4-H AG INNOVATORS EXPERIENCE
PRESENTED BY BAYER

TEEN FACILITATOR GUIDE

PROTECT THE PLATE

NATIONAL 4-H COUNCIL

Illinois Extension
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

BAYER

PROTECT THE PLATE

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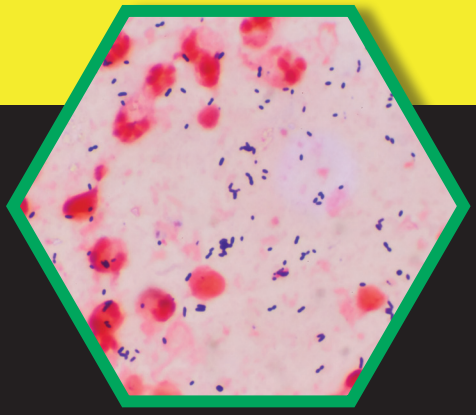

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WELCOME

Agriculture innovations play an important role in today's farming methods. Farmers can use innovative technologies to strengthen yields and overall productivity. The Protect the Plate 4-H Ag Innovators Experience explores how different technologies have transformed agriculture and how farmers must continue to innovate, learn, and adopt new technologies to grow more food in a sustainable manner, while focusing on food safety. Participants will discover how individuals who are creative and passionate about innovation in agriculture are needed to develop the new technologies that will allow farmers to continue to care for the land, while increasing yield and streamlining the way farms are operated.

The 4-H Ag Innovators Experience is a series of challenges where participants will explore a variety of agricultural innovations. In small teams, students will work through scenarios to solve situations that farmers, government entities, and consumers face. Youth will learn about food safety through challenges focused on pest management, EPA requirements, and foodborne illness. Once all challenges are complete, youth will have a better understanding of the food production process and safe food handling practices.

The 4-H Ag Innovators Experience is designed to be an engaging 60-minute activity, with three challenges for 3rd to 8th grade youth and teaching opportunities for older youth. This activity is ideal for summer camps, 4-H club meetings, summer reading programs, afterschool programming, special events and school collaborations, with activities intentionally aligned to the Next Generation Science Standards (NGSS).

As a Teen Facilitator for this activity, you will help youth understand the need for a variety of innovative techniques to feed the world (while limiting the impact on our planet), and to recognize that agriculture has adapted and evolved over time.

As a result, participants will:

- understand how advancing techniques in each part of the food production system are necessary to feed the world;
- understand the sciences that can empower farmers, consumers and others in the food value chain to contribute to environmental sustainability; and
- identify and illuminate the careers that today's food and agriculture industries require.

As the Teen Facilitator of this activity, you will help youth learn that:

- farmers around the world are transforming agriculture by combining modern sustainable practices and products with data science and tools;
- farmers are producing more with a smaller footprint and are contributing to biodiversity. In turn, biodiversity contributes to food production through healthier soil, pollination and pest control; and
- the need is growing for passionate individuals to take on agriculture's considerable challenges by developing the tools and technologies to feed our growing world, while acknowledging the demand for sustainability.

BACKGROUND

Have you ever wondered where your food comes from? The Protect the Plate Ag Innovators Experience should help you gain a better understanding of how your food gets to the grocery store and how it is made safe for you to eat. Food safety starts at the beginning with the planting process. Farmers need to make sure that their plants are protected from pests and disease. They are able to manage these pests in a variety of different ways, such as cultural methods. These can include: rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. There is not just one solution, but many that farmers can choose from. Once the plants are harvested, many of these products or commodities will be sent to a facility to be tested to make sure items are safe to sell. Once the commodities are found to be safe, they are passed on to locations to either be purchased for consumption or to processors if they need to be altered prior to consumption, such as soybeans made into soymilk or soybean oil.

KEY TERMS

Commodity: a product that can be bought and sold.

Environmental Protection Agency (EPA): an agency of the United States government that is responsible for protection of human health and the environment.

Food and Drug Administration (FDA): a federal agency that is responsible for protecting the public health through working on safety of medicines, veterinary drugs, medical devices, food supply, etc.

United States Department of Agriculture (USDA): provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management.

Foodborne Illness: disease caused by food contamination with bacteria, viruses, parasites or toxins.

Integrated Pest Management: strategies for pest control through a combination of techniques:

- **Biological Control:** reducing pests using known natural enemies/predators.
- **Chemical Control:** use of pesticides which are carefully and selectively applied.
- **Cultural Control:** purposeful manipulation of a garden's growth to reduce pest damage.
- **Host Resistance:** growing plants with an ability to resist pest infestation.
- **Mechanical Control:** use of various hands-on techniques that provide a protective barrier between plant and pest.
- **Physical Control:** physical removal of pests through trapping, elimination or relocation.

ACTIVITIES

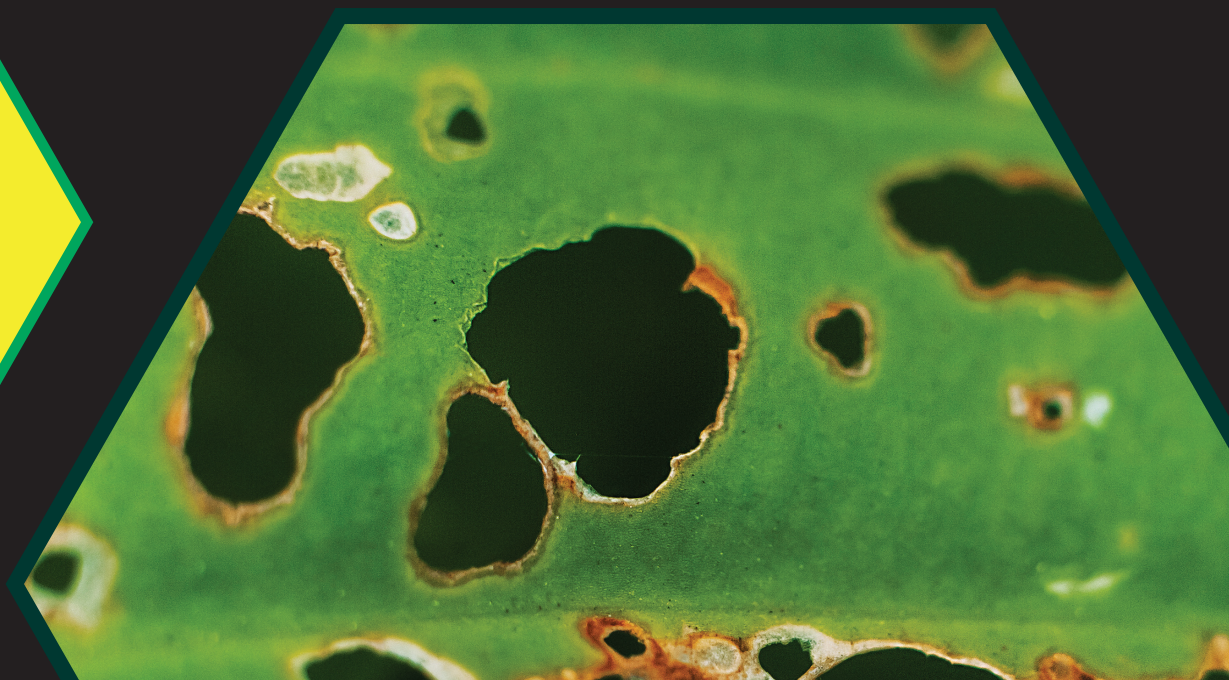
a) Activity 1: Pest ID/Pest Control Application

b) Activity 2: EPA Pesticide Levels/Limits

c) Activity 3: Foodborne Illness ID

d) Career Exploration

e) Optional Activities



KIT INVENTORY

Facilitator Guide
(Handouts in the book)

1 Field Map
(depicting what is grown, and also what is grown around their field and if those fields are organic, no spray, etc.)

2 Sets of Cards
(1 for the pests, 1 for the pest control methods)

3 Petri Dishes

3 Transparencies
(to be placed in the petri dishes to mimic the foodborne illnesses)

ACTIVITY DESCRIPTIONS

Activity 1: Pest ID/Pest Control Application

Youth must match the correct pest control method with the pest. Participants will need to examine and take into consideration the fields adjacent to theirs. This will also impact the type of pest control they choose. They will then need to identify proper application techniques. Through this activity, youth will learn how pest management on the farm is a crucial start to food safety.

Activity 2: EPA Pesticide Levels/Limits

Youth will be introduced to the EPA and learn of its policies and regulations on pesticide application as an additional layer to the complexity of food safety in the food chain. Youth will examine residue samples collected from recent shipments of produce and grains. Comparing the documented levels to the EPA's, the youth will identify those samples registering too high, and submit a report to the EPA. Youth will also then learn what happens after a report is submitted.

Activity 3: Foodborne Illness ID

A local restaurant has been closed for a foodborne illness. Participants will be presented with the reported cases of three individuals. After receiving samples of petri dishes showing bacteria growth of three possible bacteria/viruses, youth will work to identify which foodborne illness has affected the customers. Once the foodborne illness has been identified, the group will issue recommendations to the restaurant to ensure elimination of the illness and proper food safety/handling for the employees going forward.

FACILITATING THE ACTIVITIES

ACTIVITY 1: PEST ID/PEST CONTROL APPLICATION

Pests can cause issues for farmers in the fields, but they have a variety of options to chose from to help manage problems caused by pests. These include biological, chemical, cultural, physical, and chemical controls. Deciding which method to use depends on the crops planted within the farmer's field and what is planted around them.

Farmers must be cognizant of what other farmers are doing around them, for example, using chemical control could potentially impact the organic crops in a neighboring field. Much like every agricultural practice, there are pros and cons to each option of integrated pest management.

ITEMS NEEDED:

- Map of their farm - depicting what is grown, and also what is grown around their field and if those fields are organic, no spray, etc.
- Pest Cards containing the following:
  - Image of common pests
  - List of behaviors, resistance to certain pesticides, etc.
- Pest Control Methods cards containing the following:
  - Image/name of pest control method
  - What it controls/eliminates

PEST ID KEY

Soybean Pest	**Bean Leaf Beetle**	Because of the many variables producers face in terms of their crop choice, location, etc. there may be more than one pest control method solution.
Pumpkin Pest	**Squash Bug**	
Alfalfa Pest	**Alfalfa Weevil**	
Corn Pest	**Corn Rootworm**	

Group Discussion Point –
How does this protect my plate?

ACTIVITY 2: EPA PESTICIDE LEVELS/LIMITS

As we have found out from the last activity, pesticides are one of the options used to protect our food production. Though regulated, residue of these pesticides may remain on our grains, vegetables, fruits, etc. in small amounts. Safety for consumers is the priority of the EPA, therefore they establish, regulate, suspend, and sometimes revoke the tolerances of pesticides that can be left behind on our foods.

Before a tolerance, or maximum residue limit, can be set, numerous research and scientific studies are conducted for each pesticide. An assessment is performed that considers how much and how often a pesticide is used, the toxicity levels and break-down of each, how much remains on the product before reaching consumers' hands, all avenues of exposure to the pesticide, and what health risks there are to consumers of all ages. The tolerances are then set at levels that are many times lower than an amount that could potentially cause a risk. Pesticides that don't pass these tests or studies do not get approval from the EPA to be sold or used. Enforcement of EPA residue limits is upheld by several government agencies including, the FDA, the USDA and state enforcement agencies.

Products that have been treated with these pesticides, such as fruits, vegetables, grains and more, are routinely tested for various pesticide residues. Results from those tests are compared to the EPA's approved residue limits. Products found to have pesticide residues that exceed those limits are subject to be taken by the government and potentially destroyed, sometimes at the producer's expense.

For this activity, participants will examine the results of the random commodity samples taken recently. They will then compare the samples' residue levels to that of the EPA chart and decide if the sample exceeds the limits or if it's approved to move on to market. If it is not approved, they will decide what action needs to be taken.

Group Discussion Point - How does this protect my plate?

EPA Limits Chart

Pesticide residue tolerances in ppm (parts per million)

	Glyphosate	Glufosinate	Malathion
Corn (field)	5.0	.20	8.0
Soybean (hulls)	120.0	5.0	8.0

REPORT FORM

Agency: Food and Drug Administration testing facility

Date:

Product: Sample #1902 - Corn (field)

Pesticide/Herbicide Identified: Glyphosate

Residue level detected: .05 ppm (parts per million)

EPA Residue tolerance:

Action to be taken:

ACTIVITY 3: FOODBORNE ILLNESS ID

Once commodities enter the market and are purchased for consumer consumption, it is important that safe food handling practices are continued and followed to avoid foodborne illnesses from occurring.

During a foodborne illness outbreak, many agencies come together and work to solve the who, what, where, when and how. These agencies include the CDC, local, state, and federal departments of agriculture and partners in the food industry.

How can contamination occur? Let's look at the stages of farm to table.
(Source: https://www.cdc.gov/foodsafety/production-chain.html)

FOOD PRODUCTION STAGE – Food contamination can occur if an animal is sick and not properly treated, or if produce (fruits and vegetables) is treated with contaminated water before harvest.

PROCESSING STAGE – This is when food is transformed into the products we purchase at the store. Processing looks different for each food product. It can be as simple as washing the food products, such as fruits or vegetables, or complex procedures like milling grains or slaughtering animals. Food processing plants sort out damaged or unusable items and have practices in place to keep food safe at every step of the processing cycle. However, contamination can occur at any step during processing, for example if contaminated water is used, or if processing surfaces are not properly disinfected during cleaning.

DISTRIBUTION STAGE – At this point, the food has been processed and is transferred to the consumer or restaurant. During transportation, food contamination can occur if there isn't proper refrigeration or if the food is held at various temperatures throughout its journey.

PREPARATION STAGE – At this stage, food is prepared for the meal. This could be at your home or in a restaurant. Contamination occurs if those preparing the meal are sick and don't wash their hands after coughing, sneezing, or using the restroom. It can also occur if kitchen prep items such as utensils, counters, etc. are not cleaned properly. Food also needs to be stored and kept at appropriate temperatures before being prepared and served.

When a foodborne outbreak does occur, three types of data are collected to determine the root cause and develop a plan to treat and prevent further outbreak:

- Epidemiologic – Patterns and timelines of illness.
- Traceback – Looking for a common point of contamination.
- Food and Environmental Tracking – Collection and analyzation of bacteria found at locations and from sick individuals.

From there, health officials evaluate and develop an action plan, which includes, but is not limited to, the following:

- Warning the public.
- Issuing recall orders to the manufacturing plants.
- Closing restaurants or food handling facilities until they can be cleaned.

In this activity, a restaurant has been closed due to a suspected foodborne illness outbreak. Participants will study the collected bacteria and analyze it against the symptoms presented by the customers. Participants will then decide if the illnesses are a direct result of food handling practices or if they are unrelated.

As a way to enhance the lesson, facilitators could make or purchase a simulated germ lotion. Choose a facilitator (if there is more than one) to be patient zero. Before youth arrive for the program, that facilitator should apply the lotion and then proceed to touch random object around the room that the youth participants are sure to touch (e.g. pencils, chair backs, papers, etc). At the end of Activity 3, utilizing a black light, demonstrate to the participants how easily germs can spread when proper precautions like washing your hands are not taken.

Items Needed for Activity

- Handout 3 – Restaurant scenario and reports from the sick individuals
- Handout 4– Petri dishes – common foodborne illnesses and what to expect
- Handout 5 – Discussion guide for participants summarizing next steps for the customers and restaurant
- 3 petri dishes – Depicting known/common foodborne illnesses (Norovirus, E. Coli, Salmonella)

Group Discussion Point –
How does this protect my plate?

CAREER EXPLORATION

There are many opportunities for current and future generations in the field of agriculture. Check out just a few of those careers below.

- **Agri-Business**
  - Quality Assurance Manager – Enforces all state and federal guidelines for products.
  - Extension Staff – Works with land-grant universities to deliver and develop educational material to community members on topics such as agriculture, nutrition and wellness, economics, youth development and more.
- **Animal Sciences**
  - Animal Welfare Specialist – Audits production facilities on animal handling and food safety.
  - Meat Inspector – Makes sure meat products are safe from contamination and meet regulations.
- **Environmental/Natural Resources**
  - Conservation Officer – Protects local natural resources and works with other entities in doing so.
  - Irrigation Specialist – Provides advice on types of irrigation systems to meet the needs of the customer.
  - Integrated Pest Management Specialist –Works to provide growers with a comprehensive plan for their crops, including the use and application of various pest control methods.
- **Plant Science**
  - Agronomist – Provides agronomic knowledge to growers. Assists with field scouting, soil management, and more.
  - Formulation Chemist – Designs and develops prevention products for crops.
  - Entomologist – Researches insects and studies their interactions with plants.
  - Soil Scientist – Researches soil composition and advises land use.
- **Food Science**
  - Food Safety Specialist – Oversees that foods are processed by certain standards.
  - Produce Inspector – Inspects produce during growth and harvest following USDA guidelines.
  - Meat Processor – Inspects and packs final product.
- **Technology**
  - Digital Farming Lead – Provides support to growers as they implement digital products.
  - Agricultural Engineer – Designs, builds and tests equipment that will improve farming practices.
- **Sustainability**
  - Packaging Engineer – Designs packaging for food, animal and other agricultural products.
  - Sustainability Manager/Specialist - Oversees an entity's environmental impact.

OPTIONAL RELATED ACTIVITIES:

- The facilitator could make their own simulated "germs" and show the students just how quickly illnesses/diseases can spread.
- Petri Dish Experiments - Prep petri dishes and swab surfaces around your program site. Make a prediction of which surfaces will contain the most bacteria. Watch the progression of bacteria growth over the course of a week and then discuss outcomes.

FACILITATION TIPS

As a teen facilitator, what if...

- **What if your youth are not engaged in the activity?**
  - Refocus them on the scenario they are working on. For example, ask them a question pertaining to the scenario.
  - If you notice a youth is not engaged, ask them what they may think the solution might be.
- **What if you have a group member being left out?**
  - Remind the group that everyone needs to be involved in coming up with the solution.

ACTIVITY REFLECTION/ DEBRIEF

Consider going through some or all of the following questions with the participants.

- Describe your group's process for solving the scenario?
- How did each of you contribute?
- Do you feel like everyone's ideas were heard?
- Which activity was the most difficult and why?
- What was the best thing about Protect the Plate?
- Do you feel like you have a better understanding of ag innovations?
- Are you interested in learning more about careers related to agriculture and technology?

PROTECT THE PLATE

SOURCES

AG CAREERS
https://www.agcareers.com/career-profiles/

CENTER FOR DISEASE CONTROL
https://www.cdc.gov/

CODE OF FEDERAL REGULATIONS
https://www.govinfo.gov/content/pkg/CFR-2014-title40-vol24/xml/CFR-2014-title40-vol24-part180.xml#seqnum180.364

ILLINOIS DEPARTMENT OF HEALTH
https://dph.illinois.gov/

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
https://www.epa.gov/

UNITED STATES FOOD AND DRUG ADMINISTRATION
https://www.fda.gov/

UNITED STATES DEPARTMENT OF AGRICULTURE
https://www.usda.gov/

UNIVERSITY OF ILLINOIS
FarmDoc https://farmdoc.illinois.edu/

UNIVERSITY OF ILLINOIS
Extension – Crop Sciences http://extension.cropsciences.illinois.edu/

UNIVERSITY OF ILLINOIS
Extension – Home Gardening https://extension.illinois.edu/gardening

NEXT GENERATION SCIENCE STANDARDS

ELEMENTARY SCHOOL

- 3-5-ETS1-2: Engineering and Design: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 5-ESS3-1: Earth and Human Activity: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- 3-LS4-4: Biological Evolution: Unity and Diversity: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

MIDDLE SCHOOL

- MS-ESS3-3: Earth and Human Activity: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ETS1-1: Engineering Design: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

HIGH SCHOOL

- HS-ESS3-4: Earth and Human Activity: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- HS-ESS3-6: Earth and Human Activity: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
- HS-LS4-6: Biological Evolution: Unity and Diversity: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HANDOUT 1 (Use with Activity 2)

	Compound A (PPM)	Compound B (PPM)	Compound C (PPM)	Compound D (PPM)
Corn (Field)	5.0	.8	2.0	3.0
Soybean (Hulls)	5.0	.25	1.0	1.0
Grapes	X	X	1.0	2.5
Apples	X	X	1.5	2.0
Radishes	.8	X	X	2.5
Asparagus	.8	X	1.0	2.5

HANDOUT 2 (Use with Activity 2)

RESIDUE SAMPLES REPORTS

Agency:
Date:
Product: Sample # 19 Grapes
Pesticide/herbicide identified: Compound B
Residue level detected: .9 ppm (parts per million)
EPA residue tolerance:
Action to be taken:

Agency:
Date:
Product: Sample # 02 Radishes
Pesticide/herbicide identified: Compound A
Residue level detected: 1.5 ppm (parts per million)
EPA residue tolerance:
Action to be taken:

Agency:
Date:
Product: Sample # 20 Corn (Field)
Pesticide/herbicide identified: Compound C
Residue level detected: .05 ppm (parts per million)
EPA residue tolerance:
Action to be taken:

Agency:
Date:
Product: Sample # 24 Soybeans (Hulls)
Pesticide/herbicide identified: Compound D
Residue level detected: 1.0 ppm (parts per million)
EPA residue tolerance:
Action to be taken:

Agency:
Date:
Product: Sample # 4 Asparagus
Pesticide/herbicide identified: Compound A
Residue level detected: .75 ppm (parts per million)
EPA residue tolerance:
Action to be taken:

HANDOUT 3 (Use with Activity 3)

Restaurant scenario and reports from the sick individuals

One week ago, several individuals called into their local health department complaining of various symptoms. Two of the three individuals reported that they had gone to their doctors and were told that it could be a foodborne illness and were encouraged to call the health department. All three individuals indicated that they had eaten at the same local restaurant around the same time.

As a precaution, the restaurant was then ordered to be closed for inspection and evaluation.

Individual One: Reported abdominal cramping, nausea, diarrhea and dehydration. Was the only one in their party to become sick. Stated that they ate the chicken fettuccine alfredo. Became sick within 12 hours after consuming the meal.

I**ndividual Two:** Reported some cramping, headache, nausea, diarrhea and fever. Stated that they ate the Caesar salad. Became sick within 24 hours after consuming the meal.

Individual Three: Reported low-grade fever, nausea, some cramping and some body aches. Stated they ate the meatloaf. Mentioned that they had some of the symptoms prior to the meal.

Findings from the restaurant:

- Checks on refrigerators indicated that two of the three appliances were at correct temperature. One fell 2-3 degrees below temperature. It appeared the seal was starting to go bad.
- Cutting and prep utensils were clean and properly stored.
- Dry goods were properly stored in clear and well-labeled containers.
- Preparation counters were cleaned up but filmy.
- All employees interviewed were up to date on their food handler license.
- One employee did report being out sick a day before the customers had been in the restaurant but assured the health department they were following proper food handling protocols.

HANDOUT 4 (Use with Activity 3)

Norovirus

Causes – direct contact with someone who has norovirus, improper hand washing, not washing fruits and vegetables, not disinfecting food prep surfaces.
Symptoms – nausea, vomiting, diarrhea, body aches, headache, low-grade fever, tiredness.
Incubation time – 12-48 hours.
Prevention – wash your hands. Wash fruits and vegetables. Clean all utensils and prep surfaces.
Treatment – drink plenty of fluids, stay away from food preparation until at least 48 hours after symptoms cease.

E. coli

Causes – undercooked ground beef. Meat is contaminated by intestinal contents.
Symptoms – severe diarrhea and painful cramps to no symptoms.
Incubation time – 3-4 days.
Prevention – wash your hands. Wash fruits and vegetables. Clean all utensils and prep surfaces. Cook meats to correct temperature.
Treatment – drink plenty of fluids and rest.

Salmonella

Causes – usually food contaminated with animal feces. Can come from a variety of foods including meats, vegetables, eggs, and even some processed foods.
Symptoms – nausea, diarrhea, vomiting, cramping, fever, headache, body aches.
Incubation time – 12-96 hours.
Prevention - wash your hands. Wash fruits and vegetables. Clean all utensils and prep surfaces. Refrigerate or freeze foods as directed.
Treatment - drink plenty of fluids and rest.

HANDOUT 5 (Use with Activity 3)

1. What are the common symptoms between the three individuals?

2. What was the timeline for when they started to exhibit these symptoms?

3.Based on the findings, what foodborne illness(es) is likely the culprit?

4. How would the restaurant be responsible? Would the customer be responsible?

5. What needs to be done to correct the situation?

4-H PROTECT THE PLATE YOUTH PARTICIPANT SURVEY

Dear Participant,

You are being given this survey because you are part of a 4-H program or project, and we are surveying young people like you to learn about your experiences.

This survey is voluntary. If you do not want to fill out the survey, you do not need to. However, we hope you will take a few minutes to fill it out because your answers are important.

This survey is private. No one at your school, home or 4-H program or project will see your answers. Please answer all of the questions as honestly as you can. If you are uncomfortable answering a question, you may leave it blank.

This is NOT a test. There are no right or wrong answers, and your answers will not affect your participation or place in the program in any way. **Thank you for your help!**

Section I: Protect the Plate Challenge

Please select one response to each of the five statements below regarding your experiences in the Protect the Plate Challenge.

1. I thought it was important to work in a group to complete the Unlock Ag Innovations Challenge.

❑ Yes
❑ Sort of
❑ No

2. My teammates and I used good communication to complete the Challenge.

❑ Yes
❑ Sort of
❑ No

3. After completing the Challenge, I have a better understanding of how I can contribute to continuing a healthy food supply.

❑ Yes
❑ Sort of
❑ No

4. I am more interested in science and agriculture after participating in the Challenge.

❑ Yes
❑ Sort of
❑ No

5. After completing the Challenge, I have a better understanding of how science and technology help solve real life problems.

❑ Yes
❑ Sort of
❑ No

Section II: Tell Us About Yourself

6. How old are you?

____ years old

7. What grade are you in? If it is summer break, which grade will you be starting in the fall?

____ grade

8. Which of the following best describes your gender? (Check one box.)

❑ Female (girl)
❑ Male (boy)
❑ My gender identity is not listed
❑ I don't want to say

9. Which of the following best describes your race and ethnicity? (Select all that apply.)

❑ American Indian or Alaskan Native
❑ Asian
❑ Black or African American
❑ Hispanic or Latino
❑ Native Hawaiian or Other Pacific Islander
❑ White or Caucasian
❑ More than one race
❑ I don't know

10. Which of the following best describes the primary place where you live? (Check one box.)

❑ Farm
❑ Rural (non-farm residence, pop. < 10,000)
❑ Town or City (pop. 10,000 – 50,000)
❑ Suburb of a City (pop. > 50,000)
❑ City (pop. > 50,000)

Thank you very much!

Please return this survey as directed.

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Visit www.cropscience.bayer.us and follow us on Facebook, Twitter, Instagram and YouTube at Bayer4CropUS.

Thank you notes should be addressed to:

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St. Louis, MO 63167

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