



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 foodborne 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.

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

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

Good Agricultural Practices have been developed jointly by the agricultural industry and government. These provide guidelines that reinforce already stringent laws governing food safety on U.S. farms.

A small percentage 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) 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

Health Education

Grade 5

Nutrition and Physical Activity 1.5.N

Grade 7

Nutrition and Physical Activity 1.3.N, 1.4.N

CAUSE & EFFECT ACTIVITY ANSWER KEY

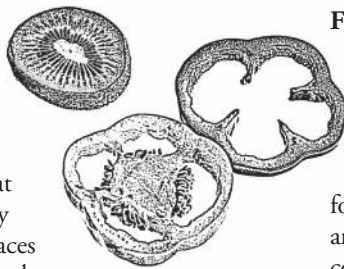
No.	Cause	Effect
1	not refrigerated	turned sour
2	washed hands	healthful salad
3	warm summer temperatures	more foodborne illnesses
4	added rennet (bacteria)	made cheese
5	core in bin	decomposed to compost

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?

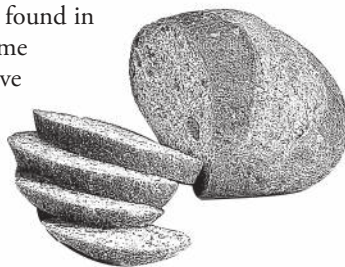
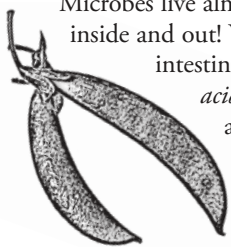
All people have a personal responsibility to keep food safe. Farmers are the first people responsible for producing healthful food. They must know how to plant, cultivate, irrigate, harvest, and store the food so that the final product is safe for the consumer. Farmers are responsible for making sure 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 more than 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

Sneezed on
food. Miss
one turn

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 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 clean paper towel to wipe off the kitchen counter and then disposed of it properly. MOVE AHEAD 3 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 used a scrub brush to wash under your fingernails before preparing dinner. MOVE AHEAD 4 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 were tired, so you left the potato salad on the counter for 2 hours before putting it away. MOVE 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.	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.	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 cut up cheese slices but didn't clean the cutting board when you finished. MOVE BACK 2 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 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.

OPERATION KITCHEN IMPOSSIBLE

Description

In this lesson, students become the head chef in a virtual kitchen. They will use mathematical knowledge, problem-solving skills and food safety guidelines to prepare a safe and nutritious meal.



Activity

Part 1: Introducing Food Safety

- 1 Brain Dump! Ask students, "What can we do to keep food safe?" Give students 30 seconds to capture their ideas on a personal sheet of paper. Capture thoughts on a common share sheet.
- 2 Instruct one student to read Chef Al's recipe card (pg. 8) out loud.
- 3 Divide students into four collaborative working groups. Assign each group one of the four safety tips below. Each group is to develop and present a 30-second song, rap, or poem sharing important information about their safety tip. Divide a large class into eight groups and feature each tip twice.
- 4 After each presentation, have the class identify an anchoring movement to recall the important concept presented. For example, students may make a motion with their hand like they are opening the refrigerator door to represent the First In, First Out (FIFO) principle.

Part 2: Applying What We Know

- 1 Lead students in a review of safety tips and anchoring movements.
- 2 Have students work individually or with a learning partner to complete the scenario-based problems on the Operation Kitchen Impossible handout (page 8). Students should use a separate sheet of paper to solve problems and record answers.
- 3 Don't forget it! Have one student read problem 10 of the handout about farmers and ranchers' commitment to food safety. Challenge each student to share with the class one personal commitment to food safety.

ANSWER KEY

- 1) a. $\frac{1}{4}$ hour; b. $1\frac{1}{2}$ hours; c. $\frac{3}{4}$ hour
- 2) 20°
- 3) 159°
- 4) 142.5 pounds beef
- 5) 25.5 gallons milk
- 6) 6 bags
- 7) $x = 2$ cups
- 8) 48 ft.^2
- 9) 6 oz. solution
- 10) Answers will vary by student.

Safety Tips

Buy it Cold—Keep it Cold!



Take food straight to the fridge after buying. Choose packages tightly wrapped without tears or holes. Freeze fresh meat if you can't use it within two days. Defrost meat in the refrigerator or using the microwave—don't leave it out!

FIFO!



When storing meat, label each package with the date and item. Practice the FIFO system, First In (the fridge), First Out!

Heat it Up Before You Eat it Up!



Foods must reach a certain temperature to be considered safe. Keep these in mind: poultry 165° , ground beef 160° , beef roasts and steaks 145° , pork 160° , leftovers 165° .

Separate—Don't Cross-Contaminate!



Keep raw meat, poultry and seafood away from other foods to prevent the spread of bacteria. Use separate cutting boards for meat and other foods. Always wash your hands and food preparation areas with soap and water before and after use.

Time

Part 1: 60 minutes

Part 2: 30-45 minutes

Materials

For class as a whole:

- Share sheet
- Markers
- Safety tips, cut out (4)

For each student:

- Operation Kitchen Impossible handout
- Personal sheet of paper
- Pencil
- Calculator (if desired)

Content Standards for California Public Schools Links

Mathematics

Grade 5

Number Sense 1.2, 2.2, 2.4, 2.5

Algebra and Functions 1.1, 1.2

Statistics, Data Analysis, and Probability 1.1

Grade 6

Number Sense 1.3, 2.1

Algebra and Functions 1.1, 2.2, 2.3

Statistics, Data Analysis, and Probability 1.1

Grade 7

Number Sense 1.2, 1.3

Algebra and Functions 1.2, 1.4, 1.5

Measurement and Geometry 1.1, 2.1

Health Education

Grade 5

Nutrition and Physical Activity 1.5.N

Personal and Community Health 1.1.P

Grade 7

Nutrition and Physical Activity 1.3.N, 1.4.N, 7.2.N

OPERATION KITCHEN IMPOSSIBLE



HELP! My name is Chef Al Fredo and I have been taken by hungry kidnappers who want my secret recipes! Tonight my restaurant, "HEY! PASTA BOWL TO ME!" will be full of guests, and I need you to stand in as head chef. I trust you will create safe and delicious food! Did you know that foodborne illness is often due to bacterial contamination linked to how the food is handled? Next to each light bulb in my kitchen I have important safety reminders. Read them first and then get cooking!

- Chef Al

Warming up!

1 Cooking food for the appropriate length of time is important in food safety! Chef Al left these times in code, by writing them as decimals. Convert the following cooking times from decimals to fractions.

A) 0.25 hours B) 1.5 hours C) 0.75 hours

Use the graph on the right to answer questions 2 and 3.

2 What is the difference in recommended internal temperature between poultry and beef steaks?

3 What is the average internal temperature for all foods listed?

Now you're cooking!

4 Chef Al warned you not to leave too much food out or it will spoil. He uses 95 lbs. of beef for 200 people, but tonight you are expecting 300 people. How many pounds of beef should you put in the fridge to thaw?

5 Dairy products need to be refrigerated so they don't go bad. Calculate how many gallons of milk you will need to make Chef Al's famous Alfredo sauce. He uses 17 gallons to serve 200 people, but you are expecting 300.

6 You pull out frozen pizza dough from the freezer that Chef Al has carefully labeled with the contents, date and amount of dough. You need 15 lbs. of dough to thaw for dinner. If each bag weighs $2\frac{1}{2}$ lbs. how many bags do you need to take out of the freezer?

On fire!

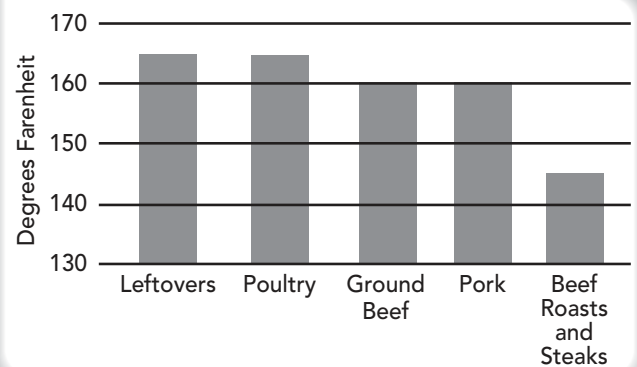
7 Chef Al left his pasta recipe in a secret code. For the amount of flour, Chef Al wrote $2(3x+4) = 20$. Solve for the variable to determine how many cups of flour are needed.

8 Make sure you don't cross-contaminate! You must clean the counter in the kitchen before you begin preparing food. The counter is 4 ft. wide and 12 ft. long. What is the area of the counter?

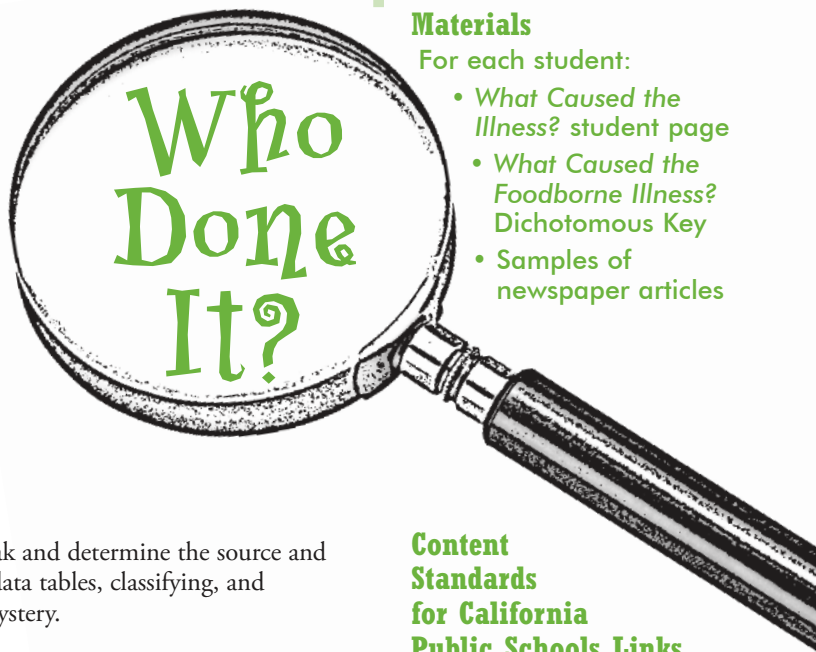
9 The antibacterial cleaning bottle says that you need $\frac{1}{2}$ ounce of solution for every 4 square feet of surface area. Using your answer from problem 8, how many ounces of antibacterial solution do you need to make sure your counter is clean?

10 American farmers and ranchers are committed to continued research in the area of food safety. What is your food safety commitment? Take a moment to write down three specific actions you will take to commit to food safety in your home.

Recommended Internal Temperature



Mighty Microbes



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

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.

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

Health Education

Grade 5

Nutrition and Physical Activity
1.5.N

Grade 7

Nutrition and Physical Activity
1.3.N, 1.4.N

**Local Health Department
Conducting Investigation!**

What Caused the Illness?

Name _____

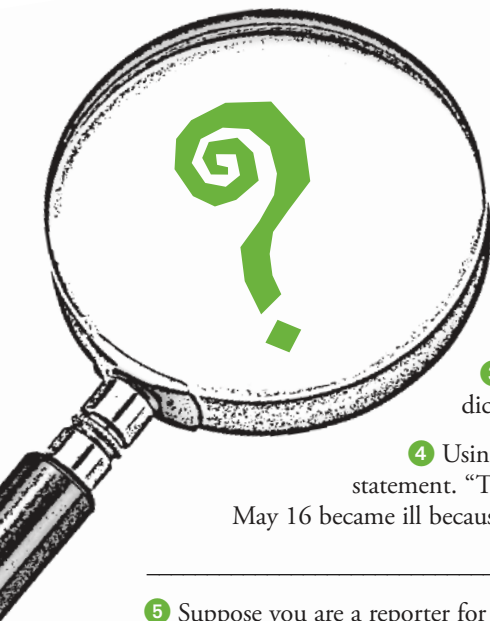
Scenario

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 foodborne pathogen, a disease-causing microorganism 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.

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



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

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

bacterial count was determined from a frozen concentrate with the same batch number. Look at the chart above.

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
			Level	
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.

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.

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

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

Health Education

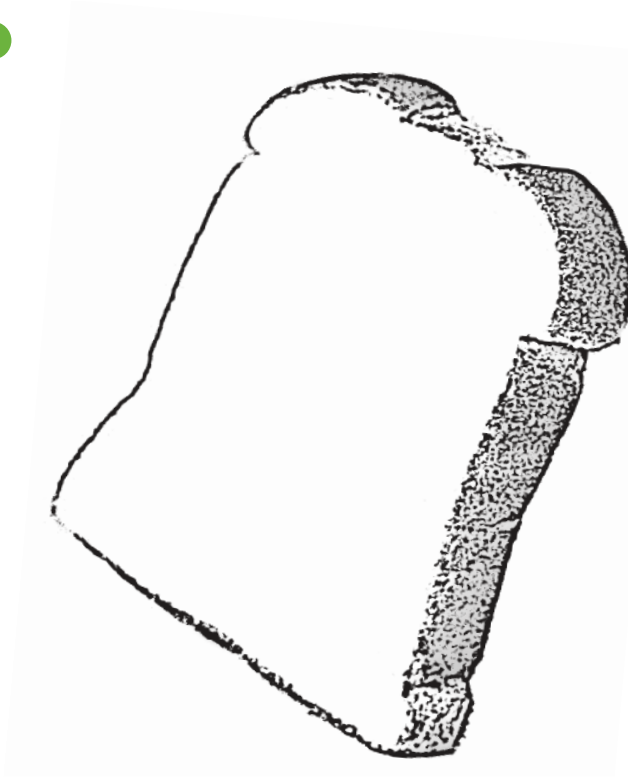
Grade 5

Nutrition and Physical
Activity 1.5.N

Grade 7

Nutrition and Physical
Activity 1.3.N, 1.4.N

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?

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?

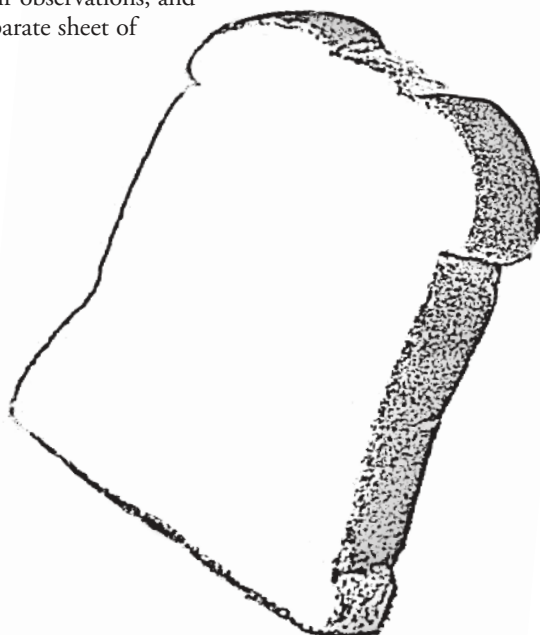
What about heat?



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 container it was in. You decide! Design your experiment, have your teacher approve your procedure, and then perform your experiment.



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.

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University of California
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Davis, CA 95616-8598
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Fax: (530) 752-4759
E-mail: ckwinter@ucdavis.edu
Website: foodsafe.ucdavis.edu

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/pdf/ida.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

LITERATURE

Capeci, Anne, Bruce Degen, John Spears and Joanna Cole. *The Giant Germ*. Scholastic, 2001.

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

California Department of Education:
www.cde.ca.gov

California Foundation for Agriculture in the Classroom:
www.LearnAboutAg.org

Centers for Disease Control:
www.cdc.gov

Fight BAC!®:
www.fightbac.org

Food Detectives Fight BAC!®:
www.fooddetectives.com

Food Safety Information and Inspection Service:
www.fsis.usda.gov/food_safety_education

FoodSafe:
foodsafe.ucdavis.edu

Gateway to Government Food Safety Information:
www.foodsafety.gov

MicrobeWorld:
www.microbeworld.org



For additional educational resources, contact CFAITC
2300 River Plaza Drive
Sacramento, CA 95833
(800) 700-AITC (2482)
www.LearnAboutAg.org

California Foundation for Agriculture in the Classroom (CFAITC) is a non-profit, 501(c)(3) organization dedicated to spreading awareness of agricultural literacy and an appreciation for the safe, fresh and abundant agricultural products we are fortunate to enjoy in California. The Foundation provides educators with free and low cost teacher-tested and standards-based resources.

