COURSE 1:

Food Production, Nutrition and Health

BEEF – IT'S WHAT'S FOR DINNER

food and nutrition sciences

PREPARATION FOR TOMORROW

CONTENTS

Project Overview

DAY	CONCEPT/DESCRIPTION
1-2	Students define pathogen and list common food-borne illness causing pathogens. Students describe symptoms of food-borne illness and sources of pathogens commonly found in food. Students explain the purpose of the project.
3	Students define health inspector and describe the responsibilities of a food inspector.
4	Students describe how bacteria impact human health. Students define STEC.
5	Students explain how STEC enters the food supply.
6	Students evaluate a risk analysis model. Students describe the steps to control STEC. Students define risk assessment and HACCP.
7	Students explain exponential growth. Students write a formula for exponential growth.

DAY	CONCEPT/DESCRIPTION
8	Students describe how bacteria spread.
9	Students define antibiotics and withdrawal period. Students describe antibiotic resistance.
10-11	Students define FATTOM. Students describe food handling procedures that minimize pathogens in food.
12-13	Students demonstrate safe food handling procedures. Students describe opportunities for STEC contamination of food. Students describe procedures for minimizing the risk of contamination.
14-17	Students develop food safety training materials.
18-19	Students facilitate a food safety training program.
20	Students summarize key factors of food safety and the key concepts of preventing STEC.

Additional Resources for Beef, It's what's for Dinner:

- http://worldofviruses.unl.edu/
- http://www.microbeworld.org/
- http://barfblog.com/

Key Question of the Day:

What are the common food safety issues?

(Each day the key question should be prominently displayed and used to open the lesson.)

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Define pathogen.
- List common food-borne illness causing pathogens.
- Describe symptoms of food-borne illnesses.
- Describe sources of pathogens commonly found in food.

Required Materials

- Computers
- Research Questions – Appendix 3 – One per student
- Flip charts
- Markers

Bell-Work

(Each day the Bell-Work question should be prominently displayed and used to open the lesson)

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"Think of a time that you heard about someone getting sick from food. Describe the situation you remember."***

OPENING

*(Designed to **prepare** students for learning. Students are prepared for learning by activating an **overview** of the **upcoming** learning experience, their **prior knowledge**, and the **necessary vocabulary**.)*

- Read the Bell-Work question and solicit responses from the students.
- As students are sharing, make a list of the symptoms and/or types of food-borne illness being discussed.
- Ask students, ***"What is it about the food that causes the illness?"***
- Students view video http://www.youtube.com/watch?v=4iaE6wwroe4, an AP report on a Salmonella outbreak from sushi.
  - › Refer back to the Bell-Work discussion and ask the students if they can explain what causes foodborne illnesses. Their response should be related to pathogens.
- Define pathogen.
  - › A pathogen is something that causes disease, usually a microorganism such as a virus or bacteria.

MIDDLE

*(Designed to provide a **structure** for learning that actively promotes the **comprehension and retention** of knowledge through the use of **engaging strategies** that acknowledge the brain's limitations of **capacity and processing**.)*

- Explain that, "Salmonella is just one example of a pathogen that can cause foodborne illness. There are many others and today we're going to learn about what they are and the impact they have on our food supply."

  ✓ **TEACHER TIP!** For this exercise, determine how to divide the students into teams and assign a pathogen to research based upon class size. For example, there are 12 pathogens. So, if the class is large, students can be split into 12 teams and each team would research one pathogen. If the class is small, one option would be to create small teams where several students per team are researching a different pathogen (or students can work independently and each research a different pathogen). Feel free to adapt the logistics to fit your particular situation. The 12 pathogens include:
  - » *Campylobacter jejuni*
  - » *Clostridium botulinum*
  - » *Clostridium perfringens*
  - » *Escherichia coli O157:H7*
  - » *Listeria monocytogenes*
  - » *Salmonella Enteritidis*
  - » *Salmonella Typhimurium*
  - » *Shigella*
  - » *Staphylococcus aureus*
  - » *Vibrio cholera*
  - » *Vibrio vulvinficus*
  - » *Yersinia enterocolitica*

- After you assign the pathogens, give students a copy of the research questions (Appendix 3).
  - › Students should have the rest of the class period to conduct their research and create their posters.
- The research questions should be divided among all of the students in the team so that each student is contributing to the assignment.
  - › The goal is for students to determine how the pathogen makes an impact on food safety and determine what can be done to protect the food supply from the pathogen.
  - › Students will keep the research questions and answers in their research journals.

- Once the teams find the answers to the research questions, they will prepare a summary poster of the pathogen with the key research points on a sheet of flip chart paper.
  - › This will be used as a resource to teach the rest of the class about the different pathogens.

CLOSING

*(Designed to promote the **retention of knowledge** through the use of engaging strategies designed to **rehearse** and **practice skills** for the purpose of **moving knowledge into long-term memory**.)*

- Provide each student with the weekly Exit Ticket handout Appendix 2.

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Summarize the meaning of food-borne illness."***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:

(Continuation of Day 1) What are the common food safety issues? Do you understand the project?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Define pathogen.
- List common food-borne illness causing pathogens.
- Describe symptoms of food-borne illnesses.
- Describe sources of pathogens commonly found in food.
- Explain the purpose of the project.

Required Materials

- Computers
- All Rubrics – Appendix 10, 11, 12, 13, 14 – One per student
- Essential Question and Engagement Scenario – Appendix 4 – One per student
- Research Questions – Appendix 3 – One per student
- Video – "Microbes Medley" (http://foodsafe.ucdavis.edu/html/video.html)
- Flip charts
- Markers

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"In one sentence, summarize what you've learned so far about foodborne illness."***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Have a brief discussion about the input the students share.
- Explain that, ***"Today we're going to be tasked with a challenge for the next couple of weeks. Once we wrap up our pathogen activity, we'll find out more about the challenge."***

MIDDLE *40 minutes*

✓ **TEACHER TIP!** Students will create a portfolio at the end of the project (on the last day) where they will compile the bodies of evidence they have created throughout the project. Remind students to save important artifacts as they complete different tasks throughout the project. Feel free to determine the best way for students to create their portfolios based upon your particular situation (e.g., if your school/district has any specific requirements, etc.).

- Students will create a 15-30 second news report to share the most important details about their pathogens with the class.
  - › They will use the posters they created as a visual aid (the way news reports may have text on the screen as the anchor is reporting).
- Give the class about 15 minutes to work on this, and to wrap up anything that is incomplete from the previous day.
- When time is up, each team will hang their posters somewhere around the room and report on their pathogens.
- Following the reports, bring the class together to debrief the exercise.

- Transition by explaining, ***"Foodborne illness outbreak are not uncommon, especially those caused by E. coli found in beef. Let's take a few minutes to learn more about what we'll be doing over the next couple of weeks to help the food inspector with this issue."***

- Give students a copy of the essential question and engagement scenario (Appendix 4) and ask them to read quietly for a few minutes.

- Ask students to find a partner (someone sitting next to them) and in 30 seconds each, they will take turns summarizing the essential question and engagement scenario.

- Bring the class back together. Distribute a copy of the project rubric (Appendix 10).

- Take a few minutes to discuss the project with the class and answer questions.

- Assign the project teams. Team size will vary depending upon class size, but should include no more than 4 students, if possible.
  - › Within teams, students should determine a team name and assign roles.

- Show the music video "Microbes Medley" by Carl Winter (in the "Video" folder).

- Ask the class to define microbe.

- Share the definition of microbe and explain that microbes can also be pathogens.
  - › According to Merriam-Webster, the definition of microbe is "an extremely small living thing that can only be seen with a microscope."

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout Appendix 2.

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Explain the goal for the project in two sentences or less."***

- Collect the Exit Ticket for the day as students leave the classroom.

- Homework: The students should create 3-5 questions each to ask the guest speaker. The questions should be related to careers, food safety, foodborne illnesses, etc.

Key Question of the Day:
What does a food inspector do?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Define food inspector.
- Describe the job responsibilities of a food inspector.

Required Materials

- Guest speaker – local food inspector
  - ✓ **TEACHER TIP!** This will require some planning ahead, in order to find a person that will be available and willing to come speak to the class. To enhance the project scenario, the guest speaker could explain why they would need help from the class and why creating a training manual for restaurant employees will be valuable.

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What role does a food inspector play in keeping the food supply safe?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Have a brief discussion about the input the students share.
- Explain that, ***"Today we're going meet the food inspector who has asked for our help in creating the training program for restaurant employees."***

MIDDLE *40 minutes*

- Visit with the students to review their questions as they are working to ensure the questions are appropriate.
- Once the students have some questions ready, introduce the guest speaker.
- After the guest has given their introduction and presentation, facilitate the question and answer session for the students.
- As time permits, debrief the presentation and have a brief discussion about what the students learned.

CLOSING *5 minutes*

- Provide each student with the weekly Exit Ticket handout Appendix 2.
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"List two facts you learned today from the guest speaker."***
- Collect the Exit Ticket for the day as students leave the classroom.

Key Questions of the Day:

How do bacteria impact human health?
What is STEC?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Describe how bacteria impact human health.
- Define STEC.

Required Materials

- Internet access
- Computers
- Texts and journal articles about bacteria
- Flip charts
- Markers

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What do you know about bacteria?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Capture responses on a sheet of flip chart paper.

MIDDLE *40 minutes*

- Refer back to project description. Ask students, ***"What problem are we trying to solve?"***
  - › After students share their responses, make the point that since the goal is to create a training program, we'll need plenty of background information to ensure that we understand the problem we're trying to solve, and to help us develop an effective, research-based solution.
- ***"How do scientists solve problems?"*** Review the steps of the scientific method.
  1. Ask a question
  2. Do background research
  3. Construct hypothesis
  4. Collect data
  5. Analyze data
  6. Draw conclusions
  7. Communicate results
- Ask the class, ***"Where are we in the scientific method process?"***
  - › After students respond, explain that, ***"That's right! We're at step 2, which means we need to conduct background research."***
  - › ***"What research must we conduct?"*** Have students work with their team to develop a list of questions they have about bacteria.
    - » *Examples: What are bacteria? How are they helpful to humans? How are they harmful to humans? How do we control them? How do they reproduce or grow?*

  - Monitor team progress in listing questions. Have each team break into pairs and conduct research online or using texts and articles you provide.
  - Allow approximately 15 minutes for research (or less if students are finished early).

- Pairs return to group, share the information they found, and capture it in their journals. Groups should add new information to the list you collected on the board at the beginning of the class. They can cross off things they found to be false.

- Ask the class, ***"Now that you have more knowledge about bacteria, let's dig a bit deeper."***

- Have the following signs posted around the room on flip charts:
  - STEC stands for…
  - E. coli is a gram-negative bacteria. What does that mean?
  - What shape is E. coli bacteria?
  - E. coli is facultative. What does facultative mean?
  - What are the symptoms of shiga toxins?
  - Is STEC deadly?
  - ✓ **TEACHER TIP!** These are the answers for your reference, but don't post them or share them with the class:
    - *STEC stands for shiga-toxigenic Esterichia coli.*
    - *E. coi is a gram-negative bacteria (according to www.cdc.gov, gram-negative bacterial cause infections, are resistant to medications and antibiotics, and have built-in abilities to find new ways to be resistant).*
    - *E. coli is a rod shaped bacteria.*
    - *Facultative bacteria can grow with or without oxygen, so they can be aerobic or anaerobic.*
    - *Shiga toxins can attack the body in the gut (causing bloody diarrhea), kidneys (causing kidney failure), or the nervous system. The toxin can also cause clots to form in small blood vessels. As red blood cells try to pass through the clots they get damaged (causing anemia).*
    - *Yes, STEC is deadly to humans. No clinical illnesses have been seen in infected cattle.*

- Divide the class into small groups so that a group is assigned to each sign.

- Each group will race to find the answers to the question or statement on the sign. When a team thinks they have the correct answer, they should find the teacher to confirm. If it's correct, they should write the response on the flip chart under the question or statement. They should do this as quickly as possible.
  - ✓ **TEACHER TIP!** To encourage speedy work and competition among the teams, feel free to provide an incentive of your choice.

- When all of the teams are finished, allow the class to have a quick gallery walk to review all of the information that was gathered.

- Bring the class back together and debrief the exercise.

- Explain that, ***"Data has shown that in 2011, there were 175,905 foodborne illnesses, 2,409 hospitalizations, and 20 deaths all caused by STEC. Exposure to STEC can occur from seafood, produce, poultry, beef, eggs, or multi-ingredient foods where the contaminated ingredient was not identified. This is why we need to help educate restaurant employees about keeping food safe."***

CLOSING *5 minutes*

5 minutes

- Provide each student with the weekly Exit Ticket handout Appendix 2.

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"In three sentences, explain why Americans should be concerned about STEC."***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
How does STEC enter our food?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Explain how STEC enters the food supply.

Required Materials

- Computers
- Internet
- Projector
- Word Wall explanations – Appendix 5 – One per student
- Beef Processing Diagram – Appendix 6 – One per student
- Flip chart
- Markers

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"Where does E. coli live?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Have a brief discussion based on student responses.
- Give the class about 2 minutes to do a quick Internet search to see if they can find the answer.
- Ask students to write the answers in their research journals, but not to share them with their peers.
  - ✓ **TEACHER TIP!** Don't reveal the correct answers just yet, as they will learn more later on in the lesson.
- When time is up, explain that the answers will be revealed later in the lesson.

MIDDLE *40 minutes*

- Introduce the students to the word wall and their vocabulary logs. This is a space in the classroom where students can post new words and their definitions. Throughout today's lesson, pause for new vocabulary words. Give each student – or group of students – index cards. Students use the word wall (Appendix 5) strategies to develop definitions from the context. Use one copy of each card to create the class's word wall.
  - ✓ **TEACHER TIP!** Once the concept of a word wall is introduced, feel free to have students add terms to the word wall at any time throughout the project.
- Review the key concepts about E. coli:
  - › E. coli makes people sick (diarrhea, respiratory illness, etc.). It can kill people.
  - › It is transmitted through contaminated food and water or contact with infected humans and animals.

  - It is controlled through safe food handling, hand washing, avoiding raw meat and milk, avoiding swallowing water from pools and lakes, and sanitizing counters, cutting boards, and utensils that touch raw foods.

- At this point, revisit the Bell-Work question by asking students to share the information they found.

- Share the following information with the class:
  - The primary habitat of E. coli is the lower intestine: nutrient rich, 37°C, anaerobic=vigorous growth.
  - The secondary habitat is water, sediment, soil; nutrient poor, 10-14°C, can exceed 37°C, aerobic and anaerobic, negative growth rate.

- Explain that, ***"Since we're focusing on E. coli in beef, how exactly does STEC get into the beef supply?"***

- Project the beef processing diagram (Appendix 6) on the screen.

- Give the class a few minutes to study the diagram. Then, pose the question, ***"If E. coli lives in the intestines and the soil/water, which steps of beef processing/handling pose the biggest risk of contamination?"***
  - In their project teams, students should brainstorm possible answers for this question.
  - The answers: Contamination points include skinning, evisceration, and hands or tools of workers.

- Divide the class into three teams.

- Write each of the following on an index card and give one to each team.
  - Skinning: Dirty cattle enter processing. Dried fecal flakes, dust, dandruff become airborne. Prevention is washing the animal before slaughter or use clean paper on the head split lines.
  - Evisceration: This is the removal of intestines and organs. During this process, fecal matter can spill and expose STEC.
  - Hands and Tools: Contamination can occur from just one carcass, then transfer to another. To prevent contamination, wear gloves and wash tools in 180° water.

- Each team will create a poster on the flip chart paper explaining the three key methods of contamination.
  - ✓ **TEACHER TIP!** Teams may use the Internet to find additional information if time permits.

- Once the posters are ready, students can hang them around the room and each team will present the information to the class.

- Students will record the information from the presentations in their research journals.

- Bring the class back together and discuss potential interventions for cattle. Explain that there are three types:
  - Physical Controls (use temperature, filtration, dying, or radiation to control bacteria) – examples include hide washing, hot water wash for tools, steam sanitizing, trimming visually compromised, high pressure processing
  - Biological Controls (use other living organisms to control bacteria through predation and parasitism) – examples include vaccination of live cattle, bacteriophage, direct-fed microbials, probiotics
  - Chemical Controls (use chemical compounds to control bacteria) – examples include acid washing, chemical de-hairing, ammoniation, nitrates

- Ask students to get back into their teams and ask them to add the proper interventions that correspond with their mode of contamination to the flip chart.
  - ✓ **TEACHER TIP!** Once students are back in their teams, if there's a term they are not familiar with, they may use the Internet or any other resources to find information to help them understand the concept.

- After a few minutes (when the teams appear to be finished) allow each team to present again, this time, sharing why they assigned the interventions to their topic.

- Finally, give students a copy of the beef processing diagram (Appendix 6) and ask the class the following question:
  - Which steps are the responsibilities of producers, distributors, food service professionals, government regulators, research groups, or consumers?

- Break the class into new teams, where each team is assigned to a different professional category.

- Give them a few moments to discuss the question within their teams. Then, they should mark their answers on the handout.
  - For example, the government regulators team should determine which steps on the diagram is the responsibility of government regulators.

- After a few minutes, bring the class back together and conclude the day by having a discussion to summarize what was discussed in this lesson.
  - Each team should share what steps they assigned each profession and why.

CLOSING *5 minutes*

- Students will turn in their Exit Slip for that day. They will respond to the following prompt: ***"Refer to the MyPlate graphic and explain what it suggests about how we should eat?"***

- Collect the Exit Slip for the day as students leave the classroom.

Key Question of the Day:
How can we control STEC?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Evaluate a risk analysis model.
- Describe the steps to control STEC.
- Define risk assessment.
- Define HACCP.

Required Materials

- Computers
- Internet
- Risk Analysis/Assessment – Appendix 7 – One per student
- Flip chart
- Markers

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What is risk assessment?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Even though students may not know exactly what risk analysis means, allow them to take their best guesses at a definition.
- After a brief discussion about the student's responses, explain that, ***"Risk assessment is a process used to evaluate the potential risks associated with something. So, when it comes to food safety, risk assessment involves analyzing the food hazard risks. Today, we're going to learn about how we can control STEC."***

MIDDLE *40 minutes*

- Explain that, ***"As part of a risk assessment, a HACCP is used during the processing phase to ensure that everyone involved in the process can ensure the quality and safety of the food product. HACCP stands for Hazard Analysis Critical Control Point."***
- Have the steps of HACCP written on a flip chart poster or up on the board (from Food Science and Safety by George J. Seperich pg. 227):
    1. Assess potential hazards in all stages of food production from growing/harvesting to manufacturing and preparation for consumption.
    2. Determine critical points where controls are necessary to eliminate or reduce hazards.
    3. Establish requirements or limits to be met at each critical control point.
    4. Establish procedures to monitor each critical control point.
    5. Establish corrective actions when monitoring uncovers deviations from production plan.
    6. Establish record-keeping procedures that document HACCP plan.
    7. Establish procedures to monitor effectiveness of HACCP system.

- Ask students to take a moment to read this independently.

- Bring the class back together and ask the students, ***"Where would the HACCP plan fall into beef processing to prevent STEC?"***
  - Answers may include:
    - *During the processing of the carcass*
    - *During preparation of the raw meat for consumption*

- Explain that there are three types of hazards a HACCP plan can help to prevent:
  - Biological hazards – a microbe, such as bacterium, virus, or parasite
  - Chemical – any chemical that is not allowed in food
  - Physical – physical material that is not biological or chemical that could enter a food product

- Ask students to form their project teams. Give each team about 3 minutes to brainstorm examples of each type of hazard.
  - ✓ **TEACHER TIP!** Students may use the Internet for clues if they need help while brainstorming.

- When time is up, bring the class back together and create a master list for each category.

- Ask each team to share their examples and add them to the list.

- Explain why their responses might be right or wrong.
  - ✓ **TEACHER TIP!** Examples for each category include (but are not limited to):
    - *Biological – STEC, salmonella, listeria, etc.*
    - *Chemical – There are two categories - toxins found in nature (e.g., arsenic which is found in soil) and chemicals from the growing, harvesting, and processing stages (e.g., pesticides, fungicides, insecticides, antibiotics, etc.).*
    - *Physical – hair, bone, glass, metal, plastic, stones, wood, etc.*

- Debrief the discussion by explaining that, ***"A HACCP plan can help us identify and prevent these hazards at critical points in food processing."***

- Transition to the next topic, which is the five steps for controlling STEC.
  - Have the five steps written somewhere visible and review them with the class:
    - *Step 1 – Detection*
      - Develop & validate tests for STEC-8
      - Design sampling protocol for cattle & beef
      - Implement technologies for sampling at all stages
      - Develop better sensors
    - *Step 2 – Biology*
      - Characterize strains of STEC
      - Identify modifiable risks to limit outbreaks
      - Determine presence of STEC
    - *Step 3 – Interventions*
      - Develop & validate interventions for cattle, hides, carcasses, ground, & non-intact beef
      - Compare energy, water, and economic cost/benefits of interventions
    - *Step 4 – Risk Analysis and Assessment (give this team a copy of Appendix 7)*
      - Create risk models for STEC contamination
      - Validate corrective actions
    - *Step 5 – Risk Management and Communication*
      - Translate research into user-friendly food safety materials
      - Provide & promote useful risk assessment participation & understanding
      - Develop & deliver STEC materials for food safety professionals, regulators, educators, and consumers.

- Divide students into five teams. Give each team an index card with the information for the corresponding step listed.

- Give the class about 5-10 minutes to take notes and determine the best way to present the information to their peers.

- Then, bring the class back together and create new teams, where one student from each of the five step groups is in a new team (that means that each new team will have one representative for each step).

- In the new teams, students will have about 5-10 minutes to teach each other about the steps. Students should take notes to describe each step in their research journals.

- When students are finished, bring the class back together and debrief the exercise by having a class discussion about how these steps apply to the prevention of STEC.

- Show the class Appendix 7 and explain how to interpret the risk analysis/assessment model.

- Conclude by asking the class to move back into their project teams. Ask them to think back to the discussion from yesterday about the roles of the food safety professionals.

- Ask the class, ***"As a team, take about 5 minutes to group the objectives you learned for each step by the professional(s) who should be responsible for them. Keep in mind that you may have more than one objective per professional."***

- When students are finished, bring the class back together and ask each team to share their responses.

- Conclude by explaining, ***" If we were to fit into one of those categories, it would be a food service manager. So, what objectives are your responsibility?"***
  - ✓ **TEACHER TIP!** This is meant to help connect back to the project scenario. Responses should include translate research into user-friendly food safety materials, promote useful risk assessment and understanding, execute risk assessment procedures.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"In one sentence, summarize how STEC enters the food supply. In one sentence, explain how STEC contamination can be prevented."***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
How quickly do bacterial colonies grow?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Explain exponential growth.
- Write a formula for exponential growth.

Required Materials

- M&Ms divided into one bag or container per group
- M&M lab sheet and chart – Appendix 8 – One per student
- Calculators

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"Suppose you have $10. For two weeks (14 days), your rich uncle offers to do one of the following:***
  a) Increase what you had the previous day by $50, or
  b) Increase what you had the previous day by 50%
  Which option will give you more money?"

OPENING *5 minutes*

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Discuss with students to see if any already know about exponential growth.
- Explain that, ***"Today we're going to explore what happens with bacteria if contamination occurs."***

MIDDLE *40 minutes*

- Walk through the math for the money question:

BY $50 - ADD $50 TO AMOUNT NOW	
DAY	AMOUNT
0	10
1	60
2	110
3	160
4	210
5	260
6	310
7	360
8	410
9	460
10	510
11	560
12	610
13	660
14	710

BY 50% - MULTIPLY AMOUNT NOW BY 1.5	
DAY	AMOUNT
0	10
1	15
2	22.5
3	33.75
4	50.625
5	75.9375
6	113.906
7	170.859
8	256.289
9	384.433
10	576.65
11	864.976
12	1,297.463
13	1,946.195
14	2,919.293

- Ask students, ***"Why does the addition of 50% each day end with more money?"***
  - Keep the discussion going until you get to an explanation that includes multiplication working more quickly than addition.
  - Provide definitions:
    - *Linear growth – growth in a population that occurs by addition*
    - *Exponential growth – growth in a population that occurs by multiplication*
  - Have students determine which is linear and which is exponential in our example.
  - ***"We calculated the amount of money we would have by calculating each day. If we wanted to calculate an amount for a long period of time, using the table to get each day would be a really inefficient method. Instead, we can use a formula to calculate the final amount. Look at your definition of Exponential Growth and at how we calculated our growth rate. Which mathematical function(s) do you think we'll use?"***
    - *Discuss until students get to multiplication and exponents.*
    - *Provide formula where y = final amount, C = original amount, r = growth rate (as a decimal value) , and t = time or repetitions*
    - *Thus*
    - *Double check with calculated answer.*

- Have students work with a partner. Distribute M&M labs (Appendix 8) and explain directions.
  - ✓ **TEACHER TIP!** Use pennies or marked chips instead of M&Ms

- Circulate to monitor progress and answer questions.
  - ✓ **TEACHER TIP!** Brush up on the math and graphing skills required for this lab before running it with students.

- Tell students to add their thoughts about Exponential Growth to the board as they work.

- Bring the class back together to review their labs and clarify the calculations for exponential growth.

- When groups have finished, collect labs.
  - ✓ **TEACHER TIP!** These labs can be graded. Decide on how to weight these in the project before you distribute and inform students.

- ***"Let's think about all of this in terms of our STEC bacteria and how quickly their population would grow. Under ideal conditions, E. coli bacteria have a generation time of 17 minutes. Generation time is the amount of time it takes for a bacterial population to double; thus an E. coli colony doubles every 17 minutes. If you start with two E. coli cells, how many will you have in 85 minutes?"***
  - *Walk through together:*
  - *C = 2, r = 2 (because it doubles), t = 5 (the number of repetitions of the generation time 85minutes/17minutes)*
  - *= 64 cells*

- Practice individually. How many E. coli cells will you have after:
  - *5 hours (300 minutes) = 410,493.5421 round to 410,494 cells*
  - *8.5 hours (510 minutes) = 2,147,483,648 cells*
  - *24 hours (1,440 minutes) = 6.310689441x cells*

- Ask the class, "So, why do we have to be careful about STEC contamination?"

- Have a brief class discussion and allow students to share their thoughts.

CLOSING *5 minutes*

- Students will turn in their Exit Slip for that day. They will respond to the following prompt: ***"What does fast food do to our diet?"***

- Collect the Exit Slip for the day as students leave the classroom.

Key Question of the Day:
How does bacteria spread?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Describe how bacteria spread.

Required Materials

- Glo-Germ kit
- Video – "You Better Wash Your Hands" (http://foodsafe.ucdavis.edu/html/video.html)
- Sink with soap and water
- Paper towels
- One bottle of hand sanitizer

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What impact does the rate of bacterial reproduction have on how contamination spreads? State your opinion in one sentence."***

OPENING *5 minutes*

✓ **TEACHER TIP!** Before the class arrives, "contaminate" a few areas of the room with the Glo-Germ dust. Note that it can be difficult to get the dust to stick to surfaces like door knobs (it might help to mix it with a little bit of sensitive hand cream or use the gel or oil form instead of the powder). Pick places to contaminate that students are likely to touch (e.g., a few desks, your desk, the pencil sharpener, door knobs, etc.). You can also sprinkle it on the floor in isles where students walk. Do not mention this to the class until the end of the lesson.

✓ **TEACHER TIP!** Mix your own Glo-Germ with unscented lotion and glow in the dark paint.

✓ **TEACHER TIP!** Instead of a Glo-Germ kit, purchase Glo-Germ powder/gel separately and buy a black light bulb from a hardware store.

- Read the Bell-Work question and solicit responses from the students.
- Make a list of student responses on the board or on a flip chart.
  - › Facilitate a brief discussion based up student responses.
- Explain that, ***"We know from the M&M lab how quickly bacteria can multiply, so now we're going to explore how bacteria spread. In a place like a restaurant, we want to prevent the spread of bacteria."***

MIDDLE *40 minutes*

- Ask the class, ***"Raise your hand if you had a cold or sickness recently. Sickness could be anything from a cold to food poisoning."***
  - › Take a poll.

- Ask the class, ***"So, for those of you who raised your hand, how did you catch your sickness?"***
  - Possible responses may include:
    - *From friends*
    - *From siblings*
    - *From eating bad food*
    - *From touching something (like a grocery store cart)*
    - *Unknown*

- Explain that, ***"We're going to do a little demonstration to see if we can find out exactly how quickly bacteria spread."***

- Go around the room with the black light to examine all of the student's hands for contamination. Place the students into two groups:
  - Contaminated hands
  - Non-contaminated hands

- Ask the students with the contaminated hands to shake one of the students whose hands are not contaminated. Then, have students go back to their respective groups.

- Go around to the students in the non-contaminated group with the black light and see if their hands have become contaminated.

- Pause for a brief discussion about what happened and discuss the concept of hand washing to prevent the spread of bacteria (or germs).
  - Ask the students in the contaminated hands group to share the parts of the room that they touched.
  - Make the point that you don't know what other people are touching or where their hands have been, so a simple act of shaking hands or a high five can instantly spread bacteria. It's not just touching other people. Imagine touching your face, touching your food during lunch, rubbing your eye, or any of the many other things that could cause you to ingest the bacteria.

- Bring the class back together. Go around the room with the black light to show the areas of contamination.
  - Ask students to lift their feet and check under shoes and on the floor as well. Explain that those are the areas where initial transmission occurred.

- Divide the class into the following groups:
  - Hand sanitizer – these students will sanitize their hands following the instructions on the bottle.
  - Hand washing unknown time with or without soap – these students will just wash their hands like they normally would and may or may not use soap (they won't keep track of time).
  - Hand washing for 15 seconds with soap– these students will wash their hands for 15 seconds with soap and water.
  - Hand washing for 15 seconds without soap – these students will wash their hands for 15 seconds with just water.
  - ✓ **TEACHER TIP!** If you have enough students in the class with contaminated hands, use all of the groups listed here. If not, use the hand sanitizer group and the washing for 15 seconds group. That way you can compare the difference, if any, between simply using hand sanitizer and proper hand washing.

- Before getting started, ask students in each group to hypothesize what they think will happen when they wash their hands (e.g., will the contaminant disappear or still be on their hands?).

- Once they have a hypothesis, have each team proceed with cleaning their hands following the protocol they were given.

- When they are finished, have the class sit in their groups. Go around the room with the black light and inspect everyone's hands.

- Ask the following questions:
  - Did the contamination disappear? Why or why not?
  - For students whose hands are still showing contamination, ask them what they did differently and why they think their hands are still contaminated.
  - How did washing with water and/or soap and water compare to using hand sanitizer?
  - What would happen if a chef at a restaurant had contaminated hands?

- Debrief the exercise by discussing the importance of washing hands to prevent the spread of bacteria.

- Show the video "You Better Wash Your Hands" Carl Winter (in the "Video" folder). Review the steps of proper hand washing (e.g., warm water, soap, wash for 15 seconds).

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Explain what you learned today about the spread of bacteria in two sentences."***

- Collect the Exit Ticket for the day as students leave the classroom

Key Questions of the Day:
What are antibiotics?
What is antibiotic resistance?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Define antibiotics.
- Define withdrawal period.
- Describe antibiotic resistance.

Required Materials

- Antibiotic resistance lab kit: https://lab-aids.com/kits-and-modules/details/NATURAL-SELECTION-AND-ANTIBIOTIC-RESISTANT-BACTERIA-SEPUP
- Video – Antibiotics and cattle video

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"Describe a time when you were sick and had to take antibiotics."***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- After students share their responses, explain that ***"We've been learning all about bacteria – how they grow, how they spread – today we're going to learn about how to treat them if faced with a bacterial infection."***

MIDDLE *40 minutes*

- Using antibiotics is a form of intervention when a person or animal is sick.
- Explain that, ***"Antibiotics can be used to treat animals when they are ill with a bacterial infection. Let's explore an example with cattle."***
- Show antibiotics in cattle video (in the "Video" folder).
  - Define withdrawal period
    - *The amount of time from ingestion of the antibiotic to when it is completely out of an animal's system. Animals may not be slaughtered for human consumption until the withdrawal period is over.*
- Ask students, ***"How many days does a typical prescription of antibiotics last?"***
  - The answer is 10 days.
- Ask the class, ***"Why is it important to take the entire prescription?"***
- Complete the Antibiotic Resistance lab from Lab-Aids: https://lab-aids.com/kits-and-modules/details/NATURAL-SELECTION-AND-ANTIBIOTIC-RESISTANT-BACTERIA-SEPUP

- Debrief the lab and ask students to write one paragraph in their research journals in response to the following question:
  - ***"Why is it important to complete the dosage of antibiotics in infected cattle?"***

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What happens if you skip a dose of antibiotics? Why should any leftovers be discarded once a treatment is completed?"***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
How do we eliminate pathogens in food?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Define FATTOM.
- Describe food handling procedures that minimize the pathogens in food.

Required Materials

- Markers (or colored pencils, crayons, etc.)
- Construction paper
- Flip charts
- Lab Materials (The Science of Cooking a Hamburger Lab adapted from Science and our Food Supply by NSTA and FDA pages 64-65):
  - 0.5lb (227g) of raw hamburger meat
  - 2 plates or bowls to place the hamburger on
  - 2 self-sealing plastic bags
  - 3 sterile Petri dishes with nutrient agar and covers
  - Paper towels
  - Safety globs and aprons for anyone handling the meat
  - Knife for cutting hamburger package
  - Sterile cotton swabs

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What can you do to keep food safe?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Make a list of the ideas that students share.
- Explain that, ***"Until now, we have been learning about all of the dangers that could impact the food supply. Today we are going to learn about what causes pathogens to thrive in food, so that we can be proactive and eliminate them."***

MIDDLE *40 minutes*

- Explain that, ***"Let's meet a good friend of mine. His name is FAT TOM. He is here to help us learn how to keep food safe. His mission in life is to control the growth of existing microorganisms so that we don't get sick with foodborne illness."***
  - ✓ **TEACHER TIP!** Using a sheet of flip chart paper, draw a stick figure of a person and write "FAT TOM" somewhere on the paper. Post the drawing somewhere in the room, but keep it hidden until you get to this part of the lesson.
- Reveal the drawing of FAT TOM. By then, students will see that it's not a real person, but an acronym to remember that will help us keep microorganisms out of food.
- Have a flip chart for each letter of the acronym hanging around the room with the following information:
  - F is for Food – All microbes need a food source. Yeast prefers simple sugars. Mold can grow in very poor nutritional conditions. Bacterial prefer protein-based foods.
  - A is for Acid – Bacteria, yeast, and mold grow best in neutral conditions (pH = 7). Molds grow at a lower pH (acidic) than yeasts and bacteria. Bacteria will not grow at pH less than 4.6.

- ✓ **TEACHER TIP!** For this poster, draw the pH scale and identify acids, bases, neutral, and then indicate the information provided for this category.
  - › T is for Time – Microorganisms need time to reproduce. Lower temperatures inhibit reproduction. Keep cold foods cold until cooking and hot foods hot once cooked.
  - › T is for temperature – The danger zone for temperature is 40° – 140° F, as cold foods should be kept at less than 40° and hot foods should be kept higher than 140°. The danger zone for time is 2 hours (throw away any foods that have sat out for longer than two hours).
  - ✓ **TEACHER TIP!** A nice visual for this poster would be to draw a thermometer and highlight the temperature danger zone.
  - › O is for Oxygen – Molds are aerobic. Yeasts are facultative anaerobic. Bacteria are aerobic, anaerobic, and facultative.
  - › M is for Moisture – All microbes need moisture to grow and reproduce.

- Give the students about 5-10 minutes to visit each poster and take notes in their research journals during a gallery walk.

- Bring the class back together and transition to hamburger lab by explaining, ***"Now, we're going to take a closer look at how FATTOM contaminates your food by focusing on "T for Temperature."***
  - ✓ **TEACHER TIP!** The following lab is adapted from The Science of Cooking a Hamburger Lab from Science and our Food Supply by NSTA and FDA pages 64-65. The day before the lab, purchase the hamburger meat (buy the cheap stuff!) and disinfect the knife that will be used to cut the meat. Then, divide the hamburger package in half by cutting through the entire package (even the tray). Put each half in a self-sealing bag and seal. Label one bag "chilled" and refrigerate immediately. Label the other bag "room temperature" and leave it out at room temperature at least overnight. Place the packages on plates or in a bowl to prevent the raw meat juice from leaking.

- Ask the class, ***"Given what you know about bacteria and FATTOM, create a hypothesis to answer this question - what do you think the bacterial count will be between the meat that is refrigerated versus the meat that was left out at room temperature?"***
  - › Students will form a hypothesis as a team.

- Quickly review the scientific method.

- To conduct the experiment:
  - › Remind students that when completing a lab, they need to wear safety gloves since they are handling raw meat.
  - › One team member will label a Petri dish "1 – Control" since there won't be any meat inoculated in this dish.
  - › One student will label a Petri dish "2 – Chilled" and swab the hamburger that was stored in the refrigerator. Then, they swab the meat and inoculate the dish.
  - › Students will tape all of the dishes so that they are sealed.
  - › Place the dishes in an incubator at 35°C for 1-2 days.
  - ✓ **TEACHER TIP!** Remind students to take their meat samples from the center of the meat, away from where the package was cut.
  - › One team member will label a Petri dish "3 – Room Temp." and swab the hamburger that was left at room temperature. Then, they will inoculate the dish.

- Explain to the class that the meat came from one package that was divided in half to create the samples. Ask the class, ***"Why did we cut the package in half instead of buying two separate packages?"***
  - › The reason is that in order to get accurate results, the meat had to come from the same package. Every package of meat could have a different bacteria count, therefor introducing different variables and producing inaccurate results.

- Students will write up the lab procedures in their research journals.

- Debrief the day by having a brief discussion to review and summarize FATTOM and the purpose of the lab.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"In thinking about our project goals, how can what we learned today about FATTOM apply to the restaurant industry?"***

- Collect the Exit Ticket for the day as students leave the classroom

Key Question of the Day:
(Continuation of Day 10)
How do we eliminate pathogens in food?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Define FATTOM.
- Describe food handling procedures that minimize the pathogens in food.

Required Materials

- Markers (or colored pencils, crayons, etc.)
- Construction paper
- Flip charts

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What are you expecting to observe in your petri dishes today?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- As students share their responses, have a brief discussion about the importance of observing the results and collecting data.

MIDDLE *40 minutes*

- In their lab teams, give students about 5-10 minutes to observe the results of their petri plates.
  - ✓ **TEACHER TIP!** Encourage students to compare their petri plates to the other teams just to see the similarities and differences in the results.
- While in their teams, students should discuss the results in relation to their hypothesis and determine if their predictions were right or wrong.
  - › Bring the class together and ask them to share their thoughts on this.
- In their teams, students should take about 15-20 minutes to discuss and write a written responses for the following questions in their research journals:
  - › Did the cold kill the bacteria in the refrigerated sample?
    - » *Answer – there may be some bacterial growth, since cold doesn't kill bacteria, but keeps the bacteria from growing while the food remains chilled.*
  - › What did you observe in the unrefrigerated sample?
    - » *Answer – Since the meat was exposed to the danger zone for several hours, more bacteria should have grown than on the refrigerated sample.*
  - › What can you conclude about what went wrong in handling and storing this meat?
    - » *Answer – There is always the possibility that the meat could have been contaminated before we purchased it. However, since we left some of the meat unrefrigerated, we allowed the meat to become exposed to FATTOM.*

- What other variables could have contributed to the microbial growth?
  - *Answer – Improper inoculation of the petri dish, contaminated swabs, improper handling of the petri dish, etc.*
- Who has the final responsibility for the safety of this burger?
  - *Answer – We do, because it's our responsibility once we purchase the food from the store to ensure that it remains safe.*
- Could you cook the unrefrigerated meat thoroughly and make it safe to eat?
  - *Answer – No, because if food is left unrefrigerated, bacteria cells will grow and more heat is required to kill additional cells. Plus, leaving the meat at room temperature invites the possibility of cross-contaminating surfaces, hands, etc. So, the room temperature meat should have been thrown away if left out longer than two hours.*

- Students should write the conclusion for their experiments in their research journals.

- Transition by explaining that, "In addition to FATTOM, the 4Cs is another acronym that could have prevented the contamination that occurred in our meat samples.

- Give students about 5 minutes to research the 4Cs of food safety.

- Even if students haven't found the answers, bring the class together when time is up and ask students to share what they found.

- The 4Cs include:
  - Clean – wash hands and surfaces
  - Cook – cook foods to the proper temperatures
  - Chill – foods properly by refrigerating promptly
  - Combat cross-contamination – don't cross-contaminate (keep meat and vegetables separated during food preparation)

- In their research journals, students should create a Venn diagram to compare and contrast the differences between FATTOM and the 4Cs.

- Ask students to respond to the following question, ***"Which part(s) of the 4Cs could have helped to reduce microbial growth in our meat samples?"***

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"If you could share one thing you learned form this experiment with a friend or family member about food safety, what would it be?"***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:

What food safety procedures must be followed at each stage of beef handling to keep food free of STEC?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Demonstrate safe food handling procedures.
- Describe opportunities for STEC contamination.
- Describe procedures for minimizing the risk of STEC contamination.

Required Materials

- Project Management Log – Appendix 9 – One per student

Bell-Work

- Provide students with the weekly Bell-Work sheet – Appendix 1
- ***"List 3 procedures for keeping food safe from STEC?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Have a brief discussion about food safety as students share their responses.
- Transition by explaining that, ***"We have compiled all of the information we need from the previous lessons to start creating our training materials."***

MIDDLE *40 minutes*

- Assign each project team to a target audience:
  - Receiving and storage
  - Cooking and preparation
  - Serving
  - ✓ **TEACHER TIP!** There should be at least three teams in the class so that each team can complete one of these topics. Together, these topics will encompass everything that restaurant employees need to know about food safety.
- Give each team the Project Management Log Team Tasks (Appendix 9). Share that students will be using this log to document the work they are doing in their teams.
- First, each team will develop a list of rules & procedures that their target audience must follow to prevent STEC contamination of hot and cold beef products in the restaurant, based upon the research collected during the project.

- Once they have identified the key information they'll need for the project, they should brainstorm the type of training materials they want to create. There will be four components of the training materials:
  - Text – A reading, PowerPoint or something similar that teaches key concepts and vocabulary.
  - Hands-on activity – An activity that emphasizes essential skills and knowledge for your target audience.
  - ✓ **TEACHER TIP!** Example activities include proper hand washing, proper food storage techniques, etc. If possible, try not to share these examples with the students. Instead, use this information to guide them in this direction if they are struggling to think of ideas.
  - Video – A brief educational video you create that demonstrates essential skills and knowledge for your target audience.
  - Assessment – A quiz your classmates will complete after your lesson. The quiz cannot require more than 5-10 minutes to complete and must cover the key concepts of your lesson.

- The goal is to create a lesson that can be taught to the class (or the restaurant employees).
  - ✓ **TEACHER TIP!** Depending upon the class size, adjust the length of the lesson. For a larger class, 15-20 minutes would be a good starting point, but if the class is very small, a 20-30-minute lesson would be appropriate, too.

- By the end of the class period, each team should have an outline explaining the deliverables they will create for the training materials.

- Students should use the project management log to list the roles of each individual student on the team.
  - Visit each team as they complete the form and ask questions about their progress. Answer their questions.

- Collect and review students' plans. Pose questions back to the groups – in writing on their sheets – about things they may have missed.
  - ✓ **TEACHER TIP!** Add-in activities such as:
    - *Make posters on sanitary health practices and place in FACS/school kitchens*
    - *Health Inspector visit to class/school*
    - *Food Service training (such as ServSafe) for students*
  - ✓ **TEACHER TIP!** Additional video resource about problems in restaurants: http://www.nbcnews.com/id/3473728/ns/dateline_nbc-consumer_alert/t/dirty-dining/#.V46NLZMrLpA

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What is your role on the team? What tasks are you responsible for completing?"***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:

(Continuation of Day 12) What food safety procedures must be followed at each stage of beef handling to keep food free of STEC?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Demonstrate safe food handling procedures.
- Describe opportunities for STEC contamination.
- Describe procedures for minimizing the risk of STEC contamination.

Required Materials

- Internet access
- Computers
- Paper
- Markers
- Other craft supplies (anything that might be used to make a poster or brochure)
- Cameras – must have video capability (could also use cell phones or iPads/tablets depending upon school technology use policy)
- Movie editing software – (Windows MovieMaker is standard in windows machines and fairly easy to use)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What do you need to accomplish today?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Return students' planning sheets to them and have them sit in their groups.

MIDDLE *5 minutes*

- Students will work with their teams to continue planning for the project. They will determine:
  - A list of materials needed to complete the project – include all technology and time outside of the classroom.
  - A list of safe handling rules they will be teaching.
  - A description of the activity they will include in their presentation.
- Each team completes a written list of materials they will need in order to complete their project. This list must include a leadership role assigned to each student in the team – head of video, text, hands-on activity, or assessment. Remember that the head of each section is responsible for coordinating getting that piece done and presenting that portion of the lesson to the class. Everyone must contribute to all pieces of the presentation.
- Once they have this information ready, students will share it with the teacher for feedback. If any changes are necessary, they will be made at this time.
- Each team has 1-3 minutes to ask the rest of the class (or you) questions (technology issues? Preferred formats? Good sources?)
- Once the project plans are approved by the teacher, students may begin working on their projects.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What do you think will be the easiest part of the project? The hardest part?"***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
How do I create food safety training materials?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Develop food safety training materials.

Required Materials

- Internet access
- Computers
- Paper
- Markers
- Other craft supplies (anything that might be used to make a poster or brochure)
- Cameras – must have video capability (could also use cell phones or iPads/tablets depending upon school technology use policy)
- Movie editing software – (Windows MovieMaker is standard in windows machines and fairly easy to use)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What do you hope learners will gain from participating in your food safety training?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- When students are finished sharing, remind them to keep these goals in mind as they develop their materials.

MIDDLE *40 minutes*

- Students will sit with their teams and create a daily task list to help keep them on track.
- Next, they'll work on the project pieces for the entire class period.
- Circulate among the teams to answer questions and monitor progress.
  - ✓ **TEACHER TIP!** Since the team members will be working on the different components simultaneously, four class periods should be enough time for students to work on their projects depending on the class size and how efficient the students work. They may need to spend some time outside of class working on this if they fall behind.
- At the end of the class period, ask each team to revisit their task list and cross items they have completed so that they can plan for the next day and determine if any homework is necessary.
- Give students an opportunity to ask any questions before they leave for the day.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"How is your team working together? What could you be doing better or differently?"***
- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:

(Continuation of Day 14)
How do I create food safety training materials?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Develop food safety training materials.

Required Materials

- Internet access
- Computers
- Paper
- Markers
- Other craft supplies (anything that might be used to make a poster or brochure)
- Cameras – must have video capability (could also use cell phones or iPads/tablets depending upon school technology use policy)
- Movie editing software – (Windows MovieMaker is standard in windows machines and fairly easy to use)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What do you need to accomplish today?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Take a moment to address any questions or concerns that students have about their projects.

MIDDLE *40 minutes*

- Students will sit with their teams and create a daily task list to help keep them on track.
- Next, they'll work on the project pieces for the entire class period.
- Circulate among the teams to answer questions and monitor progress.
- At the end of the class period, ask each team to revisit their task list and cross items they have completed so that they can plan for the next day and determine if any homework is necessary.
- Give students an opportunity to ask any questions before they leave for the day.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"If you had to rank your team a percentage complete, what would it be?"***
- Collect the Exit Ticket for the day as students leave the classroom

Key Question of the Day:
(Continuation of Day 15)
How do I create food safety training materials?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Develop food safety training materials.

Required Materials

- Internet access
- Computers
- Paper
- Markers
- Other craft supplies (anything that might be used to make a poster or brochure)
- Cameras – must have video capability (could also use cell phones or iPads/tablets depending upon school technology use policy)
- Movie editing software – (Windows MovieMaker is standard in windows machines and fairly easy to use)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What has been the most challenging part of the project, so far?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Take a moment to address any questions or concerns that students have about their projects.

MIDDLE *40 minutes*

- Students will sit with their teams and create a daily task list to help keep them on track.
- Next, they'll work on the project pieces for the entire class period.
- Circulate among the teams to answer questions and monitor progress.
- At the end of the class period, ask each team to revisit their task list and cross items they have completed so that they can plan for the next day and determine if any homework is necessary.
- Give students an opportunity to ask any questions before they leave for the day.
- Remind the class that they'll only have one more day to work on this in class.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What part of your project are you most excited to share and why?"***
- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
(Continuation of Day 16)
How do I create food safety training materials?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Develop food safety training materials.

Required Materials

- Internet access
- Computers
- Paper
- Markers
- Other craft supplies (anything that might be used to make a poster or brochure)
- Cameras – must have video capability (could also use cell phones or iPads/tablets depending upon school technology use policy)
- Movie editing software – (Windows MovieMaker is standard in windows machines and fairly easy to use)

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What's left for your team to complete?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Take a moment to address any questions or concerns that students have about their projects.

MIDDLE *40 minutes*

- Students will sit with their teams and create a daily task list to help keep them on track.
- Next, they'll work on the project pieces for the entire class period.
- Circulate among the teams to answer questions and monitor progress.
- Remind each team to spend some time planning for their presentations.
- At the end of the class period, ask each team to revisit their task list and cross items they have completed so that they can plan for the next day and determine if any homework is necessary.
- Give students an opportunity to ask any questions before they leave for the day.
  - ✓ **TEACHER TIP!** Depending on the class size and the progress they have made at this point, determine if extra time is needed. If not, proceed with presentations.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"Are you ready for your presentations? Why or why not?"***
- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
How do I facilitate a food safety training program?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Develop food safety training materials.

Required Materials

- Internet access
- Computers
- Presentation Rubric – Appendix 10 – One per team for the teacher
- Team Evaluation Form – Appendix 11 – One per student
- Project Presentation Audience Feedback – Appendix 12 – One per student per presentation
- Collaboration Rubric – Appendix 14 – One per team
- Guests to serve as the food inspector

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What are the qualities of a good presenter? What are the qualities of a good audience?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
  - Presenter: good eye contact, project voice, good posture, etc.
  - Audience: quiet, eyes foreword, raise hands for questions, etc.
- Take a moment to review the qualities of a good presenter and a good audience.
- Introduce the guest food inspector.
  - ✓ **TEACHER TIP!** Remember to secure the guest food inspector ahead of time. This step is not required but is nice to have. Note that presentations could take two days, so if the guest can't be there for both days, you may need to adjust this so that all teams present in one day.

MIDDLE *40 minutes*

- Provide 5 minutes for the first team to set-up. During this time, share their topic with the other students and have each student write 1-3 questions he or she has about safe food handling and the team's topic.
- Give students a copy of the project presentation audience feedback from (Appendix 12).
- The first team will present.
- When the team is finished, the students ask the questions they prepared before the presentation.

- While the team cleans up and the next team sets up, students complete the rubric evaluating the presentation and writes questions for the next team/topic.

- Appendix 14 is for the teacher to use to assess team collaboration.

- When the presentations are finished, give each student a copy of the team evaluation form (Appendix 11) to complete. Collect them when the students are finished.

- Collect rubrics after each presentation.

- Collect all project materials from each team at the end of each presentation.
  - ✓ **TEACHER TIP!** Depending upon the number of students in the class and the lengths of the presentations, presentation days can be adjusted. Duplicate this day if needed, and use Day Nineteen for the last day of presentations.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What did you learn from the presentation today? List two new facts."***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
(Continuation of Day 18)
How do I facilitate a food safety training program?

Estimated Time

One 50-minute class period

Learning Objectives

As a result of this lesson, students will be able to:

- Facilitate a food safety training program.

Required Materials

- Internet access
- Computers
- Project Rubric – Appendix 10 – One per team for the teacher
- Team Evaluation Form – Appendix 11 – One per student
- Project Presentation Audience Feedback – Appendix 12 – One per student per presentation
- Collaboration Rubric – Appendix 14 – One per team
- Guests to serve as the food inspector

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"So far, has the training been helpful? Why or why not?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- Take a moment to review the qualities of a good presenter and a good audience.

MIDDLE *40 minutes*

- Provide 5 minutes for the first team to set-up. During this time, share their topic with the other students and have each student write 1-3 questions he or she has about safe food handling and the team's topic.
- Give students a copy of the project presentation audience feedback from (Appendix 12).
- The next team will present.
- When the team is finished, the students ask the questions they prepared before the presentation.
- While the team cleans up and the next team sets up (if any), students complete the rubric evaluating the presentation and writes questions for the next team/topic.
- Collect rubrics after each presentation.
- Appendix 14 is for the teacher to use to assess team collaboration.
- When the presentations are finished, give each student a copy of the team evaluation form (Appendix 11) to complete. Collect them when the students are finished.
- Collect all project materials from each team at the end of each presentation.

- After the last presentation, have the guest food inspector address the class and provide some feedback about the presentations.

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What did you learn from the presentation today? List two new facts."***

- Collect the Exit Ticket for the day as students leave the classroom.

Key Question of the Day:
What did you learn from this project?

Estimated Time

Two 50-minute class periods

Learning Objectives

As a result of this lesson, students will be able to:

- Summarize the key factors of food safety.
- Summarize the key concepts for preventing STEC

Required Materials

- All project notes and materials
- Self-Reflection Form – Appendix 13 – One per student

Bell-Work

- Provide students with the weekly Bell-Work sheet (Appendix 1)
- ***"What was your favorite part of this whole project?"***

OPENING *5 minutes*

- Read the Bell-Work question and solicit responses from the students.
- As students share, provide input and have a brief discussion about what knowledge was gained from the presentations.

MIDDLE *40 minutes*

- Students will complete the self-reflection form (Appendix 13).
- Students will have the entire class period to work on this.
- As students finish their essays, they should collect their evidence for this project and add it to their portfolio with their captions and descriptions for each items. Portfolios are due to the teacher at the end of the day.
- Required Portfolio Items for Project 2: Beef, It's What's for Dinner

ITEM	DESCRIPTION

CLOSING *5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"What concept from the project resonated with you the most? Why?"***
- Collect the Exit Ticket for the day as students leave the classroom.

Daily Bell-Work Journal

MONDAY **DATE**_____

TUESDAY **DATE**_____

WEDNESDAY **DATE**_____

THURSDAY **DATE**_____

FRIDAY **DATE**_____

Daily Exit Tickets

✂ -

DAY EXIT TICKET

Name: (First, Last) ______________________________

Date: ________________ Period: ________________

Topic:

✂ *Continue your answer on the back if necessary*

- -

DAY EXIT TICKET

Name: (First, Last) ______________________________

Date: ________________ Period: ________________

Topic:

✂ *Continue your answer on the back if necessary*

- -

DAY EXIT TICKET

Name: (First, Last) ______________________________

Date: ________________ Period: ________________

Topic:

✂ *Continue your answer on the back if necessary*

- -

DAY EXIT TICKET

Name: (First, Last) ______________________________

Date: ________________ Period: ________________

Topic:

✂ *Continue your answer on the back if necessary*

- -

DAY EXIT TICKET

Name: (First, Last) ______________________________

Date: ________________ Period: ________________

Topic:

✂ *Continue your answer on the back if necessary*

- -

Research Questions

1. Name of bacterium (pathogen):
2. What does it need to thrive?
3. What are the foods/sources associated with it and possible contaminants?
4. What is the implicated illness?
5. What is the incubation period for the illness?
6. What are the symptoms associated with the illness?
7. What is the duration of the symptoms?
8. What are the steps for prevention?
9. Draw a picture or make a model of your bacterium.
10. What is your bacterium's implication in the farm-to-table continuum? (Hint: How your bacterium can spread and how it can be prevented at each step)

    a. Farm
    b. Processing
    c. Transportation
    d. Retail
    e. Home (table)

Essential Question:

How do we more effectively and efficiently keep beef products safe?

Engagement Scenario:

Restaurants in our area have experienced recent outbreaks of food-borne illness related to beef. A food inspector has asked for the assistance of your class to determine what the risks are and to develop a training program for restaurant employees on how to properly handle and cook beef. Training materials should include PowerPoints, text/literature, hands-on activity, and/or video. These materials will be reviewed by professionals in the field.

You will need to research diseases related to the storage, processing, and preparation of beef. Since the bacterium E. coli is often related to beef infections, concentrate on E. coli and all of its life functions, characteristics, growth requirements, chemical and environmental growth inhibitors, and health-related issues. Investigate how restaurant workers generally work with beef and what precautions need to be taken.

How do we effectively and efficiently keep beef products safe? After reading informational text and participating in enabling learning activities on proper restaurant beef handling procedures, write a training program for restaurant employees that relates how to properly handle and prepare beef. Support your discussion with evidence from the text. In your discussion, address the credibility and origin of sources in view of your research topic. Identify any gaps or unanswered questions. Include a bibliography. You will study bacterial growth rates and patterns and will investigate bacterial structure and function during planned, hands-on, enabling activities. All of your work, calculations, data, research notes, etc., will be kept in a research log/notebook.

Once the training program is developed, create a presentation that will convince the audience to adopt the program, justifies your inclusions in the program, cites references, and outlines any problems/concerns/questions you still have. You will make this presentation to a group of state health/food inspectors and restaurant managers/owners. This audience will also review your written training program. Once this review is completed and revisions are made, you will actually use your program with restaurant employees.

Magnet Words

Students define vocabulary words using contextual clues and then use those words in a sentence to conceptualize the term.

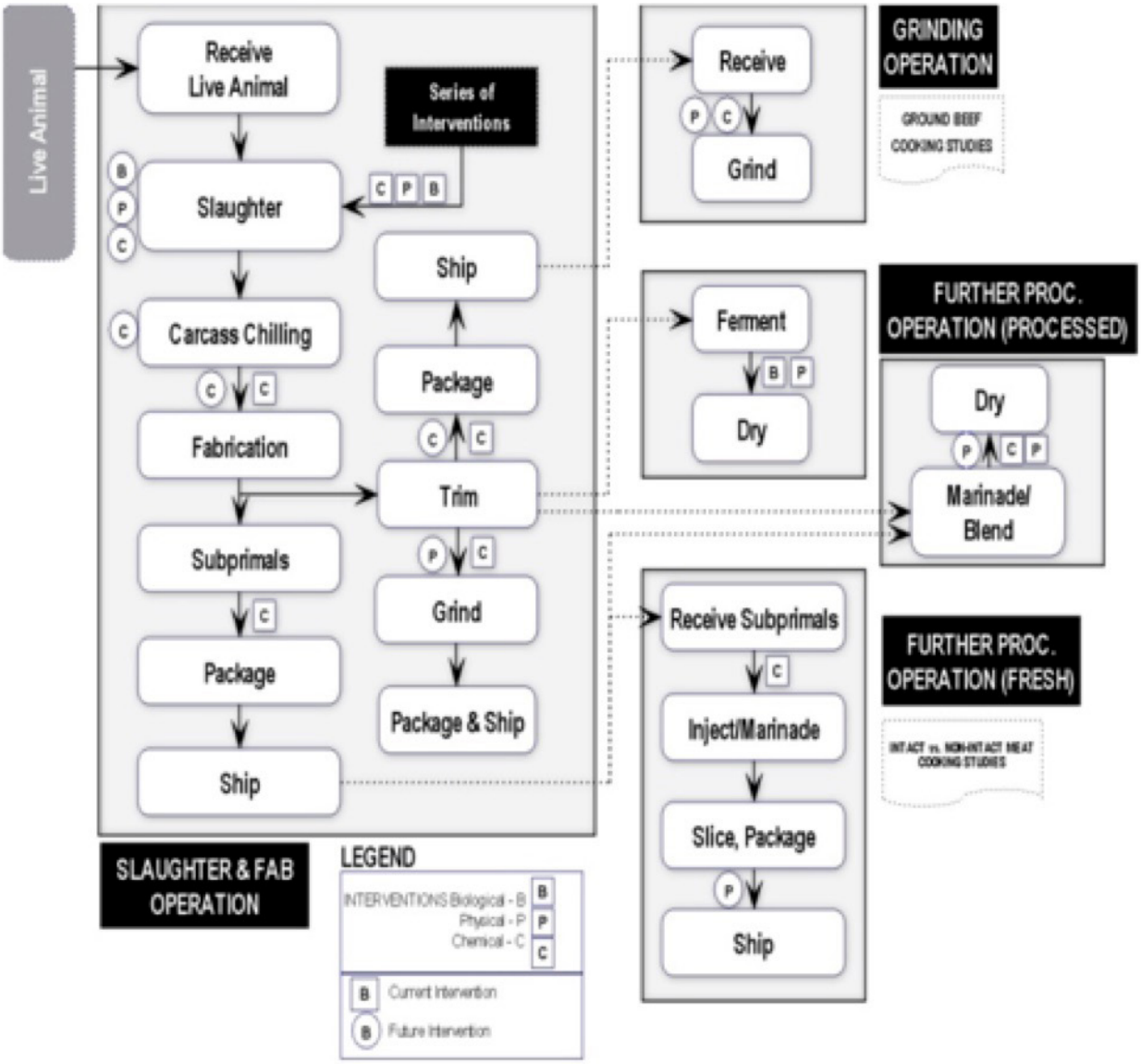
1. Write the vocabulary word on the blank side of an index card. These words can be set by the teacher or selected by the student while reading a text.

2. As the student reads, he or she writes words – on the same side of the card as the term – that are associated with or help explain the key term.

3. Next, students work in pairs to develop definitions from the thoughts written on their cards. Once students have a definition, they write it and a sentence using the word properly on the lined side of their cards.

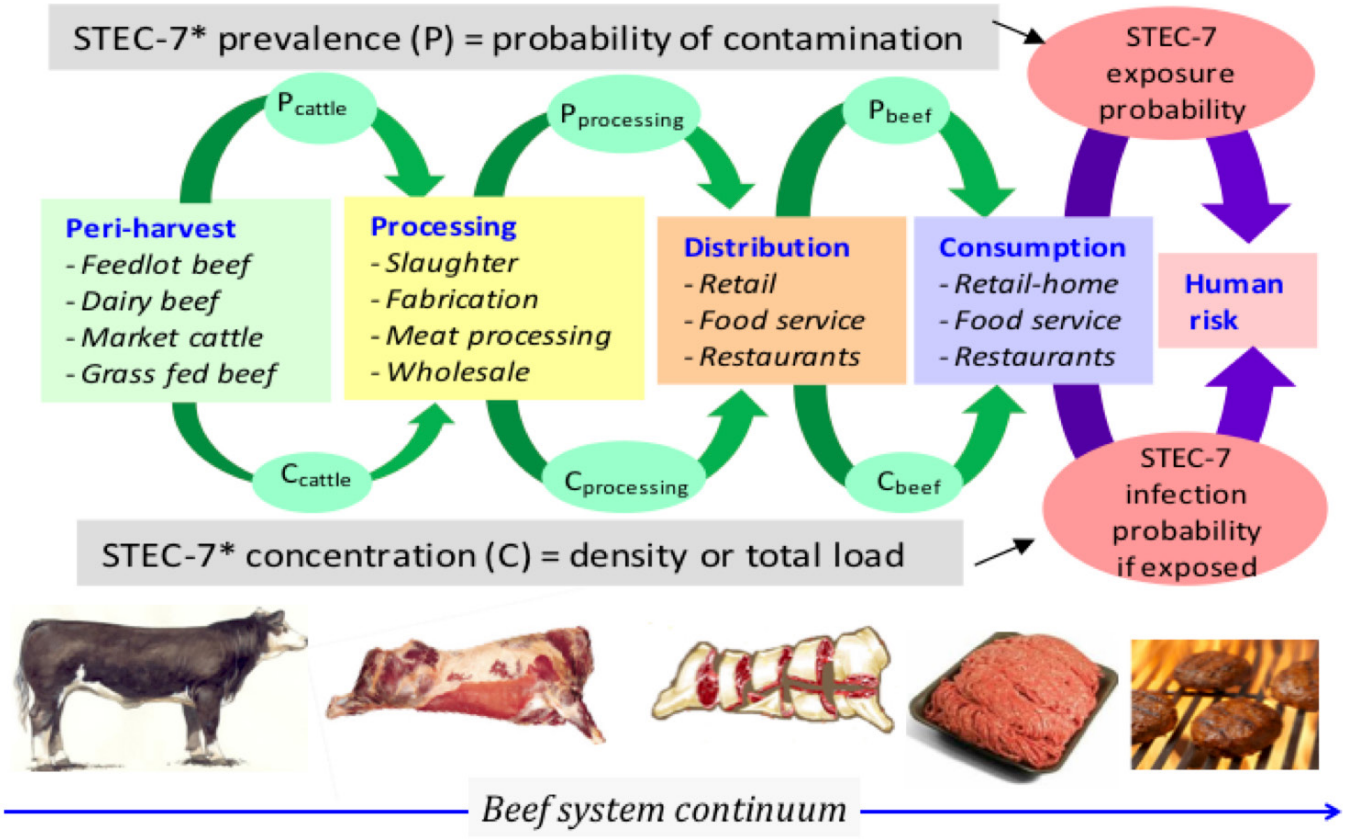
4. Students may use these cards as flash cards or to create a word wall.

Beef Processing Diagram



Which steps are the responsibility of: producers? Processors? Distributors? Food Service professionals? Government Regulators? Research Groups? Consumers?

Risk Analysis/Assessment Example



M&M Exponential Growth Lab

Name _____ Lab Partner _____

We know that bacterial cells, like STEC, grow exponentially, but what does that mean? In our experiment, an M&M represents one STEC cell. If the M&M lands "M" up, the cell divides into the parent cell and a daughter cell. Bacteria cells can divide like this without end unless they are controlled by intervention. In this experiment, we will not have an intervention to control growth. Follow the directions in this lab to determine what exponential growth is and the calculations we can use to monitor growth.

DO NOT EAT ANY OF YOUR M&Ms. YOU NEED THEM FOR THE EXPERIMENT AND WHEN YOU HAVE FINISHED, THEY WILL HAVE BEEN HANDLED BY MULTIPLE PEOPLE. THINK ABOUT THE FOOD SAFETY!

Lab Procedures

1. Place two (2) M&Ms in your cup. These represent trial number 0. Your population (# of M&Ms) is 2. This portion of the table is filled in for you.

2. Shake the M&Ms in the cup and dump them onto your table. After each time you shake the cup, approximate the percentage of M&Ms that landed with the imprint of "M" face up and record that estimate on your table (skip this step for trial 0).

3. For every M&M with the "M" showing, add another M&M. For every M&M that lands with the blank side up, do nothing. Count all of the M&Ms and record the new population on the chart under the next trial number (during trial 0 you will record the new amount under trial 1). Put all new and old M&Ms in the cup.

4. Repeat step two-three until you are done with 15 trials or until you run out of M&Ms.

TRIAL #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
# M&MS	2															
Approx # landing face up																
Calculated % landing face up																

5. Starting with Trial Number 1, graph your data (scatterplot) with the trial number on the x-axis and the number of M&Ms on the y-axis. Use a piece of graph paper and attach to this lab sheet.

6. Calculate the percentage of the M&Ms that landed face up in each trial (for trial 1, what percentage of the M&Ms that you started the trial with landed face up? Record that number under trial 1). Use this formula to calculate:

   a. $\frac{\#M\&Ms\ in\ Trial\ 2 - \#M\&Ms\ in\ Trial\ 1}{\#M\&Ms\ in\ Trial\ 1} = percentage\ landing\ face\ up$

   b. Then calculate the mean of all percentages using the formula. This mean is also the rate of growth:

      $$\frac{(\%1 + \%2 + \%3 + \%4 + \%5 + \%6 + \%7 + \%8 + \%9 + \%10 + \%11 + \%12 + \%13 + \%14)}{14}$$

      Mean of all percentages (rate of growth):_____

7. We can write an exponential growth function that models your data using the formula: $y=C(1+r)^t$ where:

   a. C = initial amount of M&Ms you started with (Trial 0). Thus, C = _____.
   b. r = rate of growth as a decimal value. Thus, r = _____.
   c. t = Time, in our case, the number of repetitions. Thus, t = _____.
   d. Fill in the variables and write your exponential growth equation:

Questions:

1. Look at your scatterplot. Should your graph ever touch the x-axis? Why or why not?

2. Using the exponential growth model you created above, predict the number of STEC cells there would be in (show your work for each!):

   a. Trial 25: _____

   b. Trial 50: _____

   c. Trial 100: _____

Project Management Log: Team Tasks

Project Name _____

Team Members _____

TASK	WHO IS RESPONSIBLE	DUE DATE	STATUS	DONE

Project Rubric

CATEGORY	EXCELLENT (15)	PROFICIENT (10)	SATISFACTORY (5)	UNSATISFACTORY OR NO ATTEMPT MADE (0)
ORGANIZATION	Includes all of the project components in an organized manner.	Missing one project component but somewhat organized.	Missing two project components and content is somewhat unorganized.	Missing three or more project components and content is unorganized.
CONTENT KNOWLEDGE	Detailed explanation of the topic. Explains the key components of the topic and can support findings with background information.	Contains a good description of the fundamentals of the topic and can somewhat support the findings with a little background information.	General to vague description of the fundamentals of the topic and has difficulty supporting the findings with background information.	Missing information regarding the description of the fundamentals of the topic, and unable to support the findings with background information.
COMPLETENESS	Project components are complete and demonstrate strong depth and breadth.	Project components are mostly complete, only moderately lacking in depth and/or breadth.	Project components are generally incomplete and lack in depth and/or breadth.	Some project components are incomplete and others completely lack depth and breadth.
SYNTHESIS	Responses are well organized, cohesive, and team components flow as a whole.	Responses are somewhat organized, cohesive, and team components sometimes lack flow as a whole.	Responses are lacking organization and cohesion and/or team components do not flow as a whole.	Responses are poorly organized, not cohesive, and the team components fail to create a whole coherent response.
REFERENCES	Thorough reference list included. References are in proper APA form and all inclusive of the citations in project.	References are missing one or two pieces of information.	References are included but not in proper form. Three or more references that are cited are missing.	No reference list included.
MECHANICS	No capitalization, spelling, punctuation or grammatical errors.	2 or less capitalization, spelling, punctuation or grammatical errors.	3-5 capitalization, spelling, punctuation or grammatical errors.	6+ capitalization, spelling, punctuation or grammatical errors.
VISUAL	Visual aids are neat, creative, and easy to follow.	Visual aids are somewhat neat, creative, and easy to follow.	Visual aids are somewhat messy, lacking creativity, and not as easy to follow.	Visual aids are messy, not creative, and difficult to follow.

Team Evaluation Form

Name _____ Date _____

Personnel Evaluation Please enter the names of your team members in the first row and complete the following personnel evaluation. **1** = Excellent, **2** = Good, **3** = Acceptable, **4** = Marginal, **5** = Unacceptable

NAME OF TEAM MEMBER	YOU			
Attended team meetings				
Was punctual				
Was willing to listen to others				
Gave the project a high priority and willingly accepted responsibilities				
Helped to identify and clarify problems				
Was willing to discuss disagreement and adapt				
Helped to make sure that everyone understood the solution				
Completed assigned tasks as promised and on time				
Saw what had to be done and did it without prompting or pressure				

1 = Too much (+60%), **2** = Above Average (40%-60%), **3** = Average (25%-40%), **4** = Below Average (15%-25%), **5** = Too little (less 15%)

Member net contribution				

The most valuable contribution of each team member was...				
Who is the Most Valuable Player? (you can mark 0 or more)				

Team Evaluation Evaluate your team's performance on the following dimensions. Assign a score of 5 where you believe your team's process is faulty and a score of 1 where you think your team is functioning well. [1: Highly effective - 5: Ineffective]

DECISION MAKING	Collaborative				Unilateral
	1	2	3	4	5
COOPERATION	Members help each other out				Members do only own work
	1	2	3	4	5
ABILITY TO HANDLE CONFLICT/DIFFERENCES	Explore and solve conflicts				Avoid or ignore
	1	2	3	4	5
BALANCE OF PARTICIPATION	Balanced workload				A few do most of the work
	1	2	3	4	5
FOCUS/ON SCHEDULE	Focused/on schedule				Digresses/off schedule
	1	2	3	4	5
COMMUNICATION	Full, open and spontaneous			Don't keep other members informed	
	1	2	3	4	5
SUPPORT	Members give others support		People do own thing, show no appreciation		
	1	2	3	4	5
TEAM SPIRIT	Members identify with their team				No team spirit
	1	2	3	4	5

Project Presentation Audience Feedback

Student Team _____

Project Name _____ Date_____

Thank you for attending our project presentations and taking the time to write thoughtful answers to the following questions:

1. What did you learn from this presentation, or what did it make you think about?

2. What did you like about this presentation?

3. Do you have any questions about the topic or about how the project was done?

4. Any other comments about this presentation?

Self-Reflection on Project Work

Think about what you did in this project and how well the project went. Write your comments in the right column.

Student Name:	
Project Name:	
Driving Question:	
List the major steps of the project:	
ABOUT YOURSELF:	
What is the most important thing you learned in this project:	
What do you wish you had spent more time on or done differently:	
What part of the project did you do your best work on:	
ABOUT THE PROJECT:	
What was the most enjoyable part of this project:	
What was the least enjoyable part of this project:	
How could your teacher(s) change this project to make it better next time:	

Collaboration Rubric

	BELOW STANDARD	APPROACHING STANDARD	AT STANDARD	ABOVE STANDARD
RESPONSIBILITY FOR ONESELF	• is not prepared and ready to work with the team • does not do project tasks • does not complete tasks on time • does not use feedback from others to improve his/her work	• is sometimes prepared and ready to work with the team • does some project tasks, but needs to be reminded • competes some tasks on time • sometimes uses feedback from others	• is prepared and ready to work with the team; is available for meetings and uses the team's communication system • does what he or she is supposed to do without having to be reminded • completes tasks on time • uses feedback from others to improve his or her work	*In addition to **At Standard** criteria:* + does more than what he or she has to do + asks for additional feedback to improve his or her work, beyond what everyone has been given
HELPING THE TEAM	• does not help the team solve problems; may cause problems • does not share ideas with other team members • does not give useful feedback to others • does not offer to help others	• cooperates with the team but does not actively help it • makes some effort to share ideas with the team • sometimes gives useful feedback to others • sometimes offers to help others	• helps the team solve problems, manage conflicts, and stay focused and organized • shares ideas that help the team improve its work • gives useful feedback (specific and supportive) to others so they can improve their work • offers to help others do their work if they need it	*In addition to **At Standard** criteria:* + steps in to help the team when another member is absent + encourages others to share ideas, helps to make them clear, and connects them to the team's work + notices if a team member does not understand something and takes action to help
RESPECT FOR OTHERS	• does not pay attention to what teammates are talking about • does not show respect for teammates (may interrupt, ignore ideas, hurt feelings)	• usually listens to teammates, but not always • is polite and kind to teammates most of the time, but not always	• listens carefully to teammates • is polite and kind to teammates	*In addition to **At Standard** criteria:* + encourages the team to be respectful to each other + recognizes everyone's strengths and encourages the team to use them