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Food Mysteries – 4-H Leader's Guide

Michigan State University Cooperative Extension Service

4-H Club Bulletin

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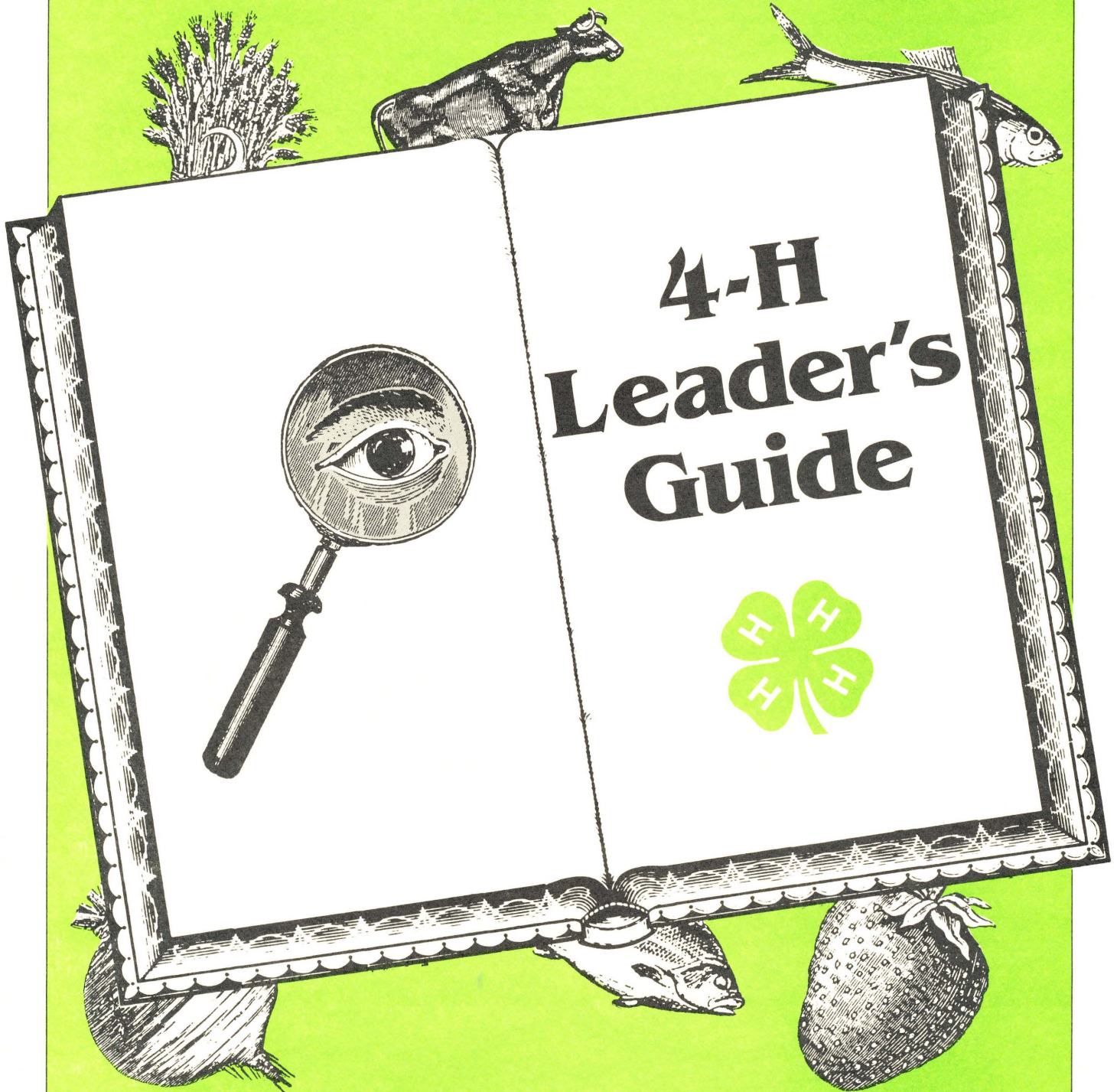
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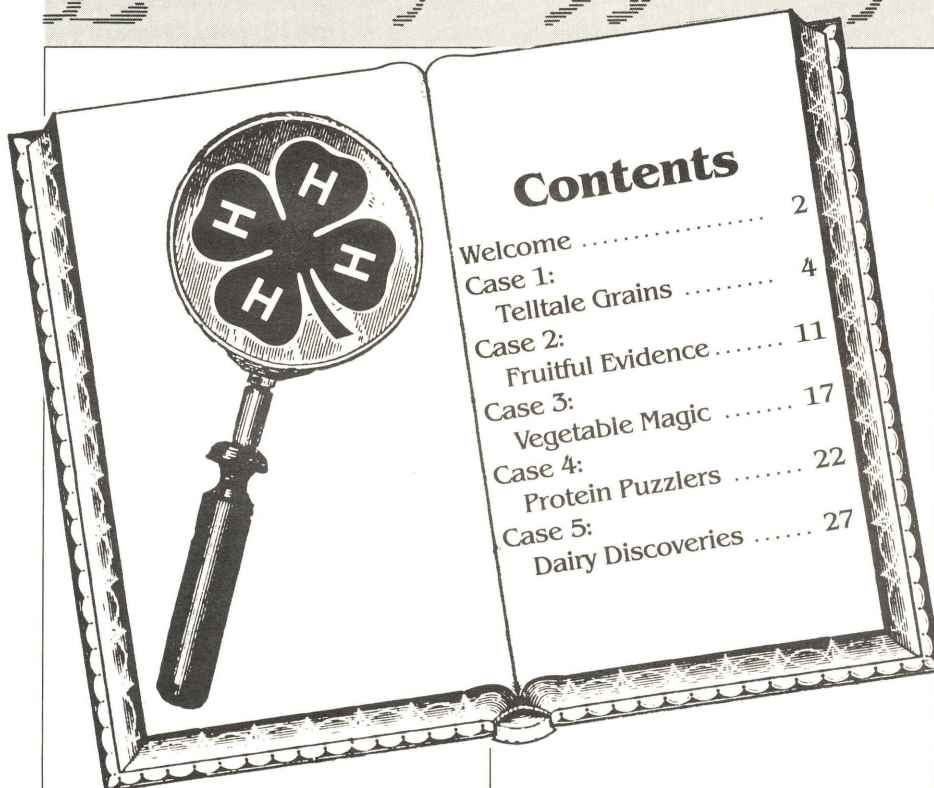
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# Food Mysteries





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## Acknowledgments

This publication was written by Stella H. Cash, R.D., Specialist, Department of Food Science and Human Nutrition, Michigan State University, and Patricia A. Hammerschmidt, Extension Associate, Food and Nutrition, 4-H Youth Programs, Michigan State University. Assistance was provided by Ruth L. Eggert, Program Leader, 4-H Youth Programs, Michigan State University.

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## How This Leader's Guide Is Organized

Each "case" includes:

- **Key Ideas**—Lists the main ideas in the case.
- **Additional Information**—Provides additional information on nutrition and food science concepts.
- **Meeting Guide**—Suggestions for organizing the meeting.
- **Solutions**—Detailed answers to experiments and questions asked within the case. Answers to puzzles are found at the end of the member's booklets and are not repeated in this guide.
- **Additional Discoveries**—Extra experiments are included so that you have the flexibility to organize meetings to meet your group's specific needs.



# Welcome to Food Mysteries!



The kitchen can be a laboratory for solving amazing mysteries about food. Experimenting with food is fun. It's a way to discover exciting facts about why certain things happen when foods are prepared. This leader's guide will help you incorporate **Food Mysteries** into your 4-H food and nutrition project.

The **Food Mysteries** series consists of five member project booklets and this leader's guide. Each member's booklet includes two food experiments designed to teach 11- to 14-year-olds about the mysteries of food. Each booklet also includes nutrition information and puzzles that reinforce the material in the experiments. The topics of the member booklets are:

- Case 1: Telltale Grains**
- Case 2: Fruitful Evidence**
- Case 3: Vegetable Magic**
- Case 4: Protein Puzzlers**
- Case 5: Dairy Discoveries**

The member booklets can be used in sequence during five consecutive project meetings or they can fit in with an ongoing food and nutrition project wherever they are most appropriate and in any order. For example, if your 4-H'ers are learning to prepare salads or vegetables, use the information and experiments from **Case 3: Vegetable Magic** to add a new dimension to their experiences. Similarly, if you are preparing foods using milk or cheese, try including **Case 5: Dairy Discoveries** at the next meeting.

**Please note!** The experiments are not designed to produce a product that can be eaten, although the results of some would be safe to consume. The "Guide to Tasting Experiment Products" on page 3 indicates which experiments have products that are safe

to taste and which are not suitable for tasting. Remember that it is not necessary for 4-H'ers to eat at every food and nutrition project meeting!

Only two of the experiments in the member's booklets require a heat source. If a stove is not readily available, you could use a toaster oven or an electric fry pan to complete the experiments.

A certificate is available for 4-H members who complete the series of five **Food Mysteries** booklets. This can provide special recognition to your 4-H'ers as well as a remembrance of the activities in which they participated. Consider inviting parents to an awards ceremony where the certificates are presented. Your county Cooperative Extension Service office can provide you with information on how to obtain the **Food Mysteries Certificate** (4-H 1423).

Have fun and enjoy learning about the mysteries of food!

## Parent Helpers and Teen Leaders

Many leaders appreciate the assistance of a teen leader or parent helper. Some clubs have helpers identified; in other clubs, the leader may have to recruit an assistant. Your 4-H members may have suggestions for people to ask.

Following are suggested responsibilities for a teen leader or parent helper:

- Assemble ingredients and equipment for the meeting.
- Guide a small work group during a project meeting.
- Work individually with a member who needs extra assistance.
- Help members with records.

- Prepare extra teaching aids.
- Demonstrate a new technique to the group.
- Make telephone calls to remind members of the next meeting.
- Plan a public display or exhibit with the members.

A key to working with an assistant is thinking ahead together. This will require personal contact with the helper to plan before each meeting. It is a good idea for the helper to arrive early for the meetings.

Although involving someone else may sometimes mean more work for you, it can increase the effectiveness of the meeting. A helper provides additional hands, ears and eyes. You may also have the satisfaction of seeing a teen leader grow in confidence and eventually become an adult leader!

## A Note About Parents

Parents will lend their support and enthusiasm to this project if kept well-informed. Remember that it is helpful for parents to know such things as:

- Time, date and location of project meeting
- Ending as well as starting time of meeting
- Transportation plans (such as car pooling)
- Project meeting plans:
  - Is money needed to share food costs?
  - Does the "tasting" of food prepared take the place of a meal?
  - Has the 4-H member accepted a specific responsibility?
  - Are there activities that can be repeated at home?
  - Are there activities the 4-H members should complete before the next meeting?



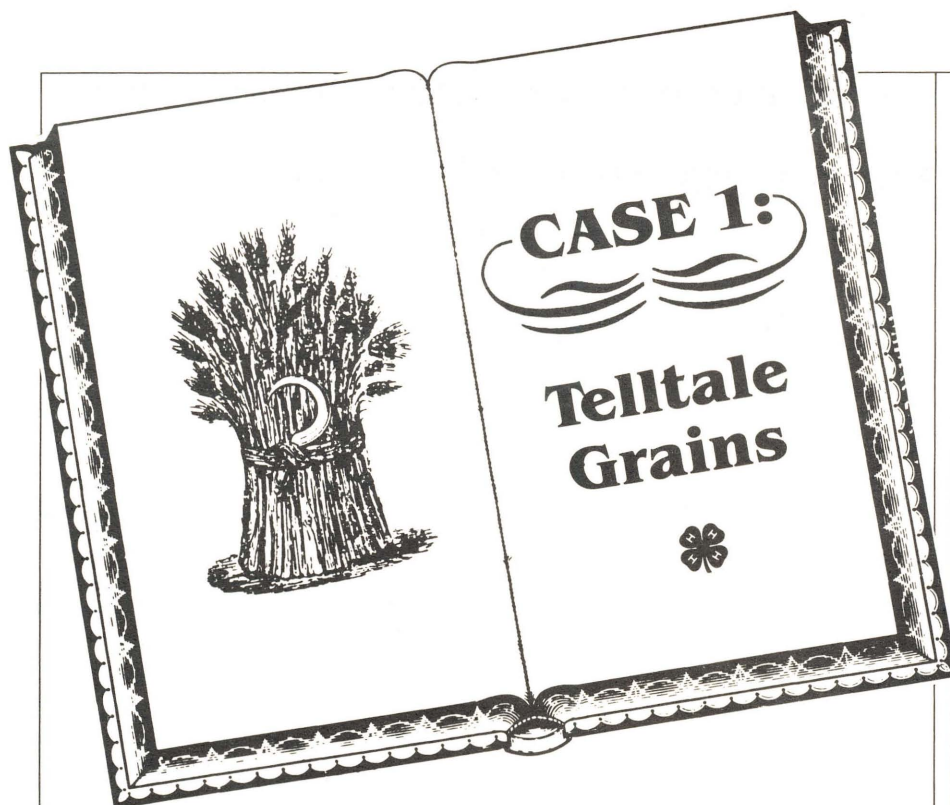
## Guide to Tasting Experiment Products

	Experiment	Not Suitable for Tasting	Safe to Taste
<b>Case 1:</b>	The Secret of the Rising Bread	X	
	Searching for Starch*	X	
	Muffin Magic**		X
<b>Case 2:</b>	O <sub>2</sub> Secrets		X
	Fruit Juicy!	X	
	Test Your Taste Buds**		X
<b>Case 3:</b>	The Red Cabbage Riddle	X	
	Red Cabbage Tells the Tale (cabbage can be cooked and eaten)		X
	Presto Chango!**		X
<b>Case 4:</b>	Baffling Beaters	X	
	Where's the Fat?	X	
	You Can Make Peanut Butter!		X
<b>Case 5:</b>	From Liquid to Solid		X
	The Sour Secret (incorporate in a recipe)		X
	The Disappearing Calcium**	X	
	Unlocking Butter Basics**		X

\*Unsafe for tasting!

\*\*Found in this leader's guide.





## ADDITIONAL INFORMATION

### Dietary Guidelines for Americans

If you consider the food habits of many people in the United States, you can see why health professionals and the government are concerned about what we eat. Overconsumption of calories or certain types of foods may contribute to the diseases people suffer from today: heart disease, cancer, liver disease and others. These diseases may be due (at least in part) to excessive amounts of fat, salt and sugar.

The **Dietary Guidelines for Americans** is information written by nutrition and health experts and published by the government. The guidelines were developed to encourage people to improve their eating habits. According to the guidelines, people should:

- Eat a variety of foods.
- Maintain desirable weight.
- Avoid too much fat, saturated fat and cholesterol.
- Eat foods with adequate starch and fiber.

- Avoid too much sugar.
- Avoid too much sodium.

The guidelines also recommend that if you drink alcoholic beverages, you should do so in moderation.

Detailed explanations of each of these recommendations can be found in **Dietary Guidelines for Americans** (2nd edition, 1985). Single copies of this publication are available free by writing the Human Nutrition Information Service, U.S. Department of Agriculture, Room 325 A, Federal Building, Hyattsville, Maryland 20782. Copies may also be obtained by contacting your county Cooperative Extension Service office.

Several recommendations found in the **Dietary Guidelines for Americans** are referred to throughout the **Food Mysteries** member's booklets:

**Case 1: Telltale Grains**—Eat foods with adequate starch and fiber.

**Case 2: Fruitful Evidence**—Avoid too much sugar and eat a



### Key Ideas

- The seeds from grain plants are milled in order to make many products people eat.
- Grains add carbohydrates, fiber, protein, vitamins and minerals to the diet.
- Milling may remove fiber, vitamins and minerals from grain foods, but grain foods can be "enriched" by having some of these minerals and vitamins added back.
- Although the protein in grain foods is incomplete, it is very important in the diet.
- Yeast produces carbon dioxide which makes bread rise.
- Iodine can be used to test foods for starch content. Iodine is poisonous if consumed.
- Grain foods are not fattening, but toppings can pile on the calories.

variety of foods.

**Case 3: Vegetable Magic**—Avoid too much sodium.

**Case 4: Protein Puzzlers**—Avoid too much fat.

**Case 5: Dairy Discoveries**—Maintain desirable weight.

### Grain Has Protein Power

Since grain foods are an important protein source, they play a critical role in the diets of people who eat little or no meat. Although grain foods are incomplete proteins (that is, they lack one or more of the eight essential amino acids), they may be eaten with other incomplete protein foods to increase their value in the diet. In other words, amino acids missing in one food may be readily available in another food. For nutritionally sound plant protein combinations, follow these three simple rules:



1. Combine legumes (dried beans, peas, lentils, soybeans and garbanzos) with grains (barley, millet, rice, oats, corn, rye and wheat). For example, eat red beans and rice or refried beans in a tortilla.
2. Combine legumes with nuts (almonds, cashews, pecans, walnuts and peanuts) and seeds (pumpkin, sesame and sunflower). For example, sesame seeds could be sprinkled on a bean dish.
3. If possible, combine eggs or dairy products with any incomplete protein source. Examples include macaroni and cheese or cereal with milk.

## Yeast Bread Tips

In "The Secret of the Rising Bread" experiment, 4-H'ers learn about the effects of temperature on yeast. They discover that warm temperatures provide the best environment for yeast to grow and produce the carbon dioxide gas needed to make bread rise. In addition to using warm water when dissolving yeast, dough should be allowed to rise in a warm place. You may want to share these possibilities with 4-H'ers:

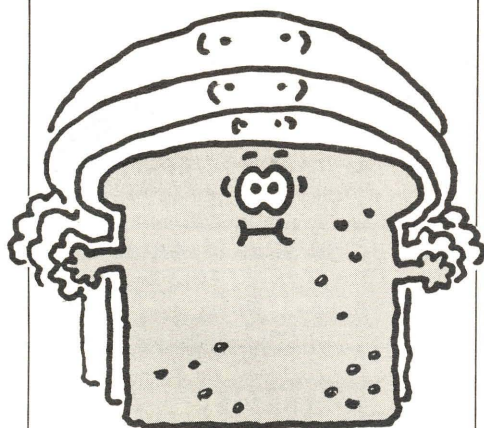
- Set the dough on the center rack of an unlit oven. Place a large pan of hot water on the lower rack.

Replace with more hot water when the water cools.

- If the oven is a gas oven with a continuously burning pilot light, it provides enough warmth for proper rising. Just set the bowl of dough in the oven.
- Microwave ovens with a low power setting can be used to aid the dough in rising. Follow the manufacturer's directions.
- Place a wire rack on top of a bowl two-thirds full of hot water. Set the bowl of dough on the rack and cover it with a clean, dry towel.

## MEETING GUIDE

**Case 1: Telltale Grains** contains two experiments—"The Secret of the Rising Bread" and "Searching for Starch." It also contains information on the sources of grains, how grains are milled and their nutritional value. This meeting guide is intended to allow 4-H'ers to begin the hands-on experiments as soon as possible after arriving at the meeting. Use the waiting times during the experiments to talk about other information found in the member's booklet.



*Illustration by [signature]*

1. Begin by reviewing with 4-H'ers the information on page 1 of the member's booklet. Have them list some of their favorite grain foods and unscramble the names of the grains.
2. Some type of bread will probably be listed as a favorite food. Ask your members how many have ever made their own bread. (If you have made bread as a 4-H club, remind them of that time.) Tell them that one of the experiments they will be trying today will allow them to discover the secret of rising bread.
3. Before beginning any experiment, review "Caution—Be Science Wise!" (page 3 of the member's booklet).
4. As a total group, read through "The Secret of the Rising Bread" experiment. Review the procedures and assign the jobs. Each 4-H member could be responsible for one step of the experiment. Complete steps 1 through 5. One or two 4-H'ers should be responsible for reminding the group when it is time to observe the size of the balloons and record this information in the chart provided.
5. To ensure that "The Secret of the Rising Bread" experiment is successful, follow these tips:
  - Check the expiration date on the yeast packages to make sure the yeast is active.
  - Be sure each balloon is pulled securely over the neck of the bottle.
  - Note that it is recommended that you use active dry yeast in this experiment rather than the rapid rising type. The rapid rising type can be used if necessary, but the warm water reaction will proceed faster than with active dry yeast and foam will eventually fill the bottle. You would need to stop the experiment when this occurs to prevent a mess!
  - Make sure the water is boiling when poured into the bottle so all yeast will be killed. An adult may need to assist members to ensure safety.
6. After setting up "The Secret of the Rising Bread" experiment, talk about "Discover Nutrition!" (page 2 of the member's booklet). Have your 4-H'ers name the parts of the grain.
7. As a total group, review and conduct the "Searching for Starch"



experiment. Perhaps each 4-H'er could be responsible for testing one food. **Note the cautions that iodine is poisonous if ingested and can stain clothing, equipment and skin.** Be sure to cover these points with 4-H'ers before beginning the experiment. Remember to have 4-H'ers answer the questions in step 6 of the experiment.

8. Keep observing the progress of the balloons in "The Secret of the Rising Bread" experiment. If other activities are needed to fill time, have members complete the "Mystery Message" and "The Nutrition Challenge" (page 6 of the member's booklet).
9. Report on the results of "The Secret of the Rising Bread" experiment. Have your 4-H'ers answer the questions in step 7 of the experiment.
10. Review the information on "Grain Has Protein Power," "Be Calorie Wise" and "Focus on You" (pages 3 and 6 of the member's booklet).
11. Encourage your 4-H'ers to do the "Try This at Home" activity on page 6 of the member's booklet and report their findings at the next meeting.
12. Review the answers to the puzzles as needed. Have members record what they learned in the space provided on page 7 of the member's booklet.
13. Clean up!

## SOLUTIONS

- "Name the Parts of These Grains" (page 2 of the member's booklet):

A = bran  
B = endosperm  
C = germ

- "Food Combinations" (page 3 of the member's booklet):

Following are examples of nutritious food combinations using different grain foods:

- Rice and red beans
- Bean tacos (beans with a corn tortilla)
- Baked beans and brown bread
- Split pea soup with rye bread
- Lentils and rice in soup
- Any grain combined with milk, cheese, eggs or a small amount of meat (Examples include a cheese sandwich, a poached egg on toast, a tamale pie with beans and cheese, and a cheese pizza.)

- "The Secret of the Rising Bread" experiment (page 4 of the member's booklet):

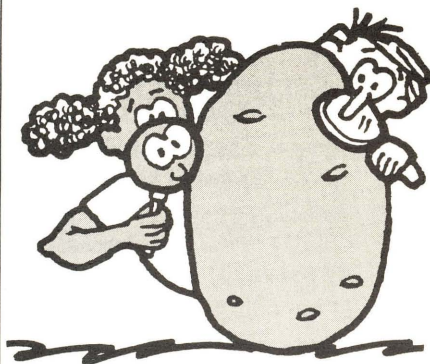
### Step 6:

Time	5 min.	15 min.	30 min.	45 min.
Ice water and yeast	Slightly pulled in	More pulled in	No change	No change
Warm water and yeast	Began to expand	Expanded more	2/3 expanded	No change
Boiling water and yeast	Slight expansion*	Completely pulled in	No change	No change

\*At first you may see a slight increase in this balloon before it collapses or is sucked inward. This is due to steam—not carbon dioxide gas—making the balloon inflate.



■ "Searching for Starch" experiment (page 5 of the member's booklet):



**Step 7:**

- *What caused the balloon to inflate?* By using sugar as food, yeasts can grow and give off carbon dioxide gas. This gas causes the balloon to rise under the right conditions (warm water).
- *Did the amount of gas produced vary with the different water temperatures?* Yes. *Which water temperature produced the most gas?* The warm water plus yeast produced the most gas and therefore the largest balloon size. There should not have been much change in the other two balloon sizes. *Why did this happen?* The cold water did not activate the yeasts so that they would produce carbon dioxide. The boiling water killed the yeast plants so that they could not produce carbon dioxide.
- *Did the amount of gas produced vary with the amount of time?* Yes. *Why did this happen?* The yeast plants need 30 to 45 minutes to produce their maximum amount of carbon dioxide gas.
- *What did you discover from this experiment that will help you when making yeast breads?* Temperature is important in the preparation of yeast breads. Temperatures that are too hot will kill the yeast; therefore, carbon dioxide gas will not be produced and bread will not rise. Cold temperatures do not kill the yeast but they do slow gas production. Recipes that direct you to allow dough to rise in the refrigerator make use of this principle to delay rising.

**Step 4:**

Food	Color	Is starch present?	
		Yes	No
Milk	yellow		X
Egg	yellow		X
Bread	blue-black	X	
Potato	blue-black	X	
Flour, cornstarch or tapioca	blue-black	X	
Cucumber	yellow		X
Sugar	yellow		X
Banana (green)*	blue-black	X	

\*Note that the amount of starch in a fruit decreases as the fruit ripens. An unripe (green) banana will react with the iodine by turning blue-black. As it ripens, however, it will no longer react positively. You may wish to also have your group test a ripe banana.

**Step 6:**

- *What types of foods are high in starch?* Foods high in starch include grain foods and some vegetables such as potatoes, yams, corn, and dried beans and peas. Less ripe fruits may also contain a fair amount of starch.
- *How would a ripe banana react with iodine?* It would not produce a bluish-black color. *Why?* As a banana ripens, much of the starch in it changes to sugar so the banana will no longer react positively with iodine.

■ **"Try This at Home" activity**  
(page 6 of the member's  
booklet):

The packages of many grain products have the term "enriched" printed on the front. The following foods are usually enriched: spaghetti, noodles, macaroni, lasagna, rice, bread, flour and some baking mixes. If the term enriched is not printed on the front of the package, check the list of ingredients to see if an enriched grain was used in the product. Many ready-to-eat cereals will include the word "fortified" on the box. Nonfat dry milk will often have "fortified with vitamins A and D" on the label.

## ADDITIONAL DISCOVERIES

"Muffin Magic" is another experiment for your group to try. A reproducible version of the experiment is on pages 9 and 10. Members could do this experiment at home if an oven is not available at the meeting place or if time does not permit.

Following are the answers to the questions in the "Muffin Magic" experiment:

**Step 11** (answers may vary slightly):

No. of strokes	Height	Outside and inside appearance	Flavor differences
10	1¾ inches	Bumpy, pebbly surface Crumbly, dense interior May see streaks of ingredients	Bitter and dry May be able to taste individual ingredients
25	2 inches	Slightly bumpy surface Round top	Bland to sweet Slightly moist
50	2½ inches	Smooth outer surface May have slight peak	Bland to sweet Slightly moist
95	2¾ inches	Peaked, smooth surface May have crack in top Holes and tunnels may be present in interior	Bland to sweet

**Step 12:**

- *Did the amount of stirring affect the formation of gluten strands?* Yes. Gluten strands develop as you stir. Underbeating produces a crumbly, dense product because air and liquid have not adequately been incorporated into the product to form gluten strands. Overbeating will stretch the gluten strands, producing holes or tunnels in the product. If you continue to stir for a long period of time (usually more than 95 strokes), the gluten strands will actually break and the product will become compact or dense, similar to when the product is underbeaten.

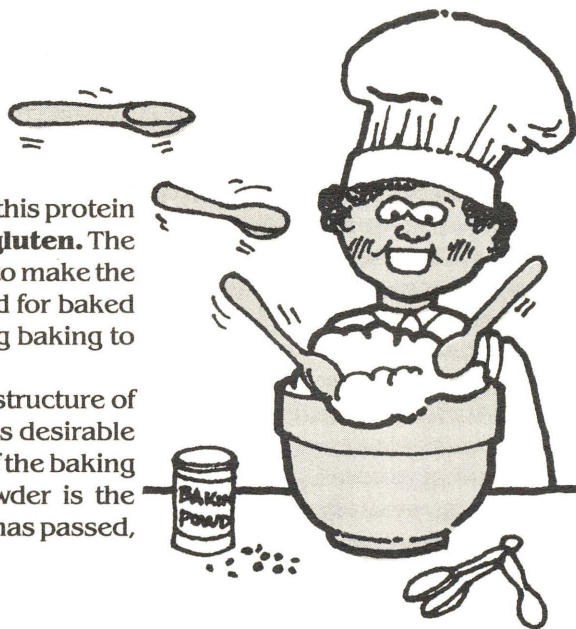


## EXPERIMENT

# Muffin Magic

Since flour is made from grains, it contains protein. When this protein is mixed with liquid and stirred, strands form that are called **gluten**. The amount of gluten formed depends on the type of grain used to make the flour. Wheat flour proteins form a lot of gluten and are good for baked products like bread, cookies and cakes. Gluten sets during baking to form the structure of the baked product.

When making muffins, you are developing gluten for the structure of the muffins. Too little or too much gluten can result in a less desirable product. **TIP:** Remember to check the date on the bottom of the baking powder can to make sure it has not expired. Baking powder is the ingredient that helps the muffins rise. If the expiration date has passed, the muffins will not rise properly.



### INGREDIENTS

- ☐ shortening or cooking spray
- ☐ 1-3/4 cups unsifted all-purpose flour
- ☐ 2 tablespoons sugar
- ☐ 2-1/2 teaspoons baking powder
- ☐ 1/2 teaspoon salt
- ☐ 1 egg, well beaten
- ☐ 3/4 cup milk
- ☐ 1/3 cup vegetable oil

### EQUIPMENT

- ☐ sifter
- ☐ measuring cups—dry and liquid
- ☐ large and small mixing bowls
- ☐ muffin pan to hold at least 8 muffins
- ☐ marker
- ☐ paper towel
- ☐ measuring spoons
- ☐ wooden spoon
- ☐ rubber spatula
- ☐ 2 pot holders
- ☐ masking tape
- ☐ 4 paper plates
- ☐ knife
- ☐ ruler

### PROCEDURE

1. Preheat the oven to 400°F.
2. Label the muffin cups with masking tape and mark them with the number of strokes. Mark two cups with "10," two with "25," two with "50" and two with "95."
3. Grease the bottoms only of eight muffin cups. To avoid greasy fingers, spread the shortening in the muffin cups with a paper towel or lightly spray the cups with cooking spray.
4. Measure the flour, sugar, baking powder and salt. Sift together into a large mixing bowl.
5. With a wooden spoon, mix the egg, milk and oil together in a small mixing bowl for about one minute. Add to dry ingredients. **Don't stir yet!**
6. **Now begin to stir and count the strokes.** After 10 strokes, place 1/4 cup batter into the two muffin cups labeled "10."
7. Stir another 15 strokes. Place 1/4 cup batter into the two muffin cups labeled "25."
8. Stir another 25 strokes. Place 1/4 cup batter into the two muffin cups labeled "50."
9. Stir another 45 strokes. Place 1/4 cup batter into the two muffin cups labeled "95." If you have any empty muffin cups left, pour the remaining batter into them to eat later if you wish.
10. Bake in the preheated 400°F oven for 25 minutes or until muffins are golden brown.
11. Answer these questions and record your findings.
  - **Before you remove the muffins from the pan,** can you see a difference in height?
  - Label each of the four paper plates with the number of strokes (10, 25, 50 and 95). Now, carefully remove the muffins from the pan and place each muffin on the plate with the number that matches the number on the pan. Use a knife to slice one muffin from each set of muffins in half **vertically**. Measure the height in the center with a ruler. Record the measurements for each muffin on the following chart. Be sure to list the unit of measurement you used with the ruler (inches or centimeters).



No. of strokes	Height	Outside and inside appearance	Flavor differences
10			
25			
50			
95			

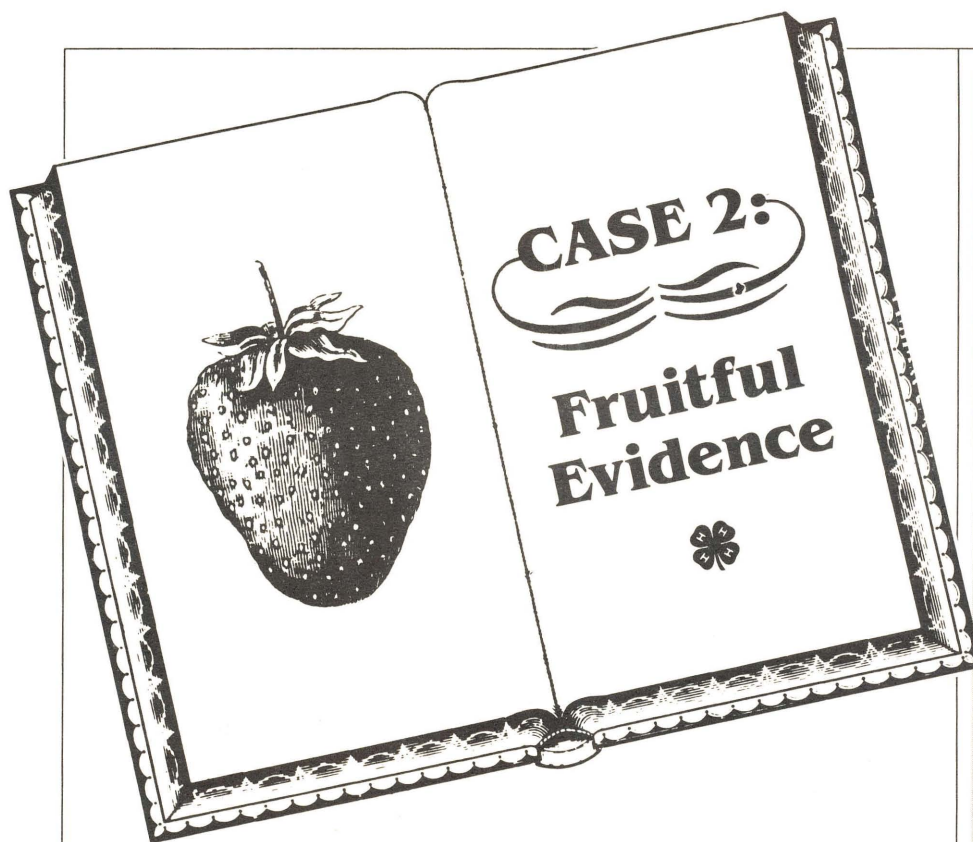
- Do you see any differences in the outside appearance of the muffins other than height? Record any differences you see for each muffin in the chart.
- Now cut the rest of the muffins in half **horizontally**. Do you see any differences in the inside appearance? Record any differences you find for each muffin in the chart.
- Taste a small sample from each of the four plates. Do you notice any flavor differences? Can you describe the differences? Record these differences in the chart.

**12.** Remember that when flour is mixed with liquid and stirred, gluten strands are formed. From what you observed and recorded, do you think the amount of stirring may affect the formation of gluten strands?

### EXPLANATION

Stirring a flour-liquid mixture develops the gluten strands. Understirring does not develop the gluten and the baked item may be low in volume and show streaks of flour. Overstirring stretches the gluten strands and tunnels form. For the best muffins, stir about 25 times.





## ADDITIONAL INFORMATION

### Snack Smart

Have you ever met anyone who didn't enjoy a snack? Besides snacking to satisfy a hungry feeling, people snack during many of the social events in our everyday lives. Can you remember the last time you went to a ballgame, movie or a party when you didn't have a snack?

Snacks have long been considered "bad" because many of the foods typically eaten as snacks are high in fat and/or sugar and thus high in calories. These foods are also often low in vitamins and minerals. However, snacking can be beneficial if the foods are selected carefully. If a nutritious snack is eaten midmorning or midafternoon, it can help prevent overeating at mealtime. Also, for young people who are growing and exercising a lot, snacks can provide the extra calories and nutrients they need.

As the group leader, discuss the following suggestions to help

improve snacking habits:

- Substitute fruit juice, milk or water for soft drinks or punches that contain a lot of sugar.
- Watch out for fried foods. Frying adds calories by increasing the amount of fat you eat.
- Go easy on donuts, candy, cookies, pies and cakes.
- Try to eat just a few chips or pretzels. These foods are high in fat and salt.
- Fruits are often canned in heavy syrup. Eat fresh fruits when possible or choose fruits canned in their own juice or in light syrup.

Ask your members for their ideas for nutritious snacks.

### Stop the Browning!

Some fruits tend to turn dark when peeled or bruised, or when their cut surfaces are exposed to the air. The darkening probably occurs because of the oxidation of certain compounds in the fruit by enzymes that are also in the fruit.

Lemon juice, which is high in



### Key Ideas

- A large variety of fruits is available throughout the United States.
- Some fruits are excellent sources of vitamin C. Other fruits provide vitamin A.
- Vitamin C helps keep tissues healthy, fights infections and helps heal wounds. In foods, it helps prevent oxidation (browning) when added to some fresh fruits and vegetables.
- Fruits contain sugar, a carbohydrate that the body can use for energy.
- Monosaccharides are simple sugars. Disaccharides are made by combining two simple sugars.
- Sources of sugar should be chosen carefully.
- Anthocyanins, color pigments, give fruits and vegetables their red, blue and purple color. Anthocyanins turn blue in alkali and red in acid.
- Snacks should be selected wisely.



acid, seems to interfere with the activity of enzymes. It is often used to coat pared fruits (such as apples, bananas, peaches and pears) to retard discoloration. Other juices high in ascorbic acid, such as pineapple and orange, also help to prevent discoloration of pared fruits. Commercial products that contain a high concentration of ascorbic acid can also be used to retard fruit browning.



## MEETING GUIDE

**Case 2: Fruitful Evidence** contains two experiments—"O<sub>2</sub> Secrets" and "Fruit Juicy." It also contains information on where fruits are grown, their nutritional value and the types of sugars found in fruits. The following meeting guide is intended to allow 4-H'ers to begin the hands-on experiments as soon as possible after arriving at the meeting. Use the waiting times during the experiments to talk about other information found in the member's booklet.

1. Begin by reviewing with 4-H'ers the information on pages 1 and 2 of the member's booklet. Have them discuss the fruits that grow well in their state and unscramble the vitamin C sources.
2. Read the "Did You Know?" information on page 2 of the member's booklet aloud. This will point out why vitamin C is needed in the body as well as how it can be used in food preparation. One of the experiments the 4-H'ers will be doing will help them discover the uses of vitamin C in preparing foods.
3. Review "Caution—Be Science Wise!" (page 3 of the member's booklet).
4. As a total group, read through the "O<sub>2</sub> Secrets" experiment. Review the procedures and assign the jobs. There are many different tasks in this experiment such as labeling, slicing each food item and sprinkling the slices. The tasks can be divided among members. Have one or two 4-H'ers responsible for reminding the group when it is time to make the 15-, 30- and 60-minute observations. **Note:** The Jonathan variety of apple is not recommended for use in this experiment since this variety does not show browning as well as other types.
5. After setting up "O<sub>2</sub> Secrets" through step 4, talk about "Getting to Know Sugars!" (page 2 of the member's booklet). Have your 4-H'ers fill in the blanks in the sentences.
6. As a total group, review and conduct the "Fruit Juicy!" experiment. Individual members may be responsible for labeling the cups and adding the indicated ingredients, or several members could present the experiment as a demonstration. Have your 4-H'ers answer the questions in step 6 of the experiment.
7. Remind your members to keep observing the progress of the browning in "O<sub>2</sub> Secrets." If other activities are needed to fill time, have members do the following in the member's booklet:
  - Read "Eat Right—The Choice Is Yours!" and list fruits and juices and classify them as fresh, canned, frozen or dried (page 3)
  - "Mystery Message" (page 6)
  - "Name Change Puzzle" (page 7)
8. Report on the results of the "O<sub>2</sub> Secrets" experiment and answer the questions in step 6.
9. Ask your 4-H'ers for their thoughts on the "Focus on You" information (page 6 of the member's booklet). Additional information on snacks can be found on page 11 of this guide. Review "The Honey Myth" (page 6 of the member's booklet) with your members.
10. Review the answers to the puzzles as needed. Have members record what they learned in the space provided on page 7 of the member's booklet.
11. Clean up!





# SOLUTIONS

■ "O<sub>2</sub> Secrets" experiment  
(page 4 of the member's  
booklet):



## Step 5:

	15 min.	30 min.	1 hour
Banana with sugar	No change	No change	Slight browning
Apple with sugar	No change	Slight browning	Light browning
Potato with sugar	No change	No change	Browning around edge
Banana with lemon juice	No change	No change	No change
Apple with lemon juice	No change	No change	No change
Potato with lemon juice	No change	No change	No change
Banana with water	Slight browning	Light browning	Browning increases
Apple with water	Slight browning	Light browning	Browning increases
Potato with water	No change	No change	No change
Banana—plain	Slight browning	Light browning	Browning increases
Apple—plain	Slight browning	Light browning	Browning increases
Potato—plain	Slight browning	Light browning	Browning increases

## Step 6:

- *What happened to the controls after 1 hour?* The slices that were left plain (the controls) turned brown after 1 hour.
- *Which treatment had the greatest effect in stopping browning after 1 hour?* Lemon juice had the greatest effect, although water effectively prevented browning of the potatoes.
- *What could you add to a fruit salad besides lemon juice to prevent browning?* Lime juice, pineapple juice or orange juice can be used to slow the browning of fruit in a fruit salad. Commercial products are also available that help prevent browning.
- *Since you may not want to add lemon juice to peeled potatoes, how can you keep them from browning?* To prevent browning of peeled potatoes, cover them with water. However, do not let the potatoes stand in water for too long. The vitamin C in the potatoes could be lost since that vitamin is easily dissolved in water.

■ "Fruit Juicy!" experiment  
(page 5 of the member's  
booklet):

## Step 4:

Cranberry juice = red color

Cranberry juice + baking soda = dark blue color

## Step 5:

Cranberry juice + baking soda + lemon juice = reddish color (although not as red as the original juice)

**Step 6:**

- *Which cup represents your "control"?* Cranberry juice with nothing added is the control.
- *What does the solution become when baking soda is added to the juice?* The solution becomes a base. *What color change did you see when the baking soda was added?* The color changed to blue.
- *What did the baking soda/juice solution change to when the lemon juice was added?* The solution changed back to an acid. *What color change did you observe when the lemon juice was added?* The color changed back toward red.

## ADDITIONAL DISCOVERIES

For an additional or substitute experiment for your group, you may want to try "Test Your Taste Buds." A reproducible version of the experiment is on pages 15 and 16.

Following are the answers to the questions in the "Test Your Taste Buds" experiment:

**Step 13:**

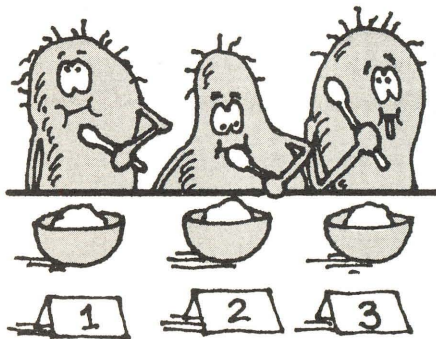
- *Which applesauce received the most points?* This will probably vary for different group members. Personal preferences play a big part in determining the acceptability of a food. Point out that not everyone has the same sense of taste.
- *Which factor is most important when selecting food—flavor, cost or convenience?* Again, answers may vary according to personal preference.
- *What principles were used in conducting this experiment that are also used in food research for sensory testing?* Many answers are possible and can include the following:
  - All samples were the same temperature when judged.
  - All samples were presented in the same shape, size and color container.
  - The samples were identified by a code instead of a name. Codes such as A, B, C, D or 1, 2, 3, 4 are avoided since "A" or "1" may suggest "best" to the judges.
  - Room temperature water was sipped between tastings to clear the taste buds. Cold water was avoided since it dulls taste sensation.



## EXPERIMENT

# Test Your Taste Buds

Grocery stores provide a large variety of choices among foods, including fruits. For each food offered, there are often many brands and forms from which to select. Test your taste buds to see if you can tell a difference among various types of applesauce. You will be using many of the principles used to perform sensory tests on foods for research purposes. Sensory testing of foods means that the quality of a food product is judged by a food-testing panel using their senses—their eyes, nose and mouth.



### INGREDIENTS

- ☐ 4 medium-sized apples
- ☐ 1/4 cup water
- ☐ 3 tablespoons sugar (omit if purchased applesauce is unsweetened)
- ☐ 1 jar (24 or 25 ounces) name brand smooth applesauce
- ☐ 1 jar (24 or 25 ounces) store brand smooth applesauce
- ☐ 1 jar (24 or 25 ounces) generic brand smooth applesauce

(Note: All three jars should be the same size to aid in cost comparison. Be sure to note the price of each jar.)

### EQUIPMENT

- ☐ paring knife
- ☐ cutting board
- ☐ vegetable peeler
- ☐ measuring cups—liquid
- ☐ saucepan with lid, 1-1/2 quarts or larger
- ☐ potato masher or blender
- ☐ measuring spoons
- ☐ 4 serving dishes (the same size, shape and color)
- ☐ 4 serving spoons
- ☐ masking tape
- ☐ marker
- ☐ paper plates for taste testing (one for each 4-H member)
- ☐ spoons for taste testing (one for each 4-H member)
- ☐ paper cups with room temperature water (one for each 4-H member)

### PROCEDURE

1. Pare, quarter and core the apples.
2. Place apples and water in the saucepan. Bring to a boil. Lower the heat, cover and simmer until the apples are very tender (approximately 10 minutes).
3. Use the potato masher to mash the apples until smooth (or use a blender).
4. Stir in the sugar. (Omit if purchased applesauces are unsweetened.)
5. While setting up the remainder of the experiment, chill the warm homemade applesauce so that it will be close to room temperature for tasting. (The other purchased brands should be kept at room temperature.)
6. Use masking tape and a marker to label the serving dishes "O," "□," "△" and "X."
7. The leader or one member should place the name brand applesauce in one serving dish, the store brand in a second, the generic in a third and the homemade in the fourth. This person will need to keep track of which type of applesauce is placed in which symbol serving dish. The rest of the members should not know the type they are tasting.
8. Divide each person's paper plate for taste testing into four sections and label the sections "O," "□," "△" and "X."
9. The person keeping track should place samples of each applesauce on the corresponding section of each member's paper plate.
10. Each 4-H member should evaluate the applesauce, using the chart on page 16. Leave the value and total points columns blank for now. Each person should drink a sip of room temperature water between samples. (Cold water is not used since it may dull the sense of taste).



Applesauce	Write your comments on:			Indicate your rating of:*			Value	Total Points
	Color	Taste	Texture	Color	Taste	Texture		
O								
□								
△								
X								

\*Rate the items from 1 to 4, with 1 being the least preferred and 4 the most preferred.

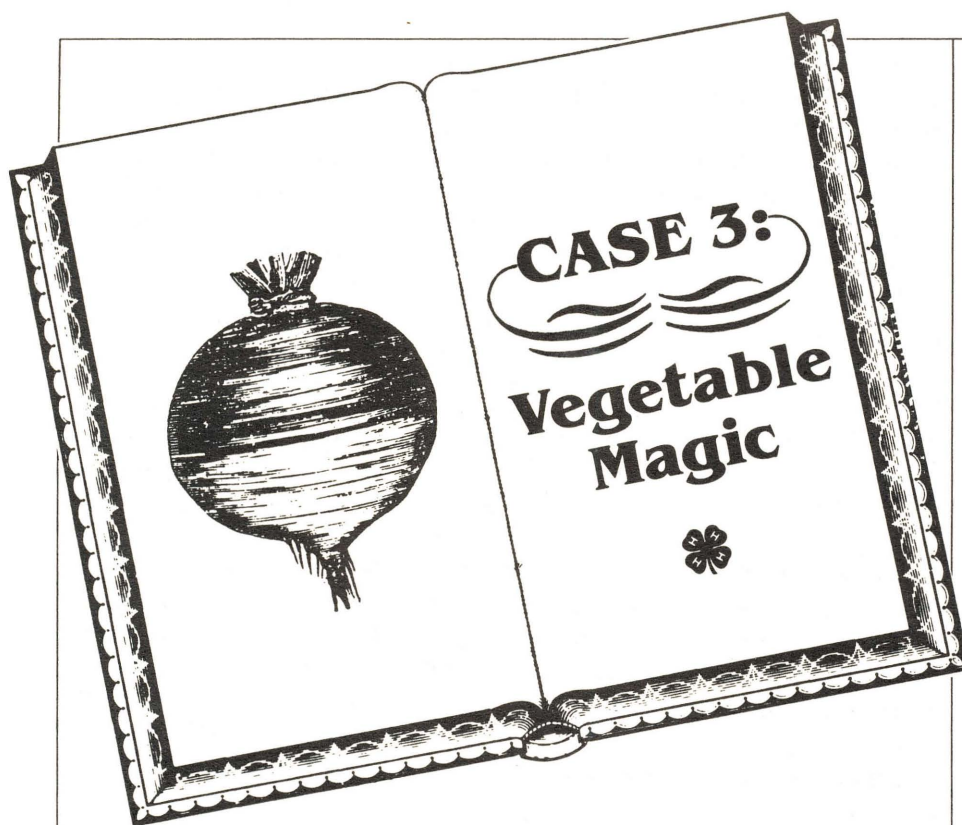
11. The leader or member that set up the taste samples can now reveal the brand of each applesauce and the cost for each brand. For your information, the average cost of 24 ounces of homemade applesauce is \$1.01. Each member should rate the value of each applesauce from 1 to 4 with 1 being most expensive and 4 the least expensive.
12. Now add the four numbers together for each variety and enter the number in the total points column.
13. As a group, discuss the following questions:
  - Which applesauce received the most points from each member of the group? Discuss everyone's comments about each applesauce.
  - Which factor do you consider most important when selecting food—flavor, cost, or convenience (homemade vs. ready-prepared)? Why?
  - What principles did you use in conducting this experiment that you think are also used in food research for sensory testing of food?

### EXPLANATION

Different brands of the same type of food can vary widely in price. **Generic brands** are those with plain labels and no brand name. These products are not advertised so the cost is usually lower than name brand foods since the expense of advertising is not added to the price of the food. Generally, the nutritional value of generic brands is equal to name brand foods, but the quality may vary. Taste may also be affected. On the other hand, sometimes the products are of very high quality.

Some stores have their own **store brands**. These are usually similar quality to name brands but lower priced. Personal preferences can play a big part in influencing selection of brands.





## ADDITIONAL INFORMATION

### To Shake or Not to Shake

The mineral sodium, which is found naturally in many foods as well as in processed foods and in table salt, has been implicated as one of the factors in high blood pressure. Obesity is another major factor. Some people with high blood pressure are sensitive to sodium. These people may be able to lower their blood pressure by decreasing their sodium intake. Since there is no way to know if you are sensitive to sodium, the U.S. government **Dietary Guidelines for Americans** and the Canadian government guidelines both recommend that we avoid too much sodium. There are many ways to cut down on sodium intake:

- Cook with only a small amount of added salt.
- Remove the salt shaker from the table.
- Try using other seasonings in place of salt.
- Limit your intake of the following

foods which are high in sodium:

- Foods prepared in brine (such as pickles, olives and sauerkraut)
- Salty snacks like salted nuts, crackers, potato chips and pretzels
- Lunch meats and frankfurters
- Seasoned salts, bouillon cubes, catsup, soy sauce, mustard and Worcestershire sauce
- Canned and instant soups
- Many cheeses

### Pills vs. Foods

The sale of vitamin pills in the United States is a multibillion dollar industry. Many people take vitamin supplements because they believe the pills will give them more energy or make them feel better. In general, nutritionists recommend that people who regularly eat a variety of foods do **not** need vitamin supplements. Only those who are known to have deficient diets, who are recovering



### Key Ideas

- Vegetables provide vitamins and fiber, and they are low in calories.
- Vitamin A helps eyes adjust to darkness and contributes to growth and healthy skin.
- Vegetables get their color from pigments in the plant.
- Dark green, deep yellow and orange vegetables contain the carotenoid color pigment which is a primary source of vitamin A.
- People should eat four or more servings of fruits and vegetables each day and a vitamin A vegetable at least every other day.
- Fast foods are typically low in vitamin A. If you eat many meals at fast food places, salad bars can provide you with some vitamin A if you select vegetables wisely.
- Color pigments in vegetables react with acids and bases which can change the normal color of the vegetable.
- Certain plant pigments in a solution can be used to determine if a food is more acidic or basic.
- Many seasonings other than salt can be added to vegetables.
- A well-balanced diet can provide the vitamins needed for good health.



from certain illnesses, or who have known vitamin deficiencies should have to take vitamin supplements.

Vitamins are essential to human life, but their true role in the body is often misunderstood. Vitamins are substances needed in very **small** amounts. For example, one ounce of vitamin B<sub>12</sub> could supply the daily needs of this vitamin for almost five million people.

Getting enough vitamins is essential to life, but the body has no use for excess vitamins. Excessive amounts of the water soluble vitamins (C and the B group) are usually excreted in the urine, but overdoses of some can create health problems. Excessive amounts of the fat soluble vitamins (A, D, E and K) can accumulate in body fat, and this is even more dangerous to your health.

### Vegetable Quality Tips

Vegetables are valued in the diet for their color, flavor, texture and nutritive value. When vegetables are handled, stored and cooked, care should be taken to retain these characteristics.

Following are things to look for in high quality vegetables:

**Asparagus**—Rounded stalk (not rigid). Compact tips.

**Beans (snap)**—Thick meaty walls (not spongy). Crisp enough to break or snap.

**Broccoli**—Small short stalks with dark green leaves. The presence of yellow flowers indicates overmaturity.

**Cabbage**—Firm. Greenish leaves. White core rather than yellow.

**Cauliflower**—Pearly white. Compact.

**Celery**—Thick, brittle stalks without deep ridges on the outside of the stalks.

**Onion**—Thin, dry skins.

**Peas**—Brittle. Well filled out pods.

**Potatoes**—Symmetrical with shallow eyes. Cut away any green color before potato is cooked.

**Root vegetables**—Clear bright skins. Plump.

**Spinach**—Dark green leaves. Succulent stems.

**Tomatoes**—Bright in color. Smooth surface.

If vegetables are picked when they are overmature, their color, flavor, texture and nutritive value may be affected. It is better to harvest slightly immature vegetables than overmature ones. Because the parts of plants eaten as vegetables grow in or near the soil,

careful washing is very important to remove soil and microorganisms.

Some parts of vegetables, like some parts of fruits, cannot be eaten. These parts are discarded. Be careful when trimming and peeling vegetables—often the nutrients go out with the peels and discards!

Vegetables are sometimes served raw, but more often they are cooked. Cooking changes the texture and flavor of vegetables and also destroys microorganisms. But don't overcook since that can destroy nutrients. If water is added when cooking vegetables, use it sparingly because some nutrients easily dissolve in the water and would be discarded when the water is removed.

## MEETING GUIDE

**Case 3: Vegetable Magic** contains two experiments—"The Red Cabbage Riddle" and "Red Cabbage Tells the Tale." This case also contains information on the nutritional value of vegetables, their color pigments, salt in the diet and tips on cooking vegetables. The following meeting guide is intended to allow 4-H'ers to begin the hands-on experiments within a short time after arriving at the meeting. Use the waiting times during the experiments to talk about other information found in the member's booklet.

1. Begin by reviewing with 4-H'ers the information on pages 1 and 2 of the member's booklet. Have them list their four favorite vegetables and name vegetables of different colors in the spaces provided. During this time, they could also unscramble the names of the vegetables high in vitamin A.
2. Review "Caution—Be Science Wise!" (page 3 of the member's booklet).
3. As a total group, read through **both** the experiments. Review the procedures and assign jobs. For these experiments, you may want to divide into two groups:
  - Detective group A could do "The Red Cabbage Riddle" experiment.
  - Detective group B could prepare the bluish-purple indicator solution for the "Red Cabbage Tells the Tale" experiment (through step 5).
4. Both groups can then participate in doing steps 6 through 11 of the "Red Cabbage Tells the Tale" experiment.



5. Group A can report their findings from "The Red Cabbage Riddle" to group B.
6. If one group finishes their task early, the members could complete the "Mystery Message" (page 7 of the member's booklet).
7. After members have reported the results of the experiments, review "The Salt Situation" and "Cooking for Keeps" (page 3 of the member's booklet).
8. Ask your 4-H members for their thoughts on the "Focus on You" information (page 6 of the member's booklet).
9. Encourage your 4-H'ers to do the "Be a Supermarket Sleuth" activity (page 6 of the member's booklet) and report their findings at the next meeting.
10. Review the answers to the puzzles as needed. Have members record what they learned in the space provided on page 7 of the member's booklet.
11. Clean up!

## SOLUTIONS

### ■ "The Red Cabbage Riddle" experiment (page 4 of the member's booklet):

#### Step 4:

- *What color did the water turn?* Blue. This is because the red anthocyanin pigment in red cabbage is water soluble, which means it dissolves in water. This pigment then turns blue when a base such as baking soda is added.
- *What color did the red cabbage turn?* Green.

#### Step 5:

- *Why do you think the cabbage changed color?* The anthocyanin (red) pigment in red cabbage turns blue when a base (baking soda) is added. The anthocyanin (white) pigment turns yellow. Since blue and yellow combine to make green, the red cabbage turns green.

### ■ "Red Cabbage Tells the Tale" experiment (page 5 of the member's booklet):

Food	Color	Indicate One:	
		Acid	Base
Vinegar	pink	X	
Baking soda	blue		X
Cream of tartar	pink	X	
Fruit juice	pink	X	
Cottage cheese	pink	X	
Orange section	pink	X	
Soft drink	pink	X	
Tomato	pink	X	
Apple	pink	X	
Egg white	blue		X

#### Step 11:

- *Do most foods react more like acids or more like bases?* Most react like acids, although foods differ in how strong an acid they are.
- *Why can red cabbage be used to test other foods to see if they are*



*acids or bases?* The pigments in red cabbage change color when an acid or base is added. This makes red cabbage useful as an indicator (a substance that can show if other foods are acids or bases). The indicator will change color depending on whether a food added to it is an acid or a base.

## ADDITIONAL DISCOVERIES

For an additional or substitute experiment for your group, you may want to try "Presto Chango!" A reproducible version of the experiment is on page 21. Whereas "The Red Cabbage Riddle" experiment in the member's booklet involved the red and white color pigments, this experiment focuses on chlorophyll, the green color pigment.

Following are the answers to the "Presto Chango!" experiment:

**Step 9:**

- *Was there a difference in the color of the two cooked samples?* Yes.
- *What color difference did you see?* When lemon juice (an acid) was added, the broccoli turned olive-green.
- *Why do you think this happened?* Acid affects the chlorophyll by causing a color change to olive-green.
- *Should the lemon juice be added before or after cooking the broccoli?* After. *Why?* If lemon juice is present during cooking, the color of broccoli will change to olive-green. If lemon juice is added after cooking, it will not cause color change. Note that overcooking can also change broccoli to an olive-green color.

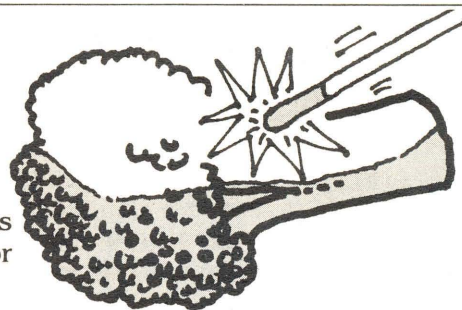




## EXPERIMENT

# Presto Chango!

The color pigment chlorophyll (green) changes color when an acid is added. Try adding lemon juice (an acid) to broccoli to see the color change for yourself.



### INGREDIENTS

- ☐ 1 cup fresh broccoli, or 1 package (10 ounces) frozen chopped broccoli, thawed
- ☐ 1 teaspoon lemon juice
- ☐ 1/2 cup water

### EQUIPMENT

- ☐ 2 saucepans
- ☐ measuring cup—liquid
- ☐ measuring spoons
- ☐ knife
- ☐ cutting board
- ☐ masking tape
- ☐ marker

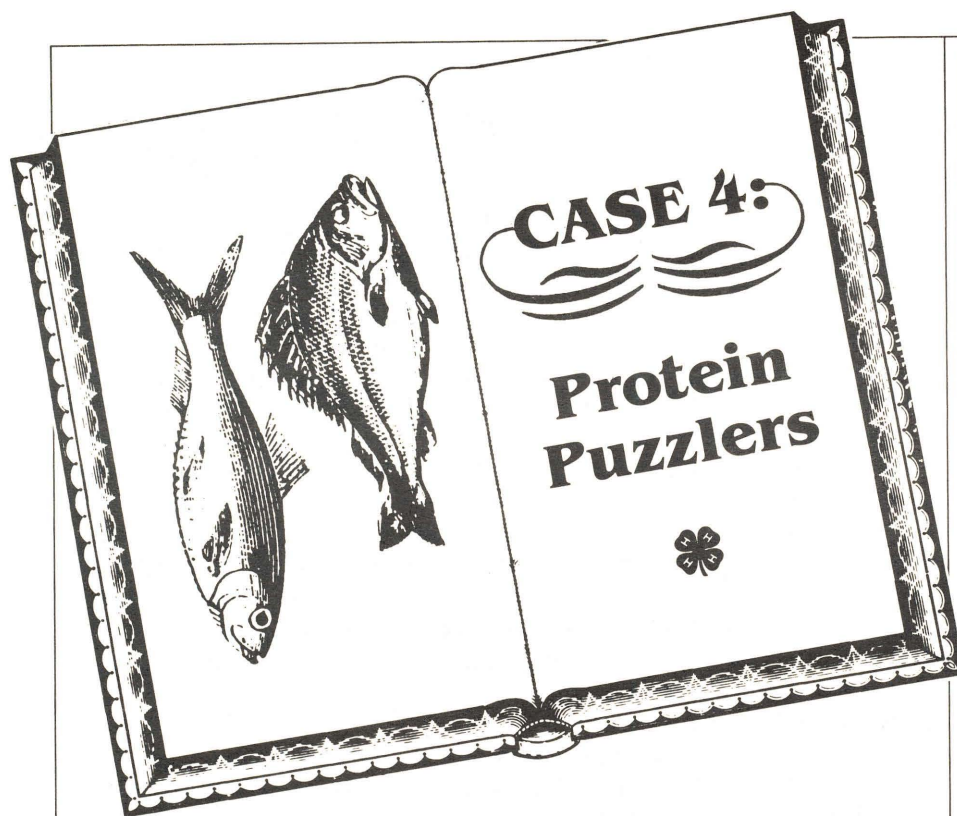
### PROCEDURE

1. Use the masking tape and marker to label the handle of one saucepan "with lemon juice" and the other handle "without lemon juice."
2. Clean the fresh broccoli.
3. Divide the broccoli equally in half and set aside.
4. Add 1/4 cup water to each saucepan. Bring the water to a boil.
5. Add the lemon juice to the saucepan labeled "with lemon juice."
6. Add half the broccoli to each saucepan. Bring to a boil again.
7. Cook both samples over medium heat for 4 to 8 minutes, until tender.
8. Remove the saucepans from the heat.
9. See if you can answer these questions based on what you observed:
  - Was there a difference in the color of the two cooked samples?
  - What color difference did you see?
  - Why do you think this happened?
  - Lemon juice is sometimes used as a seasoning for broccoli. Should the lemon juice be added before or after cooking the broccoli? Why?

### EXPLANATION

Acid will affect the chlorophyll color pigment by causing a change in color. The chlorophyll will change to an olive-green color.





## ADDITIONAL INFORMATION

### Vegetarians Don't Eat Just Vegetables!

Vegetarians do eat vegetables, of course, but they also eat other foods, depending on the kind of vegetarian they are.

- **Vegans** (VAY-gun or VEJ-an) or strict vegetarians do not eat any animal foods or animal products such as dairy products and eggs. They eat only plant foods like fruits, vegetables, nuts and grains.
- **Lacto-vegetarians** eat plant foods and dairy products, such as milk.
- **Lacto-ovo vegetarians** consume milk, dairy products and eggs but avoid meat, poultry and fish.

Some people choose to follow a partial vegetarian diet. For example, they may eat fish but not meat.

For all types of vegetarians, careful consideration must be given to meal planning to obtain the nutrients needed by the body. A good understanding of plant protein

combinations is necessary to meet the body's protein needs. This is explained further on pages 4 and 5 of this guide.

Most vegetarians can get their essential nutrients by using the following food plan. However, the vegan who doesn't use milk, dairy products or eggs should take vitamin B<sub>12</sub> supplements or use vitamin B<sub>12</sub> fortified soy milk in his or her diet. Vitamin B<sub>12</sub> is found only in animal foods.

### Food Plan for the Adult Vegetarian:

- 2 servings of milk or milk products. Soy milk fortified with vitamin B<sub>12</sub> could be substituted.
- 2 servings of protein-rich foods. This should include 2 cups of legumes daily to help meet iron requirements for women. Four tablespoons peanut butter would count as 1 serving.
- 4 servings of whole-grain breads and cereal.



## Key Ideas

- Legumes are types of beans and peas.
- Meat, fish, poultry, eggs and legumes contain protein.
- The body uses protein for growth and maintenance of cells.
- Iron is needed by the body to help make substances in blood to carry oxygen to all cells.
- Meat, poultry, fish and eggs are good sources of iron. Spinach, dried fruits, whole grains and molasses also supply iron in our diet.
- Fat is important in the diet but many people eat too much fat.
- Too much fat in the diet is associated with several serious health problems.
- Variety in the diet is a key to good nutrition.
- An acid added to a protein may affect some characteristics of the protein.
- A simple test can be used to determine if a food contains fat.
- A nut butter is made by crushing oil out of nuts.
- Fast foods are often high in calories and salt, and low in calcium, vitamins A and C.
- You can improve the nutritive value of your fast food meals by being choosy, by looking for variety and by limiting add-on foods.



- 4 servings of fruits and vegetables. This should include 1 cup of dark greens to help meet iron requirements for women.

## Meat Cookery Questions

**1. Does salt affect the cooking of food?** From the point of good nutrition, you may need to decrease the amount of salt in your diet. But how does salt affect the cooking of food? When should salt be added? If you are cooking a large or thick piece of meat, the salt will only penetrate to a depth of about 1/2 inch. If you put a lot of salt

on the outer surface of the meat, the drippings and outer layer may be too salty. The outer layer may even become dry and crusty since salt draws the juices out of meat. Salt also slows the browning of meat. Perhaps the best advice is to taste the meat after cooking before you add salt. You may decide you like the flavor without the added salt.

**2. Why does meat shrink when it is cooked?** When meat reaches a temperature of about 140°F, it begins to shrink because the protein coagulates, with loss of water and melting of fat. To decrease the

amount of shrinkage when roasting meat, cook to the recommended temperature of doneness. Also, meat cooked at lower temperatures (300 to 350°F) will be more tender and juicy than meat cooked at higher temperatures.

**3. Have you ever wondered why recipes state that large cuts of meat should be cooked with the fat side up?** As the meat cooks, the fat will melt and baste the meat. Basting helps prevent the meat from getting dry during cooking.

## MEETING GUIDE

**Case 4: Protein Puzzlers** contains two experiments—"Baffling Beaters" and "Where's the Fat?"—and one activity, "You Can Make Peanut Butter!" Information is also provided on protein, iron and fat in foods, shopping hints for meat, poultry and fish, and ways to fit fast foods into a meal plan. The following meeting guide is intended to allow 4-H'ers to begin the hands-on experiments within a short time after arriving at the meeting. Use the waiting times during the experiments to talk about other information found in the booklet.

1. Begin by reviewing with 4-H'ers the information on pages 1 and 2 of the member's booklet. Have them check the protein foods they have eaten.
2. Review "Caution—Be Science Wise!" (page 3 of the member's booklet).
3. As a total group, review the procedures and assign jobs for the "Baffling Beaters" experiment. Before beginning the experiment, ask your 4-H'ers if they have ever beaten an egg white. If not, you may want to talk about some of these points:
  - When separating the yolk from the white, it is important to not mix any of the yolk with the white. Yolks contain fat which will prevent the white from being beaten to its fullest volume.
  - The three most commonly used stages of egg white beating for recipes are foamy, soft peak and stiff peak. A definition of stiff peak is given in the member's booklet. Following are the definitions of foamy and soft peak:
 

**Foamy**—The stage in egg white beating during which air is beginning to mix into the whites. Bubbles will begin to form on the top surface; however, the whites are still fairly transparent.

**Soft peak**—The stage in egg white beating at which the egg white peaks bend over when the beaters are removed.
  - Beaten egg whites contain trapped air which is important for the rising of baked foods such as souffles and angel food cakes. Egg whites reach their fullest volume when beaten at room temperature.
  - If egg whites are overbeaten, they get dry and break into pieces. If overbeaten eggs are used in a baked product, the item will not rise well.
  - Acids, such as cream of tartar, vinegar or lemon juice, help make beaten whites more stable. The "Baffling Beaters" experiment explores how this happens.
4. Note that the egg whites in the "Baffling Beaters" experiment need

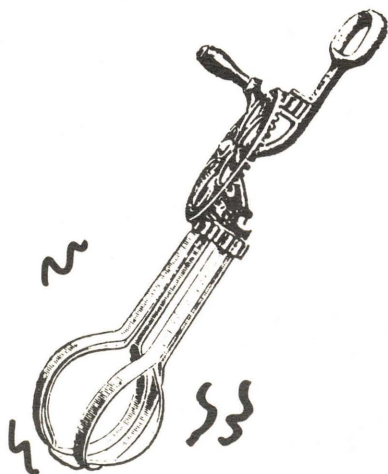


to stand approximately 1 hour before the accumulated liquid is measured. If all the egg whites will not fit in the glass, just use as much as you can. Make sure both glasses are filled to the same level.

5. After setting up the "Baffling Beaters" experiment, you may want to divide into two groups:
  - Detective group A could conduct the "Where's the Fat?" experiment. (The food spots need to dry for 20 minutes.)
  - Detective group B could do the "You Can Make Peanut Butter!" activity.
6. Both groups can then report their discoveries as well as complete step 5 (measuring the accumulated liquid) and step 6 in "Baffling Beaters."
7. If one group finishes their task early, members could complete the following activities:
  - "An 'Eggsasperating' Situation" (page 3 of the member's booklet). For this activity, you need to have one hard-cooked and one raw egg available. Explain to the group that a hard-cooked egg is solid so it will spin as one unit. When you spin the raw egg, the liquidy insides do not start spinning at the same time as the shell. This uses up energy, so the egg falls over rather than continues to spin.
  - "The Protein Name Game" (page 6 of the member's booklet).
  - "Mystery Message" (page 7 of the member's booklet).
8. After completing the "Baffling Beaters" experiment and reporting on the "Where's the Fat?" experiment, talk about "Focus on You" (page 7 of the member's booklet) which deals with fast food meals. Members can also taste the peanut butter made by the second detective group.
9. Encourage your 4-H'ers to do "An Activity to Try" (page 7 of the member's booklet) and report their findings at the next meeting.
10. Review the answers to the puzzles as needed. Have members record what they learned in the space provided on page 6 of the member's booklet.
11. Clean up!

## SOLUTIONS

### ■ "Baffling Beaters" experiment (page 4 of the member's booklet):



#### Step 5:

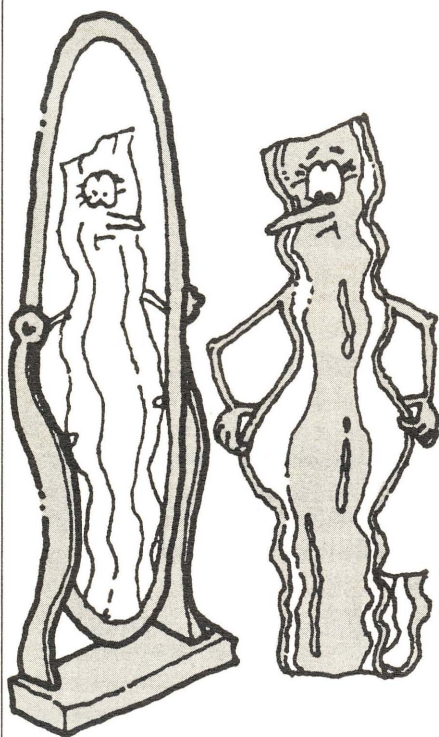
- The total amount of beating time should be greater for the egg white **with** cream of tartar. The amount of accumulated liquid should be greater for the egg white **without** cream of tartar.

#### Step 6:

- *Did it take longer to beat to stiff peaks the egg white with cream of tartar or the egg white without cream of tartar?* The egg white with cream of tartar.
- *Which egg white lost less liquid after one hour?* The egg white with cream of tartar.
- *What can you conclude about how cream of tartar affects egg whites when beaten?* Adding cream of tartar increases the time it takes to beat an egg white to stiff peaks but makes the foam more stable and therefore less likely to lose water.
- *Why would you want egg whites to be stable after beating?* Beaten egg whites add lightness to a product because of the air that is present. Stable foam will result in a lighter, higher quality product. Unstable foam collapses more easily, leaking water and losing air.



- "Where's the Fat?" experiment (page 5 of the member's booklet):



#### Step 4:

Food	Fat	Little or No Fat
Macaroni		X
Potato slice		X
Potato chip	X	
Mayonnaise	X	
Peanut	X	
Bacon	X	
Water		X
Margarine	X	

#### Step 5:

- Did the raw potato slice give you different results from the potato chip? Yes. Why did they test differently? Potato chips are fried during preparation, which adds fat. How do you think a french fry would react? It would indicate fat is present.
- Did you find a peanut has fat or does not have fat? It has fat. How do you think peanut butter would test? Peanut butter would also show fat is present.
- Did the macaroni test as having fat or not having fat? It tested as not having fat. Since macaroni is made from grain, what can you conclude in general about grain foods? They are very low in fat. How do you think a slice of bread would test? It would show little or no fat.

## ADDITIONAL DISCOVERIES

For an additional activity, your 4-H'ers may wish to explore fast foods in more detail. The "Test Your Fast Food I.Q." quiz on page 26 could be used for a discussion of various fast foods. Be sure to refer also to "Focus on You" on page 7 of the member's booklet for further information on fast foods.

Following are the answers to "Test Your Fast Food I.Q.":

- Possible reasons include the following:
  - Fast food outlets are fast, economical and convenient.
  - Fast food outlets are sanitary and provide a consistency in quality.
- False. All food, including fast food, has nutrients your body needs. There are concerns, though, that fast food meals can be low in calcium and vitamins A and C, and high in calories, sodium and fat.
- True. Fast food meals usually contain ample protein, although most Americans consume more than the recommended daily amount of protein anyway.
- d. All of the above.
- yes
  - no
  - yes
  - yes
  - yes
- Possible answers include vitamin A and vitamin C.
- Possible answers include the following:
  - Add cheese to a hamburger. This increases calcium but also adds calories.
  - Choose milk instead of a soft drink.
  - Select from the salad bar if one is available.
  - Bring raw vegetables or fruits from home.
  - Substitute a lower-calorie sandwich, if calories are a concern.



## ACTIVITY

### Test Your Fast Food I.Q.



Test your fast food knowledge. Circle the correct answer or fill in the blank.

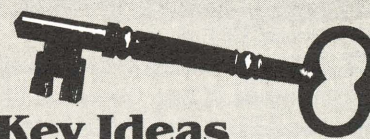
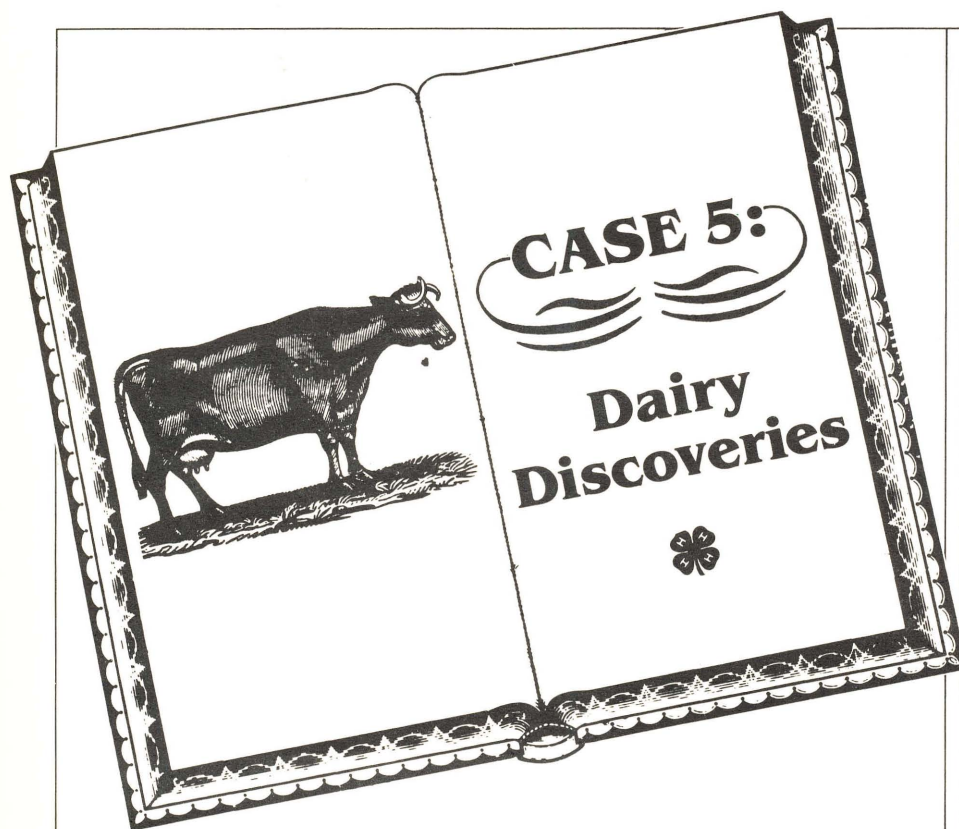
1. Name two reasons why fast food outlets are so popular.
  - a.
  - b.
2. Fast food meals are nothing but empty calories.

T                  F
3. You can get enough protein by just eating fast food meals.

T                  F
4. Which of the following meals equals about 1,000 calories?
  - a. Big Mac, french fries, vanilla shake
  - b. Fried chicken (3 pieces) mashed potatoes, gravy, coleslaw, roll, cola
  - c. Small (10-inch) deluxe pizza, cola
  - d. All of the above
5. Fast food meals are **relatively high** in:

	yes	no
a. protein	_____	_____
b. fiber	_____	_____
c. fat	_____	_____
d. sodium	_____	_____
e. calories	_____	_____
6. Name a vitamin generally low in most fast food meals.
7. Name two ways to improve choices at fast food restaurants.
  - a.
  - b.





## Key Ideas

- Milk and milk products are important throughout life.
- Milk is packed with nutrients including protein, calcium and vitamins A, D and riboflavin.
- Calcium helps blood clot and builds bones and teeth.
- Vitamin D helps bones use calcium to make them hard.
- The kind of milk or milk product you consume will affect the amount of fat you get.
- When heated, the protein in food begins to coagulate.
- Acid also can cause protein to coagulate.
- Soft drinks contain no nutrients other than sugar. Many contain caffeine, a stimulant drug.

## ADDITIONAL INFORMATION

### Make a Commitment to Calcium!

Much attention has been given to the importance of calcium in the diet throughout life. If you don't get enough calcium and vitamin D throughout early and middle life, you may experience extensive breakdown of the skeleton in your later years. Almost everyone suffers some loss in bone strength as they grow older. For many women, this loss greatly accelerates after menopause. This results in a condition called osteoporosis, which means that the bones become porous and will break easily. Osteoporosis affects one in four women over age 60.

There are a variety of risk factors that can contribute to osteoporosis. These include advancing age, being female and hereditary conditions, as well as many years of

diets low in calcium and of limited weight-bearing exercises. Young people need to be made aware of the importance of eating dairy products and other calcium-rich foods throughout life. Research suggests that a diet with sufficient calcium and vitamin D (to aid calcium absorption) is important beginning in childhood to help prevent osteoporosis from developing later in life.

### Be Fussy about Fats!

Fat is important in the diet. It helps you maintain healthy skin and hair, protects the body organs from temperature extremes, supplies a continuous reserve of energy and provides vitamins A, D, E and K which are soluble in fat. Fat also gives many foods their flavor and aroma.

Then why is there so much fuss

about eating foods high in fat? The problem faced by many people is that they include too much fat in their diets. It has been estimated that 40 to 50 percent of the calories consumed in the United States come from fats. Many authorities have suggested it is best to limit fat to no more than 30 to 35 percent of total calories.

To reduce the fat in your diet, you need to be aware of the amount of fat in various foods. Many foods that contain fat also provide essential nutrients. To get the nutrients you need without getting too much fat, do the following:

- Select lowfat dairy products.
- Choose lean meats.
- Use lowfat food preparation methods. Instead of frying foods, broil, bake or boil them. Also, be sure to trim the fat off meats.



- Reduce the amounts of fats (such as butter, margarine and sour cream) added at the table.

If you drink skim or lowfat milk, be sure that it has been fortified with vitamins A and D. Since these are fat soluble vitamins, most of the vitamins found naturally in milk would have been removed when the fat was taken out of the milk.

## Food Science Tips

**Pasteurization**—Have you ever tasted raw milk? Probably not, since 90 percent of all market milk is pasteurized. All milk contains bacteria, most of which are harmless or even beneficial. However, some bacteria that may be present in milk can cause serious illnesses. To get rid of these bacteria and to give you a safe supply of milk, most milk is pasteurized. This means it is heat-treated to

destroy disease-causing bacteria.

**Homogenization**—Most whole milk is homogenized right after it is pasteurized. The purpose of homogenization is to break up the large fat molecules found in milk into smaller globules. This process requires that milk or cream be forced through a special machine under high pressure. Following homogenization, the cream will no longer separate out from the milk. Homogenization gives milk a richer flavor with more body.

**Caring for milk**—Milk should always be kept in clean containers, stored in cold temperatures, and covered to prevent contamination. Milk is a very perishable food and should be stored in the coldest part of the refrigerator. If you allow milk to remain unrefrigerated even a short period of time, there can be a rapid increase in bacterial growth and the possibility of

spoilage. When you buy milk at the grocery, be sure to get it in your refrigerator as soon as possible after purchase.

## MEETING GUIDE

**Case 5: Dairy Discoveries** contains two experiments—"From Liquid to Solid" and "The Sour Secret." It also contains information on the nutrients in dairy products including calcium, vitamin D, fat and protein. The following meeting guide is intended to allow 4-H'ers to begin the hands-on experiments as soon as possible after arriving at the meeting. Use the waiting times during the experiments to talk about other information found in the booklet.

1. Begin by reviewing with 4-H'ers the information on pages 1 to 3 of the member's booklet. Have them answer the questions that follow "Dairy Food Focus." At this time, they can also list the dairy products they have eaten during the last five days and star the ones that are fairly low in fat.
2. Review "Caution—Be Science Wise!" (page 3 of the member's booklet).
3. As a total group, read through the "From Liquid to Solid" experiment. Divide the steps in the procedure among your 4-H members. Have one or two 4-H'ers responsible for checking the custards for doneness.
4. While the custards are baking, read through "The Sour Secret" experiment as a group. Perhaps one or two 4-H'ers will volunteer to demonstrate this experiment for the others then report their findings later in the meeting. If time permits, you may want to have members use the sour milk in a quick bread or pancake recipe.
5. Complete steps 6 and 7 in "From Liquid to Solid" and have members report the results of "The Sour Secret."
6. If one group finishes their task early, members could do the "Hidden Cheeses" word search (page 5 of the member's booklet) and "Mystery Message" (page 6 of the member's booklet).
7. Talk about "Focus on You" (page 6 of the member's booklet). For this activity, you will need a diet soft drink can and a carton of milk.
8. Review the answers to the puzzles as needed. Have members record what they learned in the space provided on page 7 of the member's booklet.
9. Clean up!



## SOLUTIONS

- **Dairy products 4-H'ers may have eaten (page 3 of the member's booklet).**

Following are dairy products the members might include on their lists. The lower-fat products are starred.

*Buttermilk	Ice cream
Cheese (natural, processed or spreads)	*Ice milk
Chocolate milk	*Lowfat milk
Condensed milk	*Lowfat yogurt
Cottage cheese (creamed)	Malted milk
*Cottage cheese (lowfat)	Milk desserts (pudding, custards)
Dairy creamer	Milkshake
Eggnog	*Nonfat dry milk
Evaporated milk	*Skim milk
Half and half	Sour cream
Heavy whipping cream	Whole milk

- **"From Liquid to Solid" experiment (page 4 of the member's manual):**

### Step 6:

	Appearance	Texture	Flavor
Baked in water	Smooth, creamy	Smooth	Good
Baked without water	Watery, not smooth Small holes/ bubbles on outside and inside	Rubbery	May taste slight caramel- like flavor

### Step 7:

- *Why does the thin liquid custard mixture thicken and set into a firm product when heated?* The protein in the eggs and milk coagulates.
- *What differences in appearance did you notice between the custards baked in water and the ones baked without water?* Custards baked in water should be smooth and creamy. The custards baked without water will have small bubbles on the outside and small holes inside. When cut, liquid will separate out from the cut surface. The top may be more brown on the custards baked without water.
- *Which method of baking is the best method for custard?* Baking in water is the best method. *Why?* The water helps protect the custards from the oven heat. This prevents the egg protein from overheating and overcoagulating which would result in a less desirable product.

- **"The Sour Secret" experiment (page 5 of the member's booklet):**

### Step 3:

- You will see a solid material settle out of the liquid. This is the protein.

### Step 4:

- The solid material does not dissolve.

### Step 5:

- *Can you tell if the protein has been changed?* Yes. *How?* A solid material will settle out of the liquid. This is the protein.



■ **"Focus On You" (page 6 of the member's booklet):**



- *What can you do to make milk sour?* Add 1 tablespoon of vinegar or lemon juice to 1 cup of fresh milk.

Bring soft drink cans (diet brands will include a nutrition label) and milk cartons to the meeting so that members can find the answers to the "Focus on You" questions. You may find some variation in ingredient listings. Following are some of the possible answers to the questions:

- *What ingredients are listed on the soft drink can?* Carbonated water, caramel color, NutraSweet brand of aspartame, phosphoric acid, potassium benzoate (a preservative), citric acid, caffeine and natural flavoring.
- *What nutrients can you expect to get from a soft drink?* You can expect to get carbohydrate (from the sugar in nondiet soft drinks), sodium and small amounts of a few minerals.
- *What ingredients are listed on the milk carton?* Milk and usually a form of vitamin A and vitamin D if the milk is lowfat.
- *What nutrients can you expect to get from milk?* You can expect to get protein, carbohydrate, fat (depending on the kind of milk), vitamins A and C, thiamin, riboflavin, calcium, vitamins D, B<sub>6</sub> and B<sub>12</sub>, phosphorous, magnesium, zinc and pantothenic acid. Some of these nutrients may be in very small quantities.

## ADDITIONAL DISCOVERIES

Reproducible versions of experiments that can be used in addition to or in place of those in the member's booklet appear in this guide. "The Disappearing Calcium" (page 31) may be done by an interested 4-H member at home since it takes three days. The member could then report his or her results at a future meeting. "Unlocking Butter Basics" (page 32) could be used to fill time during your meeting. Younger 4-H'ers would be most apt to enjoy this activity.

Following are the answers to the questions found in "The Disappearing Calcium":

### Step 4:

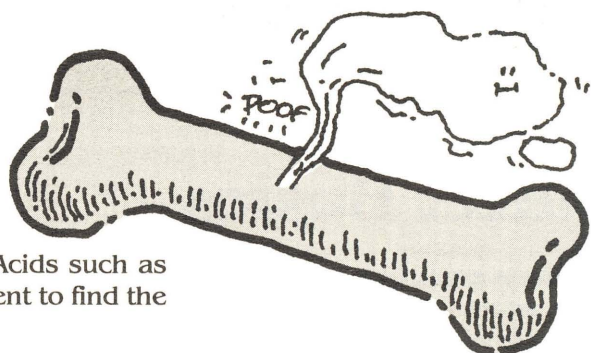
- *Why did the bone in the vinegar bend easily?* The vinegar dissolved the calcium out of the bone. Since calcium is responsible for making the bone hard, the bone bends easily when the calcium is removed.
- *Why did the bone in the water not bend easily?* Water will not dissolve calcium. Since this bone did not lose any calcium, it remained hard.
- *What might happen to your bones if you did not get enough calcium from the foods you eat?* Since calcium, along with vitamin D, causes bones to be strong and hard, your bones become brittle from lack of calcium and you would not grow properly.



## EXPERIMENT

# The Disappearing Calcium

Calcium is a nutrient that helps make bones hard. Acids such as vinegar can dissolve calcium. Try the following experiment to find the calcium!



### INGREDIENTS

- ☐ 2 chicken leg bones, meat removed
- ☐ 1/2 to 2/3 cup vinegar
- ☐ 1/2 to 2/3 cup water

### EQUIPMENT

- ☐ 2 cups or bowls
- ☐ measuring cups—liquid

### PROCEDURE

1. Place a chicken leg bone in each cup or bowl. Add water to one cup and vinegar to the second cup, so that each bone is covered.
2. Let the cups stand for three days or longer.
3. Take the bones out and compare them. Try to bend each bone. Record what you find.

4. See if you can answer these questions based on what you observed:
  - Why did the bone in the vinegar bend easily?
  - Why did the bone in the water **not** bend easily?
  - Why might happen to **your** bones if you did not get enough calcium from the foods you eat?

### EXPLANATION

Calcium and other nutrients such as vitamin D are responsible for making our bones hard. In this experiment, vinegar, which is an acid, dissolved some of the calcium out of bone, making it easy to bend. The bone placed in the water (the control) did not lose any calcium. Because of this, it remained hard and would not bend.

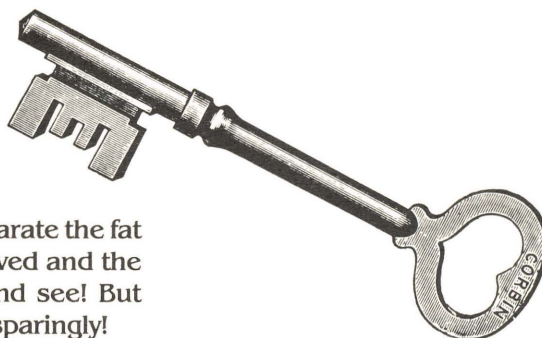
This experiment emphasizes the importance of getting enough calcium in the diet. The body uses calcium, which is stored in your bones, for several purposes. If you don't replace the calcium through the foods you eat, your bones will have less calcium because your body is using it for other purposes. Your bones can then become brittle and weak.



## EXPERIMENT

# Unlocking Butter Basics

Butter is made from cream. The cream is churned to separate the fat in the cream from the milk. Most of the milk is then removed and the butter remains. Butter is easy and fun to make. Try it and see! But remember that butter is high in fat and calories, so use it sparingly!



## INGREDIENTS

- ☐ 1/2 pint whipping cream
- ☐ salt
- ☐ cold water

## EQUIPMENT

- ☐ 2 small jars with tight fitting lids
- ☐ small dish
- ☐ spoon

## PROCEDURE

1. Divide the cream between the two jars. Put the lids on the jars.
2. Take the jars and shake them constantly for about 15 minutes. During this time, several things will happen:
  - The cream will become frothy.
  - The cream will warm up from the heat of your hand.
  - The small butterfat pieces will start to bump into each other and then begin to stick together. This is what is called churning butter.
  - The butterfat will become a round light yellow ball—butter!
3. When the butterfat becomes a round ball, carefully drain the milk into the small dish. The milk surrounding the butterball is called buttermilk. Since most of the butterfat is now in the butterball, the leftover milk (buttermilk) is low in fat. Taste the buttermilk.
4. Leave the butter in the jar and slowly run cold water over the butter to wash the milk off. Some milk will get caught inside the ball of butter, so you need to wash it out.
5. Use the back of the spoon to press the ball of butter against the side of the jar. You should see little drops of milk.
6. Wash the butter again. When you make butter that you want to keep, it is very important to get as much of the milk out as possible.
7. Taste the butter. What you have is called sweet butter. Since most butter is salted butter, you can add a pinch of salt to your butter. Work it into the butter.
8. Check your butter for color. The yellow color comes from carotene which the body can change to vitamin A.
9. Refrigerate or freeze the butter to keep it fresh.





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