant	Unmarked Plant	Marked Plant	Unmarked Plant	Marked Plant	Unmarked Plant	Marked Plant	Unmarked Plant

Semillas y Plantitas

3

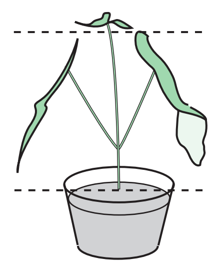
Escribe tus observaciones sobre las plantas en esta hoja.

Dibuja una semilla seca.

Dibuja una semilla remojada.

Dibuja el interior de la semilla remojada.

1. Siembra dos semillas en cada una de las cuatro macetas.
2. Cuando ya están creciendo las plantas, amarra un hilo en la base de una de las dos plantas en cada maceta. Escribe tus medidas en mm en los espacios a continuación.



Mide el tallo desde el suelo hasta la base de la hoja más alta.

Fecha	Maceta 1		Maceta 2		Maceta 3		Maceta 4	
	Planta Marcada	Planta sin Marcar	Planta Marcada	Planta sin Marcar	Planta Marcada	Planta sin Marcar	Planta Marcada	Planta sin Marcar

3

Just Growing Up

Write your prediction. What will happen if some bean plants receive more light than other bean plants?

____

Move Pots 3 and 4 to an area with less light. Continue to observe and measure the plants in each of the four pots. Record your measurements in mm below.

	SAME LIGHT				LESS LIGHT			
Date	**Pot 1**		**Pot 2**		**Pot 3**		**Pot 4**	
	Marked Plant	Unmarked Plant	Marked Plant	Unmarked Plant	Marked Plant	Unmarked Plant	Marked Plant	Unmarked Plant

Answer the questions below at the end of the experiment.

1. Describe the final appearance of the plants in Pots 1 and 2.

____

____

2. What was the average height of the plants in Pots 1 and 2? ______ **mm**

3. Describe the final appearance of the plants in Pots 3 and 4.

____

____

4. What was the average height of the plants in Pots 3 and 4? ______ **mm**

5. On a separate sheet of paper, make a bar graph of the final heights of the plants in all four pots.

6. What differences, if any, did you observe between the plants that got more light and the plants that got less light? How might you explain the observed differences?

____

____

Simplemente Están Creciendo

3

Escribe tu predicción. ¿Qué pasará si algunas plantas reciben más luz que las otras?

Mueve las macetas 3 y 4 a un área con menos luz. Continúa haciendo tus observaciones y medidas de las plantas en las cuatro macetas. Escribe tus medidas en mm en los espacios a continuación.

	LUZ				MENOS LUZ			
Fecha	**Maceta 1**		**Maceta 2**		**Maceta 3**		**Maceta 4**	
	Planta Marcada	Planta sin Marcar	Planta Marcada	Planta sin Marcar	Planta Marcada	Planta sin Marcar	Planta Marcada	Planta sin Marcar

Responde a las siguientes preguntas cuando termines el experimento.

1. Describe la apariencia final de las plantas en las macetas 1 y 2.

2. ¿Cuál fue la altura promedia de las plantas en las macetas 1 y 2? ____________ **mm**

3. Describe la apariencia final de las plantas en las macetas 3 y 4.

4. ¿Cuál fue la altura promedia de las plantas en las macetas 3 y 4? ____________ **mm**

5. En otra hoja, haz una gráfica de las alturas finales de las plantas en las cuatro macetas.

6. ¿Cuáles diferencias observaste entre las plantas que recibieron más y menos luz? ¿Cómo puedes explicar las diferencias que observaste?

4 Plant Parts You Eat

Life Science

CONCEPTS

- Consumers depend on producers for food.
- People rely on many different plants and plant parts for food.

OVERVIEW

Students observe different plant-originated foods.

SCIENCE, HEALTH & MATH SKILLS

- Observing
- Recording observations
- Using evidence
- Drawing conclusions
- Using resources to find information

TIME

Preparation: 10 minutes
Class: 30 minutes

MATERIALS

Each group will need:

- Crayon or marker
- Plastic, serrated knife
- Piece of whole fruit, vegetable or grain (see Setup)
- Sheet of white construction or drawing paper, 9 in. x 12 in.

VEGETARIAN DIETS

People who follow a vegetarian or modified vegetarian diet have to make special efforts to eat foods with enough protein. Not all plants supply the same building blocks for proteins (amino acids), so a mixture of protein sources is vital. Vegetables that are good sources of protein include peanuts, beans, lentils, chickpeas and peas.

Green plants and similar organisms produce food for all other living things on Earth. Food provides energy and nutrients for organisms, such as animals, that cannot trap energy from the sun through photosynthesis. Some animals, called primary consumers, eat only plants. Others, known as omnivores, eat plants and animals. Most humans are omnivores. However, some people chose to eat only foods that come from plants. Plant-based foods supply vital nutrients that our bodies cannot make for themselves. These nutrients include vitamins, which are chemicals necessary for the proper functioning of the body; sugars and other carbohydrates, which provide energy; amino acids, which are the building blocks of proteins; oils, another concentrated energy source; and minerals, such as potassium, magnesium and calcium.

Unit Links

The Mysterious Marching Vegetables
Story, p. 11–17; Science boxes, p. 11–12

Explorations
Food For You!, p. 6

Humans consume a remarkable variety of plants and plant parts. However, agriculture—the cultivation of plants—is a relatively recent innovation in human history. Many historians believe that the farming of plants began about 10,000 years ago in several different parts of the world. The plants we use as food today are very different from their wild ancestors. Most food plants evolved through selection by many generations of farmers to produce larger fruits, grains and other edible parts, and to be easier to plant, harvest and process. The wide variety of foods we eat today originated in many different and geographically separate parts of the world.

Many foods come from plant roots. Important root crops include carrots, parsnips, beets, sweet potatoes, radishes, rutabagas and turnips. Potatoes, which develop underground, technically are stems that are specialized for the storage of starches. Other stems used as food include sugar cane and asparagus.

Leafy foods include chard, spinach, lettuce, brussels sprouts, cabbage, collards and kale. All of these look like leaves. However, foods that come from bulbs, such as onions, leeks and garlic, also are made of leaf parts (the enlarged bases of long, slender leaves). Celery and rhubarb stalks actually are the supporting stems (petioles) of leaves.

Flowers are not eaten frequently, but cauliflower, broccoli and artichokes all are made up of flowers. Fruits and seeds, which develop after flowers are pollinated, are important food sources. Fruits include familiar foods such as oranges, lemons, grapefruit, limes, apples, peaches, pears, grapes, melons, cherries, plums, tomatoes, all squashes, blueberries, green beans and chile peppers. Mangos, bananas, avocados, figs, breadfruit, eggplant, cucumbers, guava, pomegranates, dates, papaya, olives and zucchini also are fruits. As a general rule, keep in mind that anything with seeds is a kind of fruit.

Seeds often contain stored food resources (carbohydrates, oils, proteins) to fuel growth of the tiny plant each contains. Important seeds that we eat are beans, peas, lentils and chickpeas. All of these are members of the bean, or legume, family. Food in these seeds is stored in the fleshy leaves (cotyledons) of the plant embryo. Many nuts consist of seeds or parts of seeds. Examples are walnuts, pecans, almonds and peanuts.

Grains, considered to be among the first cultivated crops, are the small, dry fruits of members of the grass family. Grains look and behave very much like individual seeds. The commonly cultivated food grasses are called cereals, after the Greek goddess Ceres. Major grain crops include barley, millet, oats, rice, rye, sorghum, wheat and corn (maize). Rice, probably the most important grain, is the primary food source for more than 1.6 billion people.

SETUP

You will need to bring enough different fruits, vegetables and grains to class to provide a different one to each group of 2–4 students. Try to include at least one representative from each of the categories listed below. Fresh, whole examples are best.

- **Roots:** examples include carrot, beet, radish, or sweet potato
- **Leaves:** lettuce, spinach or scallions (students can observe that the fleshy bulb of the scallion or green onion is made up of overlapping leaf bottoms)
- **Stems:** asparagus (potato is a confusing example, except to discuss with students afterwards) or celery stalks (leaf stem)
- **Flowers:** broccoli, cauliflower or artichoke
- **Fruits:** apple, orange, peach, tomato or zucchini (example should have observable seeds)
- **Seeds:** dried beans, peas or lentils
- **Whole grains:** popcorn or wheat berries (white rice has most of the grain removed)

Soak examples of grains and dried seeds overnight, so that they will be soft enough for students to split open.

PROCEDURE

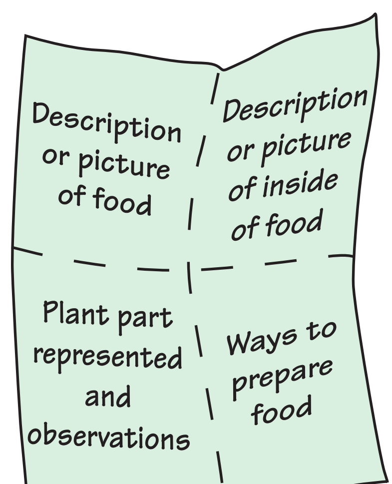
1. Help students remember basic plant parts by referring to a plant in the classroom or school yard as an example. Ask questions such as, *Why are green plants special?* (make food through photosynthesis); *Where do plants trap sunlight to make food?* (leaves and other green parts); *Where do plants*

EDIBLE PARTS

Did you know that all parts of a beet are edible? The red roots usually are cooked before eating. Baby beet leaves may be used in salads. Mature beet leaves are best steamed or sautéed. If not too fibrous, the leaf stalks can be eaten raw. Or they can be chopped up and cooked.

Photo by Savanna Nocks © White Harvest Seed Company.

Some kinds of fruits, such as bananas and watermelons, have been selectively bred to have little or no seeds.



Students will make four different sets of observations or descriptions of their food.

POSSIBLE ORIGIN OF FOOD PLANTS

Site of Origin	Common Name
China (Asia)	Buckwheat Oranges Peaches Soybeans Tea
India/Malaysia (Asia)	Bananas Breadfruit Chickpeas Mangos Black pepper Rice Safflower Sesame Sugar cane True yams
Central Asia	Apples Carrots Grapes Onions Peas Pears Radish Spinach
Near East	Figs Lentils Melons Oats Rye Wheat
Mediterranean	Asparagus Beets Cabbage Leeks Lettuce Olives
Africa	Barley Coffee Millet Okra Sorghum
Mexico/ Central America	Avocado Beans Cacao Corn Sweet potato Chile pepper Winter squash
South America	Peanuts Pineapple Potato Tomato

take in the water and nutrients that they need? (roots); *How can we get more plants?* (planting seeds or other reproductive parts of plants, such as stem sections); *Where do seeds come from?* (flowers, which develop fruits and seeds).

2. Follow by having students think about all the foods they have eaten that day that came from plants. Examples might include bread from wheat; cereals from oats, wheat and corn; juice from oranges and apples; etc. Ask, *Did you know that we eat many different parts of plants?*
3. Give each group of students a sheet of drawing paper, a plastic knife and one of the plant foods you have brought to class. Direct students to fold the sheet in fourths, creating four spaces in which to record information (see illustration, sidebar, p. 19).
4. Give students an opportunity to observe and discuss their respective food items briefly before continuing.
5. Have groups provide the following information in the four squares on their sheets. In the first square, students should write a description of and/or draw the outside of the food. Before they fill in the second square, direct students to cut the food in half or in several pieces, so that they can observe the interior. Have them write a description of and/or draw the inside of the food in the second square.
6. Have students use their observations to describe in the third square what plant part or parts is/are represented by the food. They also should report the observations they used to reach their conclusions. For example, carrots have fine roots still attached to the large central root, and some students may have observed that carrots grow underground, etc.
7. In the final square, have students report different ways to prepare and eat the food. You may want to spend an extra class period on this step to allow students time to visit the library or to access the Internet to gather additional information.
8. Have each group share the information about its plant food with the rest of the class. You may want to contribute some fun facts about plant parts and food. For instance, we know that potatoes are stems, not roots (because a potato in water will produce leaves at the top and roots at the bottom); artichokes are similar to huge sunflower buds; and pineapples consist of the fleshy stems and flowers of a tropical plant.

VARIATIONS

- Push toothpicks into the side of a potato and suspend it in a glass of water. Students will be able to observe the formation of stems, leaves and roots.
- Food crops have originated in many different parts of the world. Scientists estimated where each crop originated by using archeological evidence and locating where wild relatives of the food crop still grow. Have students use the library to investigate the places of origin of some common foods.

Food Webs

5

Life Science

Environments, such as oceans, forests, lakes and deserts, are homes to different communities of organisms. Within each distinct environment, plants, animals and other living things must find ways to obtain water, food and other necessary resources. Different kinds of organisms have different needs. As seen in the previous activities, plants need air, water, nutrients (usually from soil) and light. Animals need air, water and food.

All animals depend on plants and other producers. Some animals eat plants for food. Other animals eat animals that eat the plants, and so on. Some organisms even feed on waste and dead material. The general sequence of whom eats whom in an ecosystem is known as a food chain. Energy is passed from one organism to another at each step in the chain. Most organisms, however, have more than one food source. Thus, a web, which depicts all of the different foods eaten by each animal, is a more accurate model of interactions within an ecosystem.

This activity lets students construct possible food webs for different ecosystems, as they learn about the roles of different kinds of living organisms.

Unit Links

The Mysterious Marching Vegetables
Story, p. 18–21;
Science boxes,
p. 14–15, 19–20

Explorations
Sun Power section,
p. 2–3

SETUP

You will need to make copies of the six sets of Ecosystem Cards (pages 23–28) for students in advance. Each group of students will receive one set of the cards. Have students work in teams of 4.

PROCEDURE

1. Remind students of the previous activity in which they explored plants that people eat. Ask, *Do people only eat one kind of food? What kinds of food do people eat?* Explain to students that most other animals also have several food sources, although not all animals are omnivores (eat plants and animals).
2. Discuss with students the different kinds of consumers:

   Herbivores (primary consumers) feed on plants and other producers. Cows, camels, caterpillars and aphids are herbivores.

   Carnivores (secondary consumers) feed on other animals. Most consumers are animals, but a few are plants that trap and digest insects. There can be several levels of carnivores in a food chain. Lions, owls and lobsters are carnivores.

   Omnivores eat plants and animals. Pigs, dogs, humans and cockroaches all are omnivores.

CONCEPTS

- Producers make all the molecules they need from simple substances and energy from the sun.
- All other living things depend on producers for food.
- Living things that must eat other organisms as food are known as consumers.
- Food webs show all of the different interactions among producers and consumers in an ecosystem.

OVERVIEW

Students construct possible food webs for six different ecosystems.

SCIENCE, HEALTH & MATH SKILLS

- Inferring
- Integrating information
- Drawing conclusions

TIME

Preparation: 10 minutes
Class: 30–45 minutes

MATERIALS

Each group will need:

- Set of crayons: one each of blue, green, red and yellow
- Set of Ecosystem Cards representing one ecosystem (see SETUP)
- Sheet of white construction or drawing paper, 9 in. x 12 in.

OMNIVORE

The American black bear's diet is varied, but mostly vegetarian, including twigs, roots, berries, young plants, and buds. Insects—from beetles to ants to bee larvae eaten with honey—are also important. Small mammals and fish augment the diet, when they are easily caught.

Highly adaptable and with varied food tastes, the American black bear inhabits a wide range of forested habitats in North America.

Sources: Smithsonian National Zoological Park and the U.S. Fish and Wildlife Service (FWS). Photo courtesy of the FWS National Digital Library.

Decomposers and scavengers feed off the dead remains and waste of other organisms at any step along a food chain. Scavengers, such as vultures and flies, feed on remains of animals that have been killed or that die naturally. Decomposers live off waste products and parts of dead organisms. Many kinds of bacteria and fungi (molds and mushrooms) are decomposers. The decomposers themselves are important food sources for other organisms that live in soil, such as worms and insects.

3. Give each group of students a different set of Ecosystem Cards. Each set consists of six cards depicting producers and consumers typically found within a given environment.
4. Have students in each group read the information on the cards.
5. Ask students to identify which organisms are the producers in their ecosystems. Next, have the members of each group identify which cards represent different kinds of consumers (herbivores, carnivores and scavenger/decomposers).
6. Once students have identified the producers and different kinds of consumers in their ecosystems, have them discuss "who might eat whom" among the organisms depicted on their cards. For example, in the Freshwater Pond set of cards, the bluegill fish (carnivore) might eat dragonfly nymphs and snails. The snail (decomposer/scavenger) might eat the green algae, as well as waste or dead body parts from all of the other organisms in the system. Have students consider possible food sources for each of the organisms in their ecosystem.
7. Give each group a sheet of drawing paper. Instruct students to write the names of each of the organisms in their ecosystems around the edges of the sheet. Have them write the names of the producers in green, the herbivores in yellow, the carnivores in blue and the decomposer/scavengers in red.
8. Next, have students draw lines to connect each consumer to all of its food sources. They will find that there are many ways to connect even as few as six organisms within an ecosystem.
9. Encourage students to think about the complex relationships within ecosystems by asking questions such as, *What would happen if there were no producers in your ecosystem? No decomposers? Where would humans fit in your food web? Do humans also depend on many different plants and animals?*

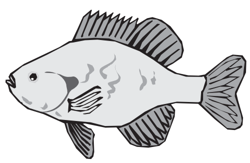
VARIATIONS

- Have students (individually or in groups) draw pictures of their ecosystems, including the organisms they used to construct their food webs.
- Have students conduct additional research about the ecosystems and/or organisms that they used for the food webs by consulting resources available at the library, on the Internet or from CD ROM software.

Ecosystem Cards: Freshwater Pond

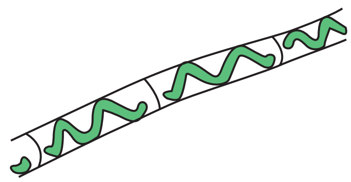
Tarjetas de Ecosistemas: Estanque de Agua Dulce

BLUEGILL
The bluegill is a silver-blue fish with brown stripes. It likes to lay its eggs in the mud at the bottom of ponds. Bluegills eat insects, snails, tadpoles and even small fish.



MOJARRA AZUL
Es un pez azul y plateado con franjas de color café. Le gusta poner sus huevos en el lodo que se encuentra al fondo de los estanques. A la mojarra le gusta comer insectos, caracoles, renacuajos y peces pequeños.

GREEN ALGAE
Most ponds have green scum on top. This scum is made of millions of tiny algae. Algae use energy from the sun to make their own food.

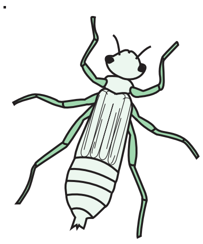


ALGA VERDE
La mayoría de los estanques tienen verdín flotando en el agua. El verdín parece espuma verde y está compuesto de millones de algas diminutas. Las algas utilizan la energía solar para hacer su alimento.

HERON
The heron is a large bird with long, slim legs that allow it to wade in the water when looking for food. Herons catch many kinds of small animals with their long beak

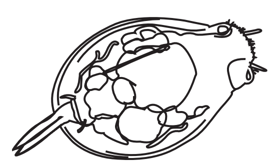
GARZA
La garza es un pájaro grande que tiene patas largas y delgadas porque le gusta caminar por el agua cuando busca animales para comer. Las garzas atrapan muchos animales pequeños con sus picos largos.

NYMPHS
Dragonflies lay their eggs in water. The young insects that hatch are called nymphs. They eat small animals and waste at the bottom of ponds.



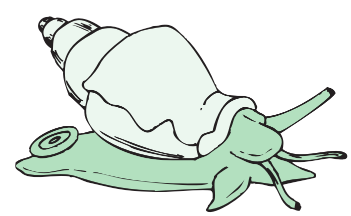
NINFAS
Las libélulas ponen sus huevos en el agua. Los insectos jóvenes que nacen de los huevos se llaman ninfas. Las ninfas comen animales pequeños que viven en el fondo de los estanques.

ROTIFER
Rotifers are tiny swimmers. They have fine hairs that help them swim. Rotifers eat algae and other very small organisms in water.



ROTÍFEROS
Los rotíferos son nadadores diminutos. Tienen pelos finos que los ayudan a nadar. Los rotíferos comen algas y otros organismos diminutos que viven en el agua.

SNAIL
Snails carry their shells on their backs. They eat bits of dead plants and animals and parts of water plants.



CARACOL
Los caracoles cargan sus conchas en sus espaldas. Los caracoles comen pedacitos de plantas y animales muertos y pedazos de plantas acuáticas.

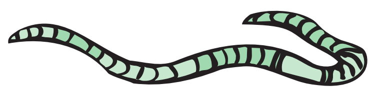
Ecosystem Cards: Temperate Forest

Tarjetas de Ecosistemas: Bosque Templado

BLACK BEAR
Black bears will eat almost anything. They especially like to eat berries, acorns and even insects.

OSO NEGRO
A los osos negros les gusta comer muchas cosas. En particular, les gusta comer bayas, bellotas y también insectos.

EARTHWORM
The earthworm burrows through soil and eats bits of dead plant material and other waste along the way.



LOMBRIZ
La lombriz excava la tierra y se come los pedacitos de plantas muertas y de otros organismos que encuentra.

GREY SQUIRREL
Squirrels are good climbers and build their nests in trees. They often eat acorns and other kinds of nuts.

ARDILLA GRIS
Las ardillas son hábiles en trepar árboles y es allí donde construyen sus nidos. Éstas frecuentemente comen bellotas y otras nueces.

OAK TREE
There are several kinds of oak trees in the temperate forest. Oak trees are very tall. The nuts of oak trees are called acorns. Many different animals eat acorns.

ROBLE
Existen varios tipos de árboles de roble en el bosque templado. Los robles son muy altos. Las nueces de los robles se llaman bellotas. Diferentes animales comen bellotas.

RASPBERRY
Raspberry bushes grow in clearings and at the edge of the forest. Many animals like to eat the sweet berries.

FRAMBUESA
Los arbustos de frambuesa crecen en los claros y las afueras del bosque. A varios animales les gusta comer estas bayas dulces.

RED FOX
Foxes are able to run quickly through the forest. They hunt and eat small animals.

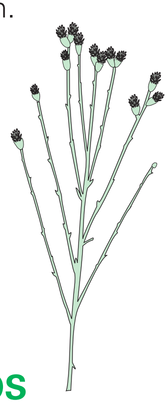
ZORRO COLORADO
Los zorros pueden correr rápidamente por el bosque. Los zorros cazan animales pequeños para comer.

Ecosystem Cards: Desert Grassland

Tarjetas de Ecosistemas: Pastizal Árido

DESERT GRASSES

Many grasses grow in the desert. Some of them grow and make seeds after a good rain.



PASTOS DEL DESIERTO

Varios tipos de pasto crecen en el desierto. Algunas de estos pastos crecen y producen semillas después de una buena lluvia.

KANGAROO RAT

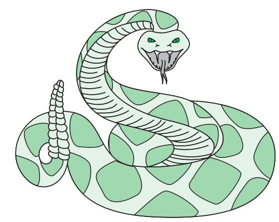
This rodent burrows in the ground and is a good jumper. It sleeps during the day and comes out at night, when the air is cooler. It eats seeds and some insects.

RATA CANGURO

Este roedor se esconde excavando en la tierra y es un buen saltador. Duerme durante el día y sale durante la noche cuando la temperatura ha bajado. Come semillas y algunos insectos.

RATTLESNAKE

Several kinds of rattlesnakes live in the desert. They are able to slide sideways over sand. Rattlesnakes eat rodents and lizards.

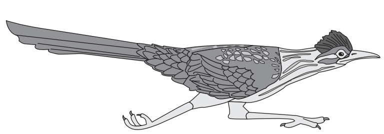


VÍBORA DE CASCABEL

Varios tipos de víbora de cascabel viven en el desierto. Estas serpientes pueden deslizarse de lado a lado sobre la arena. Las víboras de cascabel comen roedores y lagartijas.

ROADRUNNER

This striped bird can run very fast to chase prey and escape predators. It eats other animals, like snakes, insects and lizards.

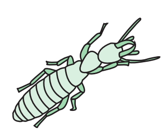


CORRECAMINOS

Este pájaro puede correr rápidamente para perseguir a sus presas y escaparse de sus depredadores. Se come a otros animales, tales como serpientes, insectos y escorpiones.

TERMITE

Termites are insects that live in large groups, called colonies. They build mounds in the ground in which to live. Termites eat tough dead plant material and other waste.

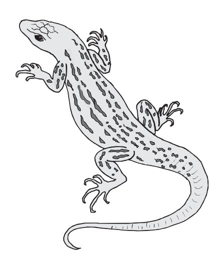


TERMITA

Las termitas son insectos que viven en grupos grandes llamados colonias. Ellas construyen montículos en la tierra que usan como vivienda. Las termitas comen pedazos resistentes de plantas muertas y otros residuos.

WHIPTAIL LIZARD

This striped lizard blends into the landscape. It moves very quickly as it searches for termites, beetles and insect larvae to eat.



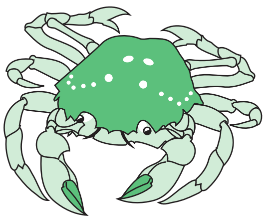
HUICO

Este lagarto rayado puede esconderse en el paisaje. Es muy activo en su búsqueda de termitas, escarabajos y larvas de insectos para comer.

Ecosystem Cards: Coastal Ocean

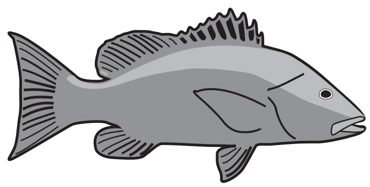
Tarjetas de Ecosistemas: Océano cerca de la Costa

CRAB
Crabs are animals with hard shells and legs with joints. They use their two claws to hunt small animals for food.



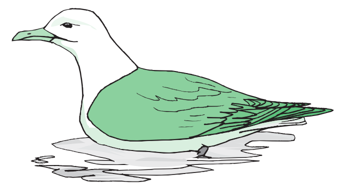
CANGREJO
Los cangrejos son animales que tienen un caparazón duro y patas articuladas. Tienen dos pinzas que usan para cazar animales pequeños para comer.

GRAY SNAPPER
The gray snapper lives near the ocean shore. It eats crabs, shrimp and small fish.



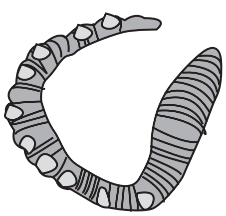
PARGO DE MANGLAR
El pargo de manglar es un pez que vive cerca de la orilla del mar. Come cangrejos, camarones y peces pequeños.

HERRING GULL
This medium-sized white and gray bird has webbed feet that allow it to swim. It eats small fish and small sea animals with shells.



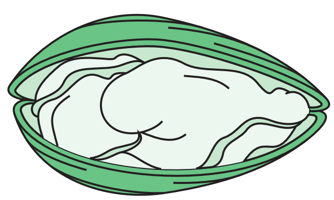
GAVIOTA ARGÉNTEA
Este pájaro blanco y gris es de tamaño mediano y tiene patas palmeadas para nadar. Come peces pequeños y animalitos con caparazones.

LUGWORM
Lugworms are ocean-living worms that feed on the remains of plants and animals. They dig burrows into the sand.



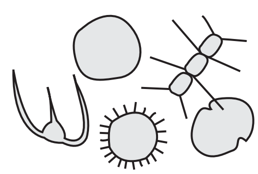
GUSANO MARINO
Los gusanos marinos son gusanos que viven en el océano. Éstos comen los restos de plantas y animales. Hacen túneles en la arena.

MUSSEL
Mussels are animals with two-part shells. They attach themselves to rocks and feed on tiny plants and animals in water.



MEJILLÓN
Los mejillones son animales que viven en conchas de dos partes. Se adhieren a las rocas y comen pequeños animales y plantas que viven en el agua.

PLANKTON
Plankton is made up of tiny plants and animals that live in ocean water. Many kinds of plankton are green and are able to use energy from the sun to make their own food.



PLANCTON
El plancton está compuesto de pequeños animales y plantas que viven en el agua del océano. Muchos tipos de plancton son verdes y pueden usar la energía procedente del sol para hacer su propio alimento.

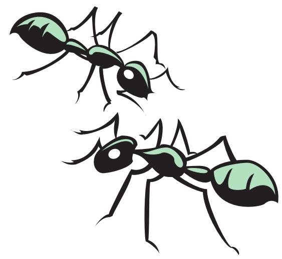
Ecosystem Cards: American Rain Forest

Tarjetas de Ecosistemas: Bosque Lluvioso Americano

ANTEATER
Anteaters are related to possums. They have long noses, no teeth and sharp claws. Anteaters eat ants, termites and grubs.

OSO HORMIGUERO
Los osos hormigueros pertenecen a la familia de las zarigüeyas. Tienen narices largas, garras afiladas y no tienen dientes. Comen hormigas, termitas y gusanos.

AZTECA ANTS
These ants like to live inside hollow stems. They use nectar and other plant parts as food.

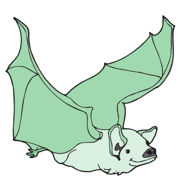


HORMIGAS AZTECAS
A estas hormigas les gusta vivir dentro de tallos de árboles huecos. Les gusta comer néctar y otras partes de plantas.

CECROPIA TREE
The cecropia tree has hollow stems and leaves that look like umbrellas. Each leaf produces nectar. Each cecropia tree produces thousands of fruits.

ÁRBOL CECROPIA
El árbol cecropia tiene tallos huecos y hojas que parecen paraguas. Cada hoja produce néctar. Este árbol produce miles de frutas.

FRUIT BATS
Different kinds of bats look for nectar and pollen to eat from trees whose flowers bloom at night. Some of these bats also eat fruit.

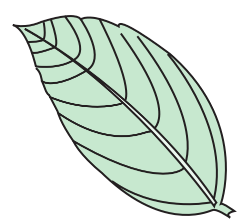


MURCIÉLAGOS FRUTEROS
Diferentes tipos de murciélagos buscan néctar y polen durante la noche para alimentarse. Éstos buscan árboles que florecen en la noche. Algunos también comen frutos.

FUNGUS
Many kinds of fungus break down dead trees and other plants on the damp forest floor.

HONGO
Muchos tipos de hongos descomponen árboles muertos y otras plantas que se encuentran sobre el suelo húmedo del bosque.

KAPOK TREE
This is a very tall tree that grows on the edges of forests. Its flowers open only at night and produce nectar and pollen.

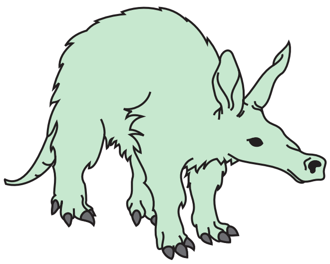


ÁRBOL CAPOQUERO
Éste es un árbol muy alto que crece en las afueras del bosque. Sus flores abren solamente durante la noche y producen néctar y polen.

Ecosystem Cards: African Grasslands

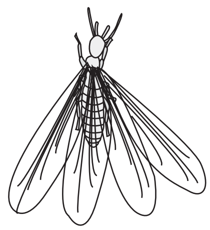
Tarjetas de Ecosistemas: Pastizal Africano

AARDVARK
The aardvark is an African anteater. It uses its long tongue to catch termites.



CERDO HORMIGUERO
El cerdo hormiguero es el oso hormiguero africano. Usa su lengua larga para atrapar termitas.

AFRICAN TERMITES
These insects build large houses above the ground. They eat dead plants or use them to grow fungus to eat.

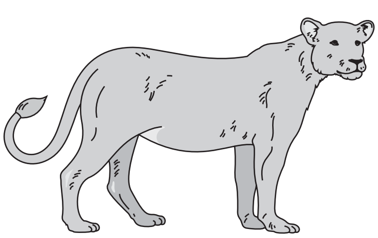


TERMITA
Las termitas africanas son insectos que construyen viviendas enormes sobre la tierra. Las termitas comen plantas muertas o las utilizan para cultivar hongos como alimento.

GRASSES
Many kinds of grasses grow in the rich soils of African grasslands. They are food for many different animals.

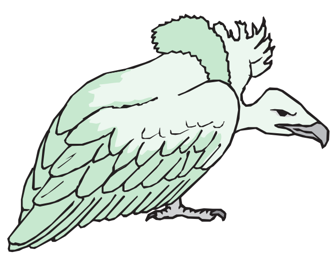
PASTOS
Muchas clases de pasto crecen en los suelos fértiles del África. Estos pastos son el alimento de diferentes variedades de animales.

LIONS
Lions live in groups. Female lions are hunters. They catch other animals for food.



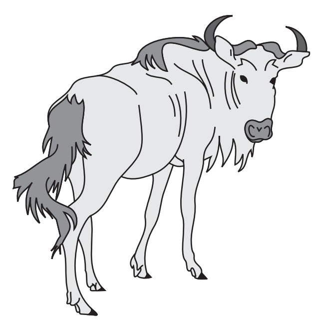
LEÓN
Los leones viven en grupos. Las hembras son cazadoras. Ellas cazan otros animales para alimentarse.

VULTURE
Vultures are large birds with curved beaks. They eat the remains of dead animals.



BUITRE
Los buitres son pájaros grandes que tienen picos curvos. Ellos comen los restos de animales muertos.

WILDEBEEST
A wildebeest is a kind of antelope. It can run quickly and has long, curved horns. Wildebeests eat grass.



ÑU
El ñu es un tipo de antílope. Puede correr rápidamente y tiene cuernos largos y curvos. Estos animales comen hierbas.

Digestion

6

Life Science

Food must be broken down, both physically and chemically, before it can be used by the cells within an organism. The process of breaking food down into usable components is known as digestion. Within the human body, digestion begins in the mouth, where pieces of food are mechanically broken, by chewing, into smaller pieces. In addition saliva mixes with the food and begins to break it down. After food is swallowed, other components of the digestive system—stomach, small intestine, large intestine, liver and pancreas—continue the process of making food available for use by cells in the body.

The stomach serves as a powerful mixing machine in which food is combined with special chemicals (enzymes) that begin to break large food molecules into smaller ones. Food usually stays in the stomach for two to three hours, after which it passes into the small intestine, where it is combined with secretions from the liver and pancreas. These very important organs produces substances (bile from the liver and pancreatic fluid from the pancreas) that help break down fats, proteins and carbohydrates into smaller molecules. The small intestine is responsible for absorbing the nutrients released during digestion. The walls of the small intestine are covered with millions of tiny, finger-like projections called villi. These structures increase the surface area of the small intestine to facilitate the absorption of nutrients into the bloodstream.

Proteins and their building blocks (amino acids) are vital to every cell in the body. Humans are not able to make their own amino acids, so they must include protein (equivalent to 4 ounces of chicken white meat) in their daily diet. During digestion, proteins are broken down into the different amino acids of which they are made. Then the body builds new proteins from the amino acids. You might say that the amino acids are recycled!

This activity will allow students to observe how chemicals in the body begin to break down proteins.

Unit Links

The Mysterious Marching Vegetables
Story, p. 21–25

Explorations
Chew On This, p. 8;
Neat Teeth, p. 8

SETUP

You will need meat tenderizer, located in the spice section at the grocery store, and a piece of sliced turkey luncheon meat for each group. Have students conduct this activity in groups of four.

SAFETY

Have students wash hands before and after the activity. Clean work areas with disinfectant.

CONCEPTS

- Food must be broken down into smaller units before it can be used by the body.
- Digestion is the process of breaking food down.
- Special chemicals in the body break food molecules into smaller units.
- Proteins—found in all meats, dairy products and vegetables (especially peas and beans)—are important for muscles and cell growth and repair.

OVERVIEW

Students learn about digestion and proteins by observing the action of meat tenderizer on luncheon meat.

SCIENCE, HEALTH & MATH SKILLS

- Predicting
- Making qualitative observations
- Drawing conclusions

TIME

Preparation: 10 minutes
Class: 30 minutes

MATERIALS

Each group will need:

- 2 clear, resealable plastic bags, sandwich size
- 1/2 slice of turkey luncheon meat
- 1/2 tsp of meat tenderizer, or papaya enzymes (available at health food stores)
- Plastic, serrated knife

PROCEDURE

Session 1: Setting up

1. Let Materials Managers collect 1/2 slice of turkey luncheon meat, a plastic knife and two resealable plastic bags. Have the groups label their bags "1" and "2." Ask students, *What happens to food when you eat it? Do you think that food stays the same inside your body?* Discuss students' ideas about digestion. Mention that they will be able to explore what happens to one kind of food—turkey meat (protein)—when digestion begins.
2. Have the students in each group cut the piece of turkey in half and place one section in the bag labeled "1." Direct them to place the other section in bag "2" and to add 1/2 teaspoon of meat tenderizer to that bag. Have them seal the bag and shake the turkey slice within the bag so that it is well coated with the tenderizer.
3. Have the students place the bags to one side of the classroom for about an hour. (If students will be making observations the following day, refrigerate the bags to prevent spoilage.) Have students write, in their journals or on a sheet of paper, what they predict will happen to the slices of turkey.

Session 2: Making observations

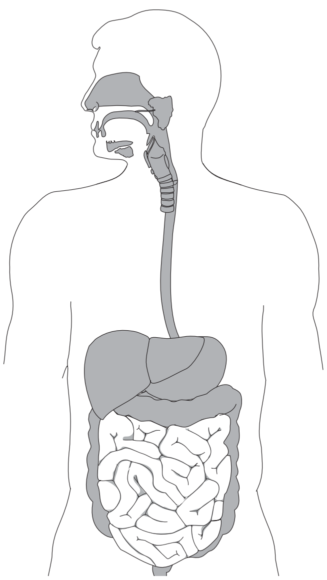
1. Have students observe the texture and color of the meat samples without removing them from the plastic bags. Ask, *Is there anything different about the turkey that was combined with the meat tenderizer? What do you think happened?*
2. Ask students to think about the changes they observed in the meat with tenderizer. Mention that the substance they added was a chemical that helps soften the muscle fibers in meat by beginning to break them down into smaller pieces.
3. Help students understand that similar substances work within their stomachs and small intestines to break down the food they eat. Have students draw or write about their observations.
4. Mention that turkey meat is a muscle. Help students understand that protein is the building block for muscles and that it is used inside each muscle cell. Protein that we eat must be broken into smaller components before it can be used by our bodies. You may want to mention that the chemical meat tenderizer also is a kind of protein. It provides another example of the variety of roles that proteins play inside plants and animals.

VARIATIONS

- Students can investigate the importance of chewing by repeating the experiment using a finely chopped piece of luncheon meat and comparing the outcomes.

ENZYMES

Meat tenderizer contains an enzyme called papain, which is extracted from the papaya plant. Enzymes break proteins apart into amino acids—smaller molecules that are the building blocks of new proteins that the body needs. Amazingly, enzymes themselves also are a kind of protein molecule!



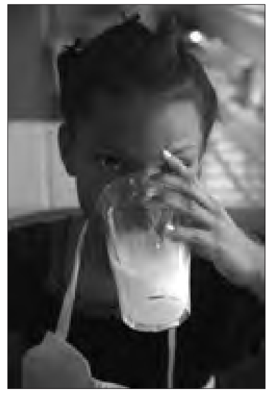
The total surface area of the inside of the small intestine is about 250 m^2, about the same area as a tennis court!

SOURCES OF PROTEINS

Foods that are rich in protein include meats, poultry, fish, dairy products, eggs, peas, dried beans, lentils and chick peas.

Food Safety and Nutrition

Environment and Health Basics



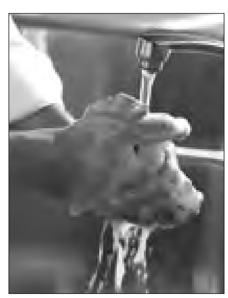
Food affects health and well-being in two important ways. First, we require appropriate amounts of different kinds of foods to supply the energy and nutrients we need for daily activities and for growth and maintenance of our bodies. Second, food can contain contaminants that can make us sick.

Carbohydrates, fats and proteins are our main sources of energy. Our bodies also need protein to maintain muscles and carry out many functions inside cells. Small amounts of vitamins and minerals also are necessary.

Food becomes available for use by the body through the process of digestion. Digestion breaks down large food molecules into smaller ones that can be transported and used by the body.

Many Americans eat too much refined sugar and unhealthy fats. Examples of foods with little nutritional value, or with too many added calories, are soft drinks, chips, greasy fried foods, candy and snack cakes. A diet that has a lot of "junk" foods is harmful in two ways. First, it does not provide all of the vitamins, minerals and other substances needed for growth and health. Second, a diet with many sweets and fatty foods often delivers too many calories. When a person eats more calories than he or she uses up through movement and exercise, the body stores the excess energy as fat. Excess body weight can contribute to a number of serious health problems, such as type 2 diabetes, heart disease and stroke.

How foods are grown and prepared also is important. Plants and animals can take in small amounts of pollutants (harmful chemicals) from water, food or soil. These pollutants can accumulate in the bodies of other living organisms that eat the smaller plants or animals—a process known as bioaccumulation. Food also can be spoiled by bacteria. Most bacteria that cause food-related illnesses are spread because hands and food preparation areas are not kept clean or because food is not kept at the proper temperature.



Simple actions, such as washing hands before eating or preparing food, help to reduce the possibility of spreading bacteria or other harmful substances to food.

CHILDREN'S ENVIRONMENTAL HEALTH

Children are particularly susceptible to contaminants in food and in the environment. Because their bodies are still growing and because they eat more fruits and vegetables (which may contain chemical residues) relative to their body weights, children are more vulnerable to the harmful effects of substances such as lead and pesticides. However, many researchers believe that a healthy diet, which provides recommended amounts of vitamins and minerals, may help protect children from potentially harmful chemicals.

AVOIDING SUGARY DRINKS

Many soft drinks have around 10 teaspoons of sugar in a 12-ounce can. These drinks, which have little nutritional value, contribute to the nationwide epidemic of overweight and obesity.

Photo of handwashing courtesy of the U.S. Department of Health and Human Services. Photos of children © BrandXPictures.

Bio Build-up

Environment and Health

CONCEPTS

- Pollutants often are absorbed by organisms near the base of a food chain.
- Toxic chemicals can become concentrated in the bodies of consumers, especially those near the top of the food chain.

OVERVIEW

Students will make a model of a simple food chain and observe how toxins can accumulate in consumers at the top.

SCIENCE, HEALTH & MATH SKILLS

- Counting
- Multiplying
- Observing patterns
- Drawing conclusions

TIME

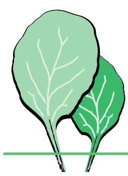
Preparation: 5 minutes
Class: 30 minutes

MATERIALS

Each student will need:

- 80 (approx.) 1/4-in. round color coding labels (dots), asst. colors
- Crayons or colored markers
- Pair of scissors
- Copy of "Bio Build-up!" sheet (p. 34 –35)

Many pollutants in the environment become introduced in very small amounts into organisms near the base of the food chain. These pollutants usually are present in the water or the soil in which producers, such as green plants and algae, or primary consumers, such as filter feeders in aquatic ecosystems, live and reproduce. Pesticides that are applied directly to plants also can be introduced into the food chain.



Unit Links

The Mysterious Marching Vegetables
Story, p. 25–26;
Science box, p. 25

Some chemical substances, such as pesticides and heavy metals (like mercury and lead), persist within the bodies of the organisms that take them in with food. These compounds are not broken down by the body, nor are they eliminated with other waste products. While most of these substances are not harmful in trace amounts, they can accumulate in the tissues of an organism over its lifetime. In addition, consumers near the top of the food chain tend to accumulate larger amounts of toxic substances in their bodies, because the pollutants become more concentrated at each step of the food chain. The actual amounts of toxins accumulated in the bodies of top consumers depend on their food sources and choices.

SETUP

As an alternative, glue and dried beans or unpopped popcorn can be substituted for the adhesive labels/dots.

Have students work in groups of 2–4 to share materials.

PROCEDURE

1. Let the Materials Managers collect adhesive dots (or alternative items) for their group (approx. 80 dots per student). Each student should complete his or her own "Bio Build-up!" sheet.
2. Ask students to think about what might happen to pollutants taken up by producers. *Would the pollutants be passed on to consumers? How about the next animal in the food chain? Would they have the pollutants too?* Tell the students that they will have an opportunity to find out what might happen to pollutants in a food chain.
3. Have students use a pair of scissors to separate 20 dots from the strip (or sheet) without removing the backing. Next, have them work through the steps described on the Bio Build-up! sheet, which depicts an aquatic ecosystem. The stickers or other markers will represent amounts of toxins consumed along each step of the food chain.
4. Once students have completed the activity, ask, *What happened to the pollutants at the last step of the food chain? Did the*

large fish have more or less pollutants than the plants at the beginning of the food chain? Did the amounts of pollutants in the plants at the beginning make a difference in the small and large fish? How could the amount of pollutants in the body of the eagle be reduced? In general, which kinds of organisms are most at risk of accumulating toxins in their bodies—producers or consumers? Students will have observed that the eagle accumulated the most pollution dots.

QUESTIONS FOR STUDENTS TO THINK ABOUT

- In addition to mercury and lead, the pesticide, DDT, is another chemical that can become concentrated in the body tissues of animals near the top of the food chain. The presence of DDT in food chains has been related to reduced populations of several large predatory birds, among other organisms. *What can you find out about DDT use in the U.S. and about the actions taken to make sure it does not become concentrated in food sources for people and animals?*
- Many toxic chemicals are stored in fatty tissues in the bodies of animals. Fat is created to store extra energy when more food is taken in than is used. See what you can find out about the role of fat in the body by checking the library or the Internet.

MERCURY IN THE FOOD CHAIN

Mercury, a toxic metal, also is the only metal that is liquid at room temperature. It is used in the manufacturing of thermometers, barometers, fluorescent lights, electrical switches and batteries, among other things. When mercury is present in lakes, it becomes transformed by bacteria into a compound that can be dissolved in water. In this form, it can enter the food chain. It ends up in seafood, which, in turn, can be eaten by people. Mercury can damage the nervous system.

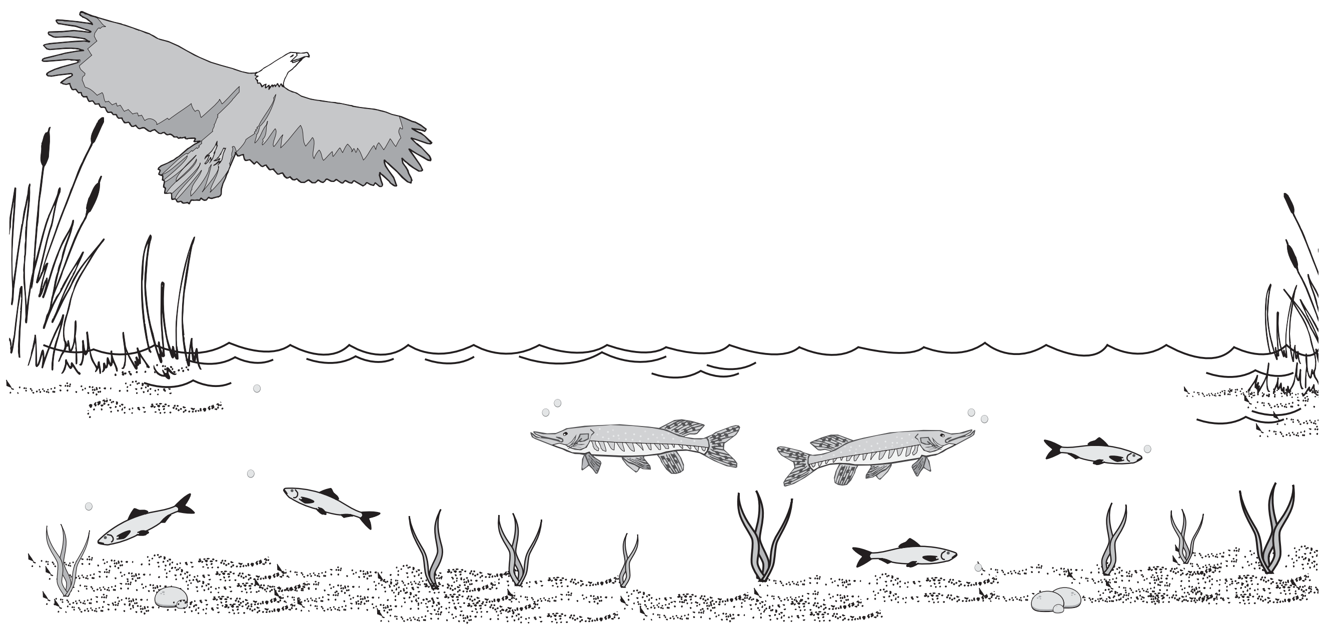
BIOACCUMULATION

Bioaccumulation occurs when a chemical becomes more and more concentrated as it moves up through a food chain. For example, a typical food chain include algae eaten by a water flea eaten by a minnow eaten by a trout and finally consumed by a human being.

A study on DDT showed that where soil levels contained 10 parts per million (ppm), DDT reached a concentration of 141 ppm in earthworms and 444 ppm in robins.

Source: Extension Toxicology Network, USDA.

Bio Build-Up!



1. Sprinkle 20 pollution dots over the water plants. Many will fall onto the plants. Remove the dots that do not touch any plants. Peel the backing from each dot that falls on or touches a plant and stick the dot onto that plant.
2. Each small fish eats two water plants. Draw a line from a small fish to two plants that it eats. Count the number of dots on the plants. Stick that number of dots on the fish. Repeat for each small fish.
3. Each large fish eats two small fish. Draw a line from a large fish to two small fish that it eats. Count the number of dots on the small fish. Stick that number of dots on the large fish. Repeat for the other large fish.
4. The eagle eats both large fish. Count the dots on both large fish. Stick that number of dots on the eagle.
5. Which living organism is most in danger of being harmed by pollution? Is it a producer or a consumer? Explain your answers.

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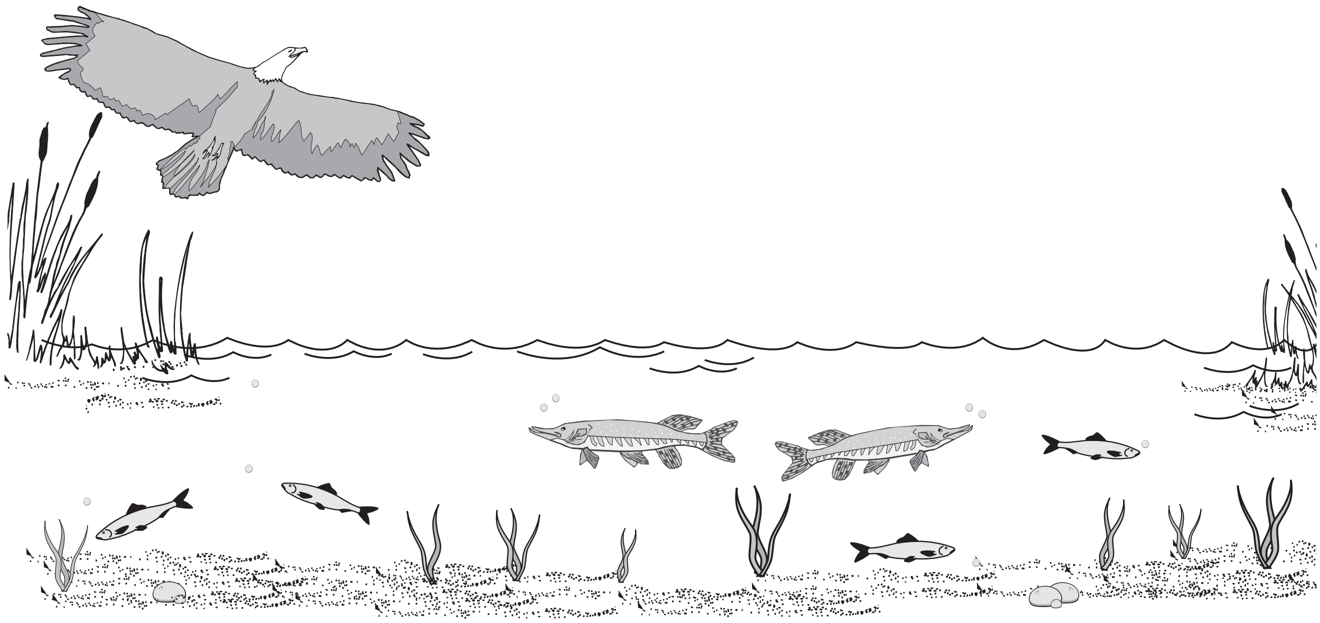
Optional

6. Find the average number of dots on each kind of plant or animal by dividing the total number of dots by the number of individuals. Use a separate sheet of paper.
7. Make a graph showing the average number of pollution dots that ended up in each kind of plant or animal.

¡Amontonamiento Biológico!

7



1. Distribuye 20 circulitos de contaminacíon sobre las plantas acuáticas. Varios circulitos caerán sobre las plantas. Remueve los circulitos que no tocan ninguna planta. Quita el papel adherido a todos los circulitos que tocan una planta y pégalos en esas plantas.
2. Cada pez se come dos plantas. Dibuja una línea para conectar uno de los peces pequeños a dos plantas. Cuenta el número de circulitos en las plantas y pega el mismo número de circulitos en el pez. Repite para cada pez pequeño.
3. Cada pez grande se come dos peces pequeños. Dibuja una línea para conectar uno de los peces grandes a dos pequeños. Cuenta el número de circulitos en los peces pequeños y pega el mismo número de circulitos en el pez grande. Repite para el otro pez grande.
4. El águila se come a los dos peces grandes. Cuenta los circulitos en los dos peces grandes. Pega el mismo número de circulitos en el águila.
5. ¿Cuál organismo tiene más riesgo de enfermarse por causa de la contaminación? ¿Es un productor o un consumidor? Explica tus respuestas.

Opcional

6. En otra hoja, calcula el número promedio de circulitos adquiridos por cada tipo de planta y animal. Divide el número total de circulitos por el número de individuos.
7. Haz una gráfica para representar el número promedio de circulitos de contaminación que adquirió cada tipo de organismo.

8 They're Everywhere: Bacteria

Environment and Health

CONCEPTS

- Bacteria are everywhere.
- Bacteria need food to grow.
- Bacteria are important decomposers, but they also can cause many different kinds of diseases.
- Bacteria are a major source of food contamination.

OVERVIEW

Students will grow bacteria from a variety of locations and compare the results.

SCIENCE, HEALTH & MATH SKILLS

- Designing an experiment
- Making observations
- Drawing conclusions

TIME

Preparation: 30 minutes for each session
Class: 30 minutes

MATERIALS

Each group will need:

- 6 cotton swabs
- 3 sterlized petri dishes (see Setup)
- Distilled water or boiled water (for swabs)
- Masking tape for labeling and sealing petri dishes
- Nutrient agar (order from a science supply vendor)
- Pen or markers

Bacteria are the most numerous of all things living on our planet. However, they are so tiny that it is not possible to see one without the aid of a microscope. Most bacteria must be magnified at least 400 times before they can be observed. Each bacterium (a single bacteria) consists of one cell capable of reproducing very rapidly. In fact, one bacterium cell can produce millions of others in just one day.

Unit Links

The Mysterious Marching Vegetables
Story, p. 27–31;
Science boxes, p. 15 and 34 (top)

Explorations
Tips for Healthy Living, p. 3; Not Such a New Issue, p. 6

Bacteria are essential in many ways. They are important decomposers in almost all ecosystems. Photosynthetic bacteria (also known as blue-green algae) are vital producers in aquatic ecosystems. Bacteria in the intestines of animals help break down some large food molecules during digestion.

Bacteria also can cause serious problems with food. Since bacteria are everywhere, it is easy for food to become contaminated by bacteria and begin to spoil. The slime you see on food that has been in the refrigerator too long is made of clumps of bacteria and, sometimes, fungi as well. Eating spoiled food can make humans and other animals sick.

Bacteria can be transferred to food when people do not wash their hands after using the bathroom, changing a diaper or playing with pets. Some foods, especially meats, can have bacteria on their outside surfaces. These bacteria can be transferred to other foods if knives, spoons and cutting boards used in preparing them are not washed with soap and water.

This activity allows students to observe bacteria and to compare relative amounts of bacteria living in different parts of the home, classroom or school.

> Many common kinds of food poisoning are caused by bacteria. Sometimes bacteria are carried from food into the body, where they grow and cause disease. Other times, bacteria produce poisons that cause sickness when the food is eaten. Nausea, vomiting, abdominal cramps and diarrhea are common symptoms of many food related diseases.

SETUP

Prepare the petri dishes for students. Warm the nutrient agar until it melts (about 60° C) in a pan of boiling water or in the microwave. To avoid condensation in the dishes, let the agar cool slightly before use. Open each petri dish, pour in enough agar to cover the bottom and immediately replace the cover. Let the agar solidify before use. Store the petri dishes upside down. (See "Safety Issues," sidebar, p. 37).

As an alternative to using agar, bacteria also can be grown on potato slices. Boil whole potatoes until almost soft. Using a clean, dry knife, cut potatoes into 1/4-inch slices and place each slice in a petri dish or clean resealable plastic bag. Prepare the petri dishes for students. Warm the nutrient agar until it melts.

Have students work in teams of four to plan and carry out their experiments.

SAFETY

See "Safety Issues," right sidebar.

PROCEDURE

Session 1: Setting up

1. Tell students that they will be learning about bacteria—tiny microorganisms present everywhere. Ask students to mention what they know or have heard about bacteria. List their ideas on the board.
2. Point out that bacteria are a major source of food contamination, and that students will be investigating where bacteria might be present. Ask, *Can we see where bacteria are? How might we be able to find out where the most bacteria are in the room (school, etc.)?*
3. Tell students that one way to study bacteria is to let them grow until they form a clump that is large enough to see. Mention that they will be finding and growing bacteria.
4. Have students in each group select two places that they would like to test for the presence of bacteria. Possibilities include the floor, doorknob, unwashed hands, rinsed hands, hands washed with soap and water, etc. (See "Safety," above).
5. Have the groups write descriptions of the places they plan to test and to write predictions about what they expect to find. For example, a group might predict that a sample from unwashed hands will have more bacteria than from washed hands.
6. Give each group three petri dishes (see "Safety Note," p. 36). One dish will be a control. The remaining two will be used for sampling. Students should label all three dishes.
7. Direct students to sample the areas they have chosen using clean cotton swabs dipped in distilled or boiled water. They should rub the swab several times over the area to be tested and then gently rub the swab in a zig-zag pattern over the surface of the gel mixture in the bottom of the petri dish. Instruct students to open the dishes only enough to swab the gel surface. The control dish should be rubbed (inoculated) with a clean, moist swab.
8. Tape the dishes closed for students. Store the dishes upside down.

SAFETY ISSUES

Most bacteria are harmless to healthy people. However, because some kinds of bacteria can cause disease, it is important that the Petri dishes remain closed after students have started the cultures.

Students should not collect or test saliva, tears or other body fluids.

Dispose of used cotton swabs by placing them in a resealable plastic bag. Cover swabs with a 10% bleach solution (10 mL chlorine bleach mixed with 90 mL water). Seal the bag and discard.

Dispose of cultures immediately after the activity. Carefully remove the tape used to seal each dish and place each closed Petri dish in a separate, resealable plastic bag. Pour about 20 mL of a 10% bleach solution in the plastic bag. Seal the bag. Through the sides of the closed bag, loosen the cover of the Petri dish enough to allow the bleach solution to move inside and completely cover the contents of the dish. Dispose of the plastic bag and its contents in the trash.

Follow all district and school science laboratory safety procedures. It is good laboratory practice to have students wash hands before and after any laboratory activity. Clean work areas with disinfectant.

BACTERIA BUSTERS!

- Wash hands with soap and water after using the restroom and before preparing or eating food.
- Wash cooking surfaces and utensils with warm water and soap. Use plastic or non-porous cutting boards and wash them in the dishwasher.
- Rinse fruits and vegetables under running water before cooking and eating them.
- Do not use the same knives and utensils for different kinds of meats, chicken or other cooked foods to avoid transferring bacteria from one food to another.
- Never place cooked foods on a plate which previously held raw meat, poultry or seafood.
- Do not wash raw poultry, beef, pork, lamb or veal before cooking. Any bacteria present on the surface of the meat is killed during cooking.
- Cook whole meats to an internal temperature of 145°F (3 minutes resting time), ground meats to 160°F and poultry to 165°F.
- Cook eggs until the yolk and white are firm, not runny. Don't use recipes that call for raw or partially cooked eggs.
- Refrigerate fresh foods and cooked foods promptly; keep the refrigerator temperature below 40°F.
- Pack lunches for school or work in portable coolers.
- Do not buy food in cans or jars with bulging or damaged lids.

* Source: USDA.

Session 2: Observations

1. If possible, have students observe the cultures every day for 1–3 days. After about three days, have students make detailed observations. Ask, *What has changed inside the petri dishes?* Bacteria will discolor the surface of the gel and form smooth, wrinkly or slimy blotches (called colonies) of different colors. Fungi, which form fuzzy colonies, also may be present.
2. Have students decide how many different kinds of organisms might be growing on the gel, based on differences they can observe. Do not allow students to open the dishes.
3. Next, have students decide whether some sample sources had more bacteria than others by counting the number of colonies and/or by comparing the sizes of colonies. Have them record their observations and conclusions. Have the groups share their results with the rest of the class.
4. Based on the results, have students decide which locations have the most bacteria, and which the least. Ask, *If there are bacteria all around us, why aren't all of us sick? Do all bacteria make us sick? What about the gel in the petri dishes—would you want to eat it? Do you think that it is good to have bacteria growing in our food?*
5. Help students understand that contamination of food by bacteria can cause serious health problems. Ask for suggestions on how to keep food clean. Possibilities include: using clean hands and utensils for food preparation, keeping food covered and refrigerated until used, and cooking food thoroughly to kill bacteria that might be present (see "Bacteria Busters!" left sidebar).

VARIATIONS

- Design additional experiments to test for the presence of bacteria. You might test water from different sources or see which kinds of food grow the most kinds of bacteria or become spoiled most quickly by bacteria.
- Have students investigate what happens when similar samples are grown at room temperature and in the refrigerator.

QUESTIONS FOR STUDENTS TO THINK ABOUT

Bacteria are everywhere. They can be found on nearly every surface—including skin. They also are found inside the digestive tract, in the mouth, throat and intestines. However, they are not found anywhere inside the tissues of the body or in the blood of healthy persons. Bacteria inside the body can cause serious diseases if the body's immune system is not able to fight them off. Bacteria also are helpful. Ask, *How many good uses of bacteria can you find?* Look for information about bacteria in the library or on the Internet.

Using Food Labels

Environment and Health

Beginning in 1994, the US Government began requiring manufacturers to put information about nutritional value on food labels. This information helps people make better choices about which foods to buy and eat.

All food labels must present the same basic information in a standard format. This information includes, at minimum, the amount per serving of saturated fat, cholesterol, dietary fiber, and other nutrients known to be important for health. Labels also provide nutrient reference values, expressed as "% Daily Values," to help consumers see how a food fits into an overall daily diet. It is important to pay attention to the serving sizes on any food label.

Packages also must list all ingredients in foods. This list is given in order, by weight, beginning with the ingredient that weighs the most. This information can be helpful when selecting foods.

- **Carbohydrates** are the body's main source of fuel. Starchy foods like breads, spaghetti, rice, potatoes, corn and cereals are made up mostly of carbohydrates. Sweet foods like candy, jam and syrups also are carbohydrates. Some carbohydrates, called fiber or roughage, are hard to digest. They help move waste through the digestive system.
- **Fats** include butter, margarine, lard, shortening and cooking oils. Meats, cheese, cream, chocolate and many desserts like cakes and cookies usually have a lot of fat. Fats are very concentrated sources of energy. Some kinds of fat (particularly fats that are solid at room temperature) have been linked to diseases of the heart and circulatory system. Most Americans eat too many high-fat foods.
- **Proteins** are important for growth and repair of the body. Protein-rich foods include eggs, milk products, meat, dried beans, chicken, turkey and fish. The body also uses protein as fuel to provide energy for movement and growth.
- **Minerals** are found in small amounts in foods. They are needed for many of the body's functions. For example, calcium is used to build bones and teeth and also is important for muscles and the nervous system. Iron goes into making red blood cells.
- **Vitamins** are other chemicals found naturally in food that are needed in very small amounts by the body. Fruits and vegetables are valuable sources of vitamins and minerals.

All foods also contain some water.

Unit Links

The Mysterious Marching Vegetables
Story, p. 34–35;
Sciences boxes, p. 3 and 34 (bottom)

Explorations
From the Label to the Table, p. 4; Marta Fiorotto, p. 7

CONCEPTS

- Food labels provide important information about the nutritional value of foods.

OVERVIEW

Students will learn about food labels to promote thinking about healthful eating. Students also will explore units of measurement commonly used on food labels.

SCIENCE, HEALTH & MATH SKILLS

- Measuring
- Comparing measurements
- Making observations
- Drawing conclusions

TIME

Preparation: 10 minutes
Class: 30 minutes

MATERIALS

Each group will need:
- Cup of white sugar
- Measuring cup
- Measuring spoon

Each student will need:
- Copy of student sheets (p. 41–44)

ESTIMATING SERVING SIZES

- 4 oz (1/4 lb or 114 g) of meat, poultry or fish is about the same size as a deck of cards.
- 1/2 cup of cereal or snacks is about as much as an adult can hold in his or her cupped hand.
- A 12 oz can of soft drink contains 1 1/2 cups of liquid.

HIDDEN FATS

Many crackers, cookies, candies, processed snack foods, fried foods and fast foods contain trans fat and saturated fat.

WATER FOR LIFE

Water makes up three-fourths of the brain and muscles. Every cell in the body is packed with water. Water transports nutrients and wastes, helps control temperature, and makes many chemical reactions possible. The body loses almost three liters of water every day. Some of it is replaced with food, such as fruits and vegetables, but drinking six to eight glasses of liquid each day to maintain the body's water supply is recommended.

Source: *The Science of Water Teacher's Guide.* Baylor College of Medicine.

SERVING SIZE is the amount on which the nutrition facts are based. If someone eats more than the serving size, he or she will receive more of the calories and nutrients than the amounts listed on the label. Serving sizes often are smaller than the amount a typical person might eat.

CALORIES measure the amount of energy a food can provide. Most people need somewhere around 2,000 to 2,500 calories a day to meet their energy needs.

CALORIES FROM FAT is the amount of calories that come from fats and oils in a food.

TOTAL FAT gives the weight of all the fat in one serving. Most people should have less than 65 g of fat each day.

SATURATED FAT gives just the weight of unhealthful fats in one serving. Common saturated fats are lard, butter, shortening and coconut oil.

TRANS FAT is another unhealthy form of fat. It is created during the manufacturing of vegetable shortening and some margarines.

SODIUM is the amount of salt in a food. Some people need to restrict the amount of salt in their diets.

TOTAL CARBOHYDRATE shows sugars, starches and different kinds of fiber. Most people eat too much sugar. Brown sugar, molasses, honey and corn syrup all are sugars. Dietary fiber is important to health.

PROTEIN is essential for building muscles and for many body functions.

VITAMINS AND MINERALS are materials in food that are necessary for health. It is important to meet 100% of the daily requirements of vitamins and minerals by including 5–9 servings of fruits and vegetables in each day's diet.

SETUP

Have students work in groups of 2–4. Set up sugar and other materials in a central location.

PROCEDURE

1. Remind students of the food guides they used at the beginning of this unit. Ask, *How can we be sure that the foods we eat each day contain the nutrients we need?*
2. Mention that packaged foods now have uniform labels that provide information about the nutritional value of foods. Distribute copies of the student page.
3. Have students read the label depicted on the student page out loud in their groups. Follow by helping them understand the concepts outlined in the box above.
4. Ask students, *What units of measure are mentioned on the label*? (cups and grams). Mention that they will be investigating these measures using sugar.
5. Have students, in their groups, follow the instructions on the Sugar Measures Up page. They will explore how much sugar is contained in a typical soft drink.
6. Afterwards, ask, *Were you surprised about the amount of sugar in one soft drink? How many soft drinks would you need to meet your daily total carbohydrate requirement? Do you think that that would be a good way to fuel your body?*

From the Label to the Table!

Pay close attention to serving sizes.

Look for foods with lower levels of saturated fats.

This tells you how much salt is in food.

Calcium is important for bones and teeth.

Use this section as a guide for daily planning.

The amount of calories a person needs each day depends on many factors, including exercise.

Nutrition Facts

Serving Size 1 cup (228g)
Serving Per Container 2

Amount Per Serving

Calories 250 Calories from Fat 110

	% Daily Value*
Total Fat 12g	**18%**
Saturated Fat 3g	**15%**
Trans Fat 3g	
Cholesterol 30mg	**10%**
Sodium 470mg	**20%**
Total Carbohydrate 31g	**10%**
Dietary Fiber 0g	**0%**
Sugars 5g	
Protein 5g	

Vitamin A 4% • Vitamin C 2%

Calcium 20% • Iron 4%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Products labeled “light” or “lite” must have 1/3 fewer calories or 1/2 the fat of the foods to which they are compared. “Light” also can mean that salt has been reduced by 1/2.

Look for products that have more fiber and less sugar.

Vitamins and minerals help your body function properly.

¡De la Etiqueta a la Mesa!

Presta atención al tamaño de las porciones.

Busca alimentos con niveles bajos en grasas saturadas.

Esto te dice cuánta sal hay en la comida.

El calcio es importante para los huesos y los dientes.

Usa esta sección como guía para planear tus alimentos diariamente.

La cantidad de calorías que una persona necesita diariamente depende de varios factores, incluyendo el hacer ejercicio.

Datos de Nutrición

Tamaño de la porción 1 taza (228g)
Cantidad por paquete 2

Cantidad por porción

Calorías 250	Calorías derivadas de la grasa 110
	% Valor Diario*
Total Grasa 12g	**18%**
Grasa saturada 3g	**15%**
Grasa *Trans* 3g	
Colesterol 30mg	**10%**
Sodio 470mg	**20%**
Total Carbohidratos 31g	**10%**
Fibra Alimenitcia 0g	**0%**
Azucares 5g	
Proteína 5g	

Vitamina A 4%	Vitamina C 2%
Calcio 20%	Hierro 4%

* Porcentaje del valor diario es calculado en una dieta de 2,000 calorías.

		Calorías: 2,000	2,500
Total Grasa	Menos de	65g	80g
Grasa Sat.	Menos de	20g	25g
Sodio	Menos de	300mg	300mg
Colesterol	Menos de	2,400mg	2,400mg
Total Carbohidratos		300g	375g
Fibra Alimenticia		25g	30g

Los productos que son etiquetados "light" o "lite" deben tener 1/3 de las calorías menos o de las grasas menos que los alimentos con que están siendo comparados. "Light" también quiere decir que la sal ha sido reducida a la mitad (1/2).

Busca productos que tengan más fibra y menos azúcar.

Las vitaminas y los minerales ayudan a tu cuerpo a funcionar apropiadamente.

Sugar Measures Up

9

You will need a measuring cup, a teaspoon, and sugar.

1. Think about an ordinary can of your favorite soft drink. The can holds 12 ounces of liquid. How many teaspoons of dissolved sugar do you think is in one can of soft drink?

   ____

2. On the measuring cup to the right, draw a line to show the amount of sugar you predict is in one can of soft drink.

3. Now, use the following information to answer the question below.

   An average soft drink contains about 40 grams of sugar.

   One teaspoon of sugar weighs 4 grams.

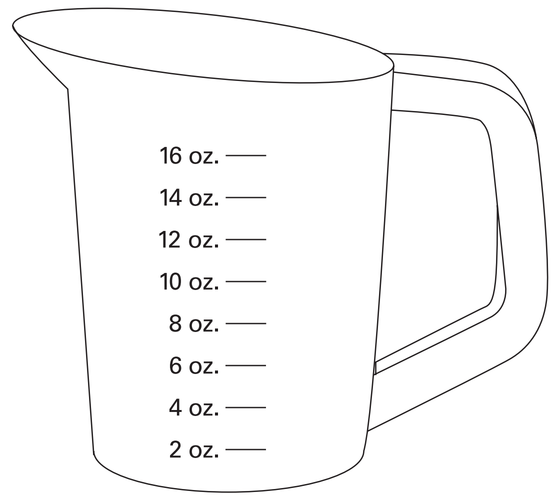
   How many teaspoons of sugar are in a can of soft drink?

   ____

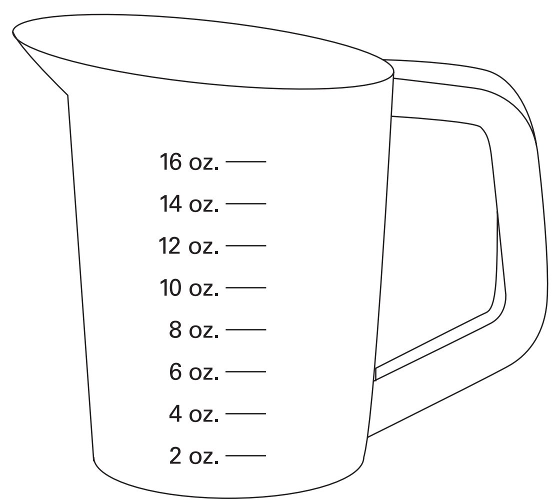
4. Put that many teaspoons of sugar into the measuring cup.

5. Look at the amount of sugar actually in your measuring cup. On the measuring cup to the right, draw a line showing the actual amount of sugar in a can of your favorite soft drink.

PREDICTION



ACTUAL



Midamos el Azúcar

Necesitas una taza de medir, una cucharita y azúcar.

1. Piensa sobre una lata de tu refresco favorito. Esta lata tiene 12 onzas de líquido. ¿Cuántas cucharaditas de azúcar disuelta tú crees que hay en una lata de refresco?

   ____

2. En la taza de medir que ves a la derecha, dibuja la cantidad de azúcar que tú predices hay en una lata de refresco.

3. Ahora, usa la siguiente información para contestar la pregunta que verás a continuación.

   Una lata de refresco promedio contiene alrededor de 40 gramos de azúcar.

   Una cucharadita de azúcar pesa 4 gramos.

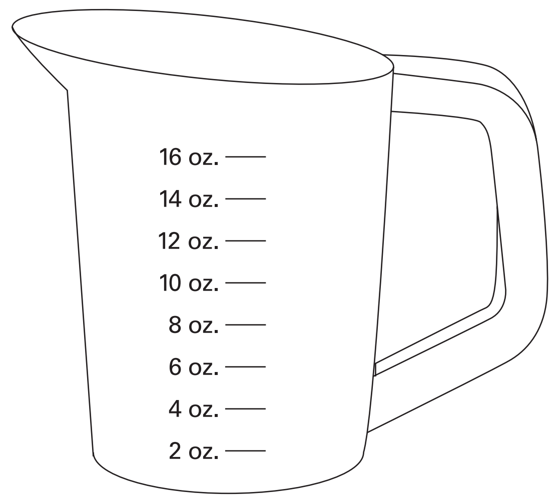
   ¿Cuántas cucharaditas de azúcar hay en una lata de refresco?

   ____

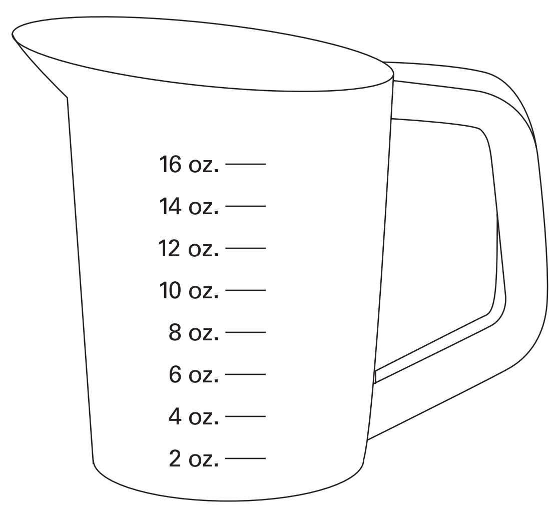
4. Echa esta cantidad de cucharaditas de azúcar en la taza de medir.

5. Mira la cantidad de azúcar que hay en la taza de medir. En la taza de medir a tu derecha, dibuja la cantidad actual de azúcar que hay en una lata de tu refresco favorito.

PREDICCIÓN



ACTUAL



Safe Food Preparation

10

Environment and Health

Simple precautions during food preparation can help to keep foods free of bacteria, and also help to reduce the consumption of chemicals applied to fruits and vegetables. Some important food preparation tips include the following.

- Always rinse fruits and vegetables, and after handling raw meat, fish or poultry.
- Always wash hands before preparing any food.
- Always wash cooking utensils, such as knives and cutting boards, in hot, soapy water.
- Clean cutting boards and work surfaces with a 1:10 bleach and cold water solution to kill bacteria.
- Always wash cutting boards between preparing different food items.
- Cook all meats, fish, eggs and poultry thoroughly.
- Use ground meats within 24 hours of purchase (or freeze them) and cook thoroughly.
- In home gardens, use pesticides as sparingly as possible.
- Avoid eating fish and seafood from polluted water.

This activity will allow students to observe safe food preparation practices while making a fun treat—ice cream!

Unit Links

The Mysterious Marching Vegetables
Sciences boxes,
p. 32–33

Explorations
How Much Fat . . ., p. 6

SETUP

Have students work in pairs and share materials to freeze the ice cream. Each student, however, should prepare his or her own batch of ice cream. Arrange measuring tools and ingredients along a counter, "cafeteria style." Students should practice safe food preparation procedures by using clean utensils, washing work surfaces and washing hands before beginning. New resealable plastic bags do not need to be washed before use.

PROCEDURE

1. Before beginning, have students talk about ways they can keep food clean during preparation. List their ideas on the board. If necessary, mention additional points listed above to complete the discussion.
2. Tell students that they will be making one of their favorite foods—ice cream. Go over the steps they will follow to make the ice cream, as listed on the "Good and Healthy!" sheet. Have students identify which steps will require care to keep their food clean.

CONCEPTS

- Simple things that can be done during food preparation reduce the risk of food contamination.
- Snacks can be nutritious and fun!

OVERVIEW

Students will learn about safe food preparation by making fruit ice cream in class.

SCIENCE, HEALTH & MATH SKILLS

- Measuring
- Planning a step-by-step procedure
- Making observations

TIME

Preparation: 30 minutes
Class: 30 minutes

MATERIALS

- Clean-up supplies

Each team of 2 students will need:

- 6 tbs of rock salt
- 1/2 gal of ice
- Clear, resealable plastic bag, freezer weight, 12 in. x 15 in. (gal size)
- Measuring cups
- Measuring spoons

Each student will need:

- 1/2 cup of whole milk
- 1/2 tsp of unflavored gelatin
- 1/4 cup of orange juice
- Clear, resealable plastic bag, freezer weight, 4 in. x 6 in.
- Plastic spoon
- Tablespoon of sugar
- Copy of "Good and Healthy!" sheet (p. 47)

FOODSAFETY.GOV

Did you know that one in six Americans will get sick from food poisoning this year alone? Food poisoning not only sends more than 100,000 Americans to the hospital each year—it also can have long-term health consequences.

3. Before beginning, have students wash their hands and work areas.
4. Have each student measure the following ingredients into a small freezer-weight resealable plastic bag: 1/4 cup of orange juice, 1/2 teaspoon of gelatin and 1 tablespoons of sugar. Have students seal, then shake the bags to mix these ingredients together. Have each student add 1/2 cup whole, unflavored milk to his or her bag.
5. Have each team of two students fill a gallon-size resealable plastic bag about halfway with ice, and then add about 6 tablespoons of rock salt.
6. Direct both members of each team to place their bags inside the gallon bag with ice and seal the large bag carefully. Have students take turns shaking the gallon bags until the mixture freezes.
7. Let students remove the smaller bags, wipe or rinse off the salt water and enjoy their sweet treat.
8. Later, have students write a paragraph describing the steps they followed to make the ice cream. Have them include descriptions of the ways they kept their food and work areas clean.

VARIATION

Let students bring raisins, chocolate chips, sprinkles, etc., from home to add to their ice cream. Or have them bring different kinds of fruit. A fourth-cup of mashed bananas or strawberries, or another kind of juice can be substituted for the orange juice.

QUESTIONS FOR STUDENTS TO THINK ABOUT

When making the ice cream, did a physical or a chemical change take place? How do we know?

Good and Healthy!

¡Rico y Saludable!

Tasty Good Ice Cream

Put the following items into a small resealable plastic bag.

- 1 tablespoon of sugar
- $\frac{1}{2}$ teaspoon of gelatin
- $\frac{1}{4}$ cup of orange juice

Seal the bag and shake it to mix the ingredients together.

Then open it and add $\frac{1}{2}$ cup of whole milk. Seal the bag again.

Fill a large plastic bag about halfway with ice, and then add about 6 tablespoons of rock salt.

Put one or two small bags into the large bag with ice. Close the large bag and shake it for about five minutes. Take out the small bags, wipe or rinse off the outsides, get a spoon and ENJOY!

Helado Delicioso

Vierte los siguientes ingredientes en una bolsa pequeña reusable:

- 1 cucharada de azúcar
- $\frac{1}{2}$ cucharadita de gelatina
- $\frac{1}{4}$ taza de jugo de naranja fresco

Cierra la bolsa y mezcla los ingredientes.

Entonces abre la bolsa y añade $\frac{1}{2}$ taza de leche. Cierra la bolsa otra vez.

Llena una bolsa grande reusable de hielo hasta la mitad y añade 6 cucharadas de sal de roca.

Pon una o dos bolsas pequeñas dentro de la bolsa grande con hielo, cierra la bolsa grande y agita por 5 minutos. Saca las bolsas pequeñas, seca la parte de afuera de cada bolsita, busca una cucharita y ¡DISFRUTA!

11

Healthy Snacks

Post-assessment

CONCEPTS

- This culminating activity is designed to assess the students' knowledge of concepts presented throughout unit, especially those related to personal nutrition.

OVERVIEW

Students will rank food labels from most to least healthful, and justify their rankings. Students also will suggest ways to keep their snacks from spoiling.

SCIENCE, HEALTH & MATH SKILLS

- Making observations
- Recording observations
- Drawing conclusions

TIME

Preparation: 10 minutes
Class: 30 minutes

MATERIALS

Each group of students will need:

- Paper and pen
- Copy of "What's Really In There?" (p. 49–50)

OPTIONAL PRE-/POST-ASSESSMENT

PICK A FOOD

Have students complete the "Pick A Food" exercise (see page 2), using the same food that they selected in the pre-assessment.

This activity is designed to assess student learning of nutrition and food-related concepts presented in the unit. Examples of the unit topics are listed below. You also may want to repeat Activity 1 as a post-assessment.

- Photosynthesis as the source of energy at the base of the food chain
- Food webs and the interrelatedness of components in ecosystems
- Where food comes from
- Choosing a healthy diet
- The persistence of certain contaminants (especially heavy metals and compounds, such as pesticides) in the food chain
- The contamination of food, especially by bacteria and other microorganisms
- Appropriate food-handling techniques to reduce the likelihood of exposure to food-borne parasites or bacterial infections, and to reduce contamination of food by pesticides and other chemicals

Unit Links

The Mysterious Marching Vegetables
Review Science boxes throughout

Explorations
We Can Make a Difference, p. 5

SETUP

Have students work in groups of 2–4.

PROCEDURE

1. Distribute a copy of the What's Really In There? student page to each group of students. Explain that they will be using their new knowledge about choosing healthy foods and food preparation.
2. Have groups discuss the contents of the foods described in each of the labels. Students should notice how many fats, carbohydrates, sugars, etc. are in each item.
3. After discussion, have each group rank the snacks in order from most healthy to least healthy. On a separate sheet of paper, students should write a short paragraph about the evidence they used to make their rankings. Each group should identify which food groups are represented in each snack, and whether the quantities are present in healthy amounts.

VARIATIONS

- Have students evaluate the quality of the different snacks for people with special needs—for example, someone who must eat less salt, sugar or fats, or someone who needs to include more fiber in his or her diet.

What's Really In There?

1. Study the information on the food labels. Rank the snacks from most healthy (number 1) to least healthy (number 5).

2. On a separate sheet of paper, write a short paragraph explaining why and how you ranked the snacks.

3. On the same sheet of paper, identify which food groups are represented in each snack. Are the quantities represented in each snack healthy amounts?

ROSIE'S ROSETTES

______

Nutrition Facts
Serving Size 1 cup (228g)
Serving Per Container 2

Amount Per Serving	
Calories 260 Calories from Fat 120	
	0% Daily Value*
Total Fat 13g	**20%**
Saturated Fat 5g	**25%**
Cholesterol 30mg	**10%**
Sodium 660mg	**28%**
Total Carbohydrate 31mg	**10%**
Dietary Fiber 0g	**0%**
Sugars 5g	
Protein 5g	
Vitamin A 4% • Vitamin C 2%	
Calcium 15% • Iron 4%	

GOOGLE BERRIES

______

Nutrition Facts
Serving Size 2 tbsp (33g)
Serving about 10
Calories 15
Fat Calories 0

*Percent Daily Values are based on a 2,000 calorie diet.

Amount Per Serving	0% Daily Value*	Amount Per Serving	0% Daily Value*
Total Fat 0g	**0%**	**Total Carbohydrate** 3g	**1%**
Saturated Fat 0g	**0%**	Dietary Fiber 1g	**4%**
Cholesterol 0mg	**0%**	Sugars 0g	
Sodium 230mg	**10%**	**Protein** less than 1g	

Vitamin A 8% • Vitamin C 6% • Calcium 0% • Iron 0%

TRIPLE TREATS

______

Nutrition Facts
Serving Size 1 oz
(28g/about 13 chips)
Serving Per Container 8

Amount Per Serving	
Calories 120 Calories from Fat 10	
	0% Daily Value
Total Fat 1g	**2%**
Saturated Fat 1g	**1%**
Cholesterol 0mg	**0%**
Sodium 140mg	**6%**
Total Carbohydrate 24g	**8%**
Dietary Fiber 2g	**8%**
Sugars 0g	
Protein 3g	
Vitamin A 0% • Vitamin C 0%	
Calcium 4% • Iron 0%	

RIFF'S QUACKY SNACKS

______

Nutrition Facts
Serving Size 1 jar (140g)

Amount Per Serving	
Calories 110 Calories from Fat 0	
	0% Daily Value
Total Fat 0g	**0%**
Saturated Fat 0g	**0%**
Cholesterol 0mg	**0%**
Sodium 10mg	**24%**
Total Carbohydrate 27mg	**67%**
Dietary Fiber 4g	**9%**
Sugars 0g	**0%**
Protein 0g	**0%**
Protein 0% • Vitamin A 6%	
Vitamin C 45% • Calcium 2%	
Iron 2%	

CRUNCHY MUNCHIES

______

Nutrition Facts
Serving Size 1 oz
(28g/about 6 chips)
Serving Per Container 9

Amount Per Serving	
Calories 130 Calories from Fat 50	
	0% Daily Value
Total Fat 6g	**9%**
Saturated Fat 1g	**5%**
Cholesterol 0mg	**0%**
Sodium 80mg	**3%**
Total Carbohydrate 19g	**6%**
Dietary Fiber 1g	**4%**
Sugars 0g	
Protein 2g	
Vitamin A 0% • Vitamin C 0%	
Calcium 4% • Iron 0%	

11

¿Qué de Verdad Hay Ahí?

1. Estudia la información que ves en cada etiqueta de alimentos. Enumera en orden estas meriendas desde la más alimenticia (número 1) hasta la menos alimenticia (número 5).

2. En otro papel, escribe un párrafo corto explicando por qué enumeraste estas meriendas así.

3. En ese mismo papel, identifica qué grupos de alimentos están representados en cada merienda. ¿Son las cantidades representadas en cada merienda cantidades saludables?

LAS ROSETAS DE ROSIE

____

Datos de Nutrición
Tamaño de la porción 1 taza (228g)
Cantidad por paquete 2

Cantidad por porción	
Calorías 260	Calorías derivadas de la grasa 120
	0% Valor Diario
Total Grasa 13g	**20%**
Grasa saturada 5g	**25%**
Colesterol 30mg	**10%**
Sodio 660mg	**28%**
Total Carbohidratos 31mg	**10%**
Fibra Alimenticia 0g	**0%**
Azucares 5g	
Proteína 5g	
Vitamina A 4% •	Vitamina C 2%
Calcio 15% •	Hierro 4%

FRESAS Y MÁS FRESAS

____

Datos de Nutrición
Tamaño de la porción 2 tbsp (33g)
Cantidad por paquete 10
Calorías 15
Calorías derivadas de la grasa 0
*Porcentaje del valor diario es calculado en una dieta de 2,000 calorías.

Cantidad por porción	**0% Valor Diario***	**Candidad por porción**	**0% Valor Diario***
Total Grasa 0g	**0%**	**Total Carbohidratos** 3g	**1%**
Grasa saturada 0g	**0%**	Fibra Alimenticia 1g	**4%**
Colesterol 0mg	**0%**	Azucares 0g	
Sodio 230mg	**10%**	**Proteína** menos de 1g	

Vitamina A 8% • Vitamina C 6% • Calcio 0% • Hierro 0%

BOCADITOS VOLADITOS

____

Datos de Nutrición
Tamaño de la porción 1 oz (28g/about 13 chips)
Cantidad por paquete 8

Cantidad por porción	
Calorías 120	Calorías derivadas de la grasa 10
	0% Valor Diario
Total Grasa 1g	**2%**
Grasa saturada 1g	**1%**
Colesterol 0mg	**0%**
Sodio 140mg	**6%**
Total Carbohidratos 24g	**8%**
Fibra Alimenticia 2g	**8%**
Azucares 0g	
Proteína 3g	
Vitamina A 0% •	Vitamina C 0%
Calcio 4% •	Hierro 0%

LOS BOCADITOS DE RIFF

____

Datos de Nutrición
Tamaño de la porción 1 jara (140g)

Cantidad por porción	
Calorías 110	Calorías derivadas de la grasa 0
	0% Valor Diario
Total Grasa 0g	**0%**
Grasa saturada 0g	**0%**
Colesterol 0mg	**0%**
Sodio 10mg	**24%**
Total Carbohidratos 27mg	**67%**
Fibra Alimenticia 4g	**9%**
Azurcares 0g	**0%**
Proteína 0g	**0%**
Proteína 0% •	Vitamina A 6%
Vitamina C 45% •	Calcio 2%
Hierro 2%	

QUESITOS TOSTADITOS

____

Datos de Nutrición
Tamaño de la porción 1 oz (28g/about 6 chips)
Cantidad por paquete 9

Cantidad por porción	
Calorías 130	Calorías derivadas de la grasa 50
	% Valor Diario
Total Grasa 6g	**9%**
Grasa saturada 1g	**5%**
Colesterol 0mg	**0%**
Sodio 80mg	**3%**
Total Carbohidratos 19g	**6%**
Fibra Alimenticia 1g	**4%**
Azucares 0g	
Proteína 2g	
Vitamina A 0% •	Vitamina C 0%
Calcio •	Hierro 0%

THE SCIENCE OF
Food

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