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Food Mysteries – Case 5: Dairy Discoveries

Michigan State University Cooperative Extension Service

4-H Club Bulletin

Stella Cash, Foods Science and Human Nutrition; Patricia A. Hammerschmidt, 4H Food program; Ruth L. Eggert, Program Leader

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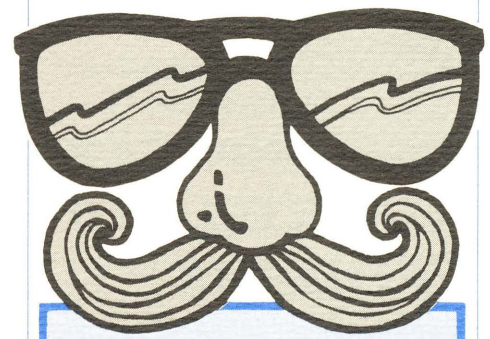
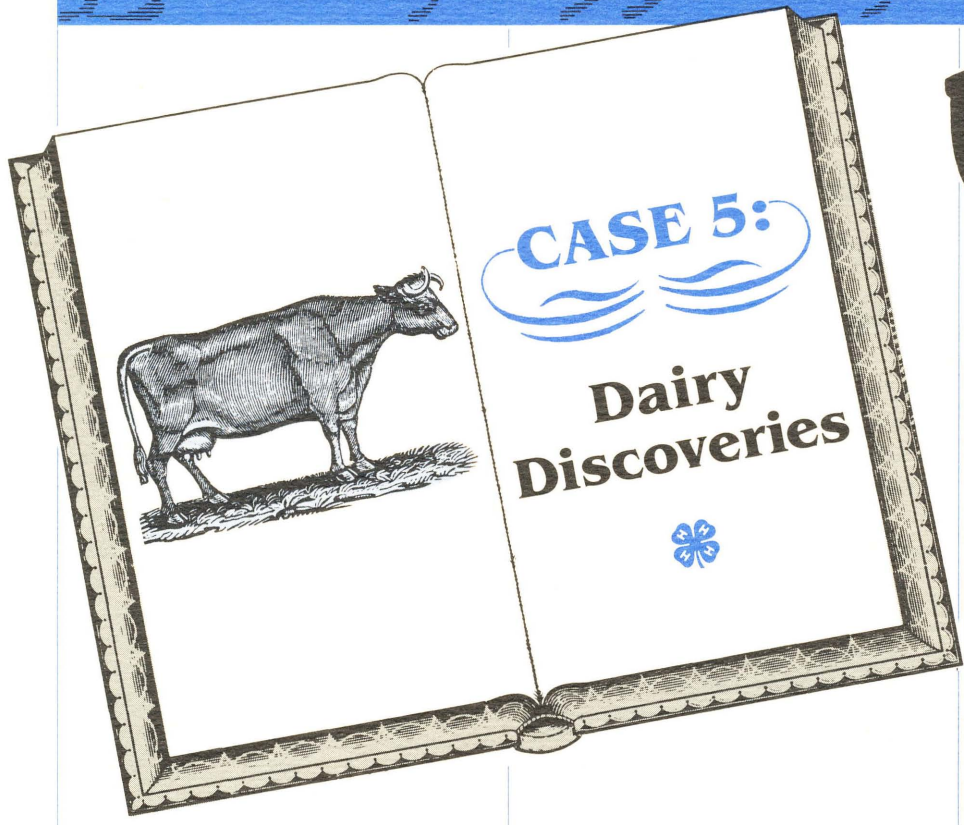
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# Food Mysteries



**BE A  
DETECTIVE!**  
Solve the  
Mystery Message

Throughout this book, you will find several underlined words printed in blue. Collect these words and place them in the space provided on page 6. Unscramble the words to solve the mystery message about dairy foods.

**C**an you name a drink that could be called "the drink of a lifetime"? If you answered **milk**, you are right! Milk is the first food for babies, and it is very important for people your age too. But did you know that adults also need milk?

Milk and milk products are packed with nutrients. Besides having protein which the body uses for growth, milk contains vitamins A, D and riboflavin, plus the mineral calcium.

## Calcium Consequences

Calcium plays several important roles in the body. Calcium is needed for your blood to clot when you get a cut. Without calcium, your body would not have strong bones and **teeth**. If you don't drink and eat calcium-rich foods throughout your life, your bones may become brittle and break easily as you grow older.

Although some calcium is found in other foods, milk and milk products are by far the main source of calcium for Americans. Compare the calcium in the following foods:

Calcium Source	Number of Milligrams
1 cup 2 percent milk	297
1 slice cheddar cheese	204
1 cup fruit yogurt	345
3 oz. salmon (with bones)	167
1/2 cup frozen collards, cooked	149

(continued on next page)



## Calcium Consequences (continued)

If you are 10 years old or younger, you need at least 800 milligrams of calcium every day. If you are 11 to 18 years of age, you need at least 1,200 milligrams each day. Look at the following chart to see how many servings of milk you need daily for good nutrition. Remember, you can also meet this requirement by eating dairy products such as yogurt and cheese.

	Amount of Milk
Children	3 cups
Teenagers	4 cups
Adults	2 cups
Pregnant and nursing women	3-4 cups
Pregnant and nursing teenage girls	4-5 cups



## The Vitamin D Drama

Vitamin D helps [bones](#) use calcium to make them hard. Think how difficult it would be to run if your bones were soft and limp like cooked spaghetti!

Only a few foods exist that contain vitamin D: eggs, liver and some fish. But this vitamin can also be obtained from sunshine! There is a substance in your skin that changes to vitamin D when the sun's ultraviolet rays reach your skin.

Vitamin D is often added to milk. Milk is a perfect choice to add this vitamin to since milk also contains calcium. Vitamin D and calcium work together to build strong bones and teeth. Read a milk carton to see if it says "Fortified with vitamin D" or "Vitamin D added."

You may also find vitamin A added to some lower fat milks. Vitamin A is found in milk fat, so when the fat is removed to make 2 percent or skim milk, the vitamin A is removed too. Vitamin A is then often added back.

## Don't Forget the Fat!

As you know, milk also contains fat. However, the amount of fat in dairy foods varies with the kind of milk product that you are using. For example, whole milk has a lot more fat in it than skim

milk. Whipping cream is another story. It is about 30 percent fat!

Look at the chart to see the different amounts of fat in several dairy foods.

### DAIRY FOOD FOCUS

Food	Calories per cup	Grams of protein	Grams of fat	Milligrams of calcium
Whole milk	150	8	8	291
Nonfat (skim) milk	86	8	Trace	302
Two percent milk	121	8	5	297
Buttermilk	99	8	2	285
Yogurt (plain)	139	8	7	274
Half and half cream	320	8	28	261
Heavy whipping cream	832	5	89	178
Cottage cheese (creamed)	217	26	10	126
Ice cream (vanilla)	269	5	14	176

Study the chart and see if you can answer these questions:

1. Which product has the most calories per one cup serving?
2. If you want to drink milk with the least amount of fat, will you still get [calcium](#)? \_\_\_\_\_ How much calcium would you get when you drink one cup of this kind of milk? \_\_\_\_\_
3. Nonfat (skim) milk and buttermilk are low in \_\_\_\_\_ and \_\_\_\_\_.
4. How does 2 percent milk compare with ice cream for calories and calcium? \_\_\_\_\_

Turn to page 8 to see if your answers are correct.

(continued on next page)



## Don't Forget the Fat (continued)

Why should you care about calories? Calories are a way to measure the energy supplied by foods. Some foods supply more calories than other foods. If you don't eat foods that provide you with enough calories, your body won't have enough energy to grow and glow! If you take in more calories than your body needs, or if you aren't active enough to use up those calories, you will gain weight.

The **Dietary Guidelines for Americans** is information written by nutrition and health experts and published by the government. The guidelines suggest that people should maintain a desirable weight. This means they should neither be too fat or too thin for their height. Being overweight or underweight can lead to health problems. Your doctor or dietitian can guide you in finding your proper weight range.

Although butter, sour cream and whipping cream are dairy products, they should be used sparingly because they are high in fat and calories.

List the dairy [products](#) you have eaten within the last five days. Put a star next to the products that are fairly low in fat.

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## Protein Power!

The protein in milk is very important. Milk is called a complete protein food because it contains all eight of the essential amino acids. Since milk contains two of the amino acids often missing in grain products, milk is an excellent partner with cereals and bread.

The use of heat and acids can affect the protein in milk but not change its nutritive value. The process of changing liquid protein into a solid by heating is called **coagulation**. Protein coagulation is one of the main

reasons food changes when it is cooked. Meat and fish become firm when cooked. Batters that contain milk or eggs change from liquids to solids. In fact, most baked goods have a "skeleton" of coagulated milk and egg protein which supports them.

### Do You Want To Know More?

The **From Liquid to Solid** experiment (page 4) will help you discover what happens to protein during cooking.

The **Sour Secret** experiment (page 5) shows how acid affects the protein in [dairy](#) foods.

Egg white protein coagulates when heated. This means it changes from an almost colorless, transparent, fairly thick liquid to a white solid. The protein in egg yolk also coagulates when heated.

## CAUTION — BE SCIENCE WISE!

Before you begin any science experiment, you should always follow these basic rules:

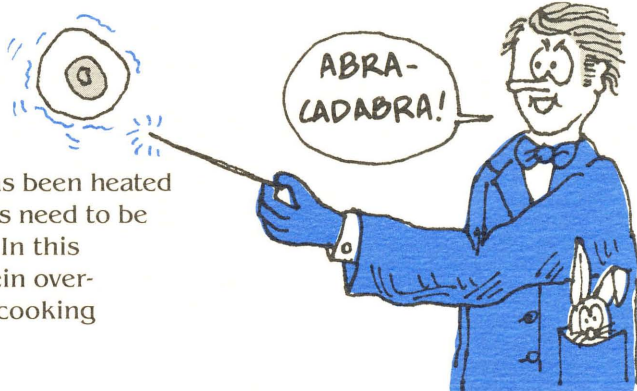
1. Be sure to read **all** directions before starting the experiments.
2. In many experiments, a "control" is used. The control is the standard against which you compare the experimental food.
3. When doing the experiments, keep everything the same as the control except for the one thing the directions say to change. Use the same size pans, the same type of bowls and the same mixing speeds. Be sure that just **one** thing changes each time.
4. Be sure to label each food when conducting these experiments. Use a piece of masking tape, a marking pencil, a crayon or anything that will help you remember which food is which. In some experiments, you'll have no trouble telling the foods apart. In others, the foods may look the same.
5. The experimental food is not meant to be perfect. Since you are purposely doing something wrong, you can't expect it to be perfect! So it's all right when something turns out "bad." That's what is **supposed** to happen.
6. Not all experiments in food science yield products that can be eaten. **Never sample products in an experiment unless your leader says they are safe to eat.**
7. Records are an important part of any scientific project. You should write down what happens in each experiment. Experiments may not turn out exactly the same every time. Recording your results will help you and others who may try to repeat your experiment.



## EXPERIMENT 1

# From Liquid to Solid

Custard is a mixture of eggs, milk and sugar that has been heated to coagulate the protein in the eggs and milk. Custards need to be cooked properly or the egg protein will overcoagulate. In this experiment, you will see what happens when egg protein overcoagulates. You will also discover the best method for cooking custard.



### INGREDIENTS

- 3 eggs
- 1/2 cup sugar
- 1/8 teaspoon salt
- 1 teaspoon vanilla extract
- 2 cups milk
- hot water

### EQUIPMENT

- 6 custard cups or other oven-proof cups
- 2 baking pans, 2 inches deep
- 1 quart mixing bowl
- electric beater or rotary egg beater
- measuring cups - liquid and dry
- measuring spoons
- 2 pot holders
- knife
- 2 paper plates
- marker
- cooling racks

### PROCEDURE

1. Preheat the oven to 350°F.
2. Combine the eggs, sugar, salt and vanilla extract in the mixing bowl with the beater. Slowly beat in the milk. Divide this mixture equally into the six custard cups.
3. Place three of the cups in the baking pan and pour **hot** water around the cups to 1 inch deep. Place the other three cups in the other pan but **do not** add hot water. Place both pans in the oven.
4. Bake the custards for about 45 minutes. Test the custards baked in water for doneness by putting the tip of a sharp knife into the center. If the knife comes out clean, the custards are done. If the knife is coated, let the custards bake a little longer.
5. Remove both the pans from the oven at the same time. Take the cups out of the water immediately and place on cooling racks. Be careful when taking the custard cups out of the water. They will be hot! Label one paper plate "baked in water" and label the other "baked without water." Put the custards on cooling racks next to the appropriately labeled paper plate. Let all six cups cool about 20 minutes.
6. Run a knife around the edge of each cup. Turn the custards out onto the labeled paper plates. Cut each custard in half vertically and record what you see. Also taste the custards and record any difference in flavor.

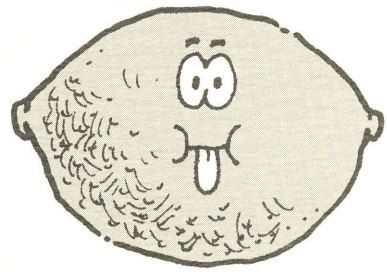
	Appearance	Texture	Flavor
Baked in water			
Baked without water			

7. See if you can answer these questions based on what you observed:
  - Why does the thin liquid custard mixture thicken and set into a firm product when heated?
  - What differences in appearance did you notice between the custards baked in water and the ones baked without water?
  - Which method of baking is the best method for custard? Why?Turn to page 8 for an explanation of **From Liquid to Solid**.

## EXPERIMENT 2

# The Sour Secret

Besides cooking, an acid such as vinegar or lemon juice can be added to a protein food to cause protein coagulation. You can tell that coagulation has occurred if solid particles form in a liquid that contains protein, such as milk. Give it a try.



### INGREDIENTS

- 1/2 cup milk
- 1 1/2 teaspoons vinegar or lemon juice

### EQUIPMENT

- measuring cup - liquid
- measuring spoons

### PROCEDURE

1. Put the milk in the measuring cup.
2. Add the vinegar or lemon juice to the milk and stir.
3. Let the mixture stand for 10 minutes. Record what you see.

4. Now stir the milk again. Do the solid materials dissolve? \_\_\_\_\_ This coagulated milk is also called "sour milk." This does not mean it is spoiled! It means that its flavor has changed. You can now use this milk in a recipe that has sour milk as one of the ingredients.

5. See if you can answer these questions based on what you observed:

- Can you tell if the protein has been changed? If so, how?
- You are making a banana bread that calls for 1 cup sour milk as one of the ingredients. What can you do to make milk sour?

Turn to page 8 for an explanation of **The Sour Secret**.

## Hidden Cheeses



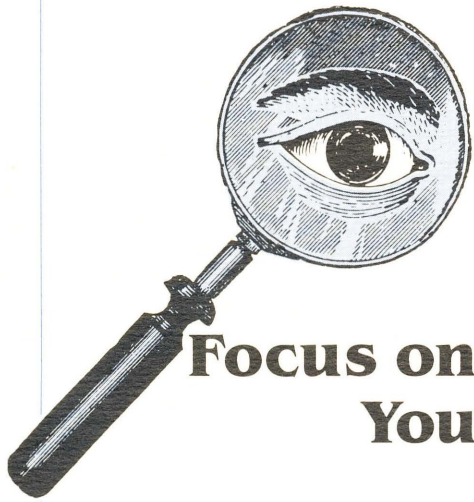
**Directions:** Cheese is a dairy food that comes in a variety of types. Each cheese in the list below is hidden in the diagram. Look for words backwards, forwards, horizontally, vertically and diagonally. Circle each word as you find it. Put a star next to the cheeses in the list that you have tasted.

MOZZARELLA	BRICK
PARMESAN	EDAM
MUENSTER	COTTAGE
SWISS	BLUE
CHEDDAR	RICOTTA
COLBY	

Turn to page 8 for the answer to this puzzle.

S	I	M	C	O	T	T	A	G	E
T	B	O	U	S	S	I	W	S	X
A	N	Z	P	E	B	R	P	I	Z
T	V	Z	O	W	N	D	M	Y	T
T	P	A	R	M	E	S	A	N	P
O	S	R	D	S	D	X	T	S	O
C	H	E	D	D	A	R	T	E	B
I	O	L	M	B	M	I	W	R	R
R	L	L	Q	O	L	C	W	T	I
Y	O	A	B	P	X	U	M	N	C
E	N	M	I	Y	T	S	E	Q	K





## Focus on You

**Q.** I like soft drinks. Why can't I just drink them instead of milk?

**A.** Probably the easiest way to answer this question is to have you look at the information on a can of soft drink and a carton of milk.

- What ingredients are listed on the soft drink can?

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- What nutrients can you expect to get from a soft drink?

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- What ingredients are listed on the milk carton?

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- What nutrients can you expect to get from milk?

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As you can see, there's quite a difference between the two!

Do you know how many calories are in a soft drink? You can expect to get about 145 calories in a 12-ounce cola type soft drink and **no** other nutrients. Compare the calories in the soft drink with the milk. What can you do if you want to reduce the calories in the milk you drink? \_\_\_\_\_

When you looked at the soft drink can, you probably found caffeine listed as an ingredient. Caffeine is a stimulant drug. It increases many of the life processes like your heart rate and blood pressure. Sometimes if you have consumed several soft drinks, coffee and teas, and have eaten foods such as chocolate, you may feel jittery and nervous. This could be because your body is having a hard time adjusting to the amount of caffeine you have consumed. If you drink diet soft drinks, you get no calories but you do get caffeine, unless you choose a decaffeinated product.



## Mystery Message

List the underlined words you found throughout this book printed in blue:

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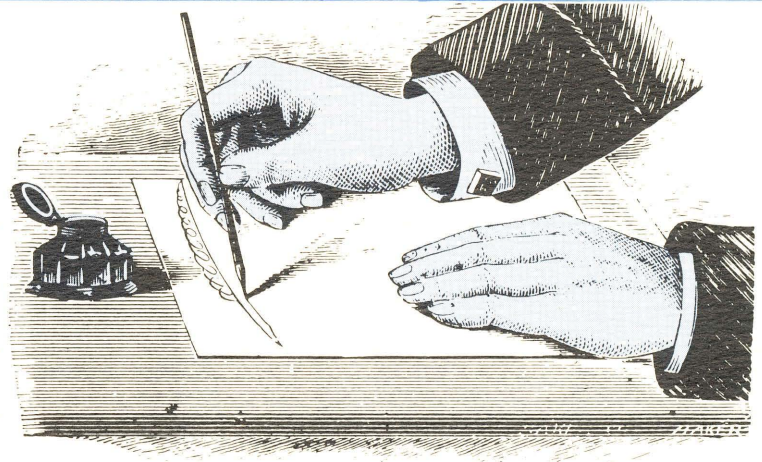
Unscramble them to solve the mystery sentence:

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Turn to page 8 to see if you correctly solved the Mystery Message.



# Record What You Learned:



Name \_\_\_\_\_

Age \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Experiments I tried:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ideas I learned from the experiments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Things I learned about nutrition:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Other food and nutrition activities I'd like to try:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



# How Did You Do?

The following are answers to the puzzles and explanations for the experiments found in this book:

## Dairy Foods Focus (page 2)

1. Heavy whipping cream. This can really add calories to those special recipes!
2. Yes - 302 milligrams.
3. Calories and fat.
4. Two percent milk is lower in calories and higher in calcium than ice cream.

## Explanation: From Liquid to Solid (page 4)

Baked custards should be cooked by placing custard cups in a pan of hot water to protect

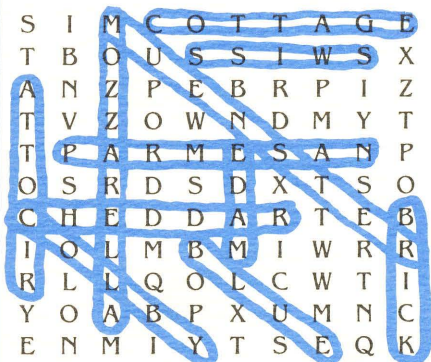
the custard from overheating which would cause the egg protein to overcoagulate. However, to prevent the custard from overcooking, the custard cups should be removed from the oven and water as soon as the custard coagulates.

The custard is done or coagulated when the tip of a sharp knife inserted in the center comes out clean. An overcooked custard will leak liquid when cut and feel tough to the touch. It also might have small bubbles on the outer surface and small holes inside. The tops are usually browner on overcooked baked custards and there may be a slight flavor difference. Overcooking can produce a caramel-like flavor.

## Explanation: The Sour Secret (page 5)

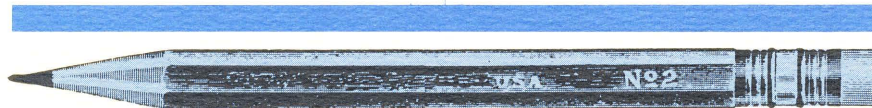
Acids such as vinegar or lemon juice cause the protein in milk to coagulate and separate out from the milk. These solid materials will not dissolve when stirred. This "secret" can be used to make sour milk from fresh milk for use in recipes in which sour milk is one of the ingredients.

## Hidden Cheeses (page 5)



## Mystery Message (page 6)

Dairy products have calcium for bones and teeth.



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. This publication was designed by Marian Reiter, 4-H Graphic Artist, and edited by Janet R. Olsen, 4-H Publications Editor.

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