



Lesson Plan

Unit 3: Lesson 3 of 3

Foodborne Illnesses and Food Allergens

Created: 08/2022 by the National FFA Organization

The purpose of this lesson is to introduce students to foodborne illnesses and common food allergens.

Student Learning Objectives:

After completing these activities, students will ...

1. Describe different foodborne pathogens.
2. Identify symptoms of foodborne illness.
3. Describe the effects foodborne allergens have on people.

Suggested Grade Level:

Grades 9 and 10 (This lesson is written so instructors can scale up or down based on class needs.)

Suggested Time: 120 minutes (*Time requirements may vary based upon student understanding and class schedule.)

Resources/References:

1. Textbook: *Principles of Food Science*, 4th Edition, Janet D. Ward (Facts/information in this lesson were obtained from the textbook.)

Lesson Preparation:

- a. Bell ringer: Needed items: moldy bread, moldy cheese, a can of soup with no label, a cup of clean water (Note: It may take several weeks to grow mold.). You will also need a copy of the "Don't Eat That!" worksheet for each student.
- b. Activity 1: Read supplies needed on attached lab sheet, and set up prior to beginning class.

Equipment and Supplies Needed:

1. "Don't Eat That!" worksheet for each student
2. "Foodborne Illness, Pathogens and Allergens" PowerPoint
3. "Food Pathogens" worksheet for each student
4. "Common Allergens in Food" worksheet for each student
5. Extension Activity:
 - a. See "Mixed up Milk Lab" attached to this lesson for lab supplies. Consider giving each group of students a different type of milk: skim, 1%, 2%, whole, half and half, heavy whipping cream and buttermilk.
 - b. One copy per student of the lab sheet "Activity 1: Mixed-up Milk"
6. Follow-up Activity: "Follow-up Activity: Common Food Allergens" worksheet for each student

Vocabulary:

1. Surface/exterior mold
2. Interior mold
3. Foodborne illness
4. Pathogenic bacteria
5. Spoilage bacteria
6. Microorganisms
7. Campylobacter
8. Clostridium botulinum
9. E. coli O157:H7
10. Listeria monocytogenes

11. Norovirus
12. Salmonella
13. Staphylococcus aureus
14. Shigella
15. Toxoplasma gondii
16. Vibrio vulnificus
17. Probiotic
18. Food allergen
19. Danger zone

Cross-Curricular Connections:

Science	English/Language Arts	Technology
Activity 1: Students conduct an experiment to see how beneficial bacteria are used in food processing.	- Bell ringer: Students are challenged to make observations and connections about items by visually inspecting them and recording their thoughts on paper. - Exit Ticket: Students share their thoughts in a verbal or written format.	Follow-up activity: Students use technology to research common food allergens and record their findings on paper.

Virtual Instruction Ideas:

This entire lesson could be taught online/virtually. The teacher would need to make sure students have all lab supplies available and a camera on their computers so they could monitor student progress, ask the exit ticket question, etc.

Student Activity Sheets:

Direct access to student activity sheets without lesson plan or answer key for easy upload to a learning management system or printing for classwork.

<https://ffa.box.com/s/l5gtxifbgrdde0qajbd8xhchp6zmnxtv> (Word)

<https://ffa.box.com/s/wg3j8gjx0zset2i9ee2ortxripfj3302> (PDF)

<https://ffa.box.com/s/0gsyy25mb6qu1is03rluerqky3gg6w1h> (Non-Designed)

<https://docs.google.com/document/d/1lxYYMPdEbPco3qxu8wt7lldAzdoLqiSumJNlK4YAdxA/copy> (Google)

These Activities are Aligned to the Following Standards:

AFNR Performance Element

- FPP.02. Apply principles of nutrition, biology, microbiology, chemistry and human behavior to the development of food products.

FFA Precept

- FFA.PL-A.Action: Assume responsibility and take the necessary steps to achieve the desired results, no matter what the goal or task at hand.
- FFA.PL-C.Vision: Visualize the future and how to get there.
- FFA.PG-J.Mental Growth: Embrace cognitive and intellectual development relative to reasoning, thinking and coping.
- FFA-CS-M.Communication: Effectively interact with others in personal and professional settings.

Common Career Technical Core

- AG-FD1 Develop and implement procedures to ensure safety, sanitation, and quality in food product and processing facilities.

NASDCTec

- AGPA01.02 Conduct food product development and research activities that demonstrate application of food science principles to enhance products.
- AGPA01.04 Identify and apply food processing, handling, and storage factors to demonstrate their impact on product quality and safety.

AFNR Cluster Skills

- CS.03. Examine and summarize the importance of health, safety and environmental management systems in AFNR workplaces.

Common Core – Reading: Informational Text

- CCSS.ELA-Literacy.RI.9-10.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- CCSS.ELA-Literacy.RI.9-10.2 Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

Common Core – Writing

- CCSS.ELA-Literacy.W.9-10.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

Common Core – Speaking and Listening

- CCSS.ELA-Literacy.SL.9-10.1.A Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- CCSS.ELA-Literacy.SL.9-10.1.C Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.

Common Core – Science & Technical Subjects

- CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- CCSS.ELA-Literacy.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Common Core – Literacy in Science & Technical Subjects: Writing

- CCSS.ELA-Literacy.WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- CCSS.ELA-Literacy.WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Common Core – Math Practices

- CCSS.MATH.PRACTICE.MP6 Attend to precision.

Green/Sustainability Knowledge and Skill Statements

- AFNR Career Cluster-Food Products and Processing Systems Pathway, Statement 2 Analyze the impact of various food production and processing practices and policies on ecological and public health.

National Standards for Financial Literacy

- Buying Goods and Services, Benchmarks: Grade 12, Statement 2 When people consume goods and services, their consumption can have positive and negative effects on others.
- Buying Goods and Services, Benchmarks: Grade 12, Statement 7 Governments establish laws and institutions to provide consumers with information about goods or services being purchased and to protect consumers from fraud.

AFNR Career Ready Practices

- CRP.02. Apply appropriate academic and technical skills. Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive.
- CRP.04. Communicate clearly, effectively, and with reason. Career-ready individuals communicate thoughts, ideas and action plans with clarity, whether using written, verbal and/or visual methods.
- CRP.05. Consider the environmental, social and economic impact of decisions. Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organizations and the environment.
- CRP.06. Demonstrate creativity and innovation. Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization.

- CRP.07. Employ valid and reliable research strategies. Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies.
- CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem.
- CRP.11 Use technology to enhance productivity. Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems.

Partnership for 21st Century Skills

- Critical Thinking and Problem Solving
- Flexibility and Adaptability
- Implement Innovations
- Information Literacy
- Productivity and Accountability
- Think Creatively

Lesson Plan:

1. **Bell Ringer:** Display the following on a front counter, teacher desk or lab station: moldy bread, moldy cheese, a can of soup with no label and a cup of clean water. Have a sign beside the items: "DO NOT EAT/TOUCH Items."
 - a. Hand out the "Don't Eat That!" worksheet to each student. Students will answer the following questions on their worksheet:
 - i. 1) What do the items have in common?
 - ii. 2) Is there anything wrong with any of the items? If so, what?
 - iii. 3) Are all items safe to consume? How do you know?
 - iv. 4) What do you think our topic for class is today?
 - b. When class begins, ask the class the above questions and review together:
 - i. 1) What do the items have in common? Some have mold; we can eat them all; all are food
 - ii. 2) Is there anything wrong with any of the items? If so, what? Mold; cannot see/smell the water or ID what is in the can; could be unsafe to consume
 - iii. 3) Are all items safe to consume? How do you know? No; no ID on the soup can; water could be contaminated; visible mold (which can be removed from the cheese, not the bread); do not eat moldy bread — it contains mold within the product (interior mold). Hard cheeses get surface/exterior mold — it can be removed.
 - iv. 4) What do you think our topic for class is today? pathogens that can make us sick = foodborne illnesses
 - v. Transition into the Introduction section of the lesson.
2. **Introduction:**
 - a. Show the following video clip: [Food Safety Music - Microbes Medley](#) (5 min).
 - b. Show/discuss the PowerPoint "Foodborne Illness, Pathogens and Allergens." Stop at slide 32. Move to Activity 1 below.
3. **Activity 1: Little Professor Moment**
 - a. Hand out the worksheet "Food Pathogens". Divide students into groups and then divide the pathogens discussed between the groups. The number of groups and pathogens per group should be determined by what makes sense for your classroom.
 - b. Have each group of students share their information with the class. Each student will then complete their chart for their notes.
4. **Activity 2:**
 - a. Show/discuss the PowerPoint "Foodborne Illness, Pathogens and Allergens." Start at slide 32.
 - b. Pass out the student worksheet titled "Common Food Allergens."
 - c. Discuss and read over the worksheet as a class.
 - d. Divide students into groups of two or three students (or allow them to decide).
 - e. Allow 15 to 20 minutes for groups to research (using online resources) and complete the worksheet.
 - f. When all groups have finished, have them take turns sharing what they learned. All students should be completing the table at the end of the activity while students share information.
5. **Follow-up:**
 - a. Collect completed student worksheets as the "Exit Ticket" for the day.
6. **Optional – Extended Learning Opportunities (Not factored into time requirement):**
 - a. Mixed-up Milk Lab
 - i. Tell students: *This lab will explain how beneficial bacteria are used in food processing.*
 - ii. Pass out the lab sheet titled "Activity 1: Mixed-up Milk." Go over the procedure with students, and assign groups and a type of milk to each group. Ask students if they have any questions. Proceed with the lab. Teachers may choose to assist students when they use the microwave.
 - iii. Remind students to answer the questions on the lab sheet.
 - iv. Once all groups are finished, either collect lab sheets (for a grade) or check for completion. Then discuss answers and post-lab results with the class. See "Key" at the end of this lesson.
 - v. Have students visit the following website: <https://www.fightbac.org/food-safety-education/home-food-safety-mythbusters/#>.
 - b. Direct them to read through the "myth busters."

- i. Other great resources can be found at <https://www.fightbac.org/flour-safety/>. Option: Have students watch the posted educational videos, or read additional information provided, and then write a short summary on what they learned.

7. **Exit Ticket:**

- a. Collect completed “Follow-up Activity: Common Food Allergens” worksheets.
- b. As students turn in their papers and walk out the door, ask them to tell you the name of one of the common food pathogens discussed in class today OR have students write the name of one foodborne pathogen on the back of their worksheets rather than verbally sharing with the teacher. Possible answers:
 - i. Campylobacter
 - ii. Clostridium botulinum
 - iii. E. coli O157:H7
 - iv. Listeria monocytogenes
 - v. Norovirus
 - vi. Salmonella
 - vii. Staphylococcus aureus
 - viii. Shigella
 - ix. Toxoplasma gondii
 - x. Vibrio vulnificus

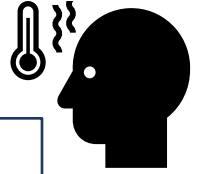
Name: _____

Aligned to the following standards: FPP.02.; FFA.PL-A; FFA.PL-C; FFA.PG-J; FFA-CS-M; AG-FD1; AGPA01.02; AGPA01.04; CS.03; CCSS.RI.9-10.1; CCSS. RI.9-10.2; CCSS.W.9-10.2; CCSS.SL.9-10.1.A; CCSS.SL.9-10.1.C; CCSS.RST.9-10.1; CCSS.RST.9-10.2; CCSS.RST.9-10.3; CCSS.RST.9-10.7; CCSS.WHST.9-10.2; CCSS.WHST.9-10.4; CCSS..MP6; AFNR Career Cluster-Food Products and Processing Systems Pathway, Statement 2; Buying Goods and Services, Benchmarks: Grade 12, Statement 2; Buying Goods and Services, Benchmarks: Grade 12, Statement 7; CRP.02; CRP.04; CRP.05; CRP.06; CRP.07; CRP.08; CRP.11

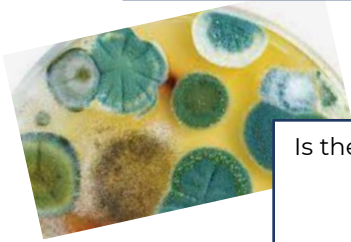
Don't Eat That!

Directions:

Observe the items on the front counter but do not touch or eat the items.



What do the items have in common?



Is there anything wrong with any of the items? If so, what?

Are all items safe to consume? How do you know?

What do you think our topic for class is today?



Name: _____

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Food Pathogens

Directions:

Complete the following chart as instructed.

Pathogen Name	Source of Contamination	Impact on Human Health	How to Avoid	Other Thoughts

In summary, what is the best way to avoid contamination of food pathogens?

Name: _____

Common Allergens in Food

Key Term: Allergen: any substance, often a protein, that induces an allergy; common allergens include pollen, grasses, dust and some medications

Concept: Describe the effects foodborne allergens have on people.

Objective: Identify 8 major food allergens.

Purpose: While more than 160 foods can cause allergic reactions (and even death) in people with food allergies, the law identifies the 8 most common allergenic foods. These foods account for 90% of food allergic reactions and are the food sources from which many other ingredients are derived.

Milk

Eggs

Fish (e.g., bass, flounder, cod)

Crustacean shellfish (e.g., crab, lobster, shrimp)

Tree nuts (e.g., almonds, walnuts, pecans)

Peanuts

Wheat

Soybeans

These 8 foods, and any ingredient that contains protein derived from one or more of them, are designated as “major food allergens” by FALCPA.

The law requires that food labels identify the food source names of all major food allergens used to make the food. This requirement is met if the common or usual name (e.g., buttermilk) of an ingredient that is a major food allergen already identifies that allergen's food source name (i.e., milk). Otherwise, the allergen's food source name must be declared at least once on the food label in one of two ways.

The name of the food source of a major food allergen must appear in parentheses following the name of the ingredient.

Examples: “lecithin (soy),” “flour (wheat)” and “whey (milk)”

– OR –

Immediately after or next to the list of ingredients in a “contains” statement.

Example: “Contains Wheat, Milk and Soy”

Food Allergen “Advisory” Labeling

FALCPA’s labeling requirements do not apply to the potential or unintentional presence of major food allergens in foods resulting from “cross-contact” situations during manufacturing, e.g., because of shared equipment or processing lines. In the context of food allergens, “cross-contact” occurs when a residue or trace amount of an allergenic food becomes incorporated into another food not intended to contain it. The FDA guidance for the food industry on potential allergens states that the food allergen advisory statements, e.g., “may contain [allergen]” or “produced in a facility that also uses [allergen]” should not be used as a substitute for adhering to current good manufacturing practices and must be truthful and not misleading. The FDA is considering ways to best manage the use of these types of statements by manufacturers to better inform consumers.

Part 1: Research

Your group will be assigned one food allergen from the list above. In your group decide how to develop a fact sheet about your allergen. Things to include on the fact sheet:

- Name
- What causes the allergic reaction
- Symptoms of the reaction
- Level of reaction

Name: _____

- Treatment for a reaction
- What foods to avoid
- Other useful information
- Your fact sheet should be one page in length and include all important information about the allergen and how to treat or avoid a reaction.
- Your teacher may make a copy of your fact sheet for all your classmates.
- You will share your information with your classmates and complete table in this worksheet.

Conclusion: Answer the following questions.
What causes foodborne allergens?

Why is food labeling important for people with food allergens?

What are the most dangerous food allergies?

Name: _____

Complete the table below with information you learn about the common allergens.

Allergen	Causes	Symptoms	Levels of Reaction	Treatment for Reaction	Foods to Avoid	Labeling Requirements
Milk						
Eggs						
Fish						
Shellfish						
Tree Nuts						
Peanuts						
Wheat						
Soy						

Name: _____

Extension Activity: Mixed-up Milk

Investigational Tools:

- 1 ½ cups of assigned milk
- 1 microwave-safe bowl
- 4 teaspoons white vinegar
- 1 mixing spoon
- 1 strainer
- 1 cheese cloth
- 1 airtight container
- Microwave

Directions:

1. Pour the milk into the bowl, and add the vinegar.
2. Microwave the bowl for 1 minute on high power.
3. Look at the mixture. What happened? Record your observations below.

4. Stir the mixture. Then, over the sink, pour it through the strainer, lined with a cheese cloth.
5. You have just made curds! What you have should look like large-curd cottage cheese.
6. Cool the solid and rinse it lightly before handling.
7. Squeeze out any remaining liquid and shape the solid with your hands.
8. Store it in the airtight container.

Outline the Facts:

- Share. Pick up your product. What does it feel like?

- Reflect. What role did the vinegar play in the experiment?

- Generalize. What kind of milk did you have? Would it work with other types of milk? Do you need white vinegar, or can you try another kind of vinegar?

- Apply. Heating the milk and vinegar caused a change in the milk's form. What other liquids can change form when combined with other ingredients?

Aligned to the following standards: FPP.02.; FFA.PL-A; FFA.PL-C; FFA.PG-J; FFA-CS-M; AG-FD1; AGPA01.02; AGPA01.04; CS.03; CCSS.RI.9-10.1; CCSS. RI.9-10.2; CCSS.W.9-10.2; CCSS.SL.9-10.1.A; CCSS.SL.9-10.1.C; CCSS.RST.9-10.1; CCSS.RST.9-10.2; CCSS.RST.9-10.3; CCSS.RST.9-10.7; CCSS.WHST.9-10.2; CCSS.WHST.9-10.4; CCSS..MP6; AFNR Career Cluster-Food Products and Processing Systems Pathway, Statement 2; Buying Goods and Services, Benchmarks: Grade 12, Statement 2; Buying Goods and Services, Benchmarks: Grade 12, Statement 7; CRP.02; CRP.04; CRP.05; CRP.06; CRP.07; CRP.08; CRP.11

Name: _____

KEY: Activity 1: Mixed-up Milk

Share. Pick up your product. What does it feel like?

Answers will vary.

Reflect. What role did the vinegar play in the experiment?

Vinegar is an acid and that lowers the pH of the milk just as the beneficial bacteria would; however, vinegar takes less time and allows the lab to be completed in one class period. It takes about eight hours for the pH levels to reach the proper level when using the bacteria so it is impossible to accomplish in one class period.

Generalize. Would this experiment work with any kind of milk? Do you need white vinegar, or can you try another kind of vinegar?

Answers will vary depending on type of milk used.

The bacteria feeds on the glucose until there is no more glucose available. Lactic acid will lower the pH to 4.5. This is the magic number because other bacteria that could spoil the food normally dies at a pH of 4.5. If the fermentation does not continue long enough to lower the pH below 4.5, the bacteria remain alive and can make the food inedible. Consider potential results by using apple cedar vinegar instead of white.

Apply. Heating the milk and vinegar caused a change in the milk's form. What other liquids can change form when combined with other ingredients?

A good bacterium that multiplies in warm milk creates the slightly sour food product known as yogurt. *Lactobacillus bulgaricus* and *Streptococcus thermophiles* are two bacteria used in yogurt production. These bacteria curdle milk, but the curds and whey do not separate. Instead, they can be used to create a thick custard. Liquids can be described as either an acid or a base. The pH scale measures the concentration of positive hydrogen (H^+) and negative hydroxide (OH^-) ions in a liquid, ranging at zero (strong acid) and up to 14 (strong alkaline). Seven is considered neutral. Distilled water, which has no flavor, is neutral since the negative hydroxide and positive hydrogen ions are present in equal amounts.

Name: _____

KEY: Follow-Up Activity: Common Allergens in Food

Conclusion: Answer the following questions.

What causes foodborne allergens?

A food allergy is a response to a food triggered by the immune system. Over 160 different foods can cause allergic reactions. The law identifies eight of the most common foods, accounting for 90% of all allergies.

Why is food labeling important for people with food allergens?

Serious illness or death may result in those individuals who consume foods which they are allergic to. It is crucial to label all foods and food ingredients so that consumers know what they are purchasing and consuming.

What are the most dangerous food allergies?

- o Milk
- o Eggs
- o Fish (e.g., bass, flounder, cod)
- o Crustacean shellfish (e.g., crab, lobster, shrimp)
- o Tree nuts (e.g., almonds, walnuts, pecans)
- o Peanuts
- o Wheat
- o Soybeans

Answers to table: Will vary depending on depth of information students gather