FOOD SAFETY FOR LIFE

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Instructor's Activity Guide

W314

NATIONAL PEER REVIEWED

HANDS ON

Real-World Lessons for Middle School Classrooms

UTEXTENSION INSTITUTE OF AGRICULTURE THE UNIVERSITY OF TENNESSEE

Approved by

GMA Science and Education Foundation

IFT feeding the minds that feed the world

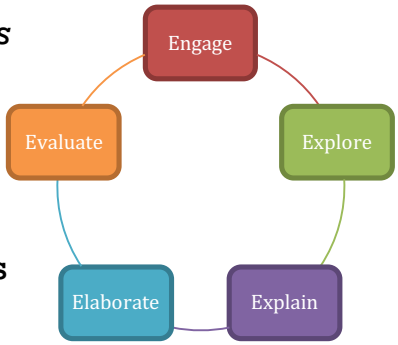
18 USC 707

Note to Instructor

Get excited! You have opened *Hands On: Real-World Lessons for Middle School Classrooms*. This curriculum is designed specifically for 4-H programs to help educate 4-H members on food safety. By using this curriculum, we can reduce the occurrence of foodborne illness through effective education by increasing awareness and encouraging the use of safe food preparation practices! Middle school aged students are the upcoming preparers of meals at home and in the food industry, so it is important for us to start educating them now.

What You Should Know About Effective Education

The *Hands On: Real World Lessons for Middle School Classrooms* curriculum follows the Inquiry 5-E Model of Instruction. Activity 1 addresses the first two stages of the model: **Engage** and **Explore**. Activity 2 continues with the Explore stage. Activity 3 transitions from Explore the content to **Explain**. Activities 4-8 focus on stage 4, **Elaborate**, allowing participants to build on previously acquired knowledge. Activities 9-10 move participants to the final stage, **Evaluate**.



5-E Model of Instruction

What You Can Do

- Be excited! Engage and encourage your 4-H members during their project journey!
- Plan ahead. Review the lesson plan and gather any necessary supplies for participants prior to having them complete the activity.
- Remember to conduct a debriefing after the completion of each activity in order for participants to share results, ask questions, and correct any misunderstandings.
- Once a participant has completed an activity, do not forget to sign off on his/her hard work on the "Participant Activity Checklist" found in both your curriculum book and the Student Activity Book.

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User Guide

What To Look Out For

Alongside the left-hand side margin of each activity, you will find learning objectives, curriculum standards, success indicators, key terms, life skills, time allotment, and necessary materials. Each activity begins with, "Getting Ready," a section designed to inform you, the instructor, of prior preparation required to complete the activity. Next, the lesson plan moves into "Connect," a section starting with opening questions for participants to *connect* the activity topic to their everyday lives. In "Discover," you will find the procedure for the activity. "Think about It" provides additional follow-up questions to ask your participants. For the "Apply" section, you will see the main activity name. The final section of the activity, "Instructor Resources," provides a list of the attached documents to further help complete the activity.

As you work through this curriculum, either as single activities or as a full project, be on the look out for the following images. Success indicators have been stamped with a green SUCCESS stamp throughout the "Discover" section for you to informally assess the participants. The blue TIPS arrow points to advice for assistance in instruction of activities. If you see the green text message box, it contains an important message for you to read aloud to your participants. Lastly, the purple fire burst will contain an interesting fact about that activity's topic. These images are designed to provide additional assistance for successful instruction of each activity!

Tags: bacteria, cell model, cooking, food safety, handwashing, internet research, microbiology, writing

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Summary of Learning Objectives

Activity	Learner Outcomes	Life Skills and SET for Life Objectives	Educational Standard*	Success Indicators
1. How Clean Are Your Hands?	• Application of the Scientific Method to conduct an investigation. • Identification of a variable and control group during a scientific investigation. • Follow appropriate lab rules and safety procedures.	Critical Thinking Disease Prevention Health Lifestyle Choices Keeping Records Problem Solving Teamwork SET Intermediate 2, 3 SET Advanced 1	NS. 5-8.1 Science as Inquiry NS.5-8.3 Life Science	1. Accurately streak his/her Petri plate according to assigned treatment. 2. Generate a well thought hypothesis.
2. How Clean Are Your Hands REALLY?	• Accurately collect data in a scientific investigation. • Connect prior knowledge to new concepts about bacteria.	Communication Critical Thinking Disease Prevention Healthy Lifestyle Choices SET Intermediate 1, 2, 3, 4, 5 SET Advanced 6	NS. 5-8.1 Science as Inquiry NS.5-8.3 Life Science	1. Completed the handwashing log. 2. Count Petri plate according to explained procedure. 3. Accurately described at least one colony on Petri plate. 4. Generate a researchable question.
3. What's Growing on Me?	• Synthesize information about pathogens and helpful bacteria into a product that clearly communicates an understanding of bacterial growth	Communication Contribution to Group Effort Healthy Lifestyle Choices Teamwork SET Advanced 3, 4, 5	NS. 5-8.1 Science as Inquiry NS.5-8.3 Life Science	1. Provide creative thoughts or inputs to RAFT brainstorming. 2. Perform or present RAFT production in front of the group.
4. I Think I'm Gonna Be Sick	• Recognize bacterial growth as an example of exponential growth. • Calculate the growth of bacteria over a given time period. • Deconstruct and solve word problems involving exponential growth.	Disease Prevention Healthy Lifestyle Choices Problem Solving Responsible Citizenship SET Advanced 2, 3, 4, 5	7.EE.A.2 7.EE.B.4	1. Willingly separates modeling clay to model cell division. 2. Completes math equations with minimal assistance
5. Kitchen Patrol Task Force	• Move around the classroom to provide a thoughtful answer to each food safety question or statement. • Assist group members in creating Public Service Announcement. • Share PSA.	Communication Contribution to Group Effort Decision Making Healthy Lifestyle Choices Sharing SET Advanced 3, 4	RI.7.4 SL.7.3a	1. Willingly participates in the carousel activity. 2. Offers creative thoughts to the group PSA. 3. Presents group PSA in front of the group.

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6. FBI: Identifying the Culprits of Foodborne Illness	• Research and communicate characteristics of bacteria that cause foodborne illness • Identify symptoms of foodborne illness • Apply knowledge of symptoms, onset time and pathogens to identify causative agents in foodborne illness scenarios • Evaluate their own understanding of the risks and preventative measures of foodborne illness	Concern for Others Critical Thinking Healthy Lifestyle Choices SET Advanced 4, 6	NSS.G.K-12.6	1. Research and complete Internet activity. 2. Use research to complete activity. 3. Willingly write a personal scenario and share with a group member.
7. Breaking News: Millions Sick and Dying	• Demonstrate proficient research skills by locating and evaluating a variety of instructor selected nonfiction • Understand the relationship between specific standard of living measures and the quality of life in a particular country • Critically analyze connections between standards of living and foodborne illness • Identify credible sources of electronic information	Communication Disease Prevention Keeping Records SET Intermediate 4, 5 SET Advanced 2, 3, 5	NSS.G.K-12.6	1. Easily researches 3 out of 5 countries. 2. Fully maps outbreaks. 3. Creates a well-defined legend for the outbreak map.
8. Kitchen Task Force Returns	• Read for detail • Identify proper food handling practices • Recognize common food safety handling mistakes	Communication Disease Prevention Learning to Learn SET Advanced 6	NL-ENG.K-12.3 NL-ENG.K-12.7	1. Accurately selects 8 out of 10 food safety mistakes.
9. Want to know the 411?	• Demonstrate expository writing skills with drafts, revisions, proper grammar, spelling, and sentence construction.	Communication Disease Prevention Learning to Learn Sharing SET Advanced 3, 4	RI.7.4 SL.7.3a	1. Offers creative thoughts to the group paper slide video. 2. Willingly participate in the filming/ presenting of video.
10. I Spy … A Bacterial Cell	• Recognize and understand major organelles in bacterial cells. • Compare and contrast bacteria cells with plant and animal cells. • Apply safe food handling behaviors.	Critical Thinking Disease Prevention Sharing SET Advanced 5	7.4.1.1.1 7.1.3.4.2	1. Accurately builds edible cell model according to instructions. 2. Completes *Reaction Guide for Safe Food Handling*.

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Participant Activity Checklist

Welcome to *Hands On: Real-World Lessons for Middle School Classrooms*! These activities have been specifically designed for 4-H members with intermediate to advanced level skills. Upon completing this project, we hope you will further investigate additional Food Safety opportunities.

Double check with your county's project guidelines for completion requirements, if you plan on competing in county project judging or plan to prepare a fair exhibit.

Activities	Date Completed	Instructor's Initials
Activity 1 How Clean Are Your Hands?		
Bacterial Growth Experiment Set-Up		
Handwashing Log		
Activity 2 How Clean Are Your Hands, REALLY?		
Bacterial Growth Experiment Observations		
Generating a Researchable Question		
Activity 3 What's Growing on Me?		
R.A.F.T.		
Activity 4 I Think I'm Gonna Be Sick		
Applying Bacterial Growth Rates		
Is it Safe to Eat?		
Activity 5 Kitchen Patrol Task Force		
Carousel Activity		
Public Service Announcement		
Activity 6 FBI: Identifying the Culprits of Foodborne Illness		
Bacteria that Cause Foodborne Illness		
What's the Cause?		
Activity 7 Breaking News: Millions Sick and Dying		
Researching Foodborne Illness Outbreaks		
Activity 8 Kitchen Patrol Task Force Returns		
Finding Food Safety Mistakes		
Activity 9 Extra! Extra!		
Paper Slide Video		
Activity 10 I Spy … A Bacterial Cell		
Anticipation Reaction Guide to Safe Food Handling		
Edible Cell Model		

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Getting Ready

	Supplies	Handouts	Facilities
Activity 1	Petri Plates, Parafilm, hand sanitizer, hand soap, permanent markers	*Bacterial Growth Experiment Set-Up* *Safety Procedures for Science Laboratories and Materials*	
Activity 2	50% bleach solution, gloves	*Generating a Researchable Question*	
Activity 3		*RAFT chart*	Projection for PowerPoint presentation
Activity 4	Crayola Model Magic, clay, or Play Dough	*Applying Bacterial Growth* *Is it safe to eat?*	Video and audio playing ability
Activity 5		*PSA Scripting Template*	Copies of carousel questions
Activity 6		*Bacteria that Cause Foodborne Illnesses* *What's the Cause*	Internet access
Activity 7	Reference maps, atlases, colored pencils, crayons, or markers	*Researching Foodborne Illness Outbreaks*	Internet access
Activity 8		*Food Safety Press Release* *Finding Food Safety Mistakes*	
Activity 9	White printer paper, colored pencils, markers, scissors, pencils, crayons	*How to Create a Paper Slide Video*	Computer or other device with recording or projection capabilities
Activity 10	Required ingredients for edible cell model: sugar cookie, pizza, or fruit pizza	*Bacterial Cell Model* *Reaction Guide to Safe Food Handling*	

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How Clean Are Your Hands?

Activity 1

Learner Outcomes
- Application of Scientific Method to conduct an investigation
- Identification of a variable and control during a scientific investigation
- Follow appropriate lab rules and safety procedures

Success Indicators
- Accurately streaked his/her Petri dish according to assigned treatment
- Generate a well thought hypothesis

Standards Supported
- NS. 5-8.1
- NS. 5-8.3

Concepts/Terms
- Agar
- Foodborne Illness
- Hypothesis
- Incubate
- Parafilm
- Pathogen

Life Skills
- Critical Thinking
- Disease Prevention
- Healthy Lifestyle Choice
- Keeping Records
- Problem Solving
- Teamwork

SET for Life
- Intermediate 2, 3
- Advanced 1

Time
- 30 minutes

Materials
- Petri Plates, Parafilm, hand sanitizer, hand soap, sharpie, markers
- Handouts: *Bacterial Growth Experiment Set-Up, SAFETY Procedures for Science Laboratories and Materials*

Getting Ready

Display the opening questions on a board as participants enter the room.

Make sure to pre-cut pieces of Parafilm prior to activity in strips approximately, 1" x 4". Note, either side of Parafilm stretches and adheres to the Petri plates.

Petri plates should be left out 24-48 hours prior to the experiment to reduce condensation on the lids.

Be sure to review *Safety Procedures for Science Laboratories and Material*.

Connect

Instructors should ask their students:

- On a scale of 1-10, how clean do *you* think your hands are right now? (1=dirtiest, 10=cleanest)
- When did you last wash your hands?
- Make a list of 10 things you have touched since you last washed your hands.

1. Discuss participants' lists of items touched. How frequently are these items cleaned and sanitized? How many other people have touched them?
2. Would any of you change your initial number regarding how clean you think your hands are? Would you raise your number or lower it? Why?
3. If participants do not intuitively make the connection between touching things and getting their hands dirty or "germy," lead them in a discussion to make this connection.

Instructor Talk …

"In this activity, we are going to conduct a hand washing lab to determine if there are microorganisms, such as bacteria, on our hands. We will also look at what impact various methods of hand washing can have on reducing the number of microorganisms on our hands."

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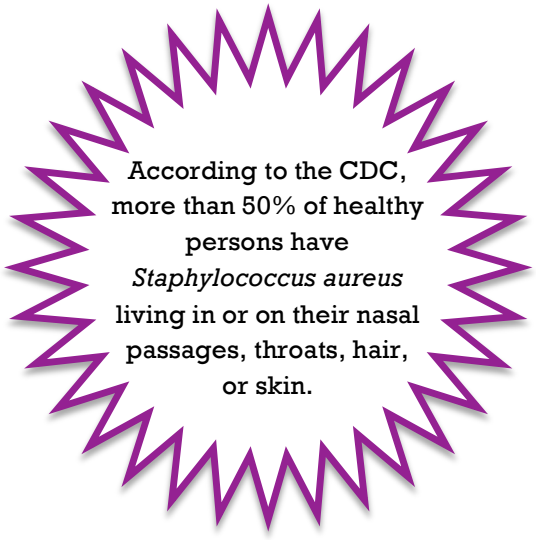
Discover

1. Have each participant shake hands with at least 3 other participants.
2. Have each participant draw a line to divide the **Petri plate** into 2 halves. Label the bottom side of the Petri plate along the edge. Using small letters have students write their name, date, & class period (if necessary).

   ** See the diagram under this activity's *Tips* section.
3. Divide participants into three groups. Give each member a different condition:
   a. Wash hands in cold water with no soap for 5 seconds
   b. Wash hands in warm water with soap for 20 seconds
   c. Hand sanitizer
4. Have each participant label the other half of the Petri plate with their treatment
   a. T1 - cold water no soap
   b. T2 - warm water, plus soap
   c. T3 – hand sanitizer
5. Have participants touch the surface of side one (non-treatment side) of the Petri plate with all 5 fingers, as if they were being fingerprinted (Make sure they do not puncture the **agar** or Jell-o like layer – it provides the nutrients for the bacteria.)
6. Allow time for participants to execute their treatment. Then have them touch the surface of their second Petri plate with all 5 fingers.
7. Wrap the plates in **Parafilm** and **incubate** the plates upside down at room temperature for 48 hours.
8. After 48 hours, each participant will record his/her observations of their Petri plates. It is important to remind students not to open the lids of the Petri plates.
9. Have each student create a **hypothesis** about what will occur after the 48-hour incubation of the Petri plates.

   Examples include:
   i. A lot of bacteria will grow on the plates with unwashed hands.
   ii. The plates with just cold water will have more bacteria than those with warm water and soap for 20 seconds.
   iii. The plates with hand sanitizer will not have any bacteria.



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Think about It

Which treatment do you think will be the most effective (i.e. have the fewest bacterial colonies)?

Do you think our plates will have different kinds or types of bacteria?

Do you ever think about how many surfaces or items you touch before grabbing a snack after school? Before an after school practice, club, or meeting? Before you start homework or studying for a test?

Apply

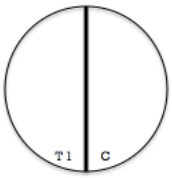
Bacterial Growth Laboratory Experiment

Handwashing Log (take home assignment to be completed for Activity 2)

Instructor Resources

- *Bacterial Growth Experiment: Set Up*
- *Safety Procedures for Science Laboratories and Materials*

Here is an example of how participants might label their Petri plates. Teachers have previous marked plates with participants' initials.



Under procedures, participants shook hands with each other. *This step will not impact the outcome of the growth lab.* It is a step to prevent participants from singling out others who may have significantly more bacterial growth on their plates. This step sets the mindset that all have "shared" germs.

Remind participants of the variables (temperature of water, length of time, presence/absence of soap) during the experiment and to record their procedure as they set-up their experiment.

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Bacterial Growth Experiment: SET-UP
Instructor Copy

Treatment _____ **Name _____**

Objective/Problem: The purpose of this experiment is:

Possible problems include:

- What is the best method of handwashing?
- How dirty are your hands?

Hypothesis:

Possible hypotheses include:

- A lot of bacteria will grow on the plates with unwashed hands.
- The plates with just cold water will have more bacteria than those with warm water and soap for 20 seconds.
- Plates with hand sanitizer will not have any bacteria.

Materials:
1 pre-poured TSA plate
Hand Soap
Hand Sanitizer
Secure location for plate incubation
Sharpie Marker
Parafilm (1" x 4" strips)

Procedures: List the step-by-step procedures of your experiment below (Step 1 has been listed for you along with the first word of each step. You must fill in the details.):

1. **Shake** hands with at least 5 people.

2. **Draw** a line to divide the Petri plate into two halves.

3. **Label** one side of the Petri plate along the edge of the bottom of the plate (side with printed writing) using small letters with your name and C (control) Label the other side with the treatment you used (T1, T2, T3).

4. **Touch** the surface of the control (C) side of your Petri plate with all five fingers as if you are being fingerprinted.

5. **Wash** hands according to the treatment you are given.
   i. Wash hands in cold water with no soap for 5 seconds.
   ii. Wash hands in warm water with soap for 20 seconds.
   iii. Use a hand sanitizer with no water or soap.

6. **Touch** the surface of the treatment side of your Petri plate with all 5 fingers.

7. **Wrap** the plate in Parafilm and incubate the plate upside down at room temperature for 48 hours.

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Bacterial Growth Experiment: SET-UP
Instructor Copy

Treatment _____ **Name _____**

Data: Fill your data into the charts below:

Day 2: Observations
Possible observations include:

	Control	Treatment
Colony Count	150	185
Description of Colonies	• Round, yellow-ish • Size of a pen tip • Some round, pink ovals • Lots of clusters	• Round, white • Not many clusters

Do NOT touch colonies growing on your plate. Once you have finished recording your observations, wash your hands thoroughly with soap and warm water.

Post-Lab Discussion Questions:

1. **What changes took place in colony growth?**

   Possible changes include:
   - More colorful growth on control side.
   - Equal amounts of growth occurred.

2. **Looking at the data, what differences do you notice between the control and treatment?**

   Possible differences include:
   - Treatment had more growth than the control.
   - Control side has more growth than the Treatment.

3. **Discuss your conclusions based on the data collected in this experiment.**

   Possible conclusions include:
   - Treatment didn't reduce the bacteria on my hands.
   - Treatment reduced the bacteria on my hands.

4. **What problems might have occurred in this experiment that might lead you to question the validity of your results?**

   Possible problems include:
   - Touched a desk/chair or door before touching plates with cleaned hands.
   - Using a different handwashing method than treatment group.

Conclusions:

Possible conclusions include:
- Create a more uniform procedure for consistent results, like measuring the water temperature.
- Handwashing can reduce the number of bacteria on my hands.

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Safety Procedures for Science Laboratories and Materials

- *Bacterial Growth Lab: Set-up*
    - Petri plates should be sealed with Parafilm, then placed upside down in a secure location and not touched until observations are made on Day 2.
    - Anytime students touch the Petri plates, they should wear gloves.
    - Have students dispose of gloves properly into the provided large zipper bag.
    - Once they are finished wearing gloves, immediately wash their hands for 20 seconds with warm water and soap.

- *Disposal and Disinfection: Must be handled by teacher only*.
    - Using the spray bottle and bleach provided in the science kit, create a 50% bleach solution (5 parts bleach: 5 parts water).
    - Petri Plates: Open plate and spray 2-3 sprays of 50% Bleach Solution, close plate, and place in Ziploc bags.
    - Gloves: Dispose into a regular trash bag along with Ziploc bags of Petri plates and spray with a generous (~10 sprays) amount of 50% Bleach Solution.
    - Countertops and Equipment (i.e markers, pencils, etc.): Use sanitizing wipes and/or 50% bleach solution spray with paper towels to clean all surfaces used and/or touched during the lab activity.
    - Sanitize student desks each day after handling the Petri plates or performing the lab activities.

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