



**Food Safety**  
**from**  
**Farm**  
**to**  
**Fork**



**An Interdisciplinary Educational Unit for Grades 5-7**



# Why Teach About Food Safety?

Americans enjoy the safest food supply in the world, yet the most common intestinal ailments in the United States are caused by foodborne illnesses. How can this be?

## Food Handling Is The Key!

This unit provides fifth through seventh graders a better understanding of food safety through real-life examples and enjoyable activities. They learn that everyone has a responsibility in minimizing food-

**The majority of foodborne illnesses associated with fresh fruits and vegetables is due to improper food handling at the foodservice or consumer level.**

borne illnesses — farmers, transporters, restaurants, grocery stores...and the consumer! Through reading, games, puzzles, math problems and science investigations, participants identify the roles each one of us plays to ensure the food we enjoy is safe to eat.

Food gathering and preparation have changed over time. Americans have gone from growing and preparing their own food to enjoying convenience foods grown by a fewer number of farmers and prepared by someone other than themselves. Thus food safety practices are important in every stage of food production, preparation, and consumption. Here are a few examples of food safety practices from each area.

## The Farm

GAPs were developed jointly by industry and the government and provide guidelines that reinforce already stringent laws governing food safety on U.S. farms.

**Only two percent of foodborne illness outbreaks can be traced back to the growing, packing, shipping, or processing of fruits and vegetables.**

## The Food Handlers

Grocery stores, transportation companies, storage facilities and restaurants have food safety rules and require employees to abide by them. Stringent regulations imposed by national, state and local governments, based on sound science, ultimately benefit the consumer.

**Did you know? It is common to find bacteria on produce, but this bacteria is not harmful to people.**

## The Consumer

This educational guide is part of a consumer food safety education program. The consumer, the person who eats the food, is responsible for making sure that the food is prepared and stored properly. This is crucial since most foodborne illness outbreaks are associated with improper handling at the restaurant or home.

So take a look through the guide. See how you can use it to teach your students about foodborne illnesses and reduce the number of foodborne illness incidents.

At the same time your class will practice reading and writing, investigate and experiment, apply math to real situations, and practice thinking critically about a topic that impacts all of us daily — food safety!

**Nutrition! Throughout the lessons, discuss the importance of eating right. The human body has natural defense mechanisms that work best when we eat right, get plenty of exercise, drink lots of water and get enough sleep!**

## Links to Content Standards for California Public Schools

Students learn and retain information best when they can relate what they learn in the classroom to their personal lives. This multidisciplinary, thematic unit on food safety includes lessons that teach or reinforce many educational Content Standards for California Public Schools. Each activity includes a listing of the specific content standards addressed. Refer to the California Department of Education Website ([www.cde.ca.gov](http://www.cde.ca.gov)) for descriptions of the educational standards.

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# SAFE

## Description

Students will learn the basic science of food safety and the importance of safe food practices while playing a board game, performing “fact or opinion” and “cause and effect” activities, and then writing an essay on what they learned.

## Activity

- 1 Explain that students will learn about the science of food safety.
- 2 Discuss the differences between “facts” and “opinions.” Select students to read dictionary definitions of these two terms.
- 3 Have students number a piece of paper from 1-6. Instruct them to listen to the statements that you read to them. They are to write an “F” next to the number if they think the statement is a fact, and an “O” if the statement is an opinion. Read the statements below, one at a time, and have the students record their answers. Discuss the answers.

### FACT OR OPINION?

- F  O 1. People should only eat cooked foods since, according to a media report, all bacteria in food are harmful.
- F  O 2. Microorganisms can live almost anywhere, even in food.
- F  O 3. To maintain your health, it is important to eat five or more servings of fruits and vegetables per day.
- F  O 4. A single bacterium is too small to see without a microscope.
- F  O 5. Scientific research has shown that the mishandling of food by the person who prepares or eats it accounts for most foodborne illnesses.
- F  O 6. People should not eat fresh foods since your aunt says they can carry bacteria like *E. Coli* and *Salmonella*.

- 4 In preparation for the game, orally read *What’s All the Talk About Food Safety?*
- 5 Create groups of three to four students. Explain *Playing it Safe* and then have the students play the game.

### Directions:

- a. Shuffle the playing cards and place them face down on the board.
  - b. Place the sponge markers on “Start.”
  - c. The first player draws a card from the top of the stack, reads it aloud, and then moves the number of spaces directed. All students should listen to the fact stated on the card, making a mental note that the statement is indeed a “fact.” If a person must move “back” but is already on “Start,” then the player should remain on “Start.”
  - d. The next player takes a turn. Continue until one player crosses the finish line. Reuse the cards, if necessary.
- 6 Remind students that a “cause” is something that makes something else happen. What happens is the “effect.” Have groups do the *Cause and Effect* activity located on the game board. Students should agree on the answers and discuss as a class.
  - 7 Have each student write a three paragraph essay that covers the following information. Once written, have students edit for proper grammar, spelling, and punctuation, including capitalization.
    - a. What is food safety and why is it important to use safe food practices?
    - b. Define “foodborne illness” and provide specific examples of foodborne illnesses.
    - c. Describe several things a person could do to prevent foodborne illnesses.

## Time

One 50-minute session

## Materials

For teams of 3-4:

- Four ½" pieces of sponge; four colors
- *What’s All The Talk About Food Safety Student Page* (page 4)
- *Playing It Safe! Game Board* (page 5)
- *Playing It Safe! Game Cards* (page 6)

## Content Standards for California Public Schools Links

### English-Language Arts

#### Grade 5

Reading 2.5  
 Writing 1.0, 1.2  
 Written and Oral English Language Conventions 1.0, 1.4

#### Grade 6

Reading 2.2  
 Writing 1.0, 1.2  
 Written and Oral English Language Conventions 1.0, 1.4

#### Grade 7

Reading 2.3  
 Writing 1.0, 1.2  
 Written and Oral English Language Conventions 1.0, 1.6

### CAUSE & EFFECT ACTIVITY ANSWER KEY

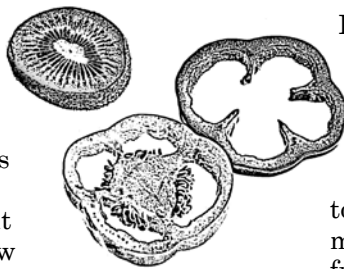
No.	Cause	Effect
1	not refrigerated	turned sour
2	washed hands	healthful salad
3	warm summer temperatures	more foodborne illnesses
4	added rennet (bacteria)	made cheese
5	core in bin	decomposed to compost

# What's All the Talk About Food Safety?

Did you ever have an upset stomach or something that people call the 24-hour flu? If your symptoms lasted less than a day, chances are your brief illness was caused by a foodborne illness. You will learn about ways you can minimize the number of foodborne incidents you have in your lifetime.

## WHAT IS A FOODBORNE ILLNESS?

A **foodborne illness** is a disease that is carried to animals or humans by food. Foodborne illnesses are caused by microorganisms such as bacteria. Not all bacteria cause disease in humans. Those that do are called **pathogens**. They grow rapidly when conditions are right — dark, damp places where temperatures range between 40° F and 140° F. Any type of food can be a source of a foodborne illness; however, high protein foods are responsible for most of them. Examples include milk and milk products, eggs, meats, poultry, fish, seafood, and soy protein food such as tofu.



## WHAT IS FOOD SAFETY?

**Food safety** is the practice of making sure that people have the healthful food they need for an active, healthy lifestyle. Some foods, particularly fresh fruits and vegetables, are not cooked before we eat them. These foods must be handled correctly to make sure they are safe to eat. The Centers for Disease Control reports the majority of foodborne illnesses associated with fresh fruits and vegetables are due to improper food handling at the foodservice or consumer level. They are contaminated with pathogens and then not cooked or stored properly. Since you handle food, you can do your part to keep your food safe.

## WHAT IS A MICROORGANISM?

Microorganisms, also known as microbes, are single-celled organisms so tiny that millions of them can fit between the eye of a needle. Individually, they can only be seen with a microscope. Colonies of microorganisms, such as mold on bread, may be visible with the eye alone. Common microbes associated with foodborne illnesses are bacteria.



## WHO IS RESPONSIBLE?

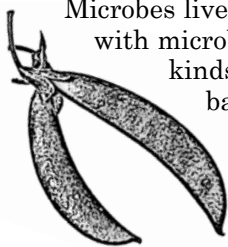
All people have a personal responsibility to keep food safe. Farmers are the first people responsible for producing healthful food. They must know how to plant, cultivate, irrigate, harvest, and store the food so that the final product is safe for the consumer. Farmers are responsible for making sure that the people involved in their operations follow the guidelines established by the United States Department of Agriculture (USDA). In the 1990s, the agricultural industry adopted some guidelines called GAPs—Good Agricultural Practices—that keep food safe at the farm level.

People who pack, process and transport food must make sure that food is kept at proper temperatures, and handled and washed appropriately. Storage facilities must be kept clean. Grocers and those who prepare and serve food at restaurants are responsible for using proper food safety procedures. You, the at-home consumer, must do your part too! It requires teamwork.

## BENEFICIAL MICROBES

Microbes live almost everywhere! In fact, you are covered with microbes inside and out! Your mouth contains over 600 kinds! Your large intestine contains *Escherichia coli*, a bacterium. *Lactobacillus acidophilus* turns milk into yogurt. *Saccharomyces cerevisiae*, also known as yeast, makes bread rise. *Bacillus thuringiensis (Bt)*, a natural pesticide, is found in the soil and is used by farmers and

home gardeners. Rhizobia are bacteria that live in the nodules of some plant roots, such as beans and alfalfa, and convert nitrogen into a form plants can use. Without microbes to decompose things, the world would be covered with waste. In fact, Earth as we know it would not exist!



## BACTERIA OUT OF CONTROL!

Under certain conditions, a bacterium can double in population every 10 to 30 minutes — usually in warm, damp and dark places. People can get sick when they eat foods that have been contaminated by harmful bacteria. *Salmonella* and *E. Coli* are common bacteria that cause foodborne illnesses. Seems funny that one form of *E. Coli* is inside our gut, but if we eat another form, it can make us sick. That's strange but true!

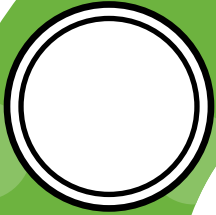
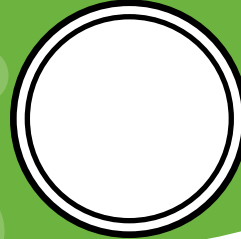
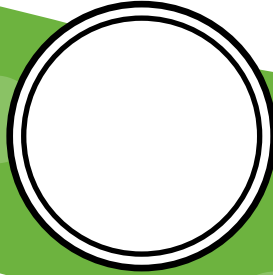
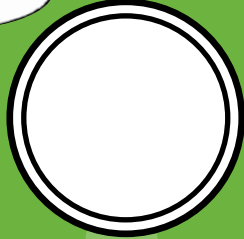
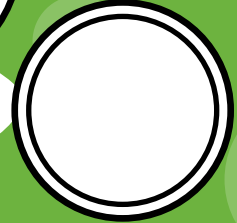
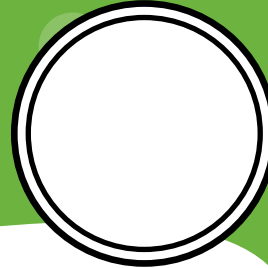
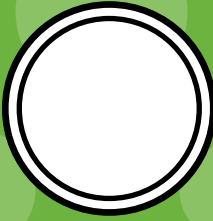
Since pathogens can live almost anywhere, it is important to clean, separate, chill, and cook your food properly... and then eat it in a timely manner.



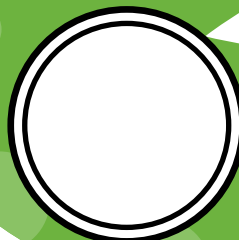
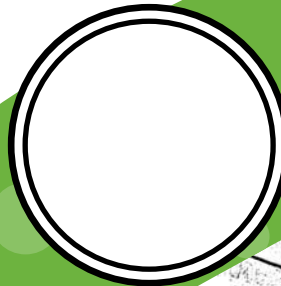
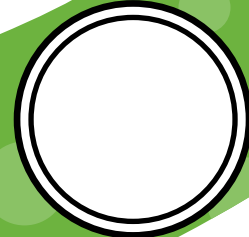
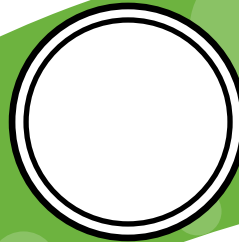
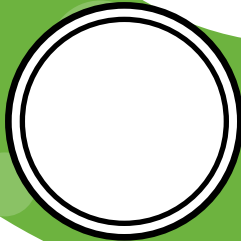
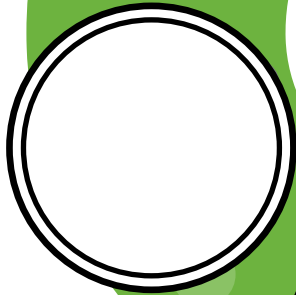
# PLAYING IT SAFE



START



CARDS



END

## Cause and Effect

Read each of the following statements. Underline the “cause” and circle the “effect.”

- 1 The milk was not refrigerated, so it turned sour.
- 2 Miguel washed his hands before making a tasty, healthful salad.
- 3 There are more foodborne illnesses in the summer because bacteria multiply quicker in warmer temperatures.
- 4 Grandma made cheese after adding rennet to milk.
- 5 Sandra threw her apple core into the outdoor bin so it would decompose and become compost.



# PLAYING IT SAFE

## Game Cards

**Instructions:** Copy and cut one set of game cards for each group.

You used a clean paper towel to wipe off the kitchen counter and then disposed of it properly.

**MOVE AHEAD 3 SPACES.**

You washed your hands for 20 seconds with warm water and soap before helping make dinner.

**MOVE AHEAD 3 SPACES.**

You pet your dog and let him lick your hand. Then you helped mom cut up lettuce for the salad without washing your hands.

**GO BACK 2 SPACES.**

You used a scrub brush to wash under your fingernails before preparing dinner.

**MOVE AHEAD 4 SPACES.**

You cooked your scrambled egg until all of it was firm.

**MOVE AHEAD 3 SPACES.**

You washed your cutting board under hot soapy water after cutting the eggs, but before you started slicing the potatoes for the salad.

**MOVE AHEAD 3 SPACES.**

You were tired, so you left the potato salad on the counter for 2 hours before putting it away.

**MOVE BACK 2 SPACES.**

When your dad barbecued, you washed the raw meat juices off the platter with warm soapy water before he put the cooked meat back on it.

**MOVE AHEAD 3 SPACES.**

You washed the plastic cutting board in the dishwasher after dinner.

**MOVE AHEAD 4 SPACES.**

You washed your hands but a towel was not close by. You wiped them on the legs of your pants.

**MOVE FORWARD 2 SPACES, THEN BACK 2 SPACES.**

You cut up the chicken for fajitas with a sharp knife and then cut your veggies without rinsing the knife or cutting board.

**MOVE BACK 4 SPACES.**

Before talking on the phone, you helped your mom put the leftovers in the refrigerator as soon as dinner was over.

**MOVE AHEAD 3 SPACES.**

You put your dish sponge in the microwave on high for one minute before you wiped off the counter.

**MOVE AHEAD 3 SPACES.**

You asked the bag clerk at the supermarket to put the chicken in a separate bag from your fruits and vegetables.

**MOVE AHEAD 4 SPACES.**

You cut up cheese slices but didn't clean the cutting board when you finished.

**MOVE BACK 2 SPACES.**

You let the kitchen sponge soak in the dishwasher overnight. In the morning you wiped down the counter with it.

**MOVE BACK 3 SPACES.**

Mom called and asked you to put the ground beef out to thaw. You placed it on the counter top all day to defrost.

**MOVE BACK 3 SPACES.**

As your chicken defrosted in the refrigerator, the juices dripped onto the refrigerator shelf. An apple rolled into the juices.

**MOVE BACK 3 SPACES.**

Your steak was barely warm and looked under-cooked when you went out to dinner with your friends. You didn't want to say anything, so you ate it anyway.

**MOVE BACK 2 SPACES.**

You dried the dinner dishes with the cloth that had been hanging all week on the refrigerator door.

**MOVE BACK 3 SPACES.**

You remembered to tie back your hair while you were making a cake for your brother's birthday.

**MOVE AHEAD 3 SPACES.**

You understand the importance of keeping hot foods hot and cold foods cold, and not cross-contaminating raw food with cooked food.

**MOVE AHEAD 4 SPACES.**

# THE CASE OF THE CROSS-CONTAMINATED HOMEWORK

## Description

Students will learn about food safety as they apply the mathematics concepts of number sense, multi-step problem solving, formulating equations, working with percentages, and using scientific notation.

## Activity

- On their own papers, have students write their personal definitions for the term “cross-contamination.” Select individuals to orally read the definitions. Then create a class definition for the term.
- Orally, read and discuss the introduction of *The Case of the Cross-Contaminated Homework*.
- Have students complete the mathematics worksheet. Remind students that there are two parts to each problem — identifying the equation and then solving it.

## ANSWER KEY

- a ●
- h ▲
- e ◆
- c ☺
- i ☹
- d ↑
- g \*
- f ★

## Time

One 50-minute session

## Materials

For each student:

- The Case of the Cross-Contaminated Homework worksheets
- Pencil
- Paper

## Content Standards for California Public Schools Links

### Mathematics

#### Grade 5

Number Sense 1.0, 1.2, 2.0, 2.1

Algebra and Functions 1.0, 1.2

Mathematical Reasoning 1.0, 1.1, 1.2

#### Grade 6

Number Sense 2.0, 2.3

Algebra and Functions 1.0, 1.2

Mathematical Reasoning 1.0, 1.1, 1.3

#### Grade 7

Number Sense 1.0, 1.1, 1.2, 1.3

Algebra and Functions 1.0, 1.1, 1.2

Mathematical Reasoning 1.0, 1.1, 1.3

**THE CASE OF THE CROSS-CONTAMINATED HOMEWORK**

Name \_\_\_\_\_

**Introduction:**  
Eighty-three percent of foodborne illnesses associated with fresh fruits and vegetables are due to improper food handling by food preparers and servers. This means by you, your family or the workers at restaurants. Most illnesses are caused when unwanted microorganisms are transferred onto the food you eat. This is called **cross-contamination**. Washing your hands before handling food is one simple thing everyone can do to reduce the spread of diseases.

**Mikael's Challenge:**  
Mikael came home from school and wrote out the first step of each of his homework questions. Unfortunately, they got cross-contaminated. Please help him decontaminate his homework as follows:  
• Match the proper equation to the correct problem and place the correct letter in the box.  
• Solve the problem on a separate sheet of paper. Be sure to show your work.  
• Write the symbol of the correct answer in the space provided.

Equation	Answer
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**Mikael's Problems**

- 83% of foodborne illnesses from fresh fruits and vegetables are caused by the improper handling of food at the restaurant or home. Write this number as a decimal.
- Bacteria are very tiny and usually clump together in spherical colonies. But, if you were to place together one inch. If this is true, then how many would make 12 inches or 1 foot? Write your answer in scientific notation. NOTE: 25,000 in scientific notation is written  $2.5 \times 10^4$ .
- One half of the people at a banquet got sick because they ate salad greens that were cut on an unclean cutting board. What percentage of the people got sick?
- If a cutting board costs \$3.98 and a cutting knife costs \$4.49, how much would it cost to have two of each item in order to prevent cross-contamination of meat and vegetables? Do not include tax in this calculation.
- If the fastest multiplying bacterium can double in 11 minutes, how long would it take to reach over 1 million cells, which would barely be visible to the naked eye?
- A group of 32 foodservice employees follow proper food handling safety rules and each wash their hands in warm, soapy water for twenty seconds before packing employees to wash their hands?  
What is the amount of time it will take for all employees to wash their hands?
- You purchase an extra large pizza for \$27.72. Your family eats all but 4 of the 12 pieces. You fall asleep before putting the leftovers in the refrigerator and later decide it is better to throw away the pizza than risk the possibility of food poisoning. How much money did you waste?
- 97 out of 1,000 people who ate at a buffet got sick. It was determined that they ate potato salad that got too warm. What percentage of the people got sick?

**MIXED-UP EQUATIONS**

- $N = 88 \times 100$
- $N = 25,000 \times 5$
- $N = (32 \times 20) + 49$
- $N = 3 \times 10^4$
- $N = \frac{92}{1000} \times 100$
- $N = \frac{27.72}{72} \times 4$
- $N = 25,000 \times 12$

i. Time: \_\_\_\_\_  
j. Time: \_\_\_\_\_

**MIXED-UP SOLUTIONS**

- ★ 9.9%
- 99%
- ◆ 83
- ▲ 50%
- ◆ 39.24
- ☺ \$16.94
- ☹ 10 minutes
- ↑ 40 seconds
- ☹ 3 hours
- ▲ 40 minutes
- ★  $3 \times 10^4$
- ▼ 99 minutes

# THE CASE OF THE CROSS-CONTAMINATED HOMEWORK

Name \_\_\_\_\_

## Introduction:

The majority of foodborne illnesses associated with fresh fruits and vegetables are due to improper food handling by food preparers and servers. This means by you, your family or the workers at restaurants. Most illnesses are caused when unwanted microorganisms are transferred onto the food you eat. This is called **cross-contamination**. Washing your hands before handling food is one simple thing everyone can do to reduce the spread of disease.

## Mikael's Challenge:

Mikael came home from school and wrote out the first step of each of his homework questions. Unfortunately, they got cross-contaminated. Please help him decontaminate his homework as follows:

- Match the proper equation to the correct problem and place the correct letter in the box.
- Solve the problem on a separate sheet of paper. Be sure to show your work.
- Write the symbol of the correct answer in the space provided.

**Equation**      **Answer**      **Mikael's Problems**



① Bacteria are very tiny and usually clump together in spherical colonies. But, if you were to place average-sized bacteria end-to-end, about 25,000 would make one inch. If this is true, then how many would fit in 12 inches or 1 foot? Write your answer in scientific notation. NOTE: 25,000 in scientific notation is written  $2.5 \times 10^4$ .



② One half of the people at a banquet got sick because they ate salad greens that were cut on an unclean cutting board. What percentage of the people got sick?



③ If a cutting board costs \$3.98 and a cutting knife costs \$4.49, how much would it cost to have two of each item in order to prevent cross-contamination of meat and vegetables? Do not include tax in this calculation.



④ If the fastest multiplying bacterium can double in 11 minutes, how long would it take to reach over 1 million cells, which would barely be visible to the naked eye?



⑤ A group of 32 foodservice employees follow proper food handling safety rules and each wash their hands in warm, soapy water for twenty seconds before packing the fruit. What is the amount of time it will take for all employees to wash their hands?



⑥ You purchase an extra large pizza for \$27.72. Your family eats all but 4 of the 12 pieces. You fall asleep before putting the leftovers in the refrigerator and later decide it is better to throw away the pizza than to risk the possibility of food poisoning. How much money did you waste?



⑦ 99 out of 1,000 people who ate at a buffet got sick. It was determined that they ate potato salad that got too warm. What percentage of the people got sick?

## MIXED-UP EQUATIONS

- a.  $N = 83 \div 100$   
 b.  $N = 25,000 \times 5$   
 c.  $N = 2(3.98) + 2(4.49)$   
 d.  $N = (32 \times 20) \div 60$   
 e.  $N = \frac{1}{2} \times 100$   
 f.  $N = \frac{99}{1000} \times 100$   
 g.  $N = \frac{27.72}{12} \times 4$   
 h.  $N = 25,000 \times 12$   
 i. Time #  

0	1
11	2
22	4
33	8

  
 j. Time #  

0	1
11	2
22	3
33	6

## MIXED-UP SOLUTIONS

- ★ 9.9%  
 + 99%  
 ● .83  
 ◆ 50%  
 \* \$9.24  
 ☺ \$16.94  
 ↑ 10 minutes, 40 seconds  
 ◎ 3 hours, 40 minutes  
 ▲  $3 \times 10^5$   
 ▼ 99 minutes

# Mighty Microbes



## Description

Students, acting as epidemiologists, look at the facts of an outbreak and determine the source and cause of an illness that makes many picnickers sick. Interpreting data tables, classifying, and reading are incorporated into this investigative epidemiological mystery.

## Activity

① Explain to the students that they will become epidemiologists and determine the cause of an illness that affected many people in a community. Have someone read the dictionary definition for “epidemiology” and discuss its meaning. Also, discuss that actual epidemiology cases are much more complex than the hypothetical case they are about to analyze.

② As a class read the foodborne illness outbreak scenario on page 10.

③ Discuss the terms “outbreak” and “dichotomous,” as well as any others the students may find difficult. Create a class vocabulary list if necessary.

Have student duos complete the activity as described on the student worksheet.

*NOTE: Have newspaper articles handy for students to use as a guideline for writing their news article as described on page 10.*

## ANSWER KEY

The unhealthy microbes in the fruit juice were most likely transmitted by an ill worker who had a foodborne illness himself. His improper handling of the cups and juice, along with warm temperatures, spread the disease to the juice. The dichotomous path used to reach this conclusion is: 1a, 2a, 3a, 4a, 5a.

**Local Health Department  
Conducting Investigation!**

## Time

Two 50-minute sessions

## Materials

For each student:

- *What Caused the Illness?* student page
- *What Caused the Foodborne Illness?* Dichotomous Key
- Samples of newspaper articles

## Content Standards

### for California Public Schools Links

#### English Language Arts

##### Grade 5

Reading 1.0, 2.0, 2.1, 2.1, 2.2

Writing 1.0, 1.2, 1.3

Written and Oral English Language Conventions 1.0, 1.4

##### Grade 6

Reading 2.0, 2.1, 2.1, 2.2, 2.5

Writing 1.0, 1.1, 1.2, 2.2

Written and Oral English Language Conventions 1.0, 1.4

##### Grade 7

Reading 2.0, 2.3

Writing 1.0, 1.1, 1.2

Written and Oral English Language Conventions 1.0, 1.4

#### Science

##### Grade 5

Investigation and Experimentation 6, 6a, 6i

##### Grade 7

Investigation and Experimentation 7, 7c, 7e

# What Caused the Illness?

Name \_\_\_\_\_

## Scenario

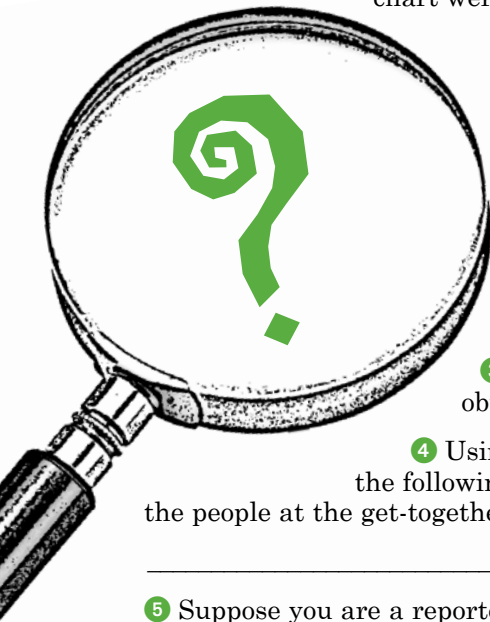
The local hospital has treated numerous people for dehydration due to uncontrollable vomiting followed by diarrhea. The county health department is conducting an investigation to determine the causative agent. It was determined that all the patients ate at a community get-together on May 16 and that the illnesses were caused by a food-borne pathogen, a disease-causing microorganism

PATIENT DATA CHART:

Patient	Hot Chocolate	Fruit Juice	Bottled Water	Granola Bar	Popcorn	Cut Vegetables	Veggie Dip	Watermelon
A	-	+	+	-	-	-	-	-
B	-	-	+	+	+	+	+	+
C	+	+	-	-	-	-	-	-
D	+	+	+	-	-	+	+	+
E	-	+	-	-	-	-	-	-
F	-	-	+	-	+	+	-	+
G	-	+	+	-	-	-	-	-
H	-	+	-	+	-	-	-	-
I	-	+	-	-	-	-	-	-
J	+	+	-	-	+	-	+	+
K	-	+	+	+	-	+	+	+
L	-	+	-	-	+	+	+	-
M	+	+	-	-	-	+	-	-
N	-	+	+	+	-	-	-	-
O	-	+	-	-	-	-	-	+
P	-	+	-	-	-	-	-	+
Q	-	+	-	-	-	-	-	-
R	+	+	-	-	+	-	-	-
S	-	+	-	-	-	-	-	-
T	+	+	-	+	-	+	-	-

+ = that person ate item    - = that person did not eat item

obtained from something the people ate or drank. Look at the data chart above. Each of the 20 people in the chart were hospitalized. Determine what food was responsible for the food poisoning.



1 From the data above, what food do you suspect caused the illness?

\_\_\_\_\_

2 In one complete sentence, describe your reasoning.

\_\_\_\_\_

3 Discuss your reasoning with the lead epidemiologist (your teacher) and then obtain the dichotomous key to continue your investigation.

4 Using the dichotomous key, determine the actual source of the illness. Complete the following statement. "Through scientific investigation, my team has determined that the people at the get-together on May 16 became ill because

5 Suppose you are a reporter for the local newspaper. Write a three to five paragraph article that describes what happened, why it happened, and how the foodborne illness could have been avoided. Before writing your story, examine a newspaper article to see how it is set up. Make sure your article has:

- a headline
- authors listed
- facts of what happened
- facts about foodborne illnesses in general
- how this incidence could have been avoided
- quotes from experts or witnesses (pretend you interviewed patients, event planners, food handlers, epidemiologists, etc.)
- been proofed for spelling, capitalization, proper punctuation, sentence structure, and flow of story

# What Caused the Foodborne Illness? Dichotomous Key

**Instructions:** Read number ①. Determine which statement, a or b, best reflects the incident and information. Proceed as directed, until the illness is traced back to its source. This is called a “trace-back,” something that epidemiologists do on a regular basis.

① The fruit juice was made from frozen fruit juice concentrate, which was pasteurized at the plant. Pasteurization is when something is heated to a temperature high enough to kill microorganisms. The can had a batch number of 10394-PR on its end. A bacterial count was determined from a frozen concentrate with the same batch number. Look at the chart above.

Orange Juice Batch Number	Bacterial Count
10393-PR	0 per 3 ml juice
10394-PR	0 per 3 ml juice
10395-PR	0 per 3 ml juice

- a. *If the bacterial count was 0 in 3 milliliters of juice, the illness was not likely caused by the concentrate itself. Go to ②*
- b. *If the bacterial count was 1 per 3 milliliters of juice or greater, the illness was likely caused by the bacteria in the concentrate before preparation. Illness came from fruit juice concentrate.*

- ② Water used to dilute the juice concentrate came from the tap and is tested by the city’s Public Works Department on a regular basis. Here are the data for a 3-week period.
- a. *If the bacterial level of the water was 0 or less, the water was not the cause. Go to ③.*
- b. *If the bacterial level of the water was 1 or higher, bacteria from the water could be the culprit.*

Test Performed	May 10	May 17	May 24	Max. Allowable
Bacterial Count	None detected	None detected	None detected	None detected
Copper (ppm)	40	30	40	170
Nitrates (mg/l)*	22	19	21	45
Calcium (ppm)**	48.2	41.7	48.1	300
Lead (ppb)***	None detected	None detected	None detected	None detected
Fluoride (ppb)***	110	98	110	2000

\* mg/l = milligrams per liter \*\* ppm = parts per million \*\*\* ppb = parts per billion

- ③ Ice was added to the juice. The ice came from ice cubes made of city water and were made fresh with clean ice cube trays.
- a. *The ice was probably not the source of illness. Go to ④.*
- b. *The ice could have been the problem.*

④ The prepared juice was at the park for the entire event on May 16 from 2 p.m. until 5 p.m. Use the following information gathered from the event manager to make an appropriate choice.

The juice was prepared at noon on May 16th in insulated jugs that each hold 5 gallons. The juice concentrate was frozen at the time it was made and was mixed with tap water. The coordinator made the volunteers wash their hands before making the juice. A few ice cubes were put into the insulated container, which the volunteers rinsed out with hot, soapy water prior to using. It was stored at room temperature until 1 p.m. at which time it was taken outside to the picnic tables. At the event, juice was removed from the container through the push button spout and placed into paper cups. The filled cups were on the table throughout the event. When necessary, new paper cups were filled with juice. The coordinator said that less people attended the event than expected but that everyone had a great time. The event ended at 5 p.m.

- a) *The juice seemed to be prepared following food safety procedures. Go to ⑤*
- b) *The juice was not prepared following basic food safety procedures. Go to ⑥.*

⑤ A quick survey of the overall health of the workers indicated that one of the workers at the fruit juice station had a severe stomachache and was feverish the night before the event.

- a) *A sick worker could have spread a foodborne illness to the guests at the event.*
- b) *A sick worker could not have spread a foodborne illness to the guests. Go to ⑥.*

⑥ Most bacteria grow best between the temperatures of 40°F and 140°F. View the chart below and the description in ④ and determine whether the outside temperature could have aided in bacterial contamination.

Temperatures at Park on May 16	
Time	Temperature
10 a.m.	62
11 a.m.	69
noon	71
1 p.m.	80
2 p.m.	85
3 p.m.	86
4 p.m.	88
5 p.m.	88
6 p.m.	87
7 p.m.	82
8 p.m.	75
9 p.m.	69
10 p.m.	61

- a. *Outdoor temperatures could have caused contamination.*
- b. *Most likely outdoor temperatures did not contribute to the illness. Go to ⑦*
- ⑦ How the juice was dispensed or stored could be the problem.
- a. *The juice could have sat in the cup for longer than two hours, as much time as it takes for harmful bacteria to reach a population that could cause illness. Juice that was not kept cool enough was most likely the problem.*
- b. *The illness was caused by something other than handling. Further investigation needs to occur before a probable cause can be determined at this time.*

## Time

- One 30-minute session
- 10 minutes
- alternate days, two weeks
- Three 50-minute sessions

## Materials

- White bread without preservatives, two pieces per team
- Re-sealable plastic bags
- Thermometer,
- Dark closet or shoebox with lid
- Hand lenses or microscopes
- Water
- Eye droppers
- Refrigerator access

## Content Standards for California Public Schools Links

### English Language Arts

#### Grade 5

- Reading 2.0, 2.1
- Writing 1.3, 1.4
- Listening and Speaking 1.0, 1.5, 2.0, 2.2

#### Grade 6

- Reading 2.0, 2.2
- Writing 1.4
- Listening and Speaking 1.0, 1.4, 1.6, 2.2

#### Grade 7

- Reading 2.0, 2.1, 2.2
- Listening and Speaking 2.0, 2.3a, 2.3b, 2.3c

### Science

#### Grade 5

- Investigation and Experimentation 6, 6b, 6c, 6h

#### Grade 6

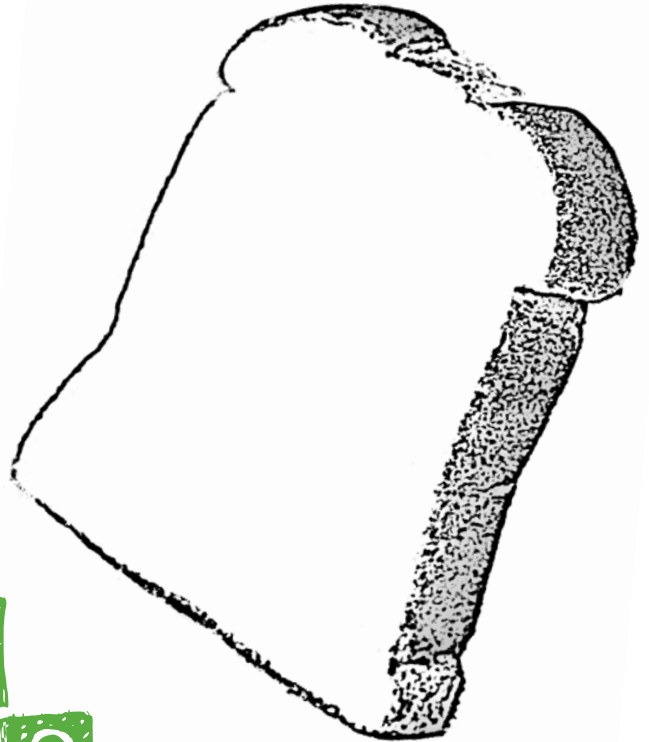
- Ecology 5
- Investigation and Experimentation 7, 7a, 7b, 7d, 7h

#### Grade 7

- Investigation and Experimentation 7, 7a, 7c, 7e

# SO...

How fast will they grow?



## Description

Students, acting as scientists, will explore bacteria and fungi. They will design an experiment that will promote or minimize the bacterial and fungal growth on a piece of white bread.

## Activity

- 1 Prior to this activity, students should understand what bacteria are and that most are beneficial. Those which cause illness are called pathogens. Review if necessary.
- 2 Show the students the supplies for an experiment they will design. The goal is to either promote or minimize bacterial/fungal growth on a piece of white bread over a two-week period.
- 3 Have the students design and complete their experiments, record observations every other day and, after two weeks, write a formal lab report using the guidelines provided.
- 4 Discuss what is needed for bacteria to grow and what might minimize their growth. Relate this to food preservation and safety.
- 5 Divide students into teams of three. Assign each group one method of food preservation — drying, freezing, canning, fermenting, smoking, salting, pasteurizing. Using books and on-line sources, they are to:
  - Research their assigned form of food preservation
  - Learn about its history
  - Create a list of examples
  - Find out how it is done today
  - Create a poster with pictures and words that describes their food preservation process.



### SAFETY NOTE:

The plastic bags which contain bread must be kept sealed and disposed of properly. Do not allow students to open the bags under any circumstances! Harmful microorganisms could be in the bag.

# SO...

## How Fast Will They Grow?

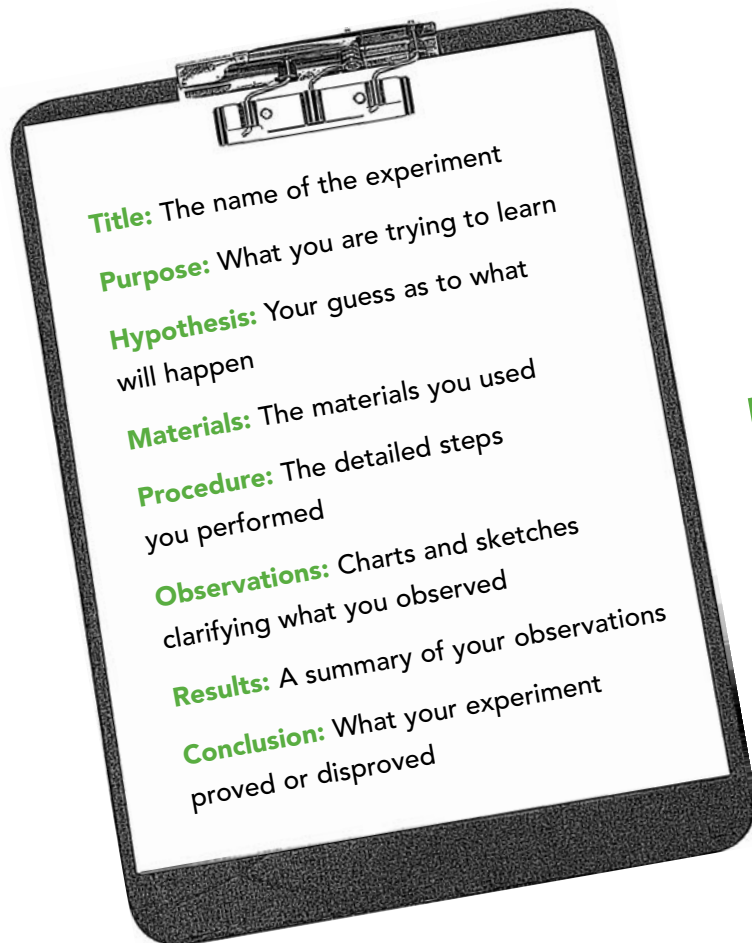
container it was in. You decide! Design your experiment, have your teacher approve your procedure, and then perform your experiment. Remember, scientists always create hypotheses, list their procedures, record their observations, and write conclusions. So, as a scientist, you will complete all of these steps on a separate sheet of paper. Here is how your completed write-up should look.

### Think About It!

Do bacteria and fungi prefer light or dark places?

What about moisture?

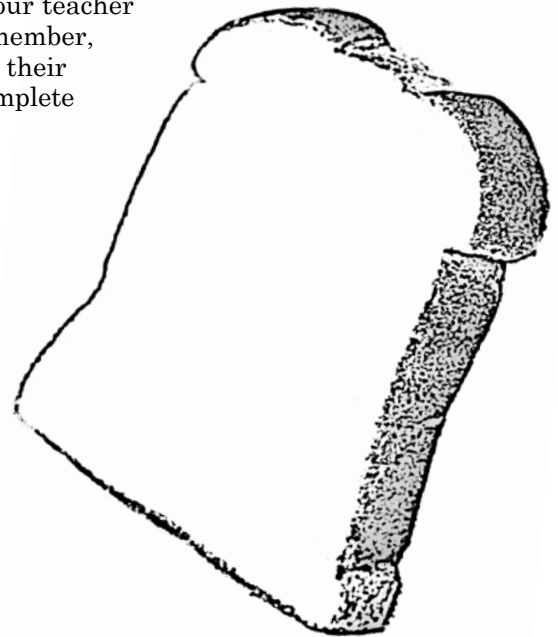
What about heat?



### Introduction

Bacteria and fungi are all around us. They are responsible for many things. Most importantly, they decompose dead plants and animals and convert them into soil and nutrients that other living things can use. They are a part of all ecosystems. Some bacteria and fungi, however, can be harmful. These are called pathogens. It is important for people to understand how to minimize the amount of pathogens so that the food they eat can be nutritious and safe.

You and your partner are to design an experiment that will encourage or discourage bacteria and fungi from growing on a piece of bread. Before you place it in the plastic bag, you may expose it to a doorknob, backpack, notebook, or even moisture or heat. Or, you may expose it to nothing other than the



### SAFETY NOTE:

Once you place your bread in the plastic bag and seal it, you may not open it under any circumstances. Some bacteria and fungi can be harmful. When finished with the experiment, give your bread, still in the sealed bag, to your teacher for proper disposal. You don't want to get a disease from a pathogen!

# How Safe Is Your Kitchen?



## Description

Restaurants and school kitchens are inspected each year by state health inspectors. They check to make sure that safe food preparation guidelines are in practice. Inspectors check equipment, storage facilities, and preparation areas.

Food safety should also be practiced at home. Choose a meal. Evaluate your kitchen during its preparation and clean-up by using the form below. Discuss your findings with your family.

## Kitchen Inspection Evaluation

Inspector: (your name) \_\_\_\_\_

Date: \_\_\_\_\_ Time \_\_\_\_\_

Meal Inspected (circle one):    Breakfast    Lunch    Dinner    Snack

### Clean

Food preparer washed hands with warm, soapy water before handling food.    Yes    No

Counter tops were cleaned before use.    Yes    No

Cutting board was cleaned after preparing **each** food item and before going on to the next food item.    Yes    No

### Separate to Prevent Contamination

Raw meat, seafood, poultry and other foods were kept separate from each other in the refrigerator.    Yes    No

A separate cutting board was used for meat or the cutting board was washed before a different food item was prepared on it.    Yes    No

Knives and cooking utensils were washed immediately after they came in contact with raw meat or eggs.    Yes    No

Cooked meat was placed on a clean dish.    Yes    No

Raw egg shells were thrown away and any areas where raw eggs were used were washed with soapy water.    Yes    No

### Cook to Proper Temperatures

Meat was cooked completely, and hot food was completely heated.    Yes    No

### Chill: Refrigerate Promptly

Leftover food was placed in the refrigerator within two hours of preparation.    Yes    No

Food meant to be cold was served cold.    Yes    No

Total number of "Yes" answers: \_\_\_ X 10 = \_\_\_\_\_

Total number of "No" answers: \_\_\_ X 0 = \_\_\_\_\_

Total Score: \_\_\_\_\_

If your score was:

**90-110:** You are **"A"** safe cook

**70-89:** You need to **"B"** a little more aware of food safety procedures.

**50-69:** You need to **"C"** the food safety rules and use them!

**below 50:** Sorry, your kitchen has been **"D"**-stroyed by microorganisms!

**WHAT'S YOUR GRADE?**

**Wash Up and Sing!** Wash your hands thoroughly with warm, soapy water prior to preparing food. While washing, sing "Happy Birthday" to yourself. This will ensure you have washed your hands long enough to adequately remove dirt, grime and germs.

**Be Careful Crossing the Meat!** Wash hands, utensils, plates and cutting boards immediately after they have been in contact with raw meat, poultry, seafood or eggs and before they come in contact with any other food, especially fresh produce.

**Microwave it!** Microwave sponges and dishcloths on high for one minute to remove any harmful bacteria.

**When in Doubt, Throw it Out!** If you think something may be old or spoiled, throw it out! Follow the old adage: It's better to be safe than sorry — or home with a bad stomachache!

## OTHER ACTIVITIES

1. Create flyers which encourage handwashing, proper food preparation and storage. Post in restrooms, lunchrooms and in areas where lunchboxes are stored.
2. Submit student-written editorials to your local newspaper on what the public can do to reduce foodborne illnesses.
3. Create a student-made refrigerator magnet that encourages proper food handling and storage.
4. Check your local public health department website and review inspection reports of your favorite local restaurants.

## RESOURCES

### Food Safety Music

Carl Winter, Ph.D. has combined his passion for music with his expertise in food toxicology to teach students and adults about food safety. Three CDs are available on a donation basis. Appropriate for all ages.

Carl Winter, Ph.D.  
Food Science and Technology Department  
University of California  
One Shields Avenue  
Davis, CA 95616-8598  
Phone: (530) 752-2647  
Fax: (530) 752-4759  
E-mail: [ckwinter@ucdavis.edu](mailto:ckwinter@ucdavis.edu)  
Website: [foodsafe.ucdavis.edu/music.html](http://foodsafe.ucdavis.edu/music.html)

### Science and Our Food Supply — Investigating Food Safety From Farm to Table

Kit includes interactive video, comprehensive reference guide, career guide, and varied activities that can be incorporated into all curricula. Separate guides for middle school and high school science teachers.

National Science Teacher's Association  
Website: [www.nsta.org/pd/fda.aspx](http://www.nsta.org/pd/fda.aspx)

### Your Game Plan for Food Safety: A Fight BAC! © Food Safety Education Program for 4th, 5th and 6th Grade Classrooms

This comprehensive program includes video, posters, experiments, activities, home survey,

take-home BAC-Catchers, and a teacher's activity and experiment guide.

It is available free from the Fight BAC! © Website. Grades K–3 and 9–12 curricula also available.

Fight BAC! ©

Website: [www.fightbac.org](http://www.fightbac.org)

## LITERATURE

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Cobb, Vicki. *Dirt & Grime, Like You've Never Seen*. Scholastic, 1998.

Latta, Sara. *Food Poisoning and Foodborne Diseases*. Enslow Publishers, Inc., 1999.

Leavitt, Judith Walzer. *Typhoid Mary*. Beacon Press, 1997.

Satin, Morton. *Food Alert!: The Ultimate Sourcebook for Food Safety*. Checkmark Books, 1999.

Woods, Michael and Mary B. Woods. *Ancient Agriculture*. Runestone Press, 2000.

## WEBSITES

Alliance for Food and Farming:  
[www.foodandfarming.info](http://www.foodandfarming.info)

California Department of Education:  
[www.cde.ca.gov](http://www.cde.ca.gov)

California Foundation for Agriculture  
in the Classroom: [www.cfaite.org](http://www.cfaite.org)

Centers for Disease Control: [www.cdc.gov](http://www.cdc.gov)

Fight BAC! © : [www.fightbac.org](http://www.fightbac.org)

Food and Drug Administration:  
[www.foodsafety.gov](http://www.foodsafety.gov)

Food Detectives Fight BAC! ©:  
[www.fooddetectives.com](http://www.fooddetectives.com)

Food Safety Information  
and Inspection Service:  
[www.fsis.usda.gov/food\\_safety\\_education/  
index.asp](http://www.fsis.usda.gov/food_safety_education/index.asp)

FoodSafe: [www.foodsafe@ucdavis.edu](mailto:www.foodsafe@ucdavis.edu)

Gateway to Government Food Safety  
Information: [www.foodsafety.gov](http://www.foodsafety.gov)

MicrobeWorld: [www.microbeworld.org](http://www.microbeworld.org)

Stalking the Microbe!: [www.microbe.org](http://www.microbe.org)

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California Foundation for  
Agriculture in the Classroom



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