Microorganisms

Educator Guide

Big Idea/Inquiry Question

What causes foodborne illness, and how can we prevent it?

Target Course and Grade

Science curricula across Canada for Grades 4–6.

This resource kit will support cross-curricular outcomes, including health and wellness, language arts and food-specific courses for Grades 4–6.

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Introduction to the Theme

This resource kit aims to empower students to examine food safety regulations and risks, evaluate diverse information related to foodborne illness, and demonstrate knowledge, skills and personal responsibilities related to food safety. The interactive activities in this kit introduce students to microorganisms, teach them about foodborne pathogens and provide hands-on experiments in which students can see how microorganisms can spread. As a final activity, students will participate in an educational bingo game about microorganisms and food safety to demonstrate their learning and consolidate their understanding.

Microorganisms

Educator Guide

Student Achievement

This resource kit includes a set of six food safety achievement badges. These badges are meant to commemorate and celebrate students learning about food safety. Use these badges throughout the resource kit as a reward for participation or, at the end, as a token of student achievement. The food safety achievement badges can be found on pages 35–36 of this Educator Guide.

A Message From Health Canada

Foodborne illness continues to be a significant health issue around the world. There are more than 4 million cases of foodborne illness in Canada annually. Each year, these illnesses result in over 11,500 hospitalizations and 240 deaths. These illnesses are caused by food that is contaminated by a variety of foodborne pathogens.

Symptoms usually include nausea, vomiting, diarrhea, stomach pain and fever. Often, people recover quickly with no lasting complications, but in some cases, serious complications can occur, including death.

Everyone has a part to play in Canada's food system. Knowing how to properly clean, separate, cook and chill foods while handling and preparing them can help you and your students prevent foodborne illness.

We have created these food safety education resources to give students the knowledge they need to make safe and healthy food preparation choices. This age group might be interested in this topic because they may be helping prepare food in their homes. Food safety education is important for creating positive habits that will last a lifetime.

Teacher Backgrounder

Safe food handling practices are important when preparing food. Knowing how to properly handle and prepare foods can help prevent foodborne illness. This resource kit focuses specifically on the role of microorganisms in foodborne illness. Microorganisms are tiny living things that are too small to be seen with the naked eye. They include bacteria, viruses and parasites. The four food safety steps (clean, separate, cook and chill) work together to stop the spread and growth of harmful microorganisms in our food. Education surrounding food safety and safe food preparation should focus on these four concepts.

Clean

The “clean” food safety step means that hands, preparation surfaces, cooking surfaces and cooking utensils are cleaned before, during and after food preparation. Hands are one of the most common means of moving microorganisms from one place to another. Reminding students to wash their hands for at least 20 seconds using soap and warm running water is important. Completing this step ensures that harmful microorganisms are not transferred from unclean surfaces to clean surfaces. Eating food or consuming beverages containing harmful microorganisms can cause foodborne illness.

Separate

The “separate” food safety step means not cross-contaminating raw food and cooked or ready-to-eat food. Raw food can contain harmful microorganisms that may be transferred to food handlers and onto ready-to-eat foods, food preparation surfaces and storage surfaces. Separating raw food, especially meat, poultry and seafood, from ready-to-eat food is an important part of safe food preparation because it prevents the transfer of harmful microorganisms from one surface to another. Raw food should remain separate from ready-to-eat food at the grocery store, in the fridge and during food preparation. Use clean cooking utensils when switching from preparing raw foods to serving ready-to-eat foods. Remember: separate, don’t cross-contaminate!

Cook

The “cook” food safety step means cooking food to its recommended safe internal cooking temperature and checking with a digital food thermometer. Cooking food to its recommended safe internal cooking temperature will destroy harmful microorganisms that cause foodborne illness. With the help of an adult, students can use a clean digital food thermometer to check that their food is cooked correctly. This resource kit includes a student-friendly *Safe Internal Cooking Temperature Chart* for students to reference. Remember, you can’t tell if food is cooked to the correct temperature simply by looking at it.

Chill

The “chill” food safety step means keeping cold food cold. The goal is to keep food out of the food temperature danger zone. This danger zone is from 4°C to 60°C (40°F to 140°F). This temperature range is where bacteria can multiply quickly and cause foodborne illness. Microorganisms grow fast if food is left in the food temperature danger zone for over two hours, and if you eat this food, it could cause foodborne illness. To prevent foodborne illness, keep hot food at or above 60°C (140°F) and cold food at or below 4°C (40°F). This resource kit provides a student-friendly *Food Temperature Danger Zone* diagram for students to reference.

Refrigerate food within two hours of serving so it's not left in the food temperature danger zone for too long. Thaw food in the fridge, under cool running water or in the microwave—not at room temperature. Keep food from the grocery store cold or frozen while in transport, and place it into the refrigerator and freezer right away. School lunches containing "fridge items" should be packed in an insulated lunch bag with an ice pack. If students are taking food that should be served warm, they can heat it up before they leave and store it in a heat-preserving container or Thermos. Remember, keep hot foods hot and cold foods cold!

Conclusion

Helping students understand the four food safety steps—clean, separate, cook and chill—will help them make safe food choices when preparing or storing food. You are encouraged to visit the "Additional Resources" on page 30 of this Educator Guide to learn more specific information about the four food safety concepts and practices. This Educator Guide also includes a Food Safety Definition for Students Handout on pages 32–34. You can use this handout to ensure learners are familiar with the vocabulary used in this resource kit.

Resource 2.1

Video

A Microorganism Adventure

Resource Description

Isabelle and her friends embark on an exciting camping adventure where they enjoy the great outdoors and gain valuable insights into the world of microorganisms. In this resource, students will explore the four food safety steps and learn about helpful and harmful microorganisms. This video offers practical tips for incorporating the four food safety steps into daily routines and for food safety on the go.

Learning Objectives

Students will be able to:

- demonstrate an awareness of the widespread distribution of microorganisms
- explain what foodborne illness is and what causes it

Instructional Plan

Before

Begin with a brief discussion as a class to see what students know about microorganisms and food safety. Have students write their ideas on a shared writing space.

During

Play the video.

Pause the video after each question prompt and discuss it as a class. See “Related Resources” on page 6 for classroom discussion strategy ideas.

As the video plays, put a check mark next to any discussion points (e.g., washing hands is important) the students mentioned during the class discussion.

After

Have students discuss the video in pairs or small groups. Then have each pair or group share a key takeaway with the class.

Answer Key

1. **Question:** Why do you think Beck is telling Dakota to wait?

   Answer: *Beck is telling Dakota to wait because they were just petting Duke (the dog) and did not wash their hands before reaching for a hot dog.*

2. **Question:** Do you know how microorganisms grow?

   Answer: *Microorganisms need food, water, air and space to grow.*

(Continued on next page)

Resource 2.1

A Microorganism Adventure

Video

Answer Key

3. **Question:** What is one thing you learned from this video?

   Answer: *Answers will vary. The discussion should focus on concepts covered in the video, such as*

   - *the four food safety steps,*
   - *how microorganisms grow,*
   - *the proper cooking temperatures for beef and*
   - *the different types of microorganisms (e.g., bacteria, viruses and parasites).*

Related Resources

- To learn more classroom discussion strategies, visit Cult of Pedagogy at https://lbrd.ca/discussionstrategies

Resource 2.2 (A)

Handout

Mission 1: *Salmonella* Cross-Contamination Experiment

Resource Description

It's a good day for an experiment! Choose one of the following experiments to learn more about microorganisms and how they spread: *2.2 (A) – Mission 1:* Salmonella *Cross-Contamination,* *2.2 (B) – Mission 2: Handwashing Experiment* or *2.2 (C) – Mission 3: Bread Mould Experiment.*

Learning Objectives

Students will be able to:

- identify ways in which food can become contaminated
- investigate the risks of cross-contaminating foods
- describe preventive measures for avoiding cross-contamination

Materials Needed

- chart paper or whiteboard (teacher)
- marker or dry-erase marker (teacher)
- access to a sink
- water-based paint
- paintbrushes
- scissors
- soap
- cardboard or sponge
- paper
- chicken template
- disposable gloves or tongs (optional – see "Teacher Tip" below)

In *2.2 (A) – Mission 1:* Salmonella *Cross-Contamination Experiment*, students will work in groups to demonstrate how microorganisms can spread by washing chicken. Students will use a chicken template, paint and running water to conduct the experiment. Watch as they make the microorganisms fly!

Instructional Plan

Before

Set up the classroom for this experiment.

- Designate a clear walking path to the sink area to avoid paint dripping on hard-to-clean surfaces (e.g., do not walk over the carpet).

Provide background information about *Salmonella* (see "Background Information" below) so that students have a foundational understanding before beginning the experiment.

Background Information

Salmonella is a bacteria that can cause severe illnesses. *Salmonella* is spread when contaminated food comes in contact with people, surfaces or other food. *Salmonella* bacteria can cause severe illnesses. Common symptoms include diarrhea, fever and chills, stomach pains and vomiting.

Ask guiding questions to confirm student understanding. Below are some examples of guiding questions:

- What type of microorganism is *Salmonella*?
- Does anyone know a symptom of *Salmonella*?

Review and simplify the experiment instructions for the class. Consider writing these instructions on chart paper or a whiteboard for students to reference. See "Sample Step-by-Step Guide" on page 8 for an example.

Resource 2.2 (A)

Handout

Mission 1: *Salmonella* Cross-Contamination Experiment

Sample Step-by-Step Guide

1. Cut out the chicken template.
2. Paint the chicken.
3. Wash the chicken.
4. Repeat Steps 2 and 3 until everyone in your group has had a turn.

During

Ask students to get into groups of four or five.

Ask students to choose someone in their group to be the notetaker. This person will record the group's predictions, observations and the answers to the reflection questions.

Give students time to discuss their predictions, then have the notetaker record them in the handout.

Review "Step 2: Washing the Chicken Experiment" with students.

Have students complete the experiment.

Ask the notetaker to record their group's observations after each group member has had a turn painting and washing the chicken.

Students can complete the reflection questions as a group.

After

Come together as a class. Ask each group to share their observations in comparison to their initial predictions.

Consider writing notes on a shared writing space to document the similarities and differences each group experienced during this experiment. For example, what groups initially predicted vs. what happened as they tried the experiment.

Consider watching *Don't Wash Your Chicken Risk Video* (see "Related Resources" on page 9). This animated video describes the risks associated with washing your chicken. This will further support the learning from *Mission 1* – Salmonella *Cross-Contamination Experiment.*

Teacher Tip

For circumstances where students are reluctant to get messy, offer disposable gloves or tongs to minimize direct contact with their hands. Another option is to have them observe their group members washing the chicken.

Resource 2.2 (A)

Handout

Mission 1: *Salmonella* Cross-Contamination Experiment

Answer Key

Step 1: Predictions

Hint: What surfaces do you think the *Salmonella* will spread to?

Students may predict that Salmonella *will most likely spread to surfaces it touches, like the tap, sink and their hands.*

Step 3: Observations

Hint: What happened when you brought the chicken to the sink to wash it? Where did the *Salmonella* spread?

Students should describe the paint (Salmonella) *as having dripped into the sink and onto nearby surfaces like the floor and counter.*

Reflection Questions

1. **Question**: Why does washing the chicken make cross-contamination more likely to happen?

   Answer: *Students should talk about how washing the chicken causes the water to splash, and splashing spreads the bacteria across the whole chicken leg and onto other surfaces in the kitchen.*

2. **Question**: Was it easy to wash the chicken? Why or why not?

   Answer: *Students should talk about how washing the chicken causes the* Salmonella *to spread easily to other surfaces you then need to clean (e.g., sink, countertop).*

3. **Question**: Do you think it's necessary to wash chicken? Explain why or why not.

   Answer: *It is not necessary to wash chicken. Student reasons should include at least one of the following:*

   - *the bacteria is killed when chicken is cooked properly*
   - *the potential risk of spreading the bacteria comes from washing the chicken*

4. **Question**: What steps can we take to prevent *Salmonella* from spreading?

   Answer: *We can prevent the spread of* Salmonella *by washing our hands often and properly, following the four food safety steps and cooking food to its recommended safe internal temperature.*

Related Resources

- Watch the *Don't Wash Your Chicken Risk Video* from Partnership for Food Safety at https://lbrd.ca/dontwashchicken

Resource 2.2 (B)

Handout

Mission 2: Handwashing Experiment

Resource Description

It's a good day for an experiment! Choose one of the following experiments to learn more about microorganisms and how they spread: *2.2 (A) – Mission 1:* Salmonella *Cross-Contamination, 2.2 (B) – Mission 2: Handwashing Experiment* or *2.2 (C) – Mission 3: Bread Mould Experiment.*

Learning Objectives

Students will be able to:

- demonstrate proper handwashing
- describe ways to ensure a clean cooking environment
- identify ways pathogens can spread between hands and surfaces

Materials Needed

- vegetable oil
- hand soap
- paper towels
- access to a sink
- a bacterial substance (e.g., pepper, glitter)
- craft paper (optional)
- disposable gloves (optional—see "Teacher Tip")

In 2.2 (B) – Mission 2: Handwashing Experiment, students will work in groups to demonstrate the spread of microorganisms using oil and a representative bacterial substance like glitter or pepper. Watch as students discover how washing their microorganism-covered hands with soap and water makes microorganisms disappear!

Instructional Plan

Before

Set up the classroom environment for this experiment.

- Have all required materials prepared and accessible to students.
- Set up an area to pour oil and the bacterial substance on the students' hands. For easy cleanup, consider putting down craft paper to protect your work area.

Consider placing a copy of the handwashing infographic (found on page 2 of *2.2 (B) – Mission 2: Handwashing Experiment*) above the sink for students to reference.

Begin with a class discussion about the importance of handwashing and the potential consequences of not doing so.

Background Information

Handwashing is important because it helps prevent the spread of harmful bacteria and viruses. If we don't wash our hands, we risk contracting and spreading infections, including foodborne illness.

Guide students through making their predictions on the handout before beginning the experiment.

Show students which surfaces they should touch for this experiment (e.g., doorknob, countertop, desk, light switch, the sink's faucet).

Resource 2.2 (B)

Handout

Mission 2: Handwashing Experiment

During

Ask students to get into groups of four or five.

Ask students to choose someone in their group to be the notetaker. This person will record the group's predictions, observations and answers to the reflection questions.

Give students time to discuss their predictions, then have the notetaker record them in the handout.

Review "Step 2: Handwashing Experiment" with students, especially proper handwashing technique as shown in the infographic.

Have students complete the experiment.

Ask the notetaker to record their group's observations after each group member has had a turn washing their hands.

Students can complete the reflection questions.

After

Have a class discussion about what each group observed when they touched the different surfaces and how this compared to their predictions.

Talk with students about the importance of handwashing as it relates to keeping them healthy.

Teacher Tip

For circumstances where students may be reluctant to get messy, offer disposable gloves to minimize direct contact with their hands. Another option is to have them participate in the prediction and observation discussions as they watch their group members spread bacteria.

Answer Key

Step 1: Predictions

Hint: Will the bacteria stick to hands and surfaces or slide off?

Student predictions should focus on which surfaces the bacteria is likely to stick to and those that are less likely.

(Continued on next page)

Resource 2.2 (B)

Handout

Mission 2: Handwashing Experiment

Answer Key

Step 3: Observations

Hint: Did the bacteria stick to one type of material more than another (skin, metal, wood, etc.)?

Student observations should indicate that the bacterial substance stuck to their skin more than it did to other materials.

Reflection Questions

1. **Question**: What happened when you washed your hands using only water?

   Answer: *Student answers should include their observations. For example, they may have noticed that the water did not take the bacteria off, that it spread the bacteria around and that the water made their hands stickier. They may say that their hands did not look or feel completely clean.*

2. **Question**: What happened when you washed your hands using soap and water?

   Answer: *Students should include their observations. For example, they may have noticed that the soap and water removed all the bacteria from their hands.*

3. **Question**: Why do you think it is important to always wash your hands with soap and water, even when they look clean?

   Answer: *It's important to wash your hands because bacteria live on everything. We use our hands throughout the day and touch many shared surfaces, so it's easy for us to pick up bacteria without being aware.*

4. **Question**: Why is it a good idea to use a paper towel to touch the tap **after** you wash your hands? Please explain.

   Answer: *Student answers should demonstrate an understanding that the paper towel acts as a barrier between freshly cleaned hands and the bacteria on the tap.*

Resource 2.2 (C)

Handout

Mission 3: Bread Mould Experiment

Resource Description

It's a good day for an experiment! Choose one of the following experiments to learn more about microorganisms and how they spread: *2.2 (A) – Mission 1:* Salmonella *Cross-Contamination, 2.2 (B) – Mission 2: Handwashing Experiment* or *2.2 (C) – Mission 3: Bread Mould Experiment.*

Learning Objectives

Students will be able to:

- detect spoiled food in a variety of situations
- identify risk factors that may cause spoilage in foods

Materials Needed

- 5 slices of bread (per group)
- 5 plastic sandwich bags (per group)
- 1 marker or 5 sticky labels (per group)
- access to a sink
- soap
- tongs
- disposable gloves
- pencil

In *2.2 (C) – Mission 3: Bread Mould Experiment*, students will work in groups to learn about mould growth as they prepare bread slices using five different preparation methods. They will observe the bread for five to ten days, taking notes along the way. At the end of the experiment, students will hypothesize what factors contribute to mould growth and why regular cleaning habits prevent mould growth.

Instructional Plan

Before

Purchase bread for the experiment. Consider buying bread from a local bakery or researching ahead of time to find a brand that does not use preservatives. Using bread with preservatives can impact the results of this experiment.

Find out what students know about the spread of germs by asking them what they think will happen to the bread after it touches different surfaces.

Set up a table with plastic sandwich bags and markers (or sticky labels) for students to label their plastic sandwich bags.

During

Ask students to get into groups of four or five.

Ask students to choose someone in their group to be the notetaker. This person will record the group's predictions, observations and answers to the reflection questions.

Review "Step 1: Thinking About the Experiment" with students.

Give students time to discuss their predictions, then have the notetaker record them in the handout.

Distribute bread slices to each group using tongs or gloves.

Have students prepare their bread slices.

- For the shared surfaces, consider a high-touch area such as a desktop, door handle or countertop.

Resource 2.2 (C)

Handout

Mission 3: Bread Mould Experiment

After the students have completed each method and labelled their bread samples, place the samples somewhere in the classroom, away from direct sunlight, where students can easily observe them over the next five to ten days.

Students will record their observations on the *Bread Mould Experiment* handout over the next five to ten days.

- Students could also create a video log to record more detailed observations.

After

Students can complete the reflection questions.

Once the experiment is complete, have a class discussion to connect this learning activity to real-life scenarios.

- How would this learning relate to preventing the spread of illnesses?

Teacher Tip

You can simplify the experiment by focusing on two or three bread preparation methods. You could also have students draw their observations instead of writing them.

Answer Key

Step 2: Predictions

Record your group's predictions in the chart below. What do you think will happen to each piece of bread over the five to ten days?

Student answers will vary. Sample answers have been listed below.

Control Bread	*We think this slice of bread won't grow mould because we only touched it with clean gloves. So no germs could get on the bread and grow mould.*
Unwashed Hands	*We think this slice of bread will grow mould quickly because our unwashed hands could have had microorganisms on them.*
Washed Hands	*We think this slice of bread might have some mould, but not a lot because we washed our hands before we touched it. But we might not have washed away all the microorganisms, so some could have made it onto this bread.*

(Continued on next page)

Resource 2.2 (C)

Handout

Mission 3: Bread Mould Experiment

Answer Key

Step 2: Predictions *(Cont'd)*

5-Second Rule	*We think this slice of bread will have a lot of mould on it because the floor is very dirty! Even though the bread was on the floor for a short time, it can still pick up lots of microorganisms.*
Shared Surfaces	*We think this slice will have a lot of mould if the surfaces we touched it with were dirty. It won't have much mould if the surfaces were clean.*

Step 4: Observations

It is important to note that the mould may not grow as we expect. Below are possible observations that students can look for in each scenario.

Control Bread	*This slice of bread might end up with a little bit of mould growing on it. It may have green or white spots.*
Unwashed Hands	*This slice of bread might have mould growing on both sides. The colour of the mould can vary, and it may appear fuzzy.*
Washed Hands	*This slice of bread might still grow mould, but not as much as the unwashed-hands bread. It may have green or white spots.*
5-Second Rule	*This slice of bread might end up with some mould growth in different spots.*
Shared Surfaces	*This slice of bread might have mould growing on both sides. The colour of the mould can vary, and it may appear fuzzy.*

Reflection Questions

1. **Question**: Which slice has the least mould? Why do you think this condition produced the least mould?

   Answer: *The control bread has the least mould. Explain to students that this is because this bread was protected from exposure to contaminants like microorganisms.*

Resource 2.2 (C)

Handout

Mission 3: Bread Mould Experiment

Answer Key

Reflection Questions *(Cont'd)*

2. **Question**: Which slice has the most mould? Why do you think this condition produced the most mould?

   Answer: *The unwashed-hands bread or shared surfaces bread will have the most mould. Explain to students that our hands and shared surfaces carry a lot of bacteria, and bacteria stick well to the bread when we touch it.*

3. **Question**: How do regular cleaning habits help prevent mould growth?

   Answer: *Students should understand that regular cleaning habits help prevent mould growth because cleaning removes some or all of the microorganisms that stay on surfaces and could cause mould to grow. Reducing the microorganisms that stay on surfaces makes it less likely for contaminants to come into contact with food. Cleaning with warm, soapy water can remove harmful microorganisms.*

Resource 2.3
Foodborne Pathogens

Presentation

Resource Description

In this presentation, students learn about foodborne pathogens. They take a closer look at the characteristics, signs and symptoms of five common foodborne pathogens and the steps we can take to protect ourselves against them. Students will review the four food safety steps as they relate to pathogens. To finish, students will complete a group challenge about a recall alert.

Learning Objectives

Students will be able to:

- identify these common food pathogens: *Salmonella, Listeria, E.coli*, norovirus and *Cyclospora*
- explain these aspects of the four food safety steps:
  - the importance of sanitation in food handling and preparation
  - the temperature range of the food temperature danger zone
  - the practices used to separate food when cutting, preparing and shopping
  - the relationship between safe internal cooking temperatures and the elimination of foodborne pathogens

Instructional Plan

Before

Begin by engaging in a graffiti wall discussion (see “Related Resources” on page 18) to find out what students know about foodborne pathogens.

Remind students that bacteria, viruses and parasites are all types of pathogens. Ask the class if they know the names of any specific pathogens (e.g., *Salmonella, E.coli*).

During

Slides 2–4

Have a brief class discussion about the prompt on Slide 3 to see what the students know before showing them the definition of microorganisms.

Slides 5– 9

Encourage students to read the slides aloud with you. Ask students if they have an example they would like to share after reading the definitions of each vocabulary term (pathogen, foodborne illness and cross-contamination).

Slides 10–13

Ask the students if they can name the four food safety steps (clean, separate, cook and chill) before going through the slides.

Briefly discuss each of the four food safety steps, highlighting the ways we can protect ourselves.

Resource 2.3
Foodborne Pathogens

Presentation

Slides 14–30

After learning about each pathogen, ask students the following questions:

- What was the name of the pathogen?
- What is one symptom of this pathogen?
- What is one way you can protect yourself from this pathogen?

Asking these questions will help reinforce what the students have learned.

Slides 31–33

Ask students to think about a time when they felt unwell.

- Could they have had foodborne illness?
- What were the symptoms?
- How long did it last?

Slides 34– 39

Pause after Slide 35 and have a brief class discussion to get students thinking about how they can practice each food safety step in real life.

- How do you or adults around you make sure your cooking surfaces are clean?
- Have you ever used a digital food thermometer? With the help of an adult, you should try!

Slide 40

Talk to the students about recall alerts. Some additional background information about food recalls and alerts is written below.

To help explain what to do when food is recalled, show students this Canadian Food Inspection Agency poster at https://lbrd.ca/recall

Background Information

Fresh vegetables and fruits are naturally free from microorganisms (e.g., bacteria, viruses and parasites) that can cause food poisoning. Fresh produce can become contaminated in various ways, including through contact with soil and contaminated water. Contamination can also occur when fresh produce comes into contact with raw food items like meat, poultry, seafood and their juices, whether at the grocery store, in the shopping cart, in the refrigerator or on counters and cutting boards in the kitchen.

The Government of Canada's *Recalls and Safety Alerts* web page includes an up-to-date list of existing recall items. Visit the *Recalls and Safety Alerts* web page at https://recalls-rappels.canada.ca/en

Resource 2.3
Foodborne Pathogens

Presentation

Slides 41–43

Ask students to get into groups of four or five.

Task each group with creating a recall alert poster for the product in the description (ABC Greens lettuce).

- Please note that this is a fictional, science-based recall alert.

Consider having students create an outline of their poster. This will help to determine if they understand the purpose of the recall and what materials they will need to complete their poster.

After

Have a class gallery walk (see "Related Resources" below) so students can share their posters with their classmates.

Answer Key

Students should include the information listed below in their posters. All information is from Slide 41.

1. **Question:** What is the product?

   Answer: *The product is lettuce from ABC Greens.*

2. **Question:** What is the issue?

   Answer: *Some batches of lettuce were contaminated with pathogenic* E. coli.

3. **Question:** What should you do?

   Answer: *Do not eat the product. Throw it out or return it at the place of purchase for a refund.*

4. **Question:** Who does this impact?

   Answer: *It impacts any person or family who has purchased this brand of lettuce.*

5. **Question:** Where has it been sold?

   Answer: *It was sold at your local grocery store.*

Related Resources

- To learn more about graffiti wall discussions, visit Teach Starter at https://lbrd.ca/graffitiwall
- To learn how to create a gallery walk with your students, visit Facing History & Ourselves at https://lbrd.ca/gallerywalk

Resource 2.4

Handout

Investigating Foodborne Pathogens

Resource Description

Welcome to the pathogen detective task force! We'll start by taking a look at how pathogens travel through our bodies, where pathogens thrive, and what our bodies do to help us fight them. In this activity, students will become detectives on a mission to investigate one of the five common food pathogens. As a group, students will reference the *2.3 – Foodborne Pathogens* presentation to complete a graphic organizer and create a demonstration of their learning.

Learning Objectives

Students will be able to:

- identify the five most common foodborne pathogens
- determine the sources of foodborne pathogens

Materials Needed

- access to the *2.3 – Foodborne Pathogens* presentation
- books and/or internet-enabled devices for additional research (optional)
- any materials needed to complete their pathogen showcase project (e.g., paper, art supplies, laptop or tablet with a slideshow program, devices for video recordings, etc.)

Instructional Plan

Before

Consider writing the names of the five pathogens on a piece of chart paper or a whiteboard so students can easily access them. The pathogens are *Salmonella* (bacteria), *Listeria* (bacteria), *E.coli* (bacteria), *Cyclospora* (parasite) and norovirus (virus).

During

Read through the "Body Defence Systems" section of the *2.4 – Investigating Foodborne Pathogens* handout.

- Check for understanding by asking students, "How do our bodies protect us from foodborne pathogens?"

Divide students into groups of five.

Have each student in the group choose one of the five pathogens to research.

Students can fill out the "Pathogen Busters Graphic Organizer" using the information from the *2.3 – Foodborne Pathogens* presentation.

Consider giving the students the option to complete additional research on their chosen pathogen.

- Students could use print or online resources for this additional research.

Assist students in showcasing their learning by providing the materials they need to create their final product.

Ask students to complete the "3-2-1 Response" section of their handout after all the groups have presented their learning.

Resource 2.4

Handout

Investigating Foodborne Pathogens

After

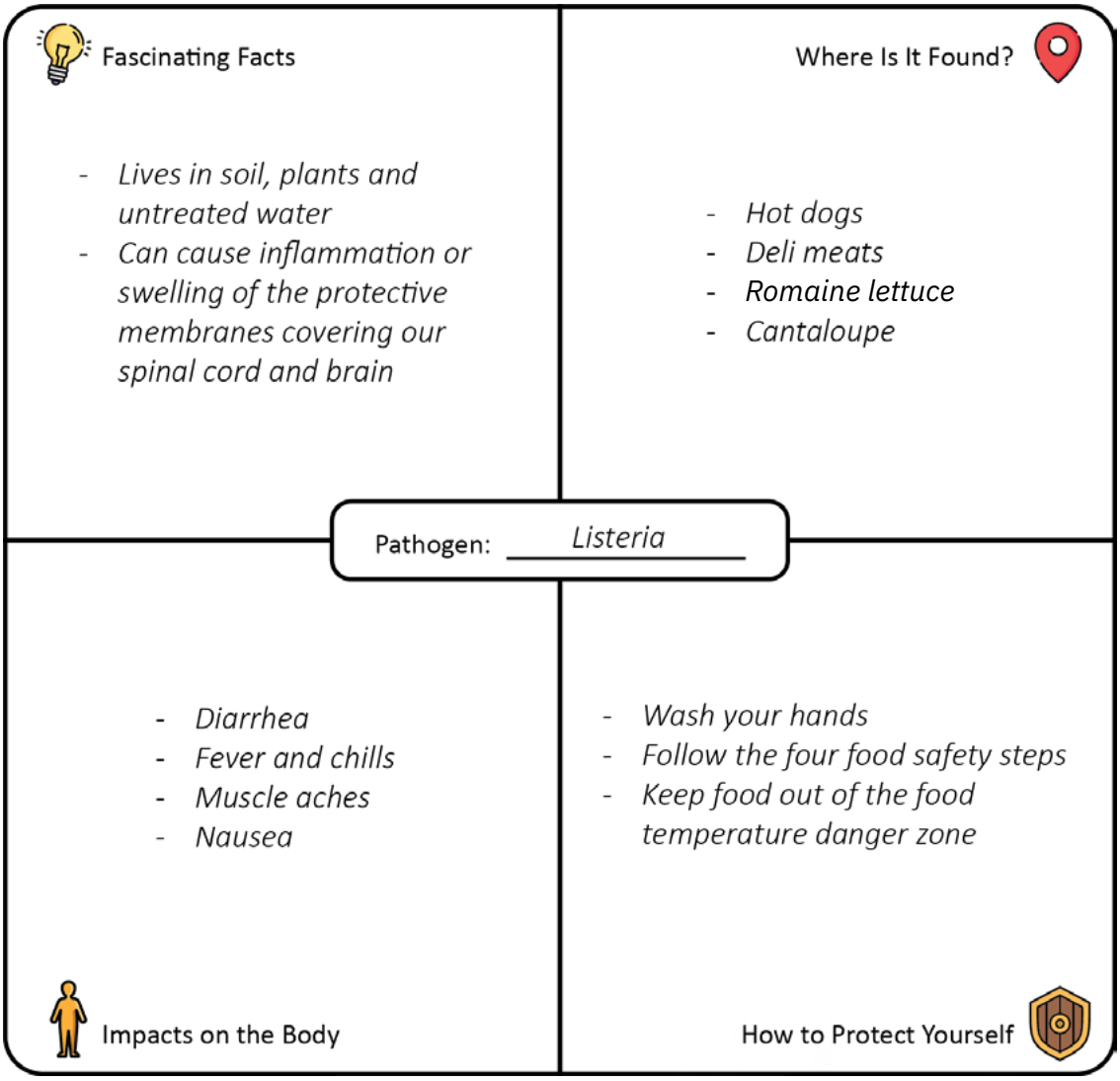
Encourage students to learn from each other. They can add to their "Pathogen Busters Graphic Organizer" or take notes while others are presenting.

Answer Key

Pathogen Busters Graphic Organizer

1. **Question:** Write facts about your pathogen using the "Pathogen Busters Graphic Organizer" below.

Sample Answer



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Resource 2.4

Handout

Investigating Foodborne Pathogens

Answer Key

3-2-1 Response

Student answers will vary. See sample answers below.

Three things I learned …

1. Salmonella *is one of the most common foodborne pathogens.*
2. *Proper food handling and hygiene practices are important to prevent foodborne illnesses.*
3. *Foodborne pathogens can cause severe health problems.*

Two things I found interesting …

1. *Listeria can grow on items at refrigerated temperatures, making it a hard pathogen to control.*
2. *Mucous is really important to keep our bodies safe.*

One connection to food safety is …

1. *Students can write about how the four food safety steps protect us from foodborne pathogens.*

Resource 2.5 (A and B)

Video

Handout

(A) Birthday Outbreak (Video)
(B) Birthday Outbreak Investigation (Handout)

Resource Description

Isabelle and her friends are celebrating a birthday party! Students will watch the *2.5 (A) – Birthday Outbreak* video to see how the four food safety steps are applied (or not applied) as Isabelle and Dakota prepare food for the party. After viewing the video, students will work together in small groups to hypothesize why Isabelle and her friends felt sick at the end of the video.

Learning Objectives

Students will be able to:

- demonstrate how bacteria is transferred from raw food to cooked food
- assess the risk of foodborne pathogens in a variety of situations
- determine the source of a foodborne pathogen

Materials Needed

- access to the *2.5 (A) – Birthday Outbreak* video

Instructional Plan

Before

Begin by having a class discussion about what students already know about the food safety steps and foodborne illnesses. This would be a great opportunity to make connections to prior learning activities like the *2.1 – A Microorganism Adventure* video and the *2.3 – Foodborne Pathogens* presentation.

During

Introduce the *2.5 (B) – Birthday Outbreak Investigation* handout.

Explain that students need to look for evidence of unsafe food practices while watching the *2.5 (A) – Birthday Outbreak* video.

Play the *2.5 (A) – Birthday Outbreak* video. Pause for a class discussion when the question “How could this illness have happened?” appears at the end.

Divide the students into groups of three or four to work on the *2.5 (B) – Birthday Outbreak Investigation* handout. Encourage evidence-based reasoning for their choices with direct examples from the video.

Play the video again. Have students complete the “Fill In the Steps” part of the worksheet as you play the video a second time.

After

Ask the students guiding questions such as these:

- What did Isabelle do to make sure the four food safety steps were followed?
- What food safety steps were missed by Isabelle?
- What roles did the other characters play in preventing or promoting food safety?

Resource 2.5 (A and B)

Video

Handout

(A) Birthday Outbreak (Video)
(B) Birthday Outbreak Investigation (Handout)

Replay the video at the end for groups to review and confirm their responses for the "Fill In the Steps" and "Case Solved" sections of the handout.

- You could also choose to pause the video and ask groups to share what they wrote for each question.

Answer Key

2.5 (A) – Birthday Outbreak **(Video)**

Question: How could this illness have happened?

Answer: *Students should focus on unsafe food practices that they observed in the video, such as these:*

- *The dish towel and cutlery were not cleaned before use (dirty dish towel and knife).*
- *The chicken was left to thaw at room temperature.*
- *The chicken was left at room temperature for more than two hours, which puts the food in the food temperature danger zone.*
- *Isabelle wiped her hands rather than washing them after touching raw chicken.*
- *The knife was not cleaned after using it on raw chicken, and then it was used to cut lettuce (causing cross-contamination).*
- *The digital food thermometer indicated that the chicken was cooked to 69°C, which is not the safe internal cooking temperature for chicken.*

2.5 (B) – Birthday Outbreak Investigation **(Handout)**

Fill In the Steps

Write or draw each step in the shoeprint. Use green to colour in the shoeprints with safe food practices. Use red to colour in the shoeprints with unsafe food practices. Discuss what could have been done differently for the red shoeprints to prevent illness.

Answers

- *Isabelle did not wash her hands (red). She should have washed her hands for 20 seconds with warm, soapy water.*
- *The dish towel and knife are unclean (red). Cooking utensils and dish towels should be cleaned before, during and after cooking.*
- *The chicken was left to thaw on the counter for three hours (red). Chicken should not be left out on the counter to thaw.*

(Continued on next page)

Resource 2.5 (A and B)

Video

Handout

(A) Birthday Outbreak (Video)

(B) Birthday Outbreak Investigation (Handout)

Answer Key

Fill In the Steps

- *Isabelle did not wash her hands after touching raw chicken. She then used the knife and returned it to the counter (red). Isabelle should wash her hands after touching raw chicken. She should also wash the knife now that she has touched it.*
- *Isabelle used the unclean dish towel to wipe her hands and then coughed (red). Dish towels should be kept clean. Isabelle should wash her hands for 20 seconds using warm, soapy water after coughing into her hands.*
- *Dakota washed their hands with soap and water (green).*
- *Dakota dried their hands on the unclean dish towel (red). Dish towels should be kept clean.*
- *Dakota cut the lettuce with the unclean knife (red). Cooking utensils should be cleaned before, during and after food preparation.*
- *Isabelle put cooked chicken on a new plate (green).*
- *The chicken was not cooked to a safe internal cooking temperature (red). We should use a digital food thermometer to ensure chicken is cooked to the recommended safe internal cooking temperature.*

(Continued on next page)

Resource 2.5 (A and B)

Video

Handout

(A) Birthday Outbreak (Video)

(B) Birthday Outbreak Investigation (Handout)

Answer Key

Case Solved

1. **Question**: What pathogen (e.g., *E. coli*, norovirus) do you think could have caused the illness that affected Ali, Beck, Isabelle and Dakota? Why?

   Answer: Salmonella *is the pathogen that caused the illness because it is commonly found in raw or undercooked poultry. Two common symptoms are fever and stomach pains, which Beck and Isabelle were experiencing.*

2. **Question:** Could Isabelle and Dakota have caused cross-contamination while they were preparing food? How?

   Answer: *Yes. Students should reference the red steps they identified in this handout's "Fill In the Steps" section.*

3. **Question:** How can cross-contamination lead to the growth and spread of harmful bacteria?

   Answer: *Cross-contamination can lead to the growth and spread of harmful bacteria because it introduces harmful bacteria to multiple surfaces.*

4. **Question:** How could the pathogens have entered the bodies of Isabelle, Dakota and their friends?

   Answer: *The pathogens could have entered the bodies of Isabelle, Dakota and their friends through their mouths when they ate food that was prepared in unsanitary conditions.*

5. **Question:** What are some risks that come with drinking or eating foods prepared by others?

   Answer: *Some risks that come with drinking or eating foods prepared by others are*

   - *getting a foodborne illness if you consume food that was exposed to cross-contamination or not cooked to a safe internal temperature*
   - *getting sick if the person preparing the food is unwell*
   - *having an allergic reaction if the person preparing the food is not aware or mindful of your allergies*

Resource 2.6 (A and B)

Handouts

(A) Food Safety Bingo Caller Cards (Handout)
(B) Food Safety Bingo! (Handout)

Resource Description

Using everything they have learned, students will recall the important aspects of food safety by playing a bingo game. Food Safety Bingo is a fun way for students to review the food safety steps (clean, separate, cook and chill) and the specific characteristics of common pathogens to show what they have learned.

Learning Objectives

Students will be able to:

- recall and apply information learned about microorganisms and foodborne illnesses

Materials Needed

- colouring supplies
- bingo dabbers (optional)
- small items (e.g., snap cubes) to use as markers (optional)
- internet-enabled devices

Instructional Plan

Before

Before playing Food Safety Bingo, have a popcorn brainstorming session (see “Related Resources” on page 29) with the class where students share facts they can remember about microorganisms and foodborne illness

During

Distribute blank bingo cards to each student.

Decide what the students will need to win (one line, an X or a full house) and communicate this to them.

Students will fill out their bingo cards by using words and pictures. Encourage them to research online if they need help with the images. For example, what does a virus look like?

Read the questions out to students. Encourage them to consider whether their answers are the correct match.

Students can say “bingo” once they think they have won.

The teacher can verify that the answers are correct.

Alternative Play

To play this bingo game in small groups, divide the students into groups of five or six. Distribute one card deck per group and blank bingo cards for each group member. Follow all of the directions above, but have one student be the bingo caller instead of the teacher. The bingo caller can decide what the students need to win: a line, an X or a full house.

Resource 2.6 (A and B)

Handouts

(A) Food Safety Bingo Caller Cards (Handout)
(B) Food Safety Bingo! (Handout)

After

Have a class discussion to consolidate learning. Make connections between the terms they matched during the game and how these relate to real-life situations involving microorganisms and foodborne illnesses (e.g., putting meat away promptly, singing the “Happy Birthday” song twice when washing your hands).

Teacher Tip

Use the questions and answers provided below to create a digital bingo game using a platform such as Kahoot! (found at https://kahoot.com).

Answer Key

1. **Question:** What type of microorganism is *Salmonella*?
   Answer: *Bacteria*

2. **Question:** What is a pathogen?
   Answer: *Tiny organism that can cause disease*

3. **Question:** One source of *Salmonella* could be from eating ____.
   Answer: *Raw or undercooked chicken*

4. **Question:** How long can cooked food be left out before it needs to be refrigerated?
   Answer: *2 hours*

5. **Question:** How do we wash fruits and vegetables?
   Answer: *Under cool running water*

6. **Question:** What is the first step you take before preparing food?
   Answer: *Wash your hands*

7. **Question:** Always separate raw foods, such as meat and eggs, from _____ and washed produce.
   Answer: *Ready-to-eat foods*

8. **Question:** What is the safe internal temperature for cooked beef burgers?
   Answer: *71°C*

(Continued on next page)

Resource 2.6 (A and B)

Handouts

(A) Food Safety Bingo Caller Cards (Handout)
(B) Food Safety Bingo! (Handout)

Answer Key

9. **Question:** What food safety step involves keeping raw and ready-to-eat foods away from each other?
   Answer: *Separate*

10. **Question:** How long should you wash your hands with warm water and soap?
    Answer: *20 seconds*

11. **Question:** What food safety step involves placing food in the fridge and freezer?
    Answer: *Chill*

12. **Question:** What type of pathogen is norovirus?
    Answer: *Virus*

13. **Question:** How can we keep cold foods cold while on the go?
    Answers: *Insulated food cooler*

14. **Question:** What can happen when a cutting board is used for raw meat, then vegetables, without being washed?
    Answer: *Cross-contamination*

15. **Question:** What temperature should food and leftovers be refrigerated at?
    Answer: *4°C*

16. **Question:** Where do good bacteria live in the human body?
    Answer: *Gut and intestines*

17. **Question:** Where do microorganisms exist in everyday life?
    Answer: *Air, water, soil or our bodies*

18. Question: Which of the four food safety steps uses a digital food thermometer?
    Answer: *Cook*

19. **Question:** What tool is used to check the internal temperature of meat?
    Answer: *Digital food thermometer*

20. **Question:** Which of the four food safety steps involves washing cooking utensils?
    Answer: *Clean*

(Continued on next page)

Resource 2.6 (A and B)

Handouts

(A) Food Safety Bingo Caller Cards (Handout)
(B) Food Safety Bingo! (Handout)

Answer Key

21. **Question:** What are the tiniest type of organisms called?
    Answer: *Microorganisms*

22. **Question:** What can you do to protect yourself from foodborne illness?
    Answer: *Use the four food safety steps*

23. **Question:** You need both _____ and water to properly wash your hands.
    Answer: *Soap*

24. **Question:** What is the food temperature danger zone range?
    Answer: *4°C to 60°C*

Related Resources

- To learn more about popcorn brainstorming sessions, visit Popcorn Carnival at https://lbrd.ca/popcornbrainstorm

Extension Activities

- Students can create a short story or comic featuring microorganisms as characters to emphasize microorganisms' impact on the world.
- Students can create a microorganism trivia game using an online program like Kahoot! (found at https://kahoot.com).

Additional Resources

For more food safety information, visit these websites.

Health Canada

- Review the four food safety steps by visiting https://lbrd.ca/foodsafetyandyou
- Learn about general food safety tips by visiting https://lbrd.ca/foodsafetytips
- Learn more about poultry safety by visiting https://lbrd.ca/poultrysafety
- Watch a video to learn how to use a food thermometer by visiting https://lbrd.ca/foodthermometers
- Get tips on safe food storage by visiting https://lbrd.ca/safefoodstorage
- View the recommended safe cooking temperatures by visiting https://lbrd.ca/safeinternaltemperatures
- View the *Tricks to Not Get Sick: Food Safety for Kids* video by visiting https://lbrd.ca/trickstonotgetsick
- Learn about food safety tips for barbecuing by visiting https://lbrd.ca/BBQtips
- Learn about food safety for First Nations and Inuit by visiting https://lbrd.ca/foodsafetyfirstnationsandinuit

Partnership for Food Safety Education

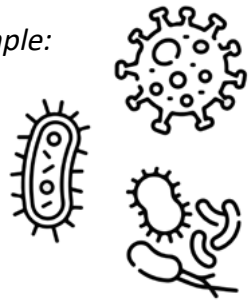
- Learn how to pack a safe lunch by visiting https://lbrd.ca/safelunch
- Continue to learn about safe poultry handling by visiting https://lbrd.ca/safepoultryhandling

Public Health Agency of Canada

- Learn more about the benefits of handwashing by visiting https://lbrd.ca/handwashing
- Watch the *Hand-Washing Heroes* video by visiting https://lbrd.ca/handwashingheroes

Food Safety Definitions for Students

Use the following handout to remember the key terms we learned! For each key term, read the definition and draw what it is describing.

Term	Definition	Draw Your Understanding
Bacteria	*Bacteria* are tiny, single-celled organisms found all around us. Some bacteria are helpful and necessary for our bodies to work properly, while others can cause infections and make us sick. An example of good bacteria would be those in our gut that help us digest food and keep our immune system healthy. Bacteria can be different shapes, such as round or rod-shaped, and they can live in many different places, including soil, water and inside our bodies.	*Example:* 
Cross-Contamination	*Cross-contamination* happens when harmful microorganisms are transferred from one surface or food to another. It can happen when a cutting board is used to cut raw meat and then not washed before it is used to cut vegetables.	
Disease	A *disease* is an illness or sickness that prevents your body from working as it should. A disease can usually be recognized by signs and symptoms.	
Foodborne Illness	*Foodborne illness* is a sickness you get from eating food that has been contaminated with harmful microorganisms and/or their toxins. It can happen when food isn't cooked properly or isn't kept at the proper temperature. It can also happen when food comes into contact with surfaces or utensils, like plates and cutlery, that have harmful microorganisms on them. Foodborne illness can also be called food poisoning.	

Food Safety Definitions for Students

Term	Definition	Draw Your Understanding
Fungi	*Fungi* are a type of living microorganism that are different from plants and animals. They are usually found in damp or dark places, like the forest floor. Fungi come in many shapes and sizes, from tiny single-celled organisms to large mushrooms. Some fungi are good for us, like mushrooms and those used to make the antibiotic penicillin. Some fungi are harmful and can make us sick.	
Germs	*Germs* refer to harmful microorganisms like bacteria, viruses and parasites that can cause disease. You cannot see, smell or taste germs.	
Microorganisms	*Microorganisms* are tiny living things that are too small to be seen with the naked eye. They include things like bacteria, viruses and parasites. While some microorganisms can make people sick, others can be very helpful and are necessary for our bodies to work properly.	
Mould	*Mould* is a fungus that can grow on many materials. Moulds need an environment with moisture, oxygen and suitable temperatures to grow.	
Organism	An *organism* is any living thing. Some organisms you can see, like plants or animals, and some you cannot see, like microorganisms.	

Food Safety Definitions for Students

Term	Definition	Draw Your Understanding
Pathogens	*Pathogens* are tiny organisms that can cause disease. They can be bacteria, viruses, parasites or other microorganisms. When we come into contact with pathogens, they can make their way into our bodies and make us sick. Some pathogens are more harmful than others, especially for people who get sick easily.	
Parasites	*Parasites* live on or inside other organisms and depend on them for food and shelter. Parasites require a host to survive. Parasites can be microscopic, like some types of bacteria and viruses, or larger, like worms and ticks. Some parasites live on the surface of a person's body, while others live inside it.	
Toxins	*Toxins* are harmful chemicals made by some living organisms. When toxins come into contact with the cells in our body, they can cause various health problems, depending on the type of toxin and the amount we are exposed to.	
Viruses	*Viruses* are even smaller than bacteria and are not technically alive because they can't divide on their own. Instead, they enter the cells of other living organisms, including humans, animals and plants, and use the cells in that organism to divide and spread. Viruses can cause many illnesses, from the common cold to more serious diseases like COVID-19.	

Food Safety Achievement Badges

Food Safety Achievement Badges