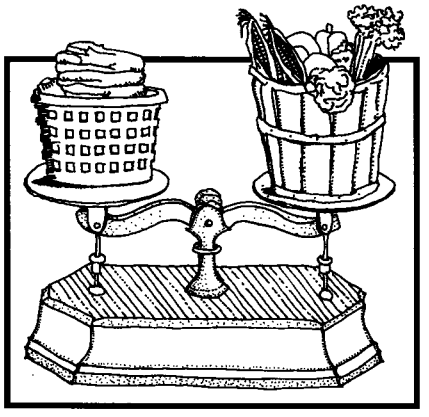
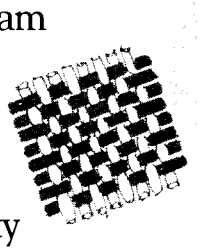
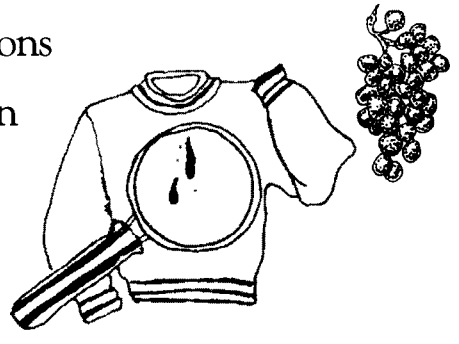
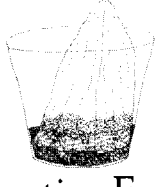


In-Touch Science: Foods & Fabrics

Contents







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Illustrations by Marcia Eames-Sheavly

Designer: Dennis F. Kulis

Editor: Susan E. Pohl

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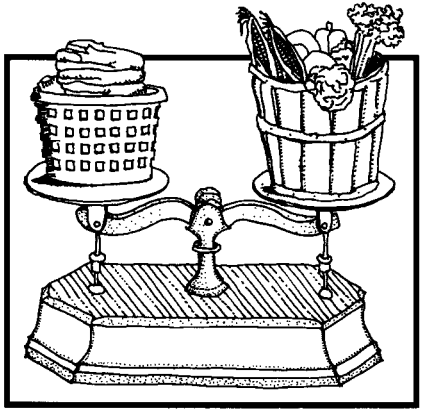


Session 5

Stain Away Gelling Discovery

These two experiments give children an opportunity to explore enzymes and their effects when laundering clothes and preparing foods. Both experiments integrate concepts introduced in previous experiments: parts of a whole, structure and change, properties of water, and chemical reactions.

In experiment 5A, "Stain Away," children make food stains on cotton fabrics and then observe the action of enzymes by trying to remove the stains with different detergents. This logically follows experiment 4A because stains are simply misplaced dyes. In experiment 5B, "Gelling Discovery," children observe the action of enzymes by making gelatin with different fruits.

Enzymes are substances that initiate many chemical reactions. They are components of many foods and laundry products. Using detergents that contain enzymes will make it easier to remove some stains. Using fruits that contain certain enzymes will prevent gelatin from setting.

The two experiments encourage children to be more curious about the many physical and chemical reactions that occur in foods and fabrics. These experiments are more challenging than the previous ones because each integrates several concepts and requires more manipulation of supplies.

Session at a Glance

- Things to Think About during the Experiment
- Focus
- Experiment
- Transition or Closure
- Supplies and Preparation
- Behind the Scenes Science

Experiment 5A

Stain Away

Plan Ahead

This session requires more planning than the others. Separating the experiments into two sessions may make a better experience for some children, but you will need to plan conversation or an activity for the 10-minute waiting periods.

These two experiments can be done successfully in a one-hour session, but you may want to allow 15 to 20 extra minutes the first time you do it. You will need two work areas: one for the fabric experiment and one for the food experiment. Each experiment contains one 10-minute waiting period, so you will be making the following transitions during the hour:

Stop after step 3 of experiment 5A.

Go to step 1 of experiment 5B.

Stop after step 8 of experiment 5B.

Go to step 4 of experiment 5A.

Stop at the end of experiment 5A.

Go to step 9 of experiment 5B.

Things to Think About during the Experiment

Work together

Guide the children through the experiment by demonstrating procedures and encouraging conversation about what they are doing and observing. Use the questions as a guide, not a script to be followed.

I wonder. . .

Encourage children to wonder about what happened or didn't happen while doing this experiment. For example, you might wonder

why some stains didn't come out.

if more washing would remove the stains.

what would happen with hotter water.

Make a list of all the "I wonder. . ." statements that you and the children can think of together. Save the list to talk about again after completing the experiment(s).

Talk about

This experiment introduces the terms "stain," "detergent," "oxygen bleach," and "enzymes." A stain results when a substance reacts chemically with fabric to create a spot of unwanted color. All stains are difficult to remove. A detergent is a cleaning product that helps remove soils and stains from fabric. Enzymes and oxygen bleach in detergents enhance removal of some stains. Different stains require different treatments. Try to provide one or more detergent labels for children to read and compare.

Stain Away

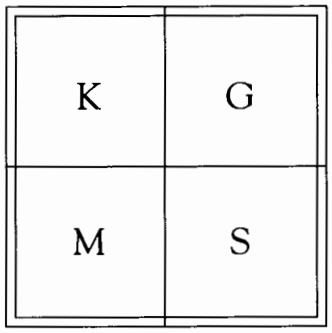
Focus

Show a stained article of clothing or fabric. Say,

> "Tell me something about this T-shirt. What might have caused this stain? What could you use to get out stains? We're going to make some food stains on cotton fabric. Then we'll do an experiment to try getting them out with different detergents."

Getting Ready to Experiment

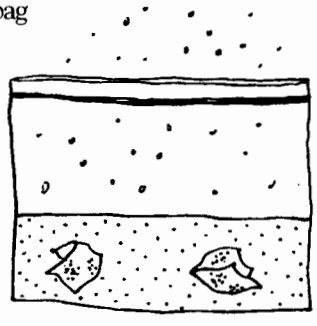
- Use newspapers or a plastic tablecloth to protect the work area.
- Mark two cotton fabric samples (4-x-4-inch swatches) as shown. Each sample is divided into four parts, labeled K (ketchup), M (mustard), G (grape juice), and S (soy sauce).



- **Know how to handle detergents safely.**

Experiment

1. Using a cotton swab, apply a *small* amount of ketchup to each fabric sample. Rub the ketchup firmly into the fabric, making a stain about the size of a quarter.
2. Repeat step 1 using a clean swab for mustard, grape juice, and soy sauce.
3. Allow the stains to set for at least 10 minutes.
4. Prepare two "washing machines." Place about 1/2 teaspoon of a detergent that contains cleaning enzymes and oxygen bleach (such as Tide with bleach) in a resealable bag labeled "E & B." In an unlabeled bag place 1/2 teaspoon of a detergent that does *not* contain enzymes or bleach (such as Arm & Hammer).
5. Add hot tap water to fill one detergent bag about one-quarter full (about 1/2 cup). Place one stained fabric in the bag. *Push out the excess air while closing the bag.* Set aside and repeat with the second bag, adding the other stained fabric.



6. *Check that the bag seals are secure.* Squeeze, roll, or shake the bags gently for 5 minutes to simulate a washing machine. Keep the bags over your work area.
7. Open one bag and remove the fabric sample. Pour the detergent water into a sink or dump container.
8. Spread out the empty bag and lay a paper towel on top of it.
9. Rinse the fabric in a dishpan of cool water. Spread the fabric on the paper towel to dry. The empty bag under the towel reminds you which detergent was used.
10. Repeat steps 7–9 with the second bag and fabric sample.

Conversation

Questions You Might Ask

- How long do stains set in clothes before laundering?
- What do you think is in detergent?
- How does the water change as you agitate the bag?
- How are the stains changing?
- What do you think enzymes do to stains?
- What do you think bleach does to stains?
- What would happen if you used cold water?
- What would happen if you didn't agitate the bag?
- What happened to the stains after 5 minutes?
- Which detergent is the better stain remover?
- Which stains were difficult to change?

Transition or Closure

If you are doing only experiment 5A, remember to review the "I wonder. . ." statements. If you do experiments 5A and 5B together, move to Focus 5B and the food experiment after step 3 of the fabric experiment (see "Plan Ahead" on page 54).

Experiment 5A

Stain Away

Supplies and Preparation

Individual items are listed. Multiply as needed for total supplies.

Focus

- ❑ stained piece of clothing or fabric

Experiment

- ❑ cotton fabric swatches (2 per person)
- ❑ permanent pen or marker
- ❑ ketchup
- ❑ grape juice
- ❑ mustard
- ❑ soy sauce
- ❑ cotton-tipped swabs
- ❑ resealable plastic bags (2 per person)
- ❑ detergent *without* enzyme and bleach
- ❑ detergent *with* enzyme and bleach
- ❑ plastic spoon
- ❑ pitcher of hot tap water
- ❑ dishpan of cool water (2 per group)
- ❑ paper towels
- ❑ newspaper or plastic tablecloth

- Cut 4-x-4-inch swatches of cotton plain weave fabric (see fabric cards located in the back of this publication).
- Have the children mark the fabric as described (p. 55). You may choose to provide premarked fabric.
- Individual packets of ketchup, mustard, and soy sauce are convenient.
- If children have difficulty handling both ends of the cotton swabs, cut the swabs in half.
- Food storage bags are usually sturdier than sandwich bags and will withstand enthusiastic agitation. The type with a color-change closure makes it easy to tell when the bags are sealed.
- Peanut butter jars or other containers with tight-fitting lids are good substitutes for bags.
- Choose two types of detergent, one with enzymes and bleach and one without. Tide with bleach and Dreft are examples of detergent *with* cleaning enzymes and oxygen bleach. Arm & Hammer, Ivory Snow, and All are examples of detergent *without* cleaning enzymes and oxygen bleach. Detergents with only cleaning enzymes include Wisk, Bold, Cheer, Tide, ERA, and Surf. A detergent with only oxygen bleach is Bright Water. **Read labels carefully because ingredients change often.**
- You may choose to prefill detergent bags. Each bag should contain about 1/2 teaspoon of detergent. Label one bag "E&B" (enzyme *and* bleach).
- Detergents may irritate the skin. Avoid extended contact with detergent, and rinse hands in clean water after the experiment. Disposable plastic gloves may be helpful for people with skin sensitivities.
- Half-gallon milk or juice containers work well for pouring warm water.

Experiment 5A

Stain Away

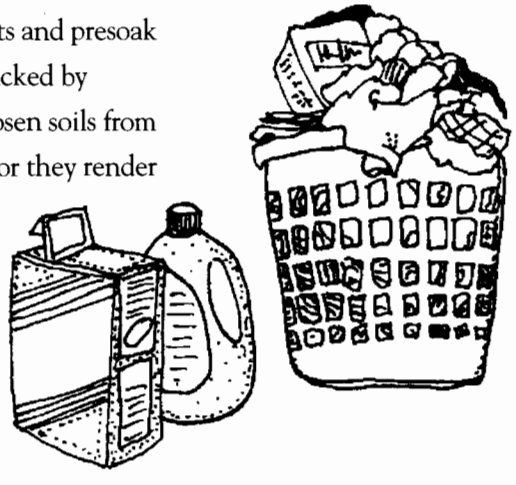
Behind the Scenes Science

Staining is the unwelcome appearance of color on a fabric. Stains come from many sources, especially food. Different foods create stains of different colors and different degrees of tenacity. All stains are the result of a chemical reaction between the staining substance and the fabric. And all stains are a challenge to remove.

How much of a challenge depends on the chemical nature of the fiber and food, the length of time the stain has set, and the staining, storage, and cleaning conditions. The standard advice for removing stains is to follow the "three P's of stain removal"—promptness, patience, and perseverance. Using the correct cleaning product may mean that you can skimp just a little on the three P's.

Stains differ from common laundry soils, which do not react chemically with the fibers and are easier to remove. For example, rinsing in water will remove an ordinary water-soluble soil such as sugar. Soaps or detergents will remove soils that do not dissolve in water such as oil, clay, proteins, and some dyes. Soaps and detergents aid cleaning by lowering the water's surface tension. Decreased surface tension allows the water quickly to wet and penetrate the fabric. Detergents then loosen, emulsify, and suspend soils by forming a bridge between the water and the insoluble soils. As the wash water goes down the drain, it drags along the detergent and the detergent drags along the soil.

Stain removal requires stronger products such as cleaning enzymes, bleach, or specialty solvents. Cleaning enzymes are included in some detergents and presoak products. They break stains into simpler forms that can then be attacked by detergents. Chlorine and oxygen bleaches whiten, brighten, and loosen soils from fabrics. They break the connection between the stain and the fiber or they render the stain colorless through oxidation. Oxygen bleach is added to some detergents; it is also sold as a separate product (nonchlorine or all-fabric bleach). Chlorine bleach is not added to detergent; it is sold separately. All bleaches can damage fabric. To minimize damage, carefully follow the manufacturer's directions printed on the product label. Specialty solvents for stubborn stains such as mustard and rust are also available.



Experiment 5B

Gelling Discovery

Things to Think About during the Experiment

Work together

Guide the children through the experiment by demonstrating procedures and encouraging conversation about what they are doing and observing. Use the questions as a guide, not a script to be followed.

I wonder. . .

Encourage children to wonder about what happened or didn't happen while doing this experiment. For example, you might wonder

what would happen if you heated kiwi.

what other fruits cause gelatin not to gel.

why fruits have enzymes.

Make a list of all the "I wonder. . ." statements that you and the children can think of together. Save the list to talk about again after completing the experiment(s).

Talk about

This experiment introduces the terms "gelatin," "gel," and "enzyme." Gelatin is a protein product. After the granules swell and dissolve in water, the gelatin forms a semirigid gel. Fruits contain many enzymes. One type of enzyme breaks down protein, thus preventing gelatin from setting (gelling).

Experiment 5B

Gelling Discovery

Focus

Show a box of powdered gelatin. Say,

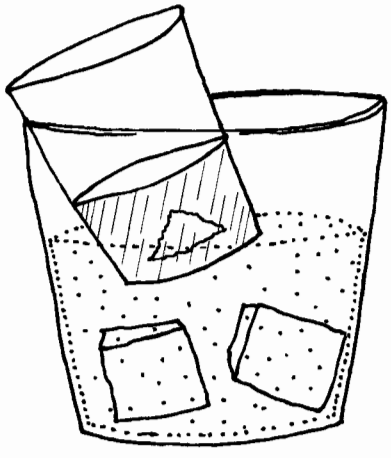
> "Tell me something about this. Have you ever prepared gelatin? How does it change after setting in the refrigerator? What can you add to it? (fruits, vegetables) Let's do an experiment to find out what happens when you mix different fresh fruits with gelatin."

Getting Ready to Experiment

- Use newspapers or a plastic tablecloth to protect the work area.
- **Know how to handle sharp knives safely.**

Experiment

1. Pour 2 tablespoons of cold water into a 9-ounce plastic cup.
2. Sprinkle a small spoonful (about 1 teaspoonful or half a packet) of unflavored gelatin over the cold water. Let stand about a minute, observing what happens.
3. Add 1/4 cup hot water (two medicine measuring cupfuls) to the gelatin. Stir until completely dissolved.
4. Divide the gelatin solution evenly among the four 3-ounce cups. Set the 9-ounce cup aside to use again in step 7.
5. Cut a small chunk of fresh pineapple, kiwi, and banana.
6. Add the fresh pineapple to the first cup, kiwi to the second cup, banana to the third cup, and a piece of canned pineapple to the fourth cup.
7. Make ice baths from four 9-ounce cups. Fill each about half full with cold water and add two ice cubes.
8. Place each 3-ounce cup of gelatin into one of the ice baths. Let stand at least 10 minutes.
9. Remove the small cups from the ice baths. Jiggle each cup to compare the firmness of gelatin mixtures.
10. Pour the contents of each cup onto a paper towel, using a knife as needed to loosen the mixture. Examine the mixtures.



Conversation

Questions You Might Ask

What happens when you add gelatin to cold water?

What happens when you add hot water?

What would happen if you didn't stir the mixture?

Tell me something about the fruits.

What do you think will happen after 10 minutes?

What happened with each sample?

Why do you think this happened?

How are fresh and canned pineapple different?

What would happen if you heated kiwi?

What other fruits could you test?

Closure: Connecting Food and Fabric

If you are doing only experiment 5B, remember to review the "I wonder. . ." statements. If you do both experiments in one session, talk with the children about how the experiments helped them to think about enzymes and the physical and chemical reactions that occur with food and fabrics. Ask, "What did you enjoy about these experiments? What did you learn about fabrics and foods?"

Show the list of "I wonder. . ." statements for both experiments. Say, "Often when scientists do experiments, they come up with lots of new ideas or questions. Which one is the most interesting to you? How could you find out more about it?"

Experiment 5B

Gelling Discovery

Supplies and Preparation

Individual items are listed. Multiply as needed for total supplies.

Focus

- ❑ box of gelatin

Experiment

- ❑ fruit
- ❑ unflavored gelatin
- ❑ pitcher of cold water
- ❑ pitcher of hot water
- ❑ ice cubes
- ❑ plastic spoon
- ❑ knife, plastic serrated or paring
- ❑ 3-ounce plastic cups (4 per person)
- ❑ 9-ounce plastic cups (4 per person)
- ❑ can opener
- ❑ paper towels
- ❑ newspapers or plastic tablecloth

- Purchase one of each: fresh pineapple, canned pineapple, kiwi, and banana.
- We recommend using the above foods for the first experience, but the following substitutions are possible: fresh and cooked kiwi instead of fresh and canned pineapple; cooked fresh pineapple for canned pineapple. Cut 10 small pieces of kiwi or fresh pineapple and microwave about 1 minute. These substitutions are not recommended for the first experience because freshness of the fruit and cooking time or temperature influence results. You may have to "mess around a bit" to observe differences.
- Unflavored gelatin will set faster than flavored gelatin products. One package contains about two teaspoons, which is enough for two participants. Because children may be less familiar with unflavored gelatin, you may want to use flavored gelatin for the focus activity.
- It is not important to measure exactly 1 teaspoon of gelatin. A small plastic spoon works well as a measuring tool.
- Gelling time is minimized by using an ice bath and making small batches of gelatin. The proportions of water and gelatin and the water temperature were altered from package directions to make it easy for each child to prepare samples.
- An adult could pour the hot water.
- Store the ice cubes in a small cooler or ice bucket if a freezer is not convenient.
- Half-gallon milk or juice containers work well for pouring both hot and cold water.

Experiment 5B

Gelling Discovery

Behind the Scenes Science

After exploring the role of enzymes in laundry detergent, this experiment shows children that enzymes are also in foods. This experiment examines one type of enzyme in fruits that prevents gelatin from setting.

Enzymes are biological substances (usually proteins) found in plants and animals that initiate a wide variety of reactions. The actions of some enzymes influence how we handle, store, and prepare foods. Enzyme reactions include browning of cut fruits, flavor changes in fruits and vegetables, and the breakdown of protein that prevents gelling of a gelatin mixture.

Fresh pineapple is the fruit most commonly known for having an enzyme (bromelin) that prevents gelatin from setting. Other fresh fruits and the enzymes that prevent gelling are kiwi (actinidin), papaya (papain), and figs (ficin). Only the papain in unripe papaya prevents gelatin from setting. Because heat inactivates the enzyme, cooked or canned fruit can be successfully mixed in gelatin.

The "Gelling Discovery" experiment provides opportunities for many observations in addition to enzyme activity. The process of making gelatin involves interaction of a powdered substance with water. Dried gelatin is allowed time to swell in cold water. This swelling increases the ease with which gelatin can be dispersed when hot water is added. Hot water and stirring help to dissolve the dry gelatin particles thoroughly by creating the framework for a semirigid gel to form when the mixture cools.