Chapter 3
Introduction to Food Safety

Chapter Overview

This chapter introduces students to fundamentals of food safety and the importance of preventing foodborne-illness in the foodservice industry.

Learning Objectives

1. Define a foodborne-illness outbreak.
2. Explain the costs associated with a foodborne-illness outbreak.
3. Identify those at high risk of contracting a foodborne illness.
4. List the ways food can become unsafe.
5. Define FAT TOM.
6. Break down the characteristics of TCS food.
7. Explain how to identify and prevent cross-contamination.
8. Define "time-temperature abuse."
9. Compare different thermometer types and explain how each type helps keep food safe.
10. Name the most common food allergens.
11. Explain the methods for preventing allergic reactions to food.
12. Summarize why a food defense system is needed.
13. Name the government agencies that regulate the restaurant and foodservice industries.
14. Explain what a food safety management system is and how it works.

Advance Preparation

Review	• Chapter 3 (Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7) • Unit Business Case "Stepping into Management"
Prepare	• Contact your school's biology department for use of the following items: baker's yeast, mason jars with lids, sugar, measuring spoons, grease pencil, microscope, graticule slides, slide covers, pipettes or droppers, glass stirring rods for activity in Section 3.2 • Menus from local restaurants for customized instruction activity in Section 3.5

Chapter Breakdown

Introduction

Resources

- PPT slides 2 to 3
- Lab Manual—Chapter 3
- Activity Guide—Chapter 3

Discuss

- Food safety involves many factors, including kitchen design, food purchasing, personal hygiene, cleaning and sanitizing, food preparation, cooking, and table service.
- All staff must be trained in proper food-handling techniques.

Section 3.1 Foodborne Illness and Its Costs

Resources

- PPT slides 4 to 8

Reinforce and Review

- A foodborne illness is transmitted to people by food. A foodborne-illness outbreak is when two or more people get the same illness after eating the same food. Outbreaks must be confirmed by laboratory analysis.

Discuss

- What is the value of a restaurant's reputation? How is a reputation developed? What happens if it's harmed?

Key Terms

- **Foodborne illness:** A disease transmitted to people by food.
- **Foodborne-illness outbreak:** When two or more people get the same illness after eating the same food, an investigation is conducted by state and local regulatory authorities, and the outbreak is confirmed by laboratory analysis.
- **High-risk populations:** Certain groups of people that have a higher risk of getting a foodborne illness than others, such as elderly people, preschool-age children, and people with compromised immune systems.
- **Immune system:** The body's defense against illness.

Customized Instruction

- **ELL:** Ask students to create a list of places that might serve food to high-risk populations.
- **Below Grade Level:** Ask students to find an article about a foodborne illness outbreak at a foodservice operation and summarize it for the class.
- **Above Grade Level:** Ask students to find an article about a foodborne illness outbreak at a foodservice operation. Write a paragraph explaining the possible outcomes of the outbreak and an additional paragraph that makes recommendations for how the organization responsible for that outbreak should address it.

Knowledge Check Answers

1. A foodborne-illness outbreak occurs when two or more people get the same illness after eating the same food, an investigation is conducted by state and local regulatory authorities, and the outbreak is confirmed by laboratory analysis.
2. High-risk populations include older adults, young children, and people with compromised immune systems.

Section 3.2 | Forms of Contamination

Resources

- PPT slides 9 to 20
- Activity Guide—Activities 3.1 and 3.2

Reinforce and Review

- There are three primary hazards to food safety: biological hazards, such as viruses, chemical hazards, such as cleaners and machine lubricants, and physical hazards, such as broken glass.
- Microorganisms that cause disease are called "pathogens." Viruses, bacteria, parasites, fungi, and biological toxins all threaten food safety.
- Bacteria need six conditions to grow: an energy source, acidity, time, temperature, oxygen, and moisture. Remember these conditions with the acronym FAT TOM.
- The temperature danger zone (TDZ) is between 41°F and 135°F (5°C and 57°C). Bacteria grow well in this range. To prevent growth, limit the time food spends in the TDZ.
- Some foods have characteristics that support bacterial growth. These foods require time and temperature control for safety (TCS) to prevent growth. These foods are called "TCS foods." Meat and milk are two examples.

Discuss

- What are some examples of foodborne pathogen organisms that can alter the appearance or odor of a food? Which foodborne pathogens cannot be detected by human senses?
- How can you tell if a variety of yeast is useful or bad? How can you tell if a mold is harmful or beneficial to the food? How can you tell if food has spoiled?
- How can you prevent physical and chemical contaminants from entering food for service?

Key Terms

- **Hazard:** Something with the potential to cause harm.
- **Contamination:** When harmful things are present in food, making it unsafe to eat.
- **Pathogens:** Microorganisms that cause illness.
- **Microorganisms:** Small, living organisms that can be seen only through a microscope; most living things, including humans, carry microorganisms on, or in, their bodies.
- **Viruses:** Microorganisms that are the leading cause of foodborne illness. They can survive refrigerator and freezer temperatures and grow inside a person's intestines after they are eaten. People can get viruses from food, water, any contaminated surface, or from other people. Examples of viruses that can cause foodborne illness include hepatitis A and Norovirus.
- **Bacteria:** A common type of microorganism; several species of bacteria are pathogens that can cause infectious diseases. Examples of foodborne bacteria include *Salmonella* Typhi, nontyphoidal *Salmonella*, *Shigella* spp., and Shiga toxin–producing *E. coli* (STEC).
- **FAT TOM:** An easy way to remember the six conditions that bacteria need to grow: food, acidity, temperature, time, oxygen, and moisture.
- **Temperature danger zone (TDZ):** The temperature range between 41°F and 135°F (5°C and 57°C), in which bacteria grow well; you can control the growth of most bacteria by keeping food out of the temperature danger zone.
- **TCS food:** Food that needs time and temperature control for safety because it is most vulnerable to pathogen growth; these types of food have the FAT TOM conditions needed for bacterial growth and are also commonly involved in foodborne-illness outbreaks.
- **Ready-to-eat food (RTE):** Food that can be eaten without further preparation, washing, or cooking; some examples include washed fruit and vegetables (both whole and cut), deli meat, bakery items, sugar, spices, seasonings, and cooked food.
- **Parasites:** Organisms that get nourishment and protection from another living organism known as a host, such as a person, animal, or plant. Parasites can live in many types of food that humans like to eat and can contaminate water. In the United States, the most common foodborne parasites are protozoa, roundworms, and tapeworms.
- **Fungi:** Organisms found in air, soil, plants, water, and some food that can cause illness but are most commonly responsible for spoiling food; mold and yeast are two examples of fungi.
- **Mold:** Tiny plants that grow under almost any condition but grow especially well in acidic food with little moisture, such as jams, jellies, and cured, salty meats, such as bacon. Mold that is visible to the human eye is actually a tangled mass of thousands of tiny mold plants. Molds often spoil food and sometimes produce toxins that can make people sick. Sometimes mold is intentionally used to affect the flavor or characteristics of a product, such as with Brie, camembert, and gorgonzola cheeses.
- **Yeast:** Microorganism that can spoil food quickly, as indicated by the smell or taste of alcohol, white or pink discoloration, slime, and bubbles; like molds, yeasts grow well in acidic food with little moisture, such as jellies, jams, syrup, honey, and fruit or fruit juice.

Classroom Activity: Science	**The Growth of Microbes** *Materials for Each Group* • Microbes • 8 oz. warm (100°F or 38°C) water • 4 glass graticule slides • 8 oz. cold (40°F or 4°C) water • 4 slide covers • 2 disposable pipettes • 1 envelope of active dry baker's yeast • 2 glass stirring rods • 2 8-oz. mason jars with lids • Pencil • 3 Tbsp. sugar in a container • Paper • Measuring spoons • Grease pencil *Procedure* 1. Divide the students into pairs or small groups. Have the students read the experiment procedure aloud together. As a group, have them write down and date a hypothesis of the outcome. 2. Fill a mason jar with 8 ounces of warm water. Add ½ tablespoon of sugar to the water. Stir. Add 1 teaspoon of yeast to the sugar–water solution. Stir. Repeat the same procedure with 8 ounces of cold water. Place two drops of the warm-water solution onto the center of a glass slide, and place a coverslip over the sample. 3. Repeat the same process, making a slide of the cold-water solution. 4. Under the microscope at lowest power, focus on the warm-water slide. Increase the power until the yeast cells are easily countable. Have the students draw evenly-spaced grids on paper. Have the students count the number of cells in three grid squares. Students should make a mark with a pencil dot in the grid square to represent each cell counted. 5. Repeat for the cold-water slide. Make sure the students label the data accordingly. 6. Screw the lids on the jars. Label the jars with the group names, date, time, and whether it's a cold-water or warm-water yeast solution. 7. Refrigerate the cold-water solution.

	8. Place the warm-water solution in the warmest overnight place available in the classroom. The next day, have the students make new slides with their cold-water and warm-water solutions. Have them repeat the process of viewing and counting the yeast cells in the samples. 9. Compare the data from both viewings of both samples. *Data Analysis* Have the students determine the percentage of colony growth or decline between the two samples of "before" and "after." For example, with the cold-water solution, if the students counted 25 cells in the grid in the first sample and 30 cells in the second sample, the increase would be 5 cells, or 20 percent. The colony grew by 20 percent in a 24-hour period. Students should compare the before and after of each temperature solution. Students should also compare the colony growth between the two temperature solutions. *Conclusions* Have the students compare their results to their hypothesis. Have the students draw conclusions about the growth of microorganisms under the various temperature conditions. *Teacher Notes: Students' conclusions will vary.*

Knowledge Check Answers

1. The six conditions are food, acidity, temperature, time, oxygen, and moisture (FAT TOM)
2. The temperature danger zone (TDZ) is the temperature range between 41°F and 135°F (5°C and 57°C). Bacteria grows well in this temperature range.
3. Most physical contamination can be prevented by inspecting food closely when it is received, practicing good personal hygiene, and following safe preparation procedures.

Section 3.3 Cross-Contamination

Resources

- PPT slides 21 to 23

Reinforce and Review

- Cross-contamination occurs when pathogens spread from one surface or food to another.

Discuss

- Picture a busy kitchen. What opportunities exist for cross-contamination to occur?

Key Terms

- **Cross-contamination:** Results when pathogens spread from one surface or food to another.

Knowledge Check Answers

1. The most basic way of preventing cross-contamination is by separating raw food and ready-to-eat food.
2. Prepare raw meat, seafood, and poultry at different times from ready-to-eat food. Properly clean and sanitize all utensils, equipment, and surfaces between products.

Section 3.4 | Time-Temperature Abuse

Resources

- PPT slides 24 to 27

Reinforce and Review

- Many foodborne illnesses happen because TCS food has suffered from time-temperature abuse, which means food has remained too long in the temperature danger zone.
- Food is also time-temperature abused any time it is cooked to the wrong internal temperature, held at the wrong temperature, or cooled or reheated incorrectly

Discuss

- What are some scenarios that could lead to time-temperature abuse at a foodservice operation?
- How can thermometers be used to prevent time-temperature abuse?

Key Terms

- **Time-temperature abuse:** Results when food has remained too long in the temperature danger zone, 41°F to 135°F (5°C to 57°C), which is the range in which pathogens grow well; the longer food stays in the temperature danger zone, the more time pathogens have to grow. In addition, food is time-temperature abused any time it is cooked to the wrong internal temperature, held at the wrong temperature, or cooled or reheated incorrectly.
- **Bimetallic stemmed thermometer:** This type of thermometer can check temperatures from 0°F to 220°F (-18°C to 104°C) through its metal stem, which makes it useful for checking both hot and cold types of food. The sensing area of the thermometer goes from the tip of the stem to the dimple; when checking temperature, insert the stem into the food up to the dimple.
- **Calibrated:** Describes a thermometer that is adjusted to ensure it gives a correct reading.
- **Ice-point method:** To calibrate, or adjust, a thermometer based on the temperature at which water freezes in order to ensure its accuracy.

Knowledge Check Answers

1. The longer food stays in the temperature danger zone, the more time pathogens have to grow.
2. Thermometers are considered a food-contact surface, so you must wash, rinse, sanitize, and air-dry them after use.

Section 3.5 | Food Allergies

Resources

- PPT slides 28 to 32

Reinforce and Review

- Food proteins that cause allergic reactions are called "food allergens." The "Big Nine" allergens cause most food allergic reactions in the United States. If a guest has a food allergy, it's important to prevent cross-contact.
- The Big Nine allergens are: eggs, crustacean shellfish, fish, milk, peanuts, soy, tree nuts, sesame, and wheat.

Discuss

- What are the main allergens in the United States?
- What is cross-contact and how can it be avoided?

Key Terms

- **Food allergy:** The body's negative reaction to a food protein.
- **Food allergens:** The naturally occurring proteins that cause allergic reactions.
- **Cross-contact:** When a food item containing an allergen comes in contact with another food item and their proteins mix; refers specifically to food allergens.

Customized Instruction

- **ELL:** Look for menus from local restaurants online and print copies for students. Ask them to identify and highlight the Big Nine allergens.
- **Below Grade Level:** Ask students to create a restaurant menu that has dishes containing each of the Big Nine allergens.
- **Above Grade Level:** Ask students to research the history of allergen awareness over the past 100 years and write an essay explaining how food allergens and awareness of food allergies have changed over time.

Knowledge Check Answers

1. Servers inform guests about food allergens on menus, listen to guests, take notes, communicate allergen special orders to back-of-house staff, and deliver allergen special orders safely.
2. Cross-contact occurs when a food item containing an allergen comes in contact with another food item and their proteins mix.

Section 3.6 | Food Defense

Resources

- PPT slides 33 to 35

Reinforce and Review

- People may tamper with food and deliberately cause foodborne illness. The best prevention tool is to make tampering difficult. Restricting access to critical parts of an operation is one tactic.
- The FDA creates the FDA *Food Code*, which recommends regulations to keep food safe. Each state decides whether to adopt all or part of the *Food Code*. State laws are enforced by state, city, or county health departments through inspections.

Discuss

- Have you ever heard of deliberate contamination of food at a foodservice operation?
- Discuss the various ways that staff can defend the food supply of their establishment.

Key Terms

- **Inspection:** A formal review or examination conducted to see if an operation is following food safety laws.

Knowledge Check Answers

1. The FDA writes the FDA *Food Code,* and each state adopts the code as it sees fit. State and local health departments then enforce laws based on the *Food Code*.
2. If violations are found, an operation may be temporarily closed. In some severe cases, an operation may be permanently closed.

Section 3.7 | Food Safety Management Systems

Resources

- PPT slides 36 to 37

Reinforce and Review

- One of the best ways for restaurant and foodservice managers to prevent foodborne illness is to develop and follow a food safety management system.

Discuss

- Why are food safety management systems important?
- What are the components of an effective food safety management system?

Key Terms

- **Food safety management system:** A group of procedures and practices that work together to prevent foodborne illness; combined, these procedures and practices control risks and hazards throughout the flow of food in an operation.
- **Active managerial control:** A manager taking responsibility to actively control risk factors for foodborne illness in a proactive, rather than reactive, way. This includes anticipating the risks and planning for them using such tools as training programs, manager supervision, and the incorporation

of standard operating procedures (SOPs), or a more complex HACCP (Hazard Analysis Critical Control Point) program.

- **Hazard Analysis Critical Control Point (HACCP):** One type of food safety management system; HACCP identifies major biological, chemical, or physical hazards at specific points within a food's flow through the operation so that those hazards can be prevented, eliminated, or reduced. An effective HACCP system is unique to the operation and based upon a written plan that considers an operation's menu, guests, equipment, processes, and operations.

Homework Activity: Literacy	**Stay ALERT** Ask students to visit the FDA's website and read about the ALERT initiative. Ask them to write a paragraph or make a graphic organizer summarizing the program's purpose and components. *Teacher Notes: Students' responses will vary but should include the program's five key points: assure, look, employees, reports, and threats.*

Knowledge Check Answers

1. It is reactive, not proactive.
2. Answers will vary but may include training programs, manager supervision, and the incorporation of standard operating procedures (SOPs).

End of Chapter

Resources

- Chapter 3 Test Bank
- PPT slide 38

Business Case Follow-Up Answers

1. Medina is responsible for actively controlling risk factors for foodborne illness. This is called active managerial control. It is important to note that active managerial control is proactive rather than reactive. Medina must anticipate the food safety risks and plan for them. She does this by creating written safety policies, training her staff, and monitoring risks.
2. Before the training, Medina may get feedback about her idea from staff who work with employees whose first language is not English. They may be able to translate the training information for her. She may try to find if she can get food allergen posters available in all the languages spoken by her staff members.

Chapter Activities Answers

- **Language Arts: Act It Out**

  Student answers will vary, but they should reflect the summation of learning in this chapter regarding the avoidance of cross-contact, steps to ensure that guests with allergies are safe, and the importance of communication.

- **Science: Pick a Pathogen**

  Answers will vary; however, the content concerning forms of contamination will best assist students in beginning research. The internet or the library can provide additional resources.

- **Math: How Fast Does It Grow?**

  In the first container, at 72 hours, there are 4 bacteria (2 × 2). At 39°F (4°C), the bacteria double every 36 hours. For the second container, at 55°F (13°C), the bacteria double every 6 hours. At the 12-hour mark, there are 4 bacteria (2 × 2). There are 8 bacteria at 18 hours (4 × 2), 16 bacteria at 24 hours (8 × 2), 32 at 30 hours (16 × 2), 64 at 36 hours (32 × 2), 128 at 42 hours (64 × 2), 256 at 48 hours (128 × 2), 512 at 54 hours (256 × 2), 1,024 at 60 hours (512 × 2), 2,048 at 66 hours (1,024 × 2), and 4,096 bacteria at 72 hours (2,048 × 2).

- **Collaboration: Public Record**

  These reports may be available online, at the county health department, or through another local agency. Some local newspapers may even publish the reports.

- **Career Readiness: Careers in Food Safety**

  Student answers will vary. For example, most health inspectors need a bachelor of science to perform the tasks of the job. Some positions may require a master of science in chemistry, or other science-related disciplines. Many registered dietitians have training in chemistry or upper-level mathematics, and often perform inspections in places like hospitals or long-term-care facilities. Consult the internet to direct the research around some interest groups in your classes, such as food science or another similar direction.

- **Critical Thinking: An Outbreak on Your Hands**

  Student answers will vary, but they should address all aspects of food safety covered in this chapter, including cross-contamination, cross-contact, and time-temperature abuse.

Review Questions Answers

1. B (Section 3.1)
2. A (Section 3.1)
3. B (Section 3.2)
4. B (Section 3.2)
5. C (Section 3.2)
6. C (Section 3.5)
7. C (Section 3.4)
8. A (Section 3.6)
9. C (Section 3.6)
10. B (Section 3.7)