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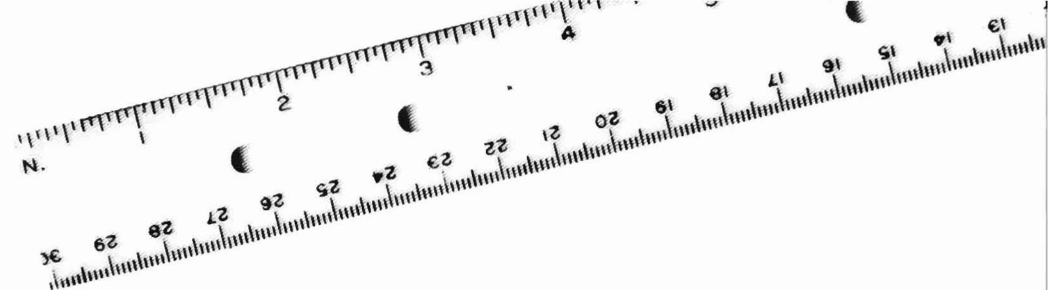
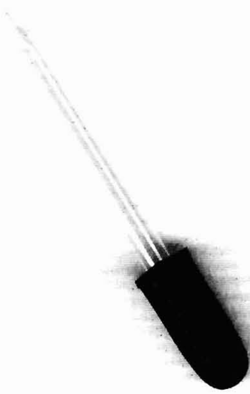
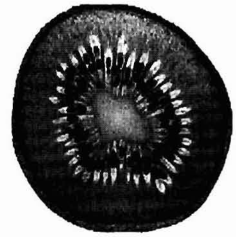


Kitchen Science for Kids

Patricia F. Thonney and Tracy J. Farrell





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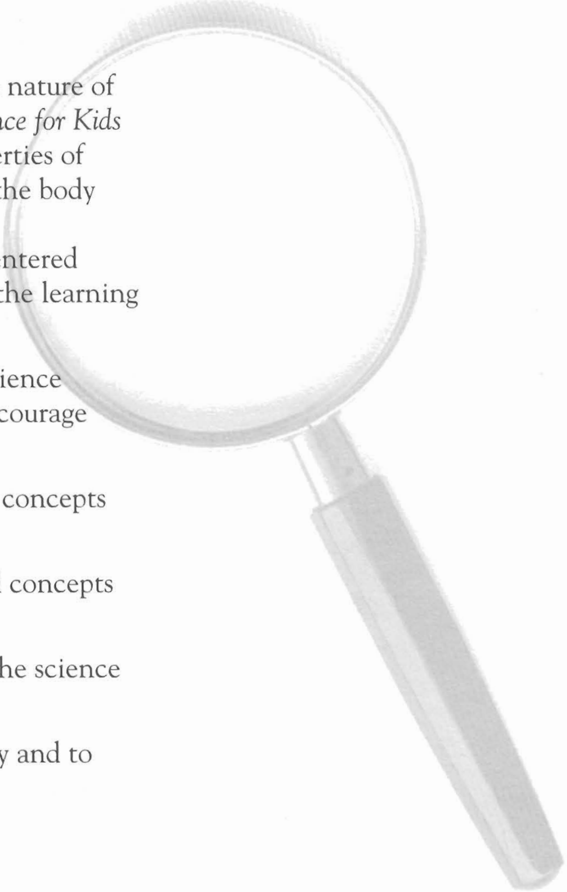
At a Glance



Nutrition embraces many science concepts. Some relate to the nature of food; some to how food is handled in the body. In *Kitchen Science for Kids* children will explore the sensory, physical, and chemical properties of food as well as nutrients as chemical components of food that the body needs to function.

Each of the five science experiments is designed for child-centered learning along with additional information for adults to guide the learning process.

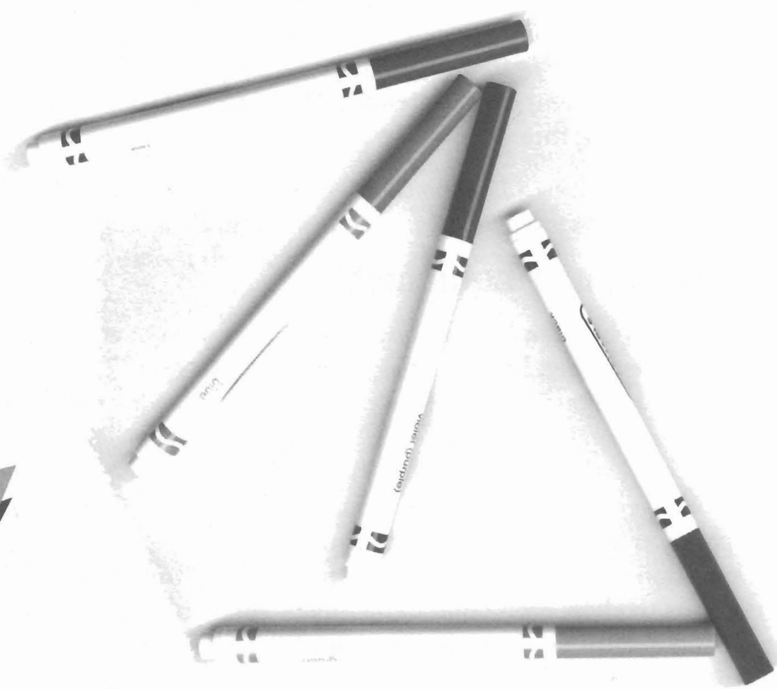
Exploring Together, a step-by-step procedure for doing the science experiment with children, including sample questions to encourage self-discovery through inquiry

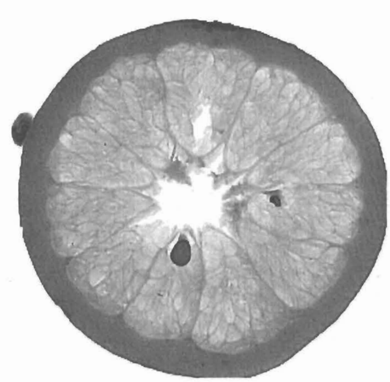
Science and Food Focus, information about science skills and concepts and their application in the study of food and nutrition

Science Skills, a list of skills related to process, technique, and concepts conveyed by the science experience

Supplies, a checklist for organizing materials and conducting the science experiment

Continuing the Experience, ideas for continuing self-discovery and to encourage flexible use of the material





Selection of Activities

The activities in *Kitchen Science for Kids* were developed to meet several challenges of incorporating an educational program into a school-age child care setting. These challenges include dealing with mixed-age groups of children, a recreational environment, limited preparation time, limited space, and limited access to kitchen facilities. Many of these problems are common to other informal education settings.

Ages and Groups

Most children ages five to twelve will easily master the techniques required to do each activity. Guided conversation by the adult will emphasize the science process skills such as predicting, observing, comparing, and communicating. The activities have been used successfully in several small group situations: grouping younger (ages five to eight) and older (ages nine to twelve) children; pairing younger and older children (buddies); and creating small groups with no attempt to separate by age. In most cases, only one adult will be needed to facilitate the discovery process, including guiding conversation, for five or six children.

Older children may grasp the underlying science concepts more readily than younger children, although younger children who have been exposed to more science opportunities may grasp concepts more readily than older children who have had limited experiences with science. All will benefit from the chance to manipulate materials and equipment, to test ideas, and to explore topics that interest them in a relaxed, nonthreatening learning environment.

Time, Space, and Equipment

Each activity can be completed in one 20-minute period or expanded to provide further learning. In a school-age child care setting a teacher might choose to introduce one 20-minute activity a week, allowing children to do additional exploration on their own during the week. In a camp setting, a counselor could work with children on the experiments during a one-week session. Members in a 4-H club could combine the experiments with food preparation activities in a five-meeting sequence.

The selection of materials and procedures for doing the activities reflects efforts to allow each child to manipulate materials and yet limit the types and quantities of supplies that need to be purchased, organized, cleaned up, and stored. It's nice to be able to gather children around a table, but it's also possible to create work areas on the floor or outside on the ground.

Flexible Programming

Presenting the five "discoveries" in *Kitchen Science for Kids* in sequence will introduce children to a range of physical and chemical properties of food, keeping the focus on science exploration. Or you may choose to use one or more of the "discoveries" to supplement a broader food preparation or nutrition education program. Although constraints of school-age child care programs were considered when developing the science experiments, the publication is designed to support science programming in a variety of informal education settings such as summer camps, 4-H clubs, EFNEP, science centers, and other community programs serving children and families.

Doing Science Together

Each discovery in *Kitchen Science for Kids* is designed for shared learning among adults and children. If possible, each adult and child should have his or her own work area for manipulating materials. The emphasis is on fun, participation, conversation, and continued exploration. Here are some tips for adults who will be guiding the science experience:

Take Time to Have Fun

Science is observing, handling materials, asking questions, finding ways to test ideas, and talking about what is observed. Give children a chance to repeat experiences, to practice skills, and to explore ideas that interest them. Give children the freedom to make their own fun.

Participate in the Process

As you introduce the activities to children, take care not to be too directive or dominating. Participate in the science experience by manipulating equipment and supplies. Let the children see that you have questions, too. Enjoy children's curiosity and discoveries. Don't expect to have all the answers. Show children that you think learning is important and fun. Embrace the unexpected with enthusiasm.

Foster Curiosity with Conversation

Young children are natural scientists. They ask questions and experiment with new ideas as they try to make sense of the world around them. Encourage this natural curiosity. Guide their learning with open-ended questions: why, how, where, how much, what would happen if? Encourage children to make predictions, to estimate, and to suggest explanations for what they observe. Introduce terms and explain concepts after children have an opportunity to make observations.

Encourage Continued Exploration

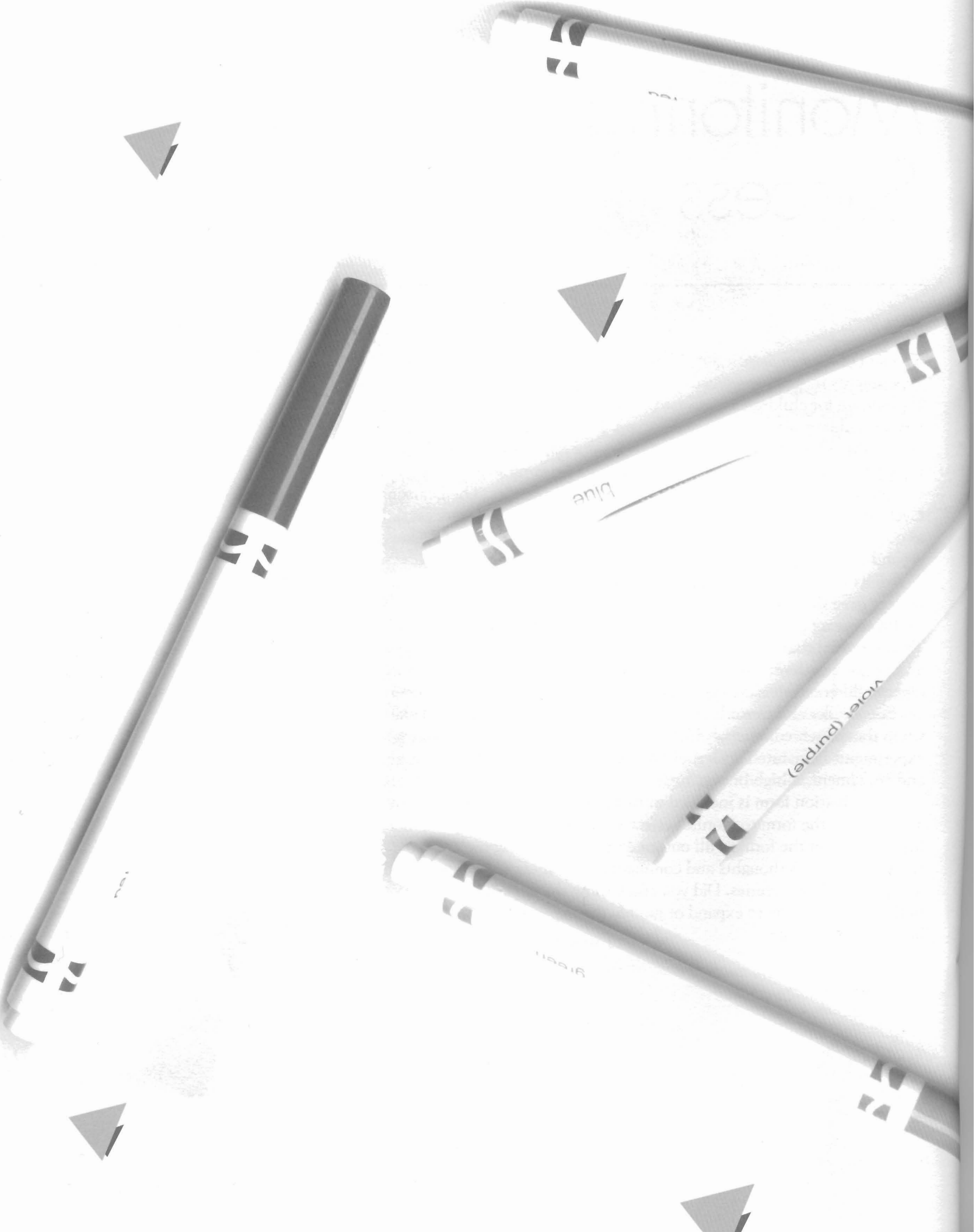
One activity can generate enthusiasm for doing more. Look for ways to continue an exploration. Provide a selection of fiction and nonfiction books that relate to the concepts. Create space for children to start collections. Start a mini-museum with "discovery boxes" that children can open and explore on their own. Offer simple science tools such as magnifying lenses and eyedroppers for children to experiment with just as a budding artist would reach for crayons and paper. Consider the experiments in this publication as only the beginning of the science and food fun you can have together.

Monitoring Success

The aim of *Kitchen Science for Kids* is to provide a collection of science experiments to support selected food and nutrition concepts that are appropriate for children ages five to twelve; make science accessible and fun for children; and encourage discovery-based learning among children and adults. The experiments in *Kitchen Science for Kids* model the Learning Cycle, a teaching strategy that embodies a learning sequence of exploration and introduction and application of concepts. The Learning Cycle allows children to experience a concept by using such process skills as observation and comparison before being given new terms or background information.

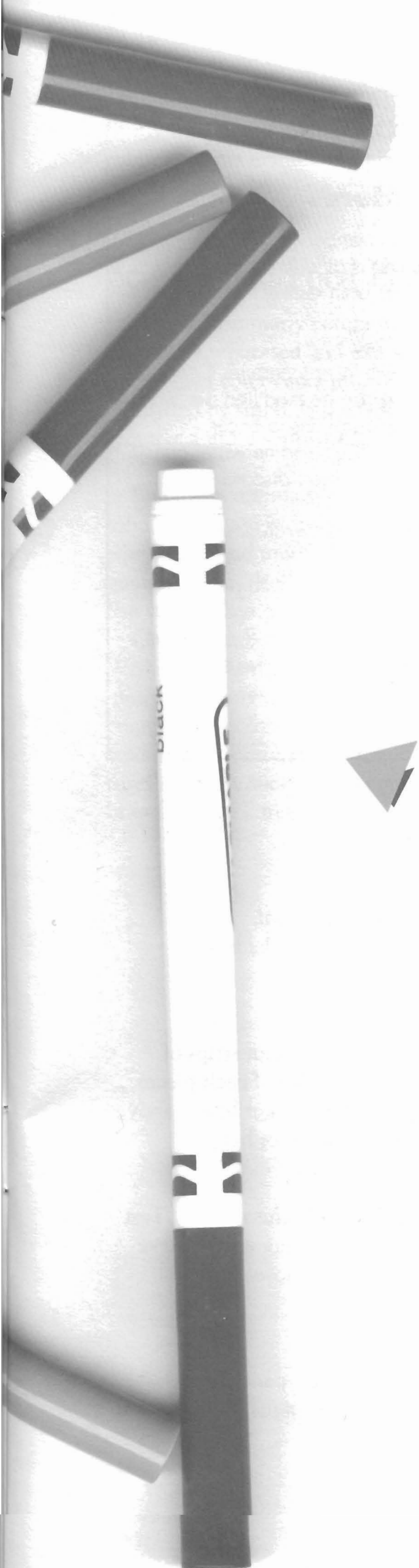
Adults who worked with children in the *Taking Time Together* pilot project gave these science activities very high marks for engaging children in the process of science (observing, comparing, conversing, and so on). They reported that children especially enjoyed manipulating eyedroppers and magnifying lenses and observing chemical reactions. Interest among older children often increased after they began manipulating the materials. Some older children who initially chose not to participate joined in when they observed other children having fun. Almost all adults using the experiments have rated both their satisfaction and the children's interest and enjoyment as high or very high.

An evaluation form is included in this publication. We encourage adults to use the form to monitor effectiveness of the teaching material. Make a copy of the form to fill out for each session you complete. To capture children's thoughts and comments, have them use a tape recorder to report their discoveries. Did you enjoy using the experiments? Did you find an effective way to expand or modify the experience? We'd love to hear your comments.



Discovery 1
Separate component parts of a mixture by using color chromatography.

Color Climbers



1. Pour a small amount of water (about 1/4 inch) in a plastic cup.
2. Choose a black or brown marker.
3. Lay a piece of coffee filter paper on a flat surface. Fold the paper in half so the top edges form a half circle.
4. Draw a curved line about 1 to 2 inches from the bottom of the folded paper. Turn the paper over and draw a similar line on the other side.
5. Pinch the paper below the marker line to form a point. Fan out the top part of the paper.
6. Set the point of the filter paper in the water. Try to keep the marker line above the water. Let go of the paper and observe what happens.
7. Leave the paper in the water and continue observing until the water has come most of the distance up the paper. Depending on the marker (color and brand) and brand of filter paper this could take 3 to 10 minutes.
8. Spread the wet filter paper on a paper towel to dry.
9. Discard any colored water and replace with fresh water.
10. Choose another marker and repeat steps 3–9 for each test. Predict what will happen. Observe what happens. Compare your predictions and observations.

Exploring Together

- ❑ What colors separated from the black or brown mark?
- ❑ What colors separated from other markers?
- ❑ Which marker contained the most colors?
- ❑ Which colors traveled the farthest?
- ❑ What markers didn't show any color separation?
- ❑ Do you think each color will always separate the same way?
- ❑ What happens if the marker line hits the water?
- ❑ What happens if you leave the paper in the water a really long time?
- ❑ What happens if you draw two color lines on top of each other?
- ❑ What happens if you draw the line higher up on the paper?
- ❑ What made the colors separate?
- ❑ What are some "hidden" components of food?
- ❑ How can scientists separate and identify them?

Supplies

- ❑ Water
- ❑ Plastic cup
- ❑ Water-soluble markers
- ❑ Coffee filter paper (round)
- ❑ Paper towels
- ❑ A sink or two containers

Notes about Supplies and Procedures

Multiply by the number of children and adults and the number of trials to determine the total supplies needed. A good guideline is at least four trials per person. Allow children the freedom to experiment with both testing markers and handling the filter paper.

This experiment works only with **water-soluble** markers.

Inexpensive round coffee filter paper works well with this procedure. Cone-shaped filter paper will also work, and the procedure can be modified accordingly. Some brands may take longer than others for separations to occur.

Only a small amount of water is needed for each trial. The same water can be reused many times unless the marker line touches the water; discard water if it takes on the color of the marker.

If you aren't near a sink, use a pitcher or container to hold fresh water and a second container for discarding dirty water.

If space is limited, wet filter papers can be stacked vertically with paper towels or paper between each one.

Encourage conversation about separation of the colors. Use the questions as a guide, but be selective and don't try to use them all. Add your own questions and those of the children.

Continuing the Experience

Encourage children to show their families this experiment.
Pass out a few extra coffee filter papers for each child to take home. Emphasize that they need to use **water-soluble** markers.

Compare types and sizes of paper.
Compare filter paper, paper towels, and notebook paper. Cut strips of different lengths. Draw a line about 1 inch from one edge of each piece; place the papers in a saucer of water, making sure the marker line is above the water. Predict what may happen and observe what does happen.

Compare types of solvents.
Repeat the test using both water and rubbing alcohol as the solvent. Test both water-soluble and permanent markers or pens. Predict and observe what happens. **Safety note:** Handling alcohol requires close adult supervision.

Create "Color Burst" artwork.
Draw designs with water-soluble markers on coffee filter paper or art paper. Use your finger to place drops of water on the designs. Predict what may happen and observe what does happen.

Experiment with foods and plants.
See what happens if you rub pieces of food or plants on the filter paper. Black jelly beans and red cabbage work well with water as the solvent. Subtle separations can be observed when color-coated candies and other plants are used. A coin or other tool can be used to rub some substances firmly into the filter paper. Compare tests using different solvents such as rubbing alcohol and water. Predict and observe what happens.
Safety note: Handling alcohol requires close adult supervision.

Science and Food Focus

Foods contain many components. Some such as a seed in fruit can be physically separated and examined with the naked eye. But to see the cells in the seed you need a microscope to enlarge the image. Odors can be identified by smell. But to identify each chemical component of the odor requires a more sophisticated method of detection such as gas chromatography.

Scientists use many techniques to isolate and study components in food. To isolate individual chemicals and quantify them requires precision equipment and methods not easily done outside of a laboratory. Yet simple qualitative methods can introduce children to the scientific process and to the varied physical and chemical nature of food.

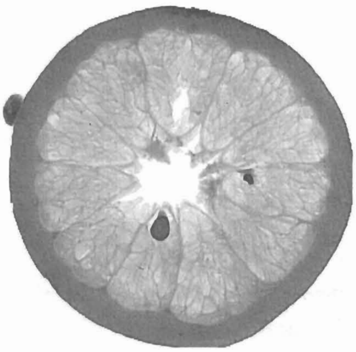
Colors can be separated by a process called **color chromatography.** With water as the solvent, particles of different sizes and weights (color molecules) travel faster or slower through the paper. This process separates component colors of a mixture. The "Color Climber" experiment demonstrates color chromatography using water-soluble markers and water. Mixtures can vary such that separations of a color are not identical; different brands of black markers, for example, usually show different separations.

Science Skills

Process
Predict
Observe
Communicate
Question
Interpret data
Control variables
Infer

Technique
Using chromatography
Testing variables

Concept
Mixture
Separating components of a whole
Chemical composition



Discovery 2
Explore the odors of foods by making and sharing "smell bottles"

A Smelly Challenge

1. Select a food (seasonings, herbs, flavorings, foods) to sample.
2. Place a sample of the food in an empty film container. Put the lid on the container.
3. Repeat steps 1 and 2 to make each "smell bottle." If you use several foods, it may be helpful to label each with a code number and record the codes on a piece of paper.

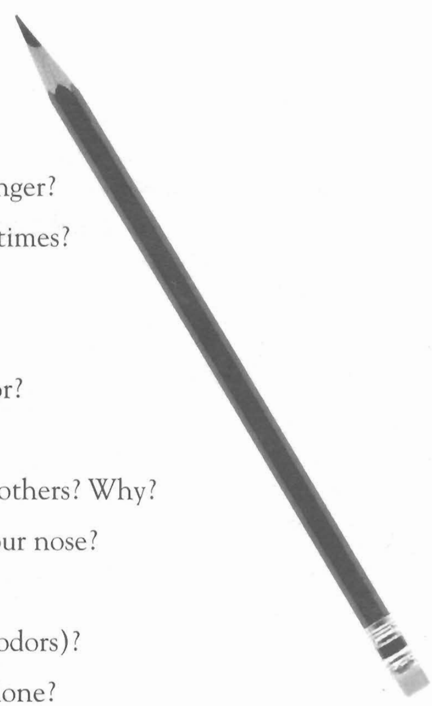
Triangle Test

Prepare two identical "smell bottles" and one that is different. Put participants' noses to the test. Can they identify the odd sample? Can they name the paired and odd samples? Challenge several more people. Are any odors easier to match or identify than others?

Matching Pairs

Prepare an even number of samples. Put peoples' noses to the test. Can they sort the samples into matching pairs? Can they name the paired samples? Challenge several more people. Are any odors easier to match or identify than others?

Exploring Together



- ❑ Can you smell anything?
- ❑ Can you do anything to make the odor stronger?
- ❑ What happens if you inhale rapidly several times?
- ❑ What happens if you block one nostril?
- ❑ Is this a familiar odor?
- ❑ What words can you use to describe the odor?
- ❑ Can you identify the odor?
- ❑ Are some odors more easily identified than others? Why?
- ❑ How does the odor get from the bottle to your nose?
- ❑ Do you see anything move to your nose?
- ❑ What would happen if you mixed samples (odors)?
- ❑ How easy was it to identify foods by smell alone?
- ❑ Describe a food you enjoy because of the way it smells.
- ❑ Describe a food you don't like because of the way it smells.

Supplies

- ❑ Food samples
- ❑ Film containers (opaque)
- ❑ Spoon
- ❑ Knife
- ❑ Cotton ball
- Paper and tape or stickers
- ❑ Pencil

Notes about Supplies and Procedures

Multiply by the number of children and adults and the number of samples per person to determine total supplies needed. To do the triangle test each child will need to prepare three samples—two the same and one odd.

Choose foods with distinctive aromas. A combination that works well for young children is cocoa, honey, cinnamon, and peanut butter. Older children can be challenged to distinguish more subtle differences or less familiar odors. Consider a variety of seasonings (cinnamon, curry, onion powder, garlic powder, black pepper, and chili powder), flavorings (vanilla, almond extract, lemon extract), and herbs (mint leaves, oregano leaves, basil leaves).

Photo stores that recycle empty film containers are a source of quantities of these containers free or children could save them from home. Film containers work well for this activity because they are small and have tight-fitting lids, but other plastic containers such as those for margarine, cream cheese, cottage cheese, or yogurt also work.

Tools used to put food samples in the film containers vary by the type of food. Viscous foods such as peanut butter, honey, or ketchup can be handled with a knife or spoon. Spillage of liquid foods such as vanilla, vinegar, or lemon juice can be reduced by soaking cotton balls in the liquid and then placing the cotton balls in the film containers.

Encourage conversation about the odors. Use the questions as a guide, but be selective and don't try to use them all. Add your own questions and those of the children.

Continuing the Experience

Continue making and sharing "smell bottles."
Encourage children to repeat the experience at home with their families.

Observe changes in the intensity of odor.
Leave the lids on one set of "smell bottles" and take them off another set. Predict what may happen and observe what happens after a few days. How do the smells compare? What might have happened to cause a difference?

Compare pleasant odors with unpleasant odors.
Select foods to compare such as burned and unburned toast, fresh and sour milk, fresh and moldy cheese, or a fresh and rotten apple. How do the smells compare? What might have happened to cause a change?

Examine the interaction of odor and taste.
Select a food that comes in different flavors such as ice cream. Select two or more flavors to sample such as strawberry and vanilla. Work with a partner. Offer a taste of the first flavor to your partner, who keeps both eyes and nose closed. Ask your partner to identify the flavor. Now tell your partner to unplug his nose and continue tasting the ice cream. Again ask your partner to identify the flavor. Were there any differences in the

two tastings? What might have caused the differences? Repeat with the second flavor and then switch tasting and serving roles.

Play a hide-and-seek game by searching for hidden scents.
Saturate cotton balls with distinctive scents such as oil of wintergreen, oil of cloves, and spearmint extract. Hide both scented and unscented cotton balls. Have children search for the balls and try to identify the scents.

Create experiments to explore other sensory properties of food.
Listen for differences in sounds of foods such as seeds; place samples in containers and shake to compare sounds. Feel differences in foods such as vegetables; place samples in a box and try to identify them by feeling without looking. Taste differences in foods such as beverages; place samples in cups and try to identify them by tasting without looking or smelling.

Science and Food Focus

The ability to observe is the most basic skill in science. It is used in developing other skills such as classifying, predicting, questioning, and inferring. Observations are perceptions of objects or events using one or more of the five senses—sight, touch, taste, smell, and hearing.

Comparing foods using the senses is an excellent way to develop observational skills. Talking about these observations helps children expand their descriptive vocabulary. A sensory activity lets children begin exploring the many properties of foods in a very personal way. "A Smelly Challenge" is just one of many activities you could select to engage children in sensory exploration of foods.

Compared to other animals, humans have a poor sense of smell. Yet an area about the size of a postage stamp in the nose enables us to identify thousands of smells. Suppose you cut open an orange and identify an odor you know as that of an orange. If you put an orange slice closer under your nose and sniff very hard, you will find that the odor is much stronger.

The orange releases tiny particles called molecules. We can't see molecules but they are in the air. When you sniff, you draw the molecules high into your nose. They land in a special place where nerves send messages to the brain. Your brain identifies the odor as that of an orange.

If you have a cold or an allergy that blocks your nasal cavity, the molecule messages can't reach the spot that can identify the odor. A food may not taste the way it should either. That is because much of what we think is taste really is smell. Taste and smell work together because the nose and mouth are closely connected.

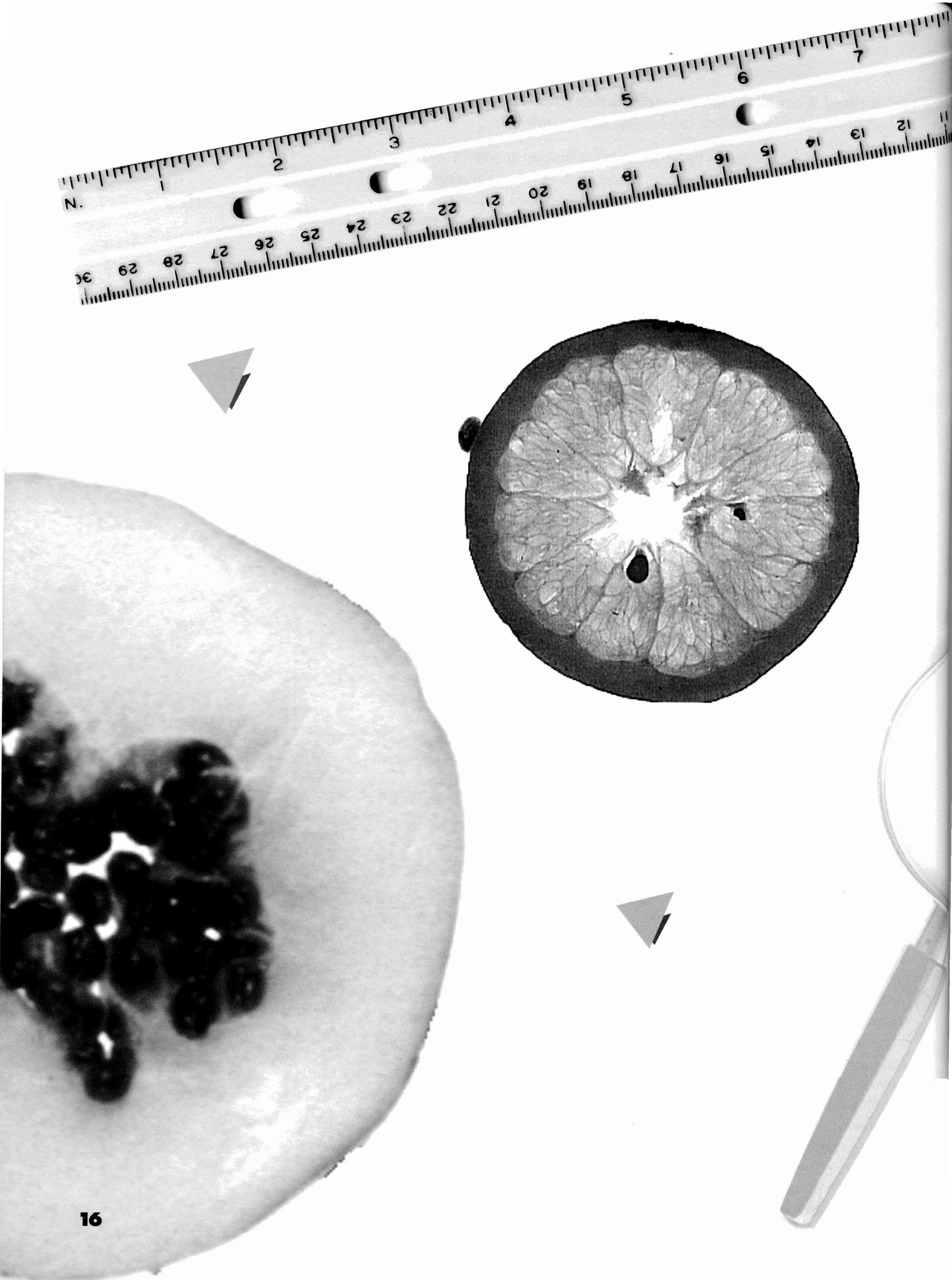
Scientists spend much time studying the odor and flavor (the combination of taste and odor) qualities of foods. Sometimes their work involves using sensory panels—people who are trained to discriminate among odors and flavors. The triangle test is just one of many tests used by sensory panels. In the triangle test an odd sample is identified in a group of three samples. Before new food products are marketed (a new apple variety, a new flavor of ice cream, or "improved flavor" of peanut butter), scientists study the thousands of chemical compounds that give flavor to food.

Science Skills

Process
Predict
Observe
Classify
Communicate
Question
Interpret data
Infer

Technique
Using the sense of smell
Handling small samples

Concept
Sensory properties of food

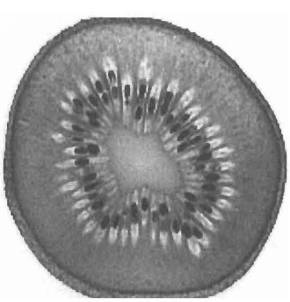


Seed Search

1. Choose a fruit. Before examining the fruit, make some predictions about the seeds. How would you describe the seeds?
2. Tear a sheet of notebook paper in half. Then fold each piece in half. Use one piece to hold the seeds, the other for any nonseed parts of the fruit.
3. Separate at least one seed from the rest of the fruit. Use a knife, if necessary, to find and isolate the seed. Keep the seed and nonseed samples close together.
4. Repeat steps 1–3 for each fruit. Compare predictions and observations, continuing with the following examinations.
5. Use a magnifying lens to examine a seed more closely. Describe what the seed looks like with and without the magnifying lens. How do different seeds compare?
6. Use a ruler to draw a 1-inch line on a piece of paper. Choose one fruit and estimate how many seeds will fit on the line. How can you check your estimation? How do different seeds compare?
7. Fill a clear measuring cup half full of water. Put the seeds of one fruit in the water. What do you observe? Remove the seeds (or pour out the seeds and water). Try the seeds of another fruit and compare the results.

Exploring Together

- ❑ Where are the seeds located in the fruit?
- ❑ How many seeds are in the fruit?
- ❑ How can you make a good estimate if there are too many seeds to count?
- ❑ How would you describe the color of the seeds?
- ❑ How would you describe the way the seeds feel?
- ❑ How would you describe the shape of the seeds?
- ❑ How would you describe the size of the seeds?
- ❑ How big are the seeds in relation to the size of the fruit?
- ❑ Are all the seeds in the fruit the same color, shape, and size?
- ❑ How are the seeds of different fruits similar? different?
- ❑ Would you eat the seeds?
- ❑ Why do fruits have seeds?
- ❑ Do all fruits have seeds? Why?
- ❑ What other foods do you think have seeds?
- ❑ What other parts of the fruit could you separate and compare?



Supplies

- ❑ Selection of fruits
- [paper
- ❑ Paper or plastic plate
- Plastic serrated knife
- Paring knife (for adult use only)
- ❑ Magnifying lens
- ❑ Ruler
- Measuring cup

about Supplies and Procedures

Multiply by the number of children and adults and the number of samples per person to determine total supplies needed.

Choose a selection of fruits appropriate for the children's skill, experience, and interest levels. Consider including fruits that will allow you to make some of the following comparisons: more and less familiar fruits; large and small fruits; large and small seeds; seeds located on the inside and on the outside of fruit; and edible and inedible seeds.

Some fruits will be more messy to work with than others. Protect work area with newspaper or plastic tablecloths. Consider using paper plates, plastic plates, or rigid trays from packaged frozen foods as a surface for separating seeds from fruits.

Plastic serrated knives are recommended. Young children may not yet be ready to handle a sharp knife. Children skilled at using sharp knives may be difficult to supervise in a group with mixed abilities. Most fruits can be cut easily with plastic serrated knives, but children should be instructed to handle even these knives with care. Adult assistance with a sharper knife may be needed for some fruits.

Encourage conversation about fruits and seeds. Use the questions as a guide, but be selective and don't try to use them all. Add your own questions and those of the children.

Continuing the Experience

Compare several samples of the same fruit.
Choose one variety of fruit such as McIntosh apples. Try to select fruits of different sizes and compare the seeds.

Compare different varieties of a fruit.
Choose several varieties of fruit such as McIntosh, Cortland, Red Delicious, and Granny Smith apples. How are they similiar and different?

Make a collection of the seeds of several plant foods.
An egg carton works well; put each kind of seed in a different cup. Label each cup with the seed name. How are the seeds similar and different? Which seeds do you eat? What foods have you eaten that contain the seeds or other parts of the plant?

Make a collection comparing seeds from both food and nonfood plants.
How are they similar and different? Do people in other parts of the world eat some seeds that you don't eat?

Create an experiment.
Seeds are only one physical component of fruit. How could you compare another component such as the juice or peel?

Science and Food Focus

When asked, "What's in an apple?" children often describe physical characteristics such as "seeds" or the "pocket for seeds" before considering the more abstract concept of nutrients. The "Seed Search" experiment gives children an opportunity to separate components and physically experience the many textures, shapes, and sizes of similar fruits.

Fruits come from plants that started as seeds, and they contain seeds. Seeds can be on the outside (strawberry) or inside (apple) of fruit. They can be edible (kiwi) or inedible (plum). Sometimes the seed is poisonous (kernel inside the pit of a peach).

Some vegetables—tomato, pepper, pumpkin, and squash—are scientifically classified as fruits because they have seeds. All plant foods grow from seeds. Other seeds we eat include wheat, oats, rice, corn, kidney beans, and lentils. Hundreds of plant foods are eaten worldwide.

Scientists spend much effort researching seeds. They work to develop new plant varieties with certain characteristics such as disease resistance, high yields, or reduced need for water. Some varieties even produce fruit without seeds (seedless grapes and watermelon).

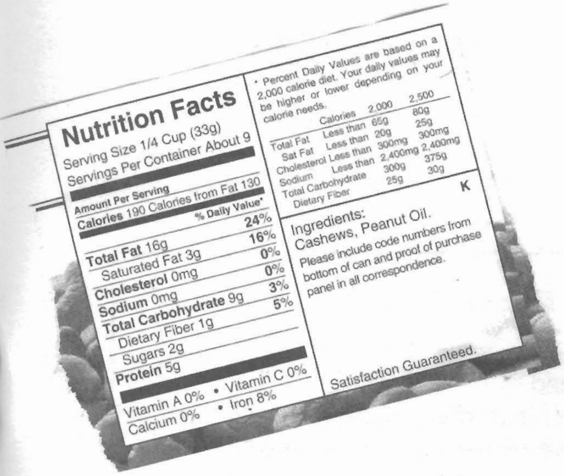
Science Skills

Process
Predict
Observe
Classify
Communicate
Question
Estimate
Measure
Interpret data
Infer

Technique
Isolating components of a whole
Handling a magnifying lens
Measuring with a ruler

Concept
Physical composition of food


Nutrition Facts
Serving Size 2 Tbsp. (32g)
Servings Per Container about 16
Calories 190
Fat Cal. 130
*Percent Daily Values (DV) are based on a 2,000 calorie diet.
Amount/Serving
%DV*
Total Fat 16g 25%
Sat Fat 3g 16%
Cholest. 0mg 0%
Sodium 130mg 5%
Amount/Serving
%DV*
Total Carb. 7g 2%
Dietary Fiber 2g 9%
Sugars 4g
Protein 8g
Iron 4% • Riboflavin 2% • Niacin 20% • Vitamin E 10%
Not a significant source of vitamin A, vitamin C, and calcium.



Finding Fat

1. Lay a brown paper towel on the table (or use a brown grocery bag or notebook paper).
2. With an eyedropper, place 2 or 3 drops of water on the paper. You should have a spot about the size of a quarter. Draw a circle around the spot and label it "water."
3. With an eyedropper, place 2 or 3 drops of vegetable oil on another part of the paper. Draw a circle around the spot and label it "oil."
4. Allow the spots to dry. Hold the paper up to the light and compare the area inside the circles. Describe what you observe.
5. Choose a food to test. Predict whether the spot on the paper will be like the water or the oil spot when it dries. Place a sample of the food on the paper.
6. Allow the spot to dry. Shake off any excess food and hold the paper up to the light. Describe what you observe.
7. Repeat steps 5–6 for each food.

Exploring Together

- ❑ What happened when the spots dried on the paper?
- ❑ How did this result compare to your predictions?
- ❑ How can foods be grouped by your observations?
- ❑ What happens if you just barely touch the food to the paper?
- ❑ What happens if you rub the food really hard onto the paper?
- ❑ What happens if you use different kinds of paper?
- ❑ Why do the water spots disappear from the paper?
- ❑ Why do the fat spots stay on the paper?
- ❑ What does "translucent" mean?
- ❑ Can you always detect fat in a food using this technique?
- ❑ Can you tell how much fat is in the food using this technique?
- ❑ Do all foods have fat?
- ❑ Can you always see the fat in food?
- ❑ What can you find out about fat by reading product labels?
- ❑ How can scientists separate and identify fat in foods?

Supplies

- ❑ Brown paper towels or bags
- ❑ Eyedropper, cotton-tipped swabs, plastic spoon or knife
- ❑ Water
- ❑ Vegetable oil
- ❑ Pencil
- ❑ Food samples
- ❑ Product labels (optional)

Notes about Supplies and Procedures

Multiply by the number of children and adults and the number of food samples per person to determine total supplies needed.

Choose a selection of foods appropriate for children's skill, experience, and interest levels. A combination that works well with young children is raw apple, raw potato, potato chip, peanut, salad dressing, margarine, and jelly. Older children can be challenged to compare a greater selection of foods, including fat-free and regular products (sour cream, cream cheese, yogurt, potato chips).

Not all testing will produce definitive results. Consider having children do the experiment and then read information about fat on food labels.

Several types of paper will work for this test. It is easiest to detect the translucent effect of fat on brown paper towels. These towels are made to be absorbent, whereas the water-repelling finish on brown grocery bags may cause water drops to bead up rather than being absorbed. Regular notebook paper works, but differences may be less visible for some foods.

Sampling can be done using fingers and not eyedroppers, but children enjoy manipulating eyedroppers and such tools encourage consistency in handling small samples.

Encourage conversation about fat and the foods being tested. Use the questions as a guide, but be selective and don't try to use them all. Add your own questions and those of the children.

Continuing the Experience

Encourage children to do this experiment with their families.
Compare foods commonly eaten at home. How many contain fat? Are any difficult to test?

Collect empty food containers or labels.
Find the list of ingredients and the nutrition information on the label. What do they tell you about fat?

Display a poster of the Food Guide Pyramid.
Ask children to explain what they think the poster tells them about food. Which categories contain foods with fat? What symbol on the poster represents fat? How is fat added to foods during cooking or at the table?

Cut pictures of foods from magazines or food packages.
Have children draw a Food Guide Pyramid on a large sheet of newsprint or pieces of newspaper taped together and then place the pictures in sections of the pyramid. Can any pictures be placed in more than one section? Why? Do you think some foods in a section contain more fat than others?

Create a sensory experiment for comparing products.
Prepare samples but keep their identity a secret. Compare them in one or more ways: use only your sense of smell; use only your sense of feeling; use only your sense of taste; use only your sense of sight. Reveal the identity of each sample and check each prediction. How well could you discriminate between high-fat and low-fat foods? Were any senses more helpful in identifying the samples than others?

Science and Food Focus

Nutrients are the chemicals in food that our bodies need to function properly. The more than forty different nutrients that are needed by the body can be grouped into six categories: water, proteins, carbohydrates (starch and sugar), fats, vitamins, and minerals. Three of these nutrients—fats, carbohydrates, and proteins—provide energy. Because fat is the most energy dense of these nutrients, a diet low in fat can help you maintain a healthy body weight. Current dietary guidelines recommend that adults and children over two years of age limit the amount of fat they eat.

Scientists use many techniques to isolate and study fat and fatlike components in foods. The results are published in food composition tables and are used to provide information on food labels. Their techniques require precision equipment and methods not easily replicated outside of a laboratory.

The "Finding Fat" test is a simple qualitative way to encourage children to think about fat in foods. Fat is only one of several components in food. Fat is different from other components in foods in the way it adheres to another medium such as paper. When rubbed onto paper, fat leaves a translucent spot (an area through which light passes). Water in food will also produce a translucent spot, but the water spot disappears when the water dries; a fat spot will not disappear from the paper.

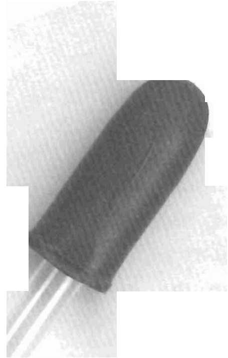
Foods that come from animals (milk and meat groups) are generally naturally higher in fat than foods that come from plants. But there are exceptions such as peanuts and avocados, which are high in fat content. There are also many low-fat dairy and lean meat choices available, and these foods can be prepared in ways that reduce their fat content. Most fruits, vegetables, and grain products are low in fat. But many popular items are prepared with fat such as french-fried potatoes, corn chips, or doughnuts so they are not such healthy choices.

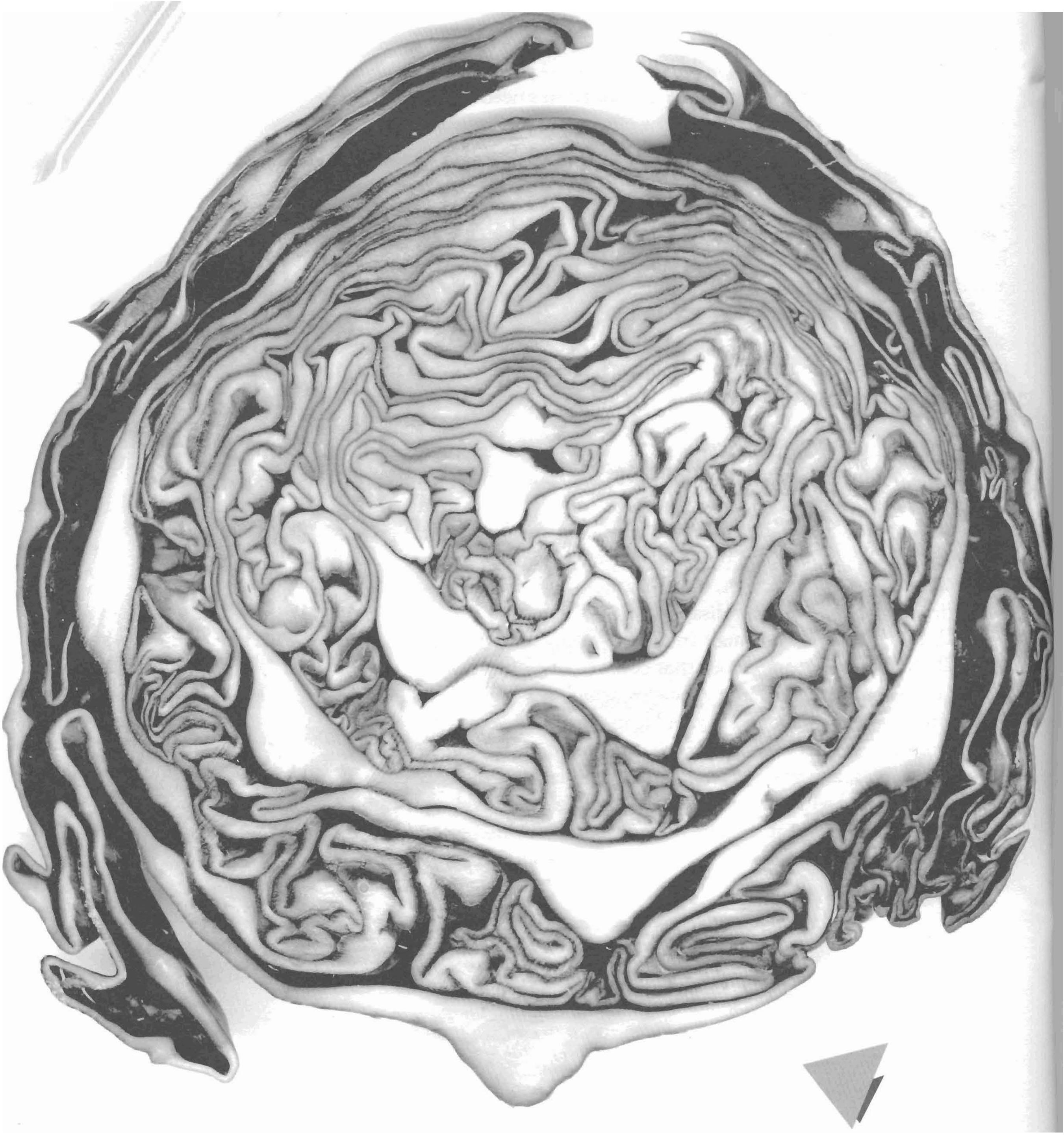
Science Skills

Process
Predict
Observe
Classify
Communicate
Question
Interpret data
Infer

Technique
Separating components of a whole
Handling small samples

Concept
Chemical composition
Mixture





Discovery 5
Explore acid/base properties of food by making an indicator

Color Changers

Making the Indicator

1. Cut a 2-inch wedge of red cabbage.
2. Tear or cut the leaves into small pieces.
3. Put the cabbage pieces into a large zip-top plastic bag or a bowl.
4. Add enough hot tap water to cover the cabbage.
5. Soak the cabbage for at least 10 minutes.
6. Pour the liquid into a pitcher; discard the leaves or save for making a salad.

Comparing Foods

1. Tape a strip of waxed paper to a table and put a piece of white paper underneath.
2. Pour water in one cup. Pour a small amount of indicator in a second cup.
3. Place 5 drops of indicator on the waxed paper; this puddle will serve as the control.
4. Place 5 more drops of indicator on the waxed paper, making a second puddle. Rinse the eyedropper in water. Place 1 drop of vinegar on this puddle. Observe what happens. Add 1 or 2 more drops of vinegar and observe what happens. Rinse the eyedropper.
5. With an eyedropper place 5 more drops of indicator on the waxed paper, making a third puddle. Rinse the eyedropper in water. Place a **very small** pinch of baking soda in the puddle of indicator. Observe what happens. Add a second pinch and observe what happens.
6. Choose a food to test. Predict what will happen. Place 5 drops of indicator on the waxed paper, making a new puddle. Rinse the eyedropper. With the eyedropper or your finger place a sample of the food in the puddle of indicator. Observe what happens.
7. Repeat step 6 for each food to be tested. Remember to rinse the eyedropper between uses.

Exploring Together

- ❑ What color changes did you observe?
- ❑ How can foods be grouped by the color changes?
- ❑ What color change was observed most frequently?
- ❑ What happens if you don't rinse the eyedropper?
- ❑ What happens if drops from two puddles are combined?
- ❑ What happens if you use only 1 drop of indicator?
- ❑ What happens if you use 10 drops?
- ❑ What happens if you add more or less of the test food?
- ❑ What made the color of the indicator change?
- ❑ What do foods with similar color changes have in common?
- ❑ What other foods could you test?

Supplies

For Making Indicator

- ❑ Red cabbage
- ❑ Plastic zip-top bag or bowl
- ❑ Hot tap water
- ❑ Container to hold strained cabbage liquid

Supplies

For Testing Foods

- ❑ Tape
- ❑ Waxed paper
- ❑ White paper
- ❑ Water
- ❑ 2 small cups
- ❑ Eyedropper
- ❑ Indicator
- ❑ Vinegar
- ❑ Baking soda
- ❑ Food samples

Notes about Supplies and Procedures

Multiply by the number of children and adults and the number of samples per person to determine total supplies needed.

Even young children can easily make the indicator using this method. If time is limited, the indicator can be made ahead and stored in the refrigerator for several days or in the freezer for several months.

A good indicator can be made with hot tap water in 10 minutes soaking time. Using boiling water or a longer soaking time draws more pigment from the cabbage leaves, making a more concentrated indicator.

The cabbage juice indicator can range in color from blue to purple, depending on the cabbage and the soaking technique.

Refrigerate or freeze the indicator for later use. Frozen indicator can be thawed and used. Leftover pieces of red cabbage can also be frozen and thawed for making indicator later.

Choose a selection of foods appropriate for the children's skill, experience, and interest levels. Some foods that might be tested are vinegar, pickle juice, lemon juice, fruit juice, light-colored carbonated beverages, milk, buttermilk, cottage cheese, egg white, cream of tartar, baking soda, and flour.

Children may need to develop skill to handle an eyedropper. For them to practice using the eyedropper, have them squeeze the bulb tight before placing in water. With the dropper in water, gradually let go of the squeezed bulb. Liquid will flow up the eyedropper. Squeeze out the water one drop at a time.

The cup of water is for rinsing eyedroppers between samples to avoid contamination. Demonstrate how to take samples of indicator, rinse the eyedropper, take samples of test foods, and rinse the eyedropper. Encourage children to understand and explore the concept of contamination but recognize that precision is not necessary for the success of this activity.

Some children may wish to repeat observations of only a few samples. Others may get absorbed in the techniques of handling the eyedroppers and samples. Encourage their curiosity by stressing the technique as well as the classification task.

Encourage conversation about the foods and color reactions. Use the questions as a guide, but be selective and don't try to use them all. Add your own questions and those of the children.

Continuing the Experience

Have children suggest other foods to test.
Provide an opportunity for additional exploration. Are some foods easier to test than others?

Test common nonfood household products.
Some possible items to test include toothpaste, aspirin, antacid tablets, alcohol, contact lens cleaner, mouthwash, powdered cleanser, detergent, or washing soda. **Caution:** Many of these products can be hazardous to handle, and close adult supervision should be provided. Compare results to those for food samples. How are they similar or different?

Make indicator paper.
Cut up strips of white paper. Dip each strip into the cabbage juice and hold it there until the paper soaks up the juice. Lay the paper strips on a plate or waxed paper to dry. Dip one end of a dried strip into a liquid you want to test. To test solids such as baking soda, dissolve a sample in water.

Science and Food Focus

Acids are chemicals that occur naturally in many foods. Foods and drinks that contain a high concentration of acid have a sour taste (lemon is an example). Foods with lesser amounts or different types of acid compounds may not taste sour (such as banana). If an acid is added to another substance it can make it sour too (lemon juice added to milk). Almost all foods are at least slightly acidic, and this property affects color, texture, and flavor when foods are cooked.

The "Color Changers" experiment provides a simple way of exploring the acidic property of food by making an indicator from cabbage juice. The indicator allows you to observe a change in color when it is combined with an acid or base. The cabbage juice is a purple or bluish-purple color. Chemicals that turn it pink are called acids; chemicals that turn it green (or shades of blue and green) are called bases. Chemicals that don't cause a color change are called neutral. The color change that is observed is called a chemical reaction.

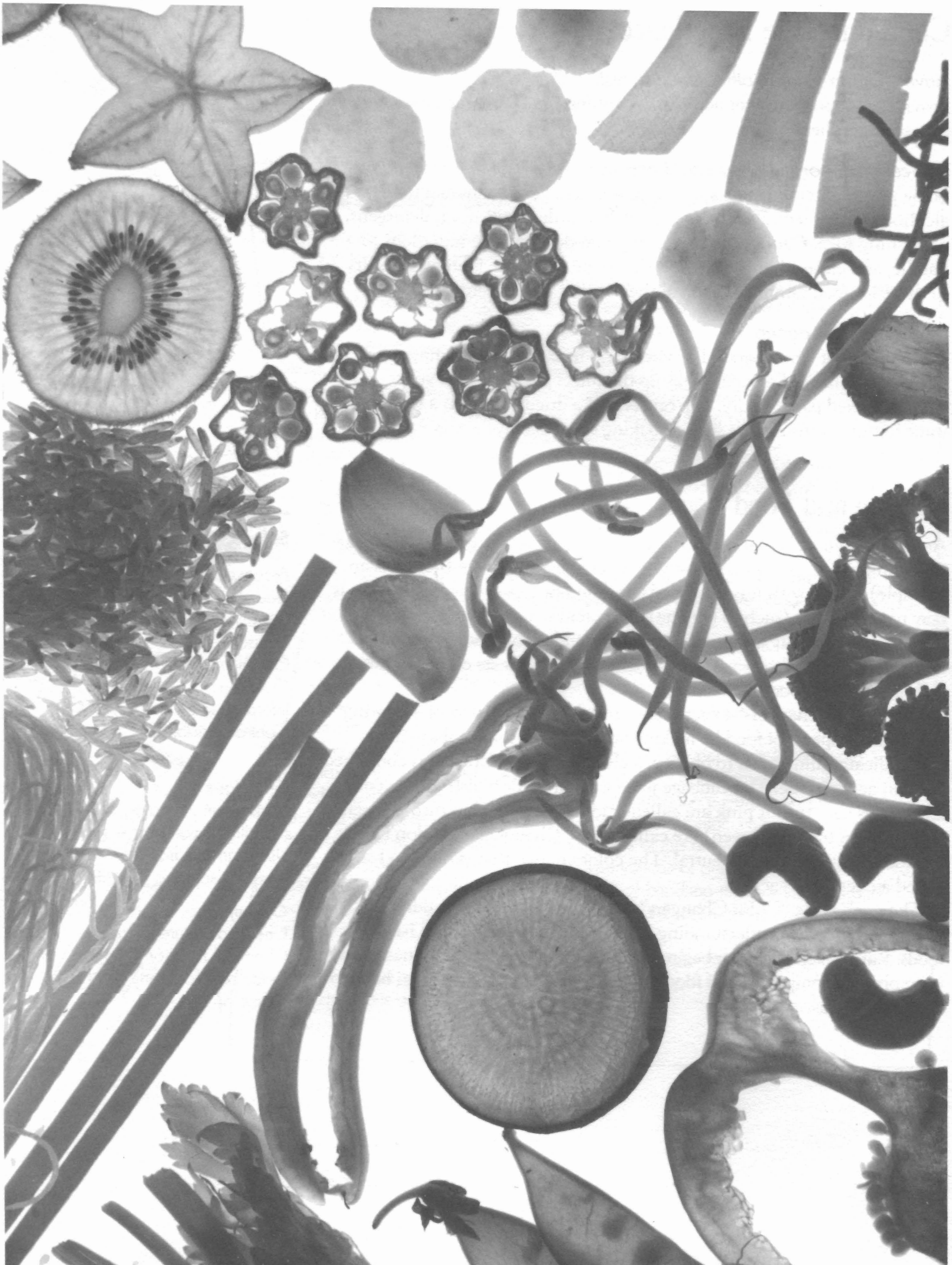
The goal of the "Color Changers" experiment is not for children to develop a complete understanding of the concept of acidic and basic foods. Rather, children can begin to realize that certain techniques allow us to observe components of food and that these observations can be used to classify foods.

Science Skills

Process
Predict
Observe
Classify
Communicate
Question
Interpret data
Control variables
Infer

Technique
Making an indicator
Handling small samples
Using an eyedropper
Keeping samples uncontaminated

Concept
Chemical nature of food
Chemical reaction
Acid/base property
Indicator



Evaluation Form

Session Components

Session completed (check one):

- ❑ Color Climbers
- ❑ A Smelly Challenge
- ❑ Seed Search
- ❑ Finding Fat
- ❑ Color Changers

Continuing the Experience activities:

- ❑ none
- ❑ sharing with family
- ❑ additional science activity
- ❑ children's books
- ❑ food preparation
- ❑ nutrition activity

Preparation

Time required to prepare for the experience

❑ less than 30 minutes ❑ 30–60 minutes ❑ more than 60 minutes

Ease of collecting supplies

(very easy) 1 2 3 4 5 (not easy)

Comments:

Participation

Number of participants:

adults ____________________

children ____________________

groups of children ____________________

Description of children:

age(s) ____________________

ethnic group(s) ____________________

sex ____________________

other ____________________

Description of setting:

- ❑ school-age child care program
- ❑ 4-H club
- ❑ EFNEP
- ❑ parenting program
- ❑ community youth program
- ❑ camp
- ❑ other: ____________________

Children's Interest and Interaction

How would you describe the children's level of interest?

(high) 1 2 3 4 5 (low)

How would you describe the amount of conversation among children?

(high) 1 2 3 4 5 (low)

How would you describe the amount of conversation among children and adults?

(high) 1 2 3 4 5 (low)

Describe any experiences or discoveries:

Your Interest

How much did you enjoy the science experience?

(high) 1 2 3 4 5 (low)

How easy was the science experience for you to do?

(high) 1 2 3 4 5 (low)

What did you especially like about the science experience?

What would you change before repeating the science experience?

Would you recommend the science experience to other educators? ❑ Yes ❑ No

Assembling a Science Kit

The science experiences in *Kitchen Science for Kids* will be easy to do with several groups of children if you have organized supplies in advance. This checklist can help you create your own traveling science kit for one or more of the experiments. Modify the list to accommodate your specific needs or selections within each experiment.

Items are listed as either nonfood or food. Storing small items in labeled bags makes it easier to use them and can help you keep track of when supplies get low. Store a consistent number of items in each bag. For example, a bag might be labeled: "Magnifying Lenses—10."

Nonfood Supplies

- ❏ magnifying lenses
- ❏ eyedroppers
- ❏ 6-inch rulers
- ❏ containers for water disposal
- ❏ plastic jug
- ❏ water-soluble markers
- ❏ plastic spoons
- ❏ plastic serrated knives
- ❏ plastic cups
- ❏ plastic plates
- ❏ paring knife
- ❏ pencils
- ❏ paper towels
- ❏ waxed paper
- ❏ white paper
- ❏ brown paper towels or bags
- ❏ masking tape
- ❏ scotch tape
- ❏ cotton balls

Food Supplies

- ❏ vegetable oil
- ❏ vinegar
- ❏ baking soda
- ❏ red cabbage
- ❏ test foods for "A Smelly Challenge"
- ❏ test foods for "Seed Search"
- ❏ test foods for "Finding Fat"
- ❏ test foods for "Color Changers"

Food Preparation

There is a sense of adventure in preparing foods, especially for children who are just learning to manipulate ingredients and equipment. When cooking together you can share much about science, math, language, culture, and creativity.

The five experiments in *Kitchen Science for Kids* show that foods are mixtures of many components and that these components can be isolated and identified. One of the reasons we spend time cooking is to create combinations of foods that we enjoy eating. In some mixtures such as baking bread chemical reactions among ingredients occur during baking to create a new product. Others are simply a physical mixture of two or more foods.

Try these mixtures for easy-to-make snacks. Most require only a few ingredients and supplies. Only a few require kitchen or small appliances. Encourage children to invent other quick snacks. We'd love to hear about any new ideas.

Graham Cracker Scram

Peanut butter
Graham crackers
Banana, sliced
Milk

Spread peanut butter on a graham cracker. Put banana slices on top. Add another cracker. Chase it down with a glass of milk.

Cracker Sandwich

Cucumber
Cheese
Crackers

Wash and peel cucumber; cut into thin slices. Put a piece of cheese on the cracker. Add another cracker. Add a cucumber slice. Top with a cracker. What other vegetables or foods could you stack this way?

Mixed Bag

Dry cereal pieces
Popcorn
Pretzels
Raisins or other dried fruits
Sunflower seeds
Peanuts
Miniature marshmallows
M&M candies

Select four ingredients for children to choose from to make a mixture. Try to include some contrasts: color, shape, feel, smell, taste, foods from different sections of the Food Guide Pyramid. Have each child place his or her mixture in a plastic bag and shake.

Cinnamon Fruit Toast

Sugar
Cinnamon
Apples or pears
Soft margarine
Bread

Combine 2 tablespoons sugar and 1 teaspoon cinnamon in a shaker container. Wash and core apple or pear; cut into thin slices. Spread a thin layer of margarine on one side of each slice of bread. Place bread on a cookie sheet. Arrange apple or pear slices on bread. Sprinkle with cinnamon-sugar mixture. Bake at 375 degrees for about 10 to 15 minutes or until bread is toasted.

Surprise Popcorn

Popcorn
Toppings

Using a hot-air popper, pop the popcorn into a large bowl. Divide among several bowls or paper cups. Sprinkle with one or more toppings: parmesan cheese, garlic powder, dill weed, cinnamon and sugar, or powdered cocoa.

Fruit Salad

Fruits

Select 3 or more fruits. Wash; peel and core if necessary. Cut into pieces. Mix together in a bowl. Spoon mixture into paper cups or ice cream cones.

Nutty Spread

Peanuts
Carrot
Raisins
Salad dressing or yogurt, low fat
Honey
Crackers

Place 1/2 cup peanuts in a plastic bag or between 2 pieces of waxed paper. Crush with a rolling pin (or use a plastic glass or can). Wash and grate half a carrot. In a bowl combine peanuts and carrots with 1 tablespoon raisins, 1 tablespoon dressing, and 2 teaspoons honey. Mix. Spread on crackers.

Fruit Kabobs

Cheese
Fruit

Select one or more kinds of cheese and fruit. Cut cheese into cubes. Wash fruit and cut into pieces, if necessary. Alternate fruit and cheese on wooden skewers or picks.

Monster Mouths

Apple
Peanut butter
Miniature marshmallows

Wash the apple and cut it into slices. Spread peanut butter on one slice. Add 3 or 4 marshmallows. Top with a second slice of apple.

Flying Saucers

Apple
Cheese spread

Remove core from apple. Stuff apple with cheese spread. Lay the apple on its side. Cut into 4 or 5 slices.

Fruit Parfait

Fruit
Yogurt, low-fat plain or vanilla
Toppings—chopped nuts, crushed vanilla wafers, crushed cereal, or sprinkles

Select one or more kinds of fruit. Wash fruit and cut into pieces, if necessary. Spoon some yogurt into a tall glass. Add a layer of fruit. Continue layering yogurt and fruit. Sprinkle lightly with your favorite topping.

Crunchy Bananas

Cereal
Orange juice
Banana

Put cereal in plastic bag; crush with a rolling pin (or plastic glass or can). Pour cereal pieces onto a plate. Pour orange juice into a saucer or shallow bowl. Cut banana into 1-inch slices. Dip banana slices into orange juice and then into cereal.

Cake with Fruit

Fruit
Angel food cake mix

Choose a fruit such as peaches or strawberries. If using fresh fruit, wash and slice it. Prepare angel food cake from a mix. Top slices of angel food cake with the fruit.

Lemonade

Lemon
Water
Sugar

Squeeze juice of one lemon. Pour about 3/4 cup of water into a glass. Add lemon juice and 1 or 2 tablespoons of sugar. Stir.

Strawberry-Banana Freeze

Strawberries, fresh or frozen unsweetened
Banana
Yogurt, vanilla lowfat

Measure 1/2 cup strawberries. (Wash and stem fresh berries.) Cut one banana into slices. In a blender combine 1 cup yogurt and bananas; blend until creamy. Slowly add strawberries; blend until smooth. Pour into paper cups and freeze.

Shake-a-Pudding

Milk, skim or lowfat
Vanilla pudding mix, instant
Fruit

Place 2 cups of milk in a quart jar with tight-fitting lid. Add one small package of instant vanilla pudding mix to the jar; screw lid on jar. Shake until mixture is smooth. Place pieces of fruit in a serving bowl or paper cups. Pour pudding over fruit. Chill.

Walking Salad

Cabbage
Celery
Carrots
Peanut butter

Wash cabbage; dry. Wash celery and carrots; cut into thin sticks. Spread each cabbage leaf with peanut butter. Place celery and carrot sticks on one edge of cabbage leaf; roll up the cabbage so the sticks are on the inside.

Bean and Tomato Salad

Green beans
Tomatoes
Cucumber
Vinegar
Vegetable oil
Sugar
Salt
Pepper

Steam 1 cup of fresh green beans (or use frozen or canned beans). Drain and put beans in large bowl. Wash 1 tomato; cut into wedges and add to beans. Peel 1/2 cucumber; cut into slices and add to bowl. In a small jar, mix 1 tablespoon vinegar, 1 table-spoon oil, 1/2 tea-spoon sugar, and a dash of salt and pepper; shake. Pour dressing over vegetables; mix.

Carrot-Raisin Salad

Carrots
Raisins
Orange juice concentrate

Wash and grate 4 carrots; put in medium bowl. Add 1 cup raisins. Mix with 3 tablespoons orange juice concentrate. Chill.

Gardener's Salad

Lettuce leaves
Cucumber
Carrot
Celery
Green pepper
Tomato
Salad dressing

Wash and dry several lettuce leaves; tear into pieces and place in large bowl. Peel 1/2 cucumber and 1 carrot; slice and add to lettuce. Wash celery, green pepper, and tomato; cut into pieces and add to lettuce. Toss all of the vegetables with a small amount of salad dressing.

Ants on a Log

Celery
Peanut butter
Raisins

Wash celery. Cut into 3-inch lengths. Spread peanut butter on the celery. Dot with raisins.

Parmesan Potato Sticks

Potatoes
Vegetable oil
Parmesan cheese, grated

Preheat oven to 425 degrees. Cut potatoes in half lengthwise; place potato halves flat side down and cut each into 4 slices. Place slices on a baking sheet. Lightly coat potatoes with oil. Bake 35 minutes, turning slices once after 15 minutes. Sprinkle slices with cheese. Return potatoes to oven for 2 more minutes or until lightly browned.

Children's Books

Many children's books can be used to extend a science experience. The concepts of physical and chemical properties, sensory properties, physical and chemical change, and components of a mixture are conveyed in the *Kitchen Science for Kids* experiments. These concepts are also conveyed through story and illustrations in the following books.

Aliki. *Milk from Cow to Carton.* 1974. Rev ed. New York: HarperCollins Trophy, 1992.

Barrett, Judi. *Cloudy with a Chance of Meatballs.* Illustrated by Ron Barrett. New York: Macmillan Aladdin Books, 1978.

Bourgoing, Pascale de, and Gallimard Jeunesse. *Vegetables in the Garden.* Illustrated by Gilbert Houbre. 1989. Reprint. New York: Scholastic, 1994.

Carle, Eric. *The Very Hungry Caterpillar.* 1969. Reprint. New York: Scholastic, 1987.

Cole, Joanna. *You Can't Smell a Flower with Your Ear!* Illustrations by Mavis Smith New York: Grosset and Dunlap, 1994.

de Paola, Tomie. *Pancakes for Breakfast.* Orlando: Harcourt Brace Jovanovich, 1978

Degen, Bruce. *Jamberry.* New York: Scholastic, 1983.

Ehlert, Lois. *Eating the Alphabet—Fruits and Vegetables from A to Z.* Orlando: Harcourt Brace Jovanovich, 1989.

Fleming, Denise. *Lunch.* New York: Scholastic, 1993

Gibbons, Gail. *The Milk Makers.* New York: Macmillan Aladdin Books, 1987

Gibbons, Gail. *The Seasons of Arnold's Apple Tree.* Orlando: Harcourt Brace Jovanovich, 1984.

Hoban, Russell. *Bread and Jam for Frances.* Illustrated by Lillian Hoban. 1964. Reprint. New York: HarperCollins Trophy, 1986.

Jeunesse, Gallimard, and Pascale de Bourgoing. *Fruit.* Illustrated by P. M. Valet. 1989. Reprint. New York: Scholastic, 1991.

Lessac, Frané. *My Little Island.* 1984. Reprint. New York: HarperCollins Trophy, 1984.

Loomis, Christine. *In the Diner.* Illustrated by Nancy Poydar. New York: Scholastic, 1993.

Low, Alice. *The Popcorn Shop.* Illustrated by Patti Hammel. New York: Scholastic, 1993.

McMillan, Bruce. *Eating Fractions.* New York: Scholastic, 1991

Shelby, Anne. *Potluck.* Illustrations by Irene Trivas. 1991. New York: Orchard Books, 1994.

Thayer, Jane. *The Popcorn Dragon.* Illustrated by Lisa McCue. 1953. Reprint New York: Scholastic, 1989.

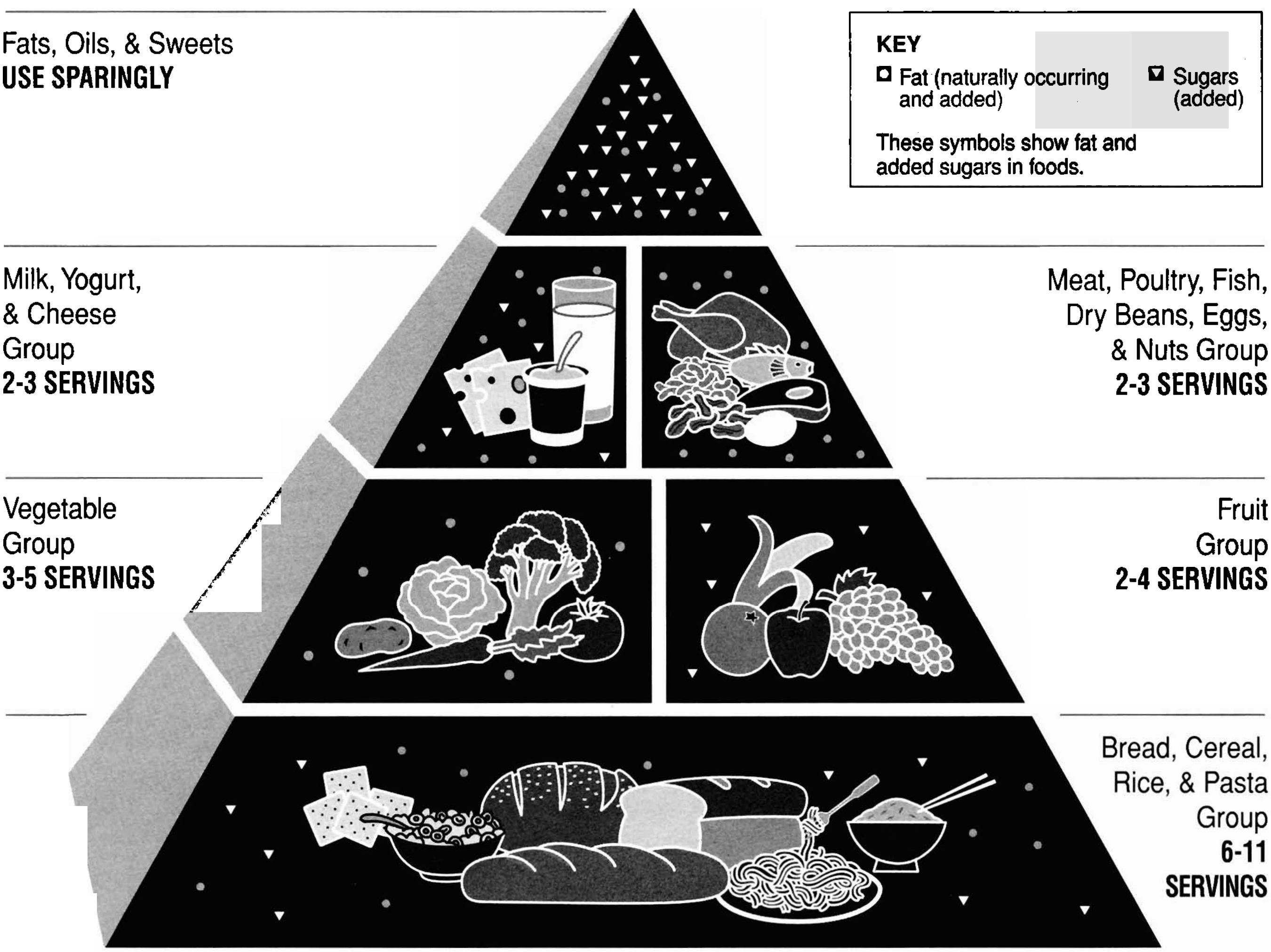
Titherington, Jeanne. *Pumpkin Pumpkin.* New York: Scholastic, 1989

Williams, Vera B. *Cherries and Cherry Pits.* New York: Morrow, 1991

Wood, Don, and Audrey Wood. *The Little Mouse, the Red Ripe Strawberry, and the Big Hungry Bear.* Illustrated by Don Wood. New York: Scholastic, 1984.

Food Guide Pyramid

A Guide to Daily Food Choices



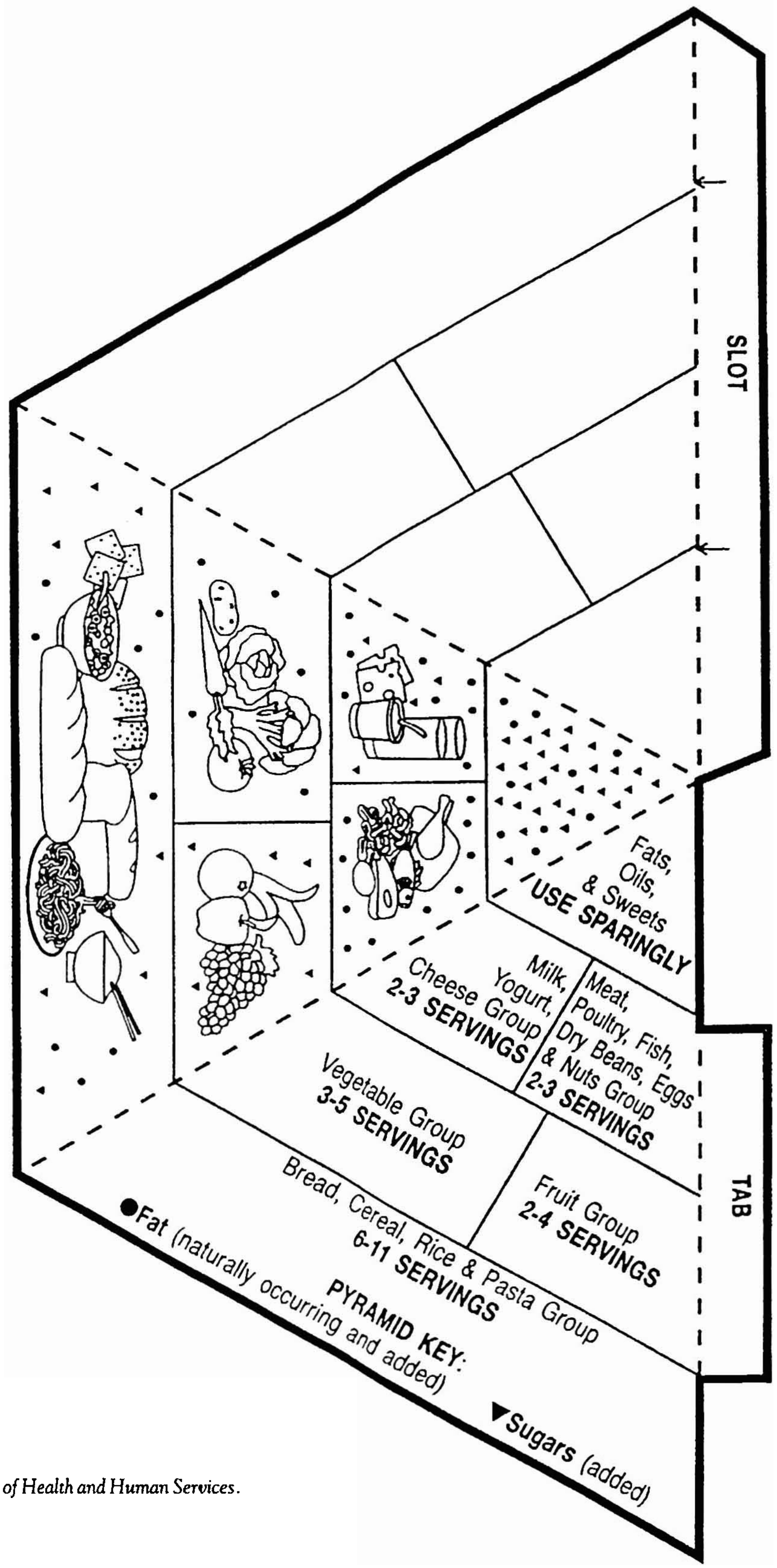
Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

Food Guide Pyramid

A Cut and Fold Activity

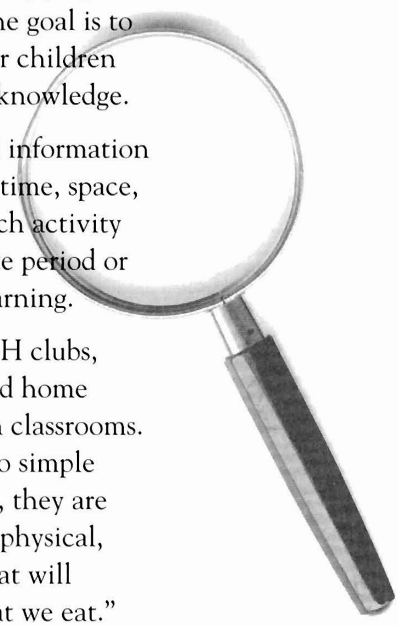
Instructions

1. Photocopy this page onto another sheet of paper. (Heavyweight paper works well.)
2. Cut out the pyramid along the heavy outer lines.
3. Cut the slot for the tab between the arrows.
4. Fold on the dashed lines.
5. Put the tab in the slot.



Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services.

This publication contains a collection of science experiments to teach food and nutrition concepts that are appropriate for children ages five to twelve. The goal is to make science accessible and fun for children and to encourage discovery-based knowledge.



The pages are filled with ideas and information for those with limited preparation time, space, and access to kitchen facilities. Each activity can be completed in one 20-minute period or expanded to provide additional learning.

This is an excellent resource for 4-H clubs, school-age child care programs, and home school. It can be adapted for use in classrooms. The authors note, "When adults do simple science experiments with children, they are helping them explore the sensory, physical, and chemical properties of food that will increase understandings about what we eat." Thus it is also the perfect parent-child guide to make constructive use of free time at home.

Kitchen Science for Kids was reviewed by an independent jury and recommended for use by 4-H nationally.

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