Food Mysteries – Case 3: Vegetable Magic

Michigan State University Cooperative Extension Service
4-H Club Bulletin

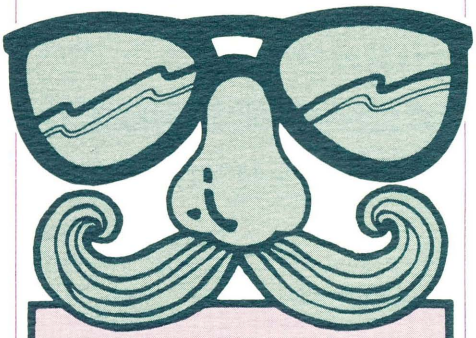
Stella Cash, Foods Science and Human Nutrition; Patricia A. Hammerschmidt, 4H Food program; Ruth L. Eggert, Program Leader

Issued July, 1987
8 pages

4-H 1419

Food Mysteries

Food Fridge



BE A DETECTIVE!

Solve the Mystery Message

Throughout this book, you will find several underlined words printed in purple. Collect these words and place them in the space provided on page 7. Unscramble the words to solve the mystery message about vegetables.

All your life, you have probably been told to eat your vegetables! But why? Vegetables taste great, add color and variety to meals, and are low in calories. Many vegetables are also packed with vitamins. List your four favorite vegetables:

_____

_____

_____

_____

Many vegetables are good sources of vitamin A, and some provide vitamin C. Vitamin C is used by the body for healthy gums, for fighting infections and for healing wounds. Vegetables also add fiber to the diet. You may know that fiber is needed in the diet to help the digestive system work properly. But why do you need vitamin A?

Do You Want To Know More?

The **Red Cabbage Tells the Tale** experiment (page 5) will teach you about the acids and bases found in foods.

Vitamin A is needed for growth, healthy skin and good vision at night. If you do not get enough vitamin A, you may not be able to see well in dim light. This is especially important when you go from a place with bright lights into a dark place. Can you think of examples of this? Do your eyes adjust easily when you go into a dark movie theater? Think how dangerous it could be if you were driving a car at night and your eyes could not adjust to the bright headlights of a car coming toward you!

(continued on next page)

You can find vegetables with vitamin A by looking at their color. The color of vegetables is due to different coloring materials in the vegetables called **pigments.** Vegetables have color pigments just like you have in your skin. Following are the names of these different color pigments in vegetables. Some of these same pigments also give fruits their rainbow of colors. See if you can name three vegetables that are the color of each pigment.

Pigment	Color(s)	Name the Vegetables
Chlorophyll (KLOR-o-fill)	Green	
Carotenoids (Ka-ROT-in-oids)	Yellow and orange	
Anthocyanins (an-tho-SY-a-nins)	Red, blue and purple	
Anthoxanthins (an-tho-ZAN-thins)	White	

Turn to page 8 for some examples of vegetables that have those colors.

Vitamin C Veggies

Besides being packed with vitamin A, some vegetables also contain vitamin C. Broccoli, brussels sprouts, cauliflower, collards and potatoes all contain vitamin C. Because people in the United States eat so many potatoes, the potato may actually provide us with up to 20 percent of our vitamin C.

The main sources of vitamin A in the diet are foods that contain the carotenoid color pigments. The pigment is changed to vitamin A in the body. You can find carotenoids in dark green, deep yellow and orange vegetables and fruits. You may wonder why dark green vegetables are good sources of vitamin A since they are green rather than orange or yellow. Although these vegetables are green because of the chlorophyll that is present, they also contain the yellow/orange carotenoid pigment. The chlorophyll just covers up the presence of the carotenoid. Foods such as milk, cheese, butter and other dairy products, eggs and liver also provide vitamin A.

You should eat four or more servings of fruits and vegetables every day. It's important to include a dark green, deep yellow or orange vegetable or fruit every other day. This will supply you with the vitamin A your body needs. Remember to choose **dark** green vegetables. The **light** green iceberg lettuce that is often used in salads is **not** a good source of vitamin A. Look at the list you made earlier of your favorite vegetables. Did you include a dark green, deep yellow or orange vegetable?

Do You Want To Know More?

The Red Cabbage Riddle experiment (page 4) will help you discover more about the pigments found in vegetables.

Fast foods usually lack vitamin A. If your diet is mainly hamburgers, french fries and shakes, you may not be getting enough of this important vitamin. To add vitamin A to your meal at a fast food restaurant, you need to go searching for it! If you can find a salad bar and if you are a careful planner, you can get the vitamin A your body needs from a tossed salad. Dark green lettuce + fresh spinach + carrots + green pepper + broccoli = A GREAT SOURCE OF VITAMIN A!

Unscramble these vegetables that are good sources of vitamin A:

TRRACO = _____

KNIPUMP = _____

LLDSRAOC = _____

IBCOCLRO = _____

HSPCAIN = _____

Turn to page 8 for the answers.

The Salt Situation

Vegetables add a lot of variety to meals. They are available fresh, canned and frozen at the supermarket. Some food companies now can vegetables without adding salt to the product. Since many of us eat too much salt, eating canned foods without added salt will help decrease the amount of salt we get in our diets.

Salt is made of sodium and chlorine. Too much sodium from salt and other foods has been found to be a problem for people who have high blood pressure. The **Dietary Guidelines for Americans** is information written by nutrition and health experts and published by the government. The guidelines suggest that people should avoid too much sodium.

We cannot predict who will develop high blood pressure, but we know that many Americans eat much more sodium than they actually need. Therefore, many health professionals believe that reducing sodium is sensible for the population as a whole. Be careful about adding salt to your food and eating too many salty and processed foods.

Many seasonings other than salt can be added to vegetables. Try sprinkling dill weed on cooked carrots or parsley on potatoes. These herbs provide added color and flavor!

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.

Cooking for Keeps

After you decide which vegetables you want to eat and which spices and herbs to add, you need to think about how to retain each vegetable's color, flavor, texture and vitamins. B vitamins and vitamin C will easily dissolve in cooking water. If you put your cooking water down the drain, the vitamins will go down the drain too! These vitamins can also be destroyed by overheating.

To help lessen the loss of vitamins in cooking, here are several suggestions:

- Wash vegetables quickly but thoroughly to remove dirt, then peel only if necessary. Leaving the peel on helps protect the nutrients in some vegetables.
- Leave vegetables whole or cut them into large pieces so there will be less surface area for the nutrients to be touched by the water.
- Cook in a small amount of water.
- Cook covered with a tight-fitting lid to help cook quickly.
- Cook for a short time. (Overcooking destroys nutrients.)
- Serve immediately for the best flavor and texture.

EXPERIMENT 1

The Red Cabbage Riddle

Anthocyanins (red) and anthoxanthins (white) are two color pigments found in vegetables. When a base is added to these pigments, the anthocyanin turns blue and the anthoxanthin turns yellow.

Red cabbage is a food that contains both of these pigments. If you add baking soda (a base) to a red cabbage, you may be in for a surprise. Give it a try!

INGREDIENTS

- ☐ **Outer 3 leaves of red cabbage**
- ☐ **1 tablespoon baking soda**
- ☐ **water**

EQUIPMENT

- ☐ **saucepan**
- ☐ **sharp knife**
- ☐ **cutting board**
- ☐ **measuring spoons**
- ☐ **wooden spoon for stirring**

PROCEDURE

1. Shred the cabbage with the knife. Put the shredded cabbage into the saucepan and add just enough water to barely cover the cabbage.
2. Add the baking soda. Stir.
3. Bring the water to a boil. Lower the heat to medium and cook for about 5 minutes, stirring occasionally.
4. Observe any color changes and fill in the blanks below:

- What color did the water turn? _____
- What color did the red cabbage turn? _____

5. See if you can answer this question based on what you observed:
- Why do you think the cabbage changed color?

Turn to page 8 for an explanation of **The Red Cabbage Riddle**.

EXPERIMENT 2

Red Cabbage Tells the Tale

In **The Red Cabbage Riddle** experiment, you discovered that the pigments in red cabbage change color when an acid or a base is added. This ability to change color makes red cabbage useful as an **indicator.** An indicator is a substance that can show if other foods are acids or bases. The color of an indicator changes depending on whether a food added to it is an acid or a base.

Here's how you can make an indicator.

INGREDIENTS

- ☐ **1/2 of a red cabbage**
- ☐ **1 to 2 cups of water**
- ☐ **1/4 teaspoon vinegar**
- ☐ **1/4 teaspoon baking soda**

And all or some of the following:

- ☐ **1/4 teaspoon cream of tartar**
- ☐ **1 teaspoon fruit juice**
- ☐ **1 teaspoon cottage cheese**
- ☐ **1 orange section**
- ☐ **1 teaspoon soft drink**
- ☐ **1 slice tomato**
- ☐ **1 slice apple**
- ☐ **1 egg white**

EQUIPMENT

- ☐ **2 large bowls**
- ☐ **grater**
- ☐ **measuring cups - liquid**
- ☐ **strainer**
- ☐ **slotted spoon**
- ☐ **cutting board**
- ☐ **knife**
- ☐ **very clean glass jar**
- ☐ **3 white dishes or custard cups**
- ☐ **measuring spoons**
- ☐ **masking tape**
- ☐ **marker**

PROCEDURE

1. Cut the cabbage into quarters. Grate it section by section into a bowl. Be careful!

2. Add between one and two cups of water until the cabbage is covered. Let the cabbage stand in the water for about 10 minutes. Stir it occasionally so that all the cabbage is moistened.

3. When the water is a bluish-purple color, remove as much of the grated cabbage as you can with the slotted spoon. Put the cabbage you removed into the remaining large bowl.

4. Pour the bluish-purple water through the strainer into the glass jar.

5. Add the drained cabbage from the strainer to the rest of the cabbage you have removed.

6. Put one tablespoon of the bluish-purple water into a small, white dish. This bluish-purple water is now the "indicator."

7. Add 1/4 teaspoon of vinegar, which is an acid. Stir well. Indicate on the chart on page 6 the color the water turned. Label this sample "Indicator plus vinegar" and set aside for later comparison.

8. Put one tablespoon of the bluish-purple indicator into a second small white dish.

9. Add 1/4 teaspoon of baking soda, which is a base. Stir well. Indicate on the chart the color the water turned. Label this sample "Indicator plus baking soda" and set aside for later comparison.

10. Use the third white dish to test other foods. (Be sure to wash and dry it each time you test a new food.) Start with one tablespoon of the bluish-purple water each time you test a new food. Add the food you are testing to the bluish-purple water and note the color change on the chart. Decide whether each food tested reacted as an acid or as a base and check the proper column on the chart. You may want to compare the foods with your samples from steps 7 and 9.

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

- Do most foods react more like acids or more like bases?
- Why can red cabbage be used to test other foods to see if they are acids or bases?

Turn to page 8 for an explanation of **Red Cabbage Tells the Tale**.

(continued on next page)

Experiment 2 (continued)

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

Be a Supermarket Sleuth!

Go to the canned vegetable section at your supermarket and look for food labels that read "No Salt Added." Make a list of all the canned vegetables you find with this label.

_____

_____

_____

_____

Focus on You

Q My friend takes all kinds of vitamin pills every day. Should I be taking them too?

A Not necessarily. The best way to give your body all the nutrients you need is to eat a **variety** of foods every day. Vitamin pills are often expensive and can harm your body if taken in large quantities. If you are eating properly, the extra vitamins from the pills are not needed. But if you think that you may not be eating properly, and if you are considering taking vitamin pills, it is best to check with your doctor or a dietitian.

About Acids and Bases...

Many foods we eat contain acid which gives them a sour taste. Lemon juice and vinegar are examples of acids we eat. We also eat certain bases, although they are not as common as acids. Baking soda, for example, is a base when it is dissolved in water.

When you add a base, such as baking soda, to an acid food, the food will become less acid and more of a base. In some foods, this will cause the color of the food to change.

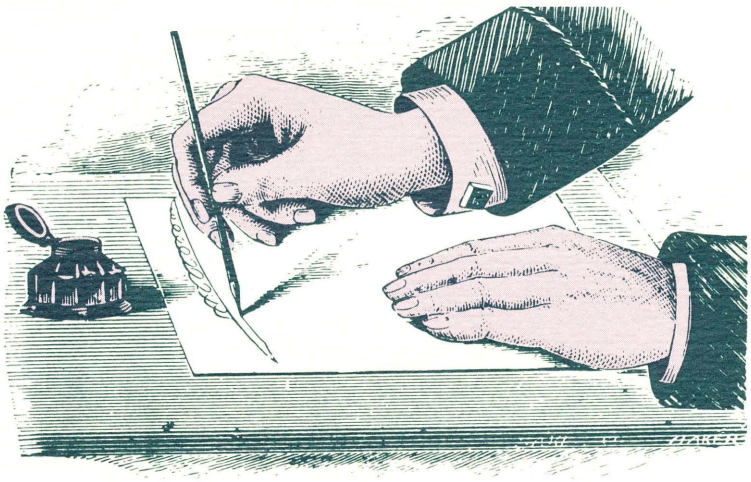
Mystery Message

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

Unscramble them to solve the mystery sentence:

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:

Name the Vegetables (page 2)

- Vegetables with the chlorophyll (green) pigment include green peppers, lettuce, asparagus, beet greens, turnip greens, mustard greens, spinach, collards, broccoli, brussels sprouts, green beans, kale and celery.
- Vegetables with the carotenoid (yellow and orange) pigment include carrots, pumpkins, sweet potatoes and winter squash.
- Vegetables with the anthocyanin (red, blue and purple) pigment include red cabbage, purple turnips, beets, radishes and red potatoes.
- Vegetables with the anthoxanthin (white) pigment include onions, leeks, cauliflower, white cabbage, parsnips and potatoes.

Unscramble the Vegetables (page 2)

TRRACO = CARROT
KNIPUMP = PUMPKIN
LLDSRAOC = COLLARDS
IBCOCLRO = BROCCOLI
HSPCAIN = SPINACH

Explanation: The Red Cabbage Riddle (page 4)

Red cabbage contains anthocyanins (red) and anthoxanthins (white). When a base such as baking soda is added to red cabbage, the anthocyanin pigment will turn blue and the anthoxanthin pigment will turn yellow. Since blue and yellow combine to make green, the red cabbage turns green.

Explanation: Red Cabbage Tells the Tale (page 5)

Red cabbage can be used to make an indicator solution. This is because the pigments in red cabbage change color when an acid or base is added. Most foods will react as an acid when the foods are added to a red cabbage indicator solution.

Mystery Message (page 7)

Dark green, deep yellow, and orange fruits and vegetables give your body vitamin A.

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.

This 4-H educational material was developed and printed through a grant from the Allen Foundation to the Michigan 4-H Foundation. The Allen Foundation, based in Midland, Michigan, provides funding to nutrition education and training programs. The Michigan 4-H Foundation is a public foundation which accepts charitable gifts and grants in support of 4-H youth work.

IP-5M-7:87-HP-JRO Price 40 cents