Making the Connections to Food Safety

Grade 8

What's That in My Food?

Using inquiry and design skills to solve a problem related to food safety

STAO/APSO

in partnership with

MAPLE LEAF

This resource has been developed by the Science Teachers' Association of Ontario / l'association des professeurs de sciences de l'Ontario with funding and technical support from Maple Leaf Foods.

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Table of Contents

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Background Information

Maple Leaf Foods (MLF), headquartered in Toronto, employs approximately 24 000 people across Canada. In 2008, Maple Leaf Foods (MLF) had sales of approximately $5.2 billion. Maple Leaf Consumer Foods produces fresh, ready-to-cook, and ready-to-eat packaged meats under brand names including Maple Leaf, Schneiders, Prime Naturally, Parma, and Shopsy's.

On August 7, 2008, Maple Leaf Foods learned that one of the products produced at its Bartor Road processing plant was being investigated by an Ontario local public health authority in connection with an outbreak of listeriosis. Over the ensuing weeks, rigorous testing was carried out, experts were consulted, recalls were issued, the plant was closed for a comprehensive examination and thorough cleaning, and both Maple Leaf Foods and the Canadian government carefully reviewed their procedures for ensuring the safety of food products. By the end of 2008, the Bartor Road facility was operating again, with enhanced testing protocols, and Maple Leaf Foods had appointed a new Chief Food Safety Officer and embarked on additional employee training and an extensive review of all manufacturing facilities.

For more details, please see
http://www.mapleleaf.com/en/pdf/Bartor_Road_Sliced_Meats_Recall_Background.pdf

Inquiry and Design Process Skills

This listeriosis outbreak and the steps that were undertaken to solve the problem present students with a dramatic real-life example of applying scientific inquiry and technological problem-solving skills to a problem related to science, technology, society, and the environment. But food safety is an issue everywhere, not just at processing plants. In a culminating task, students can apply what they have learned as they analyze a food-related process and design techniques or technology to improve the safety of the food. Alternatively, they can apply what they have learned to debate the safety of Canada's food industry.

Big Ideas

- Healthy cells contribute to healthy organisms
- Systems are interdependent

Curriculum Connections √

This series of activities can help your students achieve the following expectations in Science and Technology:

Science and Technology Expectations	**Activity**				
Understanding Life Systems	1	2	3	4	5
1.2 assess the potential that our understanding of cells and cell processes has for both beneficial and harmful effects on human health and the environment, taking different perspectives into account			√		√
Structures and Mechanisms					
2.4 use technological problem-solving skills to investigate a system that performs a function or meets a need		√		√	√
2.5 investigate the information and support provided to consumers/clients to ensure that a system functions safely and effectively				√	
3.3 identify the various components and processes of a system that allow it to perform its function efficiently and safely				√	√
3.9 identify social factors that influence the evolution of a system			√		

This series of activities can help your students reinforce skills and concept-development related to the following expectations in Mathematics, Health and Physical Education, and Language Arts. Ensure that students are familiar with these skills and concepts before being asked to apply them.

Mathematics Expectations	**Activity**				
Data Management and Probability	1	2	3	4	5
– collect data by conducting a survey or an experiment to do with themselves, their environment, issues in their school or community, or content from another subject, and record observations or measurements					√
– read, interpret, and draw conclusions from primary data and from secondary data, presented in charts, tables, and graphs			√		
– identify and describe trends, based on the rate of change of data from tables and graphs, using informal language			√		
– make inferences and convincing arguments that are based on the analysis of charts, tables, and graphs			√		√

Health and Physical Education Expectations	**Activity**				
Living Skills	1	2	3	4	5
1.5 use a range of critical and creative thinking skills and processes to assist them in making connections, planning and setting goals, analysing and solving problems, making decisions, and evaluating their choices in connection with learning in health and physical education		√		√	√
Healthy Living					
C1.2 identify situations that could lead to injury or death and describe behaviours that can help to reduce risk			√		√
C2.1 evaluate personal food choices on the basis of a variety of criteria, including serving size, nutrient content, energy value, and ingredients, preparation method, and other factors that can affect health and well-being			√		√
C2.2 demonstrate the ability to assess situations for potential dangers, and apply strategies for avoiding dangerous situations				√	√
C3.1 identify strategies for promoting healthy eating within the school, home, and community					√

Language Arts Expectations	Activity				
Reading	1	2	3	4	5
1.4 demonstrate understanding of increasingly complex and difficult texts by summarizing important ideas and explaining how the details support the main idea			√	√	
Writing					
1.2 generate ideas about more challenging topics and identify those most appropriate to the purpose					√
1.3 gather information to support ideas for writing, using a variety of strategies and a wide range of print and electronic sources					√
Media					
1.2 interpret increasingly complex or difficult media texts, using overt and implied message as evidence for their interpretations			√	√	√
1.6 identify who produces various media texts and determine the commercial, ideological, political, cultural, and/or artistic interests or perspectives that the texts may involve				√	√

Accommodations and Adaptations

Not all students in a Grade 8 classroom will be able to complete all activities or assessments as written. Adapt the teaching and learning strategies to accommodate the needs of exceptional students consistent with the strategies outlined in their IEPs. Students may require scribing, repeated instructions, working in pairs, etc.

The Ontario Curriculum Unit Planner released in 2002 provides an extensive list of accommodations and suggestions to address the needs of all students. Parts of the planner are available online at http://www.edu.gov.on.ca/eng/teachers/teachingtools.html - elemsec.

If individual Internet access is not available, or if you wish to provide alternatives to textual sources, an Internet search for "bacteria growth videos", "bacteria in food videos", or "prepare food safely videos" will provide you with a selection of video resources you can present to students. To ensure videos are suitable for your classroom, preview all videos before using them.

Safety Considerations

- Ensure students are aware of Internet safety guidelines. Follow your board's procedures for student Internet use.
- The bacteria that students culture in Activity 3 to make yogurt is not harmful. Ensure that students follow appropriate safety procedures around the hotplate and work with clean utensils. See Student Page E for details. Refrigerate the yogurt immediately after it is made. Provide individual cups and spoons for students to use to eat the yogurt. Students with dairy allergies or intolerances should not eat the yogurt.
- See Appendix pages 26, 27, and 28 for further safety information about the use of food in the science lab.

Activity 1: Identify the problem.

Time: 20 min

What You Need

- a projection device
- video message from Maple Leaf Foods' CEO, Michael McCain:
  http://www.youtube.com/user/MapleLeafFoods - p/u/15/cgk3o3AJM2U
  (Michael McCain talks about finding *Listeria* at the Bartor Road plant. The video clip at
  http://www.youtube.com/user/MapleLeafFoods#p/u/5/aFuN891WAZE
  describes parts of the clean-up and monitoring processes.)

What To Do

1. Discuss any product recalls students may be familiar with. An online search can provide a summary of current recalls for your reference.
   http://www.google.ca/search?q=Product+Recalls&hl=en&prmd=nl&source=univ&tbs=nws:1&tbo=u&ei=UEFxTOS0NYmisQP5u4XBCQ&sa=X&oi=news_group&ct=title&resnum=11&ved=0CFkQsQQwCg

   Tell students that in 2008, Maple Leaf Foods recalled and disposed of 1.3 million kg of processed meat products because tests found that some of the products contained a harmful species of bacteria. Tell students that they will be using this situation to learn about scientific problem-solving, and to analyze food safety in their environment.

2. Show the video. Lead a class discussion focusing on:
   - what the implications of a problem like this might be for society,
   - what the implications of a problem like this might mean for a large food-processing company,
   - what things Maple Leaf Foods could do to develop a solution to the problem,
   - whether students think these types or recalls are becoming more frequent and, if so, why this might be.

3. Introduce the culminating task. Let students know that the skills and understandings they develop by analyzing how Maple Leaf Foods solved this problem will help them analyze the food system in general and solve a problem related to their own safety.

Activity 2: Introduce the technological problem-solving process.

Task: Students identify, explain, and apply steps in problem-solving to various situations.

Time: 60 min

What You Need

- **Student Page A:** Problem-Solving Flowchart
- **Student Page B:** Problem-Solving Practice

What To Do

1. Ask students to think about a real-life problem they or others they know have had to solve. You can provide some examples:
   - a school has experienced some incidences of vandalism after school hours while extra-curricular activities are going on
   - on the evening you need to complete a research assignment, your older brother is using the computer to write an essay
   - you forget your key and no one else is around when you arrive home.

2. Encourage students to identify the steps that could be used to develop and implement a solution to the problem. You might:
   - hold a class discussion
   - set up a small group activity. Have each group choose a problem, or assign one. Provide ten minutes to discuss, record on chart paper, and present problem-solving steps.
   - use a Think-Pair-Share exercise. After reading a problem-solving scenario to the class, have each student record steps that could be used to solve the problem, then share ideas with a partner and revise their plan as necessary.

3. Distribute **Student Page A**: Problem-Solving Flowchart. Have students consider how the steps they identified fit with the steps on the flowchart. If you wish, modify the flowchart as a class to include steps that students agree are important. Keep a copy of this flowchart visible as students investigate the problem Maple Leaf Foods faced.

4. Distribute **Student Page B**: Problem-Solving Practice. This may have to be modified to reflect any changes made in "Step 3". Have students practise using the steps of their flowchart to solve a problem. They can use one of the examples above, or a problem of their choice. Students can then work in pairs to provide one another with feedback on their solutions and the steps they used to develop them. Alternatively, students can develop solutions in pairs, and work with another pair to provide feedback.

Taking It Further
Use the following scenario to discuss the consequences of decisions, and the role that values, past experience, and perspectives play in making tough decisions.

> On February 21, 2000, during a regular season NHL game between the Vancouver Canucks and the Boston Bruins, a series of decisions were made that resulted in escalating conflict and serious injury. Marty McSorely and Donald Brashear had a history of fighting when playing against each other. Barely two minutes into the first period, the first altercation occurred with Brashear winning the fight. Later, McSorley tried unsuccessfully to provoke Brashear into another fight. Midway through the third period, Brashear taunted the entire Bruins' bench with an exaggerated flexing of his muscles; this made McSorley angrier. With less than a minute to play in the game, McSorley jumped over the boards, skated behind Brashear, and clubbed him in the right temple with a vicious two-handed slash of his stick. Brashear's helmet slipped off just before he hit his head on the ice. He was left unconscious for several minutes and was considered lucky to survive the attack. McSorley was suspended for the rest of the season, and found guilty of assault with a weapon.

Questions for Discussion:

- What **decisions** did the players make?
- What were the **consequences** of these decisions?
- What **values** influenced the decisions made?
- What **past experiences** influenced the decisions made?
- What different **perspectives** or **points of view** are there about violence in sports?

Activity 3: Gather relevant information.

Task: In four subtasks, students investigate species of bacteria that can contaminate food and identify who is most vulnerable to this contamination. Students also investigate beneficial bacteria, meat processing, and the data collecting process.

Subtask A: Learn more about food-contaminating bacteria.

Time: 50 – 150 min, depending on option chosen

Option 1
Students conduct research on a variety of causes of foodborne illness.
What You Need

- computer access for students
- online resources about *Listeria* and other food-contaminating bacteria, populations at risk, and factors that may have contributed to the listeriosis outbreak, for example:

http://www.mapleleaf.com/en/market/food-safety/maple-leaf-action-plan/facts-about-listeria/
(Further information about *Listeria monocytogenes*, populations at risk, and details about the 2008 listeriosis outbreak are provided.)

http://www.phac-aspc.gc.ca/fs-sa/index-eng.php
(Information is provided about *Listeria monocytogenes, E. coli, Salmonella, Clostridium botulinum,* and *Shigella.*)

http://inspection.gc.ca/english/fssa/concen/causee.shtml
(Information is provided about several common causes of foodborne illness, including those listed below.)

What To Do

1. Divide the class into small groups to use the Internet links provided above to investigate several of these causes of foodborne illnesses:

   - *Listeria monocytogenes*
   - *Salmonella*
   - *Clostridium botulinum*
   - *E. coli 0157:H7 (hemolytic uremic syndrome)*
   - *Shigella*
   - *amnesic shellfish poisoning and domoic acid*
   - *Campylobacter jejuni*
   - *Ciguatera poisoning*
   - *Clostridium perfringens*
   - *Cyclospora cayetanensis*
   - *paralytic shellfish poisoning*
   - *red tide, PSP, and safe shellfish harvesting*
   - *scromboid poisoning*
   - *Toxoplasma gondii*

For each type of bacteria, students should answer these questions:

1. Where does it live?
2. How does it get into food?
3. What happens if people consume it?
4. How can it be controlled?

2. Have each group prepare a report to the rest of the class, using a format of their choice (slideshow, poster, dramatic presentation, etc.).

Cross Curriculum Connection: Presentations can be used to assess language arts skills as well as science skills.

Option 2

Students summarize information about four of the most common bacteria that cause foodborne illnesses.

What You Need

- **Student Page C:** What's That in My Food? (a *Listeria monocytogenes, E. coli, Salmonella, Clostridium botulinum* factsheet)
- **Student Page D:** Photos of *Listeria monocytogenes, E. coli, Salmonella,* and *Clostridium botulinum*.

What To Do

1. Provide students with Student Page C: What's That in My Food? and Student Page D: Photos of *Listeria monocytogenes, E. coli, Salmonella,* and *Clostridium botulinum*. Have students or small groups summarize how each organism can cause contamination. You could cut each page into four parts and provide each group with information about one species. The photos on Student Page D can be projected for the class to view.

   For each type of bacterium, students should answer these questions:

   1. Where does it live?
   2. How does it get into food?
   3. What happens if people consume it?
   4. How can it be controlled?

Subtask B: Identify and describe vulnerable groups of people.

Time: 30 min

What You Need

- computer access for students
- the Internet resources listed for Subtask A

What to Do

1. Have students return to the sources listed above, list groups of people who are especially vulnerable to food poisoning, describe why they are vulnerable, and suggest ways to decrease their risk of contracting food poisoning.

2. Create a table as a class to summarize what students learned.

Subtask C: Identify places where contamination can occur in a meat processing plant.

Time: 40 min
What You Need

- Internet access
- a projection device

What To Do

1. Show the following videos, one at a time. As students view the videos, tell them to watch for possible sites of contamination.

   http://www.youtube.com/watch?v=o9M5SMay6BI&feature=PlayList&p=363A93C45AC4E944&playnext=1&index=45

   http://www.youtube.com/watch?v=Ddfe4huxd4w&feature=PlayList&p=363A93C45AC4E944&playnext=1&index=46

   http://www.youtube.com/watch?v=MbgKctbPKHw&feature=related

2. Once the class has watched each video, have students work in small groups to make a list of all possible sources of contamination. Then create one master list for the entire class, to be used later in the unit.

Taking It Further
The following 24-page document from Penn State College of Agricultural Sciences (see address below) lists places *Listeria* is likely to be found in commercial establishments, factors that may contribute to contamination, and some strategies for avoiding contamination. It can be used for further research, if students are interested and time permits. http://pubs.cas.psu.edu/FreePubs/pdfs/uk137.pdf

Subtask D: Students identify the processes Maple Leaf Foods used to collect data in order to solve the problem.

Time: 20 min
What You Need

- Internet access
- a projection device

What To Do

1. Show the news video that outlines how the outbreak was linked to Maple Leaf Foods' Bartor Road plant.

   http://www.youtube.com/watch?v=bqUjj6BTaTo&feature=PlayList&p=4378F6D7C4404CB9&playnext=1&index=54

2. Together, develop a class list of the scientific processes that were used to gather the data that linked the *Listeria* in the contaminated foods to Maple Leaf Foods' Bartor Road plant. Remind students how they collected and cultured bacteria from various surfaces in Subtask A. Point out to students that the DNA of any living thing is unique, and the DNA of closely related organisms will be very similar. The DNA of the bacteria in the contaminated food can be compared to the DNA of the bacteria found at the processing plant. If they are almost identical, the source has been identified.

Subtask E: Culture beneficial bacteria by making yogurt.

Time: 40 min, 3 – 12 h incubation time, plus time to eat the yogurt in the next class

What You Need

- 1 medium or large cooler
- hotplate or stove
- 1 ladle
- a kitchen thermometer
- spoons and individual cups for tasting
- 1 large saucepan
- 1 large spoon for stirring
- oven mitts
- refrigerator
- flavourings, such as fruit or jam (optional)
- 2 or 3 glass or plastic 1-L containers (e.g., pitchers, empty soda bottles, etc.)
- approximately 16 250-mL glass or ceramic cups for the yogurt
- 2 – 4 L milk (Whole fat homogenized milk works best.)
- 1 small container of unsweetened, unflavoured yogurt with live cultures (For a more consistent result, you might want to try a commercially-available starter — available at most health food stores.)
- powdered milk (optional) (Use if you want your yogurt thicker. With a good starter, this usually isn't necessary.)
- **Student Page E**: Class Activity — Making Yogurt

What to Do

1. Perform the activity on **Student Page E**: Class Activity — Making Yogurt with your class. You will need to select one or more students to perform each task, but all students should complete Student Page E. In this activity, students will see how the use of bacteria can be helpful in the food industry, if all conditions are strictly followed.

2. While the yogurt is being made, students can answer the discussion questions. Later, they can discuss these as a class.

   Some notes about the procedure:

   1. **Caution:** Read the safety precautions on **Student Page E** with the class. Ensure that students understand why these are important.

   2. It is best to do this activity in the afternoon, so that the yogurt can incubate overnight. It will be alright if left alone for a little more than 6 – 8 hours, but check on it and refrigerate it as soon as you arrive at school the next morning.

   3. The milk needs to be heated to about 76-82° C (170-180° F). (At this temperature, other bacteria that might be in the milk that would compete against the bacteria that convert milk to yogurt, are killed. This temperature also changes the milk protein in a way that allows the bacteria to firm it up. Keep stirring the milk and do not let it go past 180F. If it scorches, your yogurt will taste bad.)

   4. Don't add the yogurt until the milk is below 50° C (120° F), and don't allow it to go below 32° C (90° F) before adding the yogurt. 43° C (110° F) is optimal.

   5. Keep the yogurt warm and still to encourage bacteria growth, while keeping the temperature as close to 38° C (100° F) as possible.

   6. The bacteria at work are Lactobacillus and Bifidus species, as well as other bacteria, depending on your source.

Cross Curriculum Connections: Students could calculate the amount of money saved by making 4 L of yogurt instead of buying it.

Activity 4: Develop solutions to the problem.

Task: Students brainstorm their own solutions to the *Listeria* contamination that occurred at the Maple Leaf Foods plant and analyze the solutions that Maple Leaf Foods used to end the outbreak.

Subtask A: Students brainstorm solutions.

Time: 20 min
What You Need

- chart paper or whiteboard

What To Do

1. Have students spend 10 minutes listing possible solutions to the problem of contaminated food and machinery at Maple Leaf Foods' Bartor Road plant. Then they share their list with their neighbour, revising their own list as they wish.

2. As a class, compile the lists into one master list on chart paper or whiteboard. For several of the solutions, encourage students to consider the implications for society and the environment. Save the class list for use in Subtask B.

Subtask B: Students analyze possible solutions.

Time: 70 min
What You Need

- **Student Page F:** Listeriosis: A Timeline
- Internet access for students
- online resources about the steps Maple Leaf Foods took to solve the problem of contaminated food, for example:
  http://www.mapleleaf.com/en/market/food-safety/food-safety-at-maple-leaf/archive/
  (The list of frequently asked questions on this page is clear and readable for most students.)

  http://www.mapleleaf.com/en/market/food-safety/food-safety-at-maple-leaf/enhanced-food-safety-protocols/
  (Maple Leaf Foods enumerates the details of its enhanced food safety protocols.)

  http://www.mapleleaf.com/en/pdf/Bartor_Road_Sliced_Meats_Recall_Background.pdf
  (Background and a detailed chronology of events in the Bartor Road sliced meats recall is provided.)

  http://www.listeriosis-listeriose.investigation-enquete.gc.ca/index_e.php?s1=rpt&page=summ
  (A shaded box in this executive summary provides key dates and details of Maple Leaf Foods and government monitoring process at the time of the listeriosis outbreak.)

What To Do

1. Have students work in groups to answer these questions:
   - What did Maple Leaf Foods do to solve the problem?
   - To what extent were the steps they followed similar to those you identified in Subtask 1?
   - To what extent were the steps they followed similar to those on the Problem-Solving Flowchart?
   - What were some implications for society and the environment of the solutions that were used?
   - How effective do you think Maple Leaf Foods' solutions were?

   Students can use **Student Page F** and the websites listed above as sources of information. If Internet access is limited, you could appoint a small group of students to gather the data for the entire class (answering the first question), then make copies or post it. Small groups could work with that data to answer the other questions.

2. Discuss students' answers to the above questions as a class. Encourage students to provide evidence from their research for their answers and their opinions. Invite students to share reasons their opinions may have changed over the course of this investigation.

Taking It Further

Students can conduct additional research into the analysis of the listeriosis outbreak, recommendations for improvement, and the steps taken by Maple Leaf Foods, government agencies, and regulatory bodies to solve the problem of food contamination. They will find relevant information at websites such as the following:
http://www.mapleleaf.com/en/market/food-safety/food-safety-at-maple-leaf/food-safety-pledge/
(Maple Leaf Foods summarizes the elements involved in its safety pledge.)

http://www.mapleleaf.com/en/market/food-safety/food-safety-at-maple-leaf/employee-videos/
(These videos show the importance that five Maple Leaf Foods employees place on food safety.)

http://www.listeriosis-listeriose.investigation-enquete.gc.ca/index_e.php?s1=rpt&page=tab
(The final report of the independent investigator into the 2008 listeriosis outbreak is dense and long, but includes Key Findings in point form for various sections. The main page provides a summary.)

http://www.listeriosis-listeriose.investigation-enquete.gc.ca/index_e.php?s1=rpt&page=message
(This message from Sheila Weatherill, the Head of the Listeriosis Investigative Review, could be suitable for groups to read together and highlight the key criteria for improvement.)

http://www.listeriosis-listeriose.investigation-enquete.gc.ca/index_e.php?s1=rpt&page=recommendations
(This is a comprehensive summary of recommendations by the Listeriosis Investigative Review relating to government processes, manufacturer processes, other partner processes, and communication processes.)

http://www.listeriosis-listeriose.investigation-enquete.gc.ca/index_e.php?s1=rpt&page=app-c
(This detailed report includes progress made by all organizations in the system as of July 2009 as a result of the listeriosis outbreak.)

Activity 5: CULMINATING ACTIVITY

Option 1
Students design, build, and test a solution for an issue related to food safety.

Time: 120 min, plus time outside of class
What You Need

- **Student Page A:** Decision-Making Flowchart
- **Student Page G:** Design an Investigation Checklist
- Internet access for students
- online resources about food safety, for example:
  http://www.mapleleaf.com/en/market/food-safety/food-safety-101/
  (Food safety information, an interactive exploration, the Food Safety for Families brochure, and a quiz are provided by Maple Leaf Foods.)

  http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/food-aliment/listeria-eng.php
  (The section, "Minimizing Your Risk", is especially relevant.)

  http://www.hc-sc.gc.ca/fn-an/securit/kitchen-cuisine/interact/safety-salubrite-eng.php
  (Interactive guides show safe food handling practices at home and in the grocery store.)

  http://www.phac-aspc.gc.ca/fs-sa/index-eng.php
  (Links are provided to a video about preparing safe lunches and other information about food safety.)

  http://www.health.gov.on.ca/english/public/contact/phu/phuloc_dt.html - 13
  (Links are provided to all Ontario local public health units.)

  http://pubs.cas.psu.edu/FreePubs/pdfs/AGRS86.pdf
  (Cooking for Crowds is a publication of Penn State College of Agricultural Sciences.)

What To Do
Period 1

1. Tell students they will be using their problem-solving skills to solve a real-life problem related to food safety. Allow students to choose one of the following problems or propose a problem of their choice:
   - Many harmful bacteria grow in warm environments. School lockers are often warm. How can the risk of bacterial contamination in students' lunches be decreased?
   - Food contamination often occurs when people handle food in their homes. What common activities are most likely to introduce bacteria? What simple steps can prevent contamination?
   - People who have leftover food in their fridge often do not know how old it is or how long it should be kept. What processes or tools could best help them avoid contamination?

2. Ensure that each student has a copy of **Student Page A:** Problem-Solving Flowchart and **Student Page G:** Design an Investigation Checklist to guide them through the problem-solving process. Tell students to obtain your approval for each section of the checklist before they proceed to the next.

3. Discuss with students the forms their presentation of their solution may take. For example, students may present in written format, orally, or as a video. Students' presentations should include:
   - a statement of the problem they solved
   - the data they gathered
   - the solution they developed
   - their analysis and evaluation of that solution.

4. Allow students time to begin brainstorming ways they can learn more about their problem.

Period 2

1. Allow some time in class for research, analysis, and development of a solution. Students will need to conduct some research and develop and test parts of their solution out of class as well.

2. Consult with students about their solutions, the steps they have completed, and what they learned from them.

Period 3

1. Allow time for presentations of solutions and analyses of their effectiveness.

Cross Curricular: Science and Technology, Language Arts, Mathematics

Assessment

- **Student Page I:** Inquiry and Problem-Solving Rubric

Option 2
Students debate the safety of the food industry in Canada.

Time: 250 min
What You Need

- Internet access for students
- online resources such as those referenced in other activities
- **Student Page H**: Debate Outline
- **Student Page J**: Debate Rubric

What To Do

Divide students into groups of six, and have them debate one or more of the following statements:

- In Canada, our food is safe to eat.
- You can trust the food industry today.
- Maple Leaf Foods handled the listeriosis outbreak as well as they could.

Period 1

1. Introduce the topic and divide students into groups. Distribute **Student Page H**: Debate Outline.

2. Have students in each group choose the side of the issue they will research and support.

3. Allow students time to begin brainstorming how they will present evidence for their issue.

Periods 2 and 3

1. Students begin researching and collecting information for their debate.

Period 4

1. Students use the outline to put together their debate and practise presentation skills.

Period 5

1. Present the debate.

2. After each debate, discuss with students how their opinions about the issue have changed, and why.

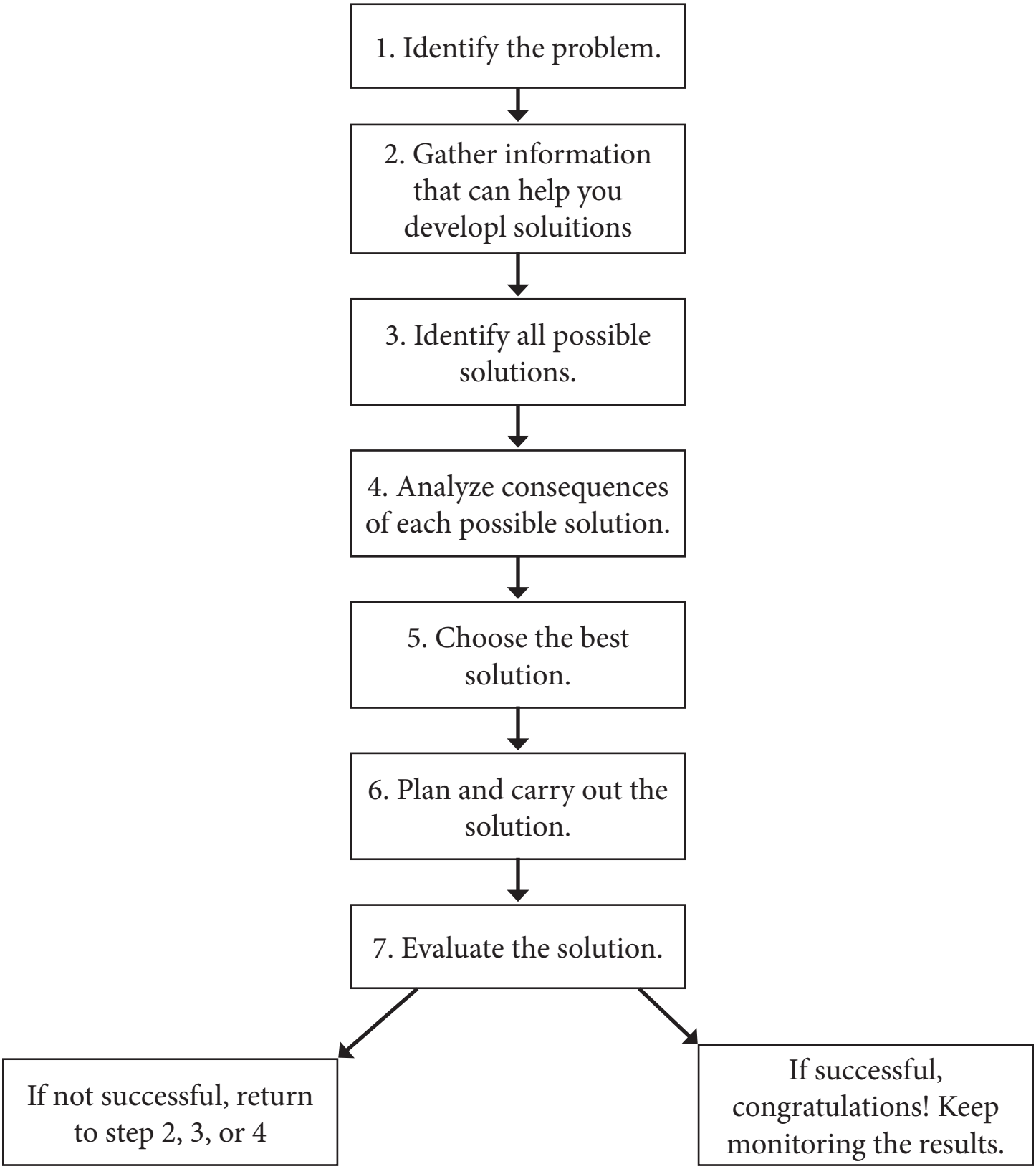
Cross-Curricular: Language Arts, Science and Technology

Assessment

- **Student Page J:** Debate Rubric

Student Page A
Problem-Solving Flowchart

You can use these steps to help you find a good solution for almsot any problem. Keep them handy.



Student Page B
Problem-Solving Practice

Use the steps in the Problem-Solving Flowchart to practise finding useful solutions to a problem.

Step 1. Describe a problem you know about.

_____

Step 2. List five places you could look for information to help you understand the problem and develop solutions. Remember, information can come from books, from interviews, from experiments, and from many other sources.

_____
_____
_____
_____
_____

Steps 3 and 4. Identify three possible solutions to the problem. List some positive and negative consequences for each possible solution.

Possible solutions	Possible positive consequences	Possible negative consequences
1.		
2.		
3.		

Step 5. Circle the solution that seems best. Why do you think it is the best solution?

_____

Step 6. Describe some criteria you could use to evaluate your solution.

_____

Student Page C
What's That in My Food?

These four bacteria are commonly found in our environment, including in our food.

Listeria monocytogenes (commonly called Listeria):

Listeria bacteria live in soil, water, and sewage. *Listeria* in the soil can contaminate crops. Humans and animals can carry *Listeria* without becoming sick. Farm animals that carry *Listeria* can contaminate meat and dairy products.

Foods contaminated with *Listeria* taste normal. Many people who consume food contaminated with *Listeria* will not become sick. Those who do develop listeriosis will experience symptoms such as vomiting, nausea, diarrhea, severe headache, and fever, usually within two to thirty days. Those most likely to become sick are pregnant women and their unborn or newborn children, the elderly, and people with immune systems that have been weakened by chemotherapy, transplants, or HIV. Listeriosis can lead to death but it can be treated with antibiotics if it is diagnosed early.

Listeria can be killed by cooking food to a safe temperature, and by pasteurizing milk.

Escherichia coli 0157:H7 (commonly called E. coli):

E. coli lives in the intestines of cattle, poultry, and some other animals. From there, it can find its way into food or water supplies. It can be transferred from manure or water to vegetables in the field, it can be spread through raw meat in meat processing plants, and it can be spread to foods in the home by pets, by cross-contamination from other contaminated foods, and by individuals who carry the bacteria.

Most people who eat food contaminated with *E. coli* develop severe cramps, nausea, vomiting, and diarrhea within hours or days. Most people eventually recover, but some develop a type of kidney failure, which can lead to permanent kidney damage, and can be fatal. Some people carry *E. coli* without becoming sick, but they can infect others by handling food. Pregnant women, the very young and very old, and people with weak immune systems are the most susceptible to the effects of *E. coli.*

E. coli can be destroyed by pasteurizing milk, juice, and cider, and by cooking food. Growth can be stopped by proper refrigeration, and spreading can be stopped by washing hands, countertops, and utensils with soap and warm water, and by keeping raw meat separate from foods that will not be cooked.

Salmonella:

Salmonella bacteria live in the intestines of some animals, including poultry and swine. Meat can become contaminated with *Salmonella* when it is processed. Other foods, including vegetables and eggs, can become contaminated with *Salmonella* when they come into contact with an infected person or animal.

People who eat food contaminated with *Salmonella* usually experience flu-like symptoms within one to three days, and recover without treatment. Occasionally, they develop a form of arthritis weeks later. Some people may not get sick at all, although they carry the bacteria and can infect others. Very young or old people, and people with weak immune systems are most likely to experience severe symptoms.

Salmonella can be destroyed by cooking food properly. Pasteurizing milk and eggs also destroys *Salmonella*.

Clostridium botulinum:

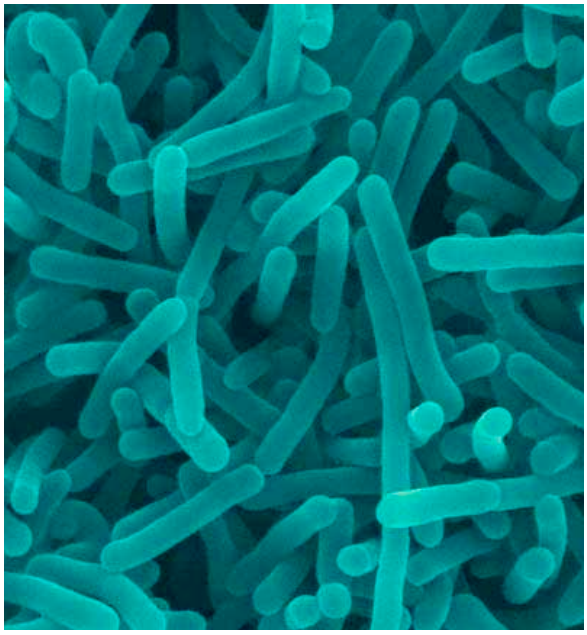
Clostridium botulinum is common in nature, but cannot grow in air. It produces botulinum toxin, a nerve poison that can cause botulism within one to three days after eating contaminated food. Botulism is a rare but serious condition that can include vomiting, headache, respiratory failure, paralysis, and occasionally death.

Because *C. botulinum* grows without air, it can grow in low-acid canned foods such as fish and vegetables that are not processed safely. It can also grow in improperly stored low-acid juices, baked potatoes, and honey.

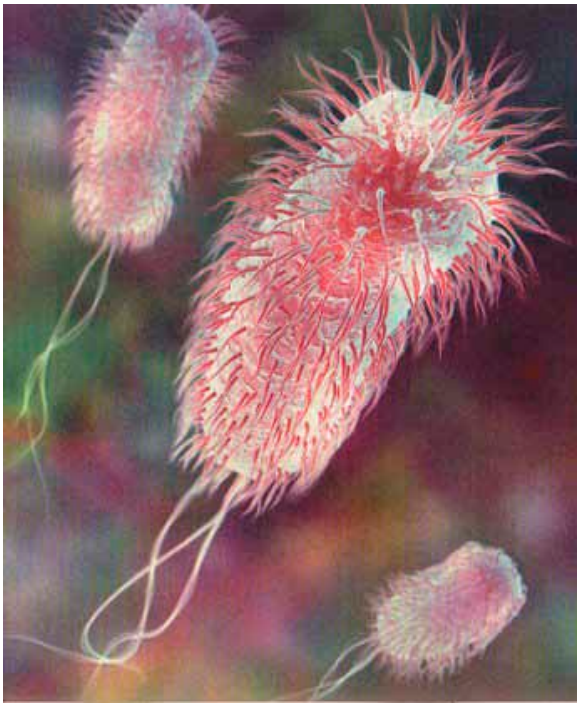
C. botunlinum can be eliminated during canning by heating to a safe temperature, for a specific period of time. Proper storage and keeping hands, utensils, and work surfaces clean during food preparation also help to prevent food from becoming contaminated. People who experience symptoms of botulism should seek medical attention immediately.

Student Page D

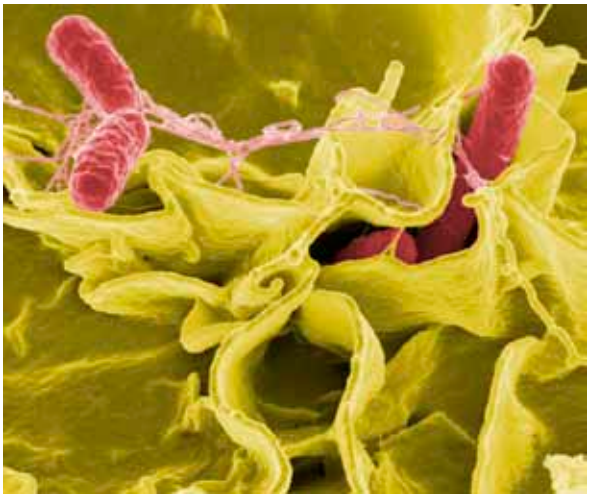
Photos of *Listeria monocytogenes, E. coli, Salmonella,* and *Clostridium botulinum*



Listeria monocytogenes
Electron micrograph: CDC/ Dr. Balasubr Swaminathan; Peggy Hayes



E. coli
Scanning electron micrograph: CDC Janice Haney Carr



Salmonella typhimurium
Scanning electron micrograph: CDC Janice Haney Carr

Clostridium botulinum
Photomicrograph: CDC

Student Page E
Class Activity — Making Yogurt

Caution

- Make sure all containers and utensils are clean.
- Keep hotplate away from the edge of the desk.
- Do not crowd the person near the hotplate.
- Use oven mitts to handle the saucepan, spoon, thermometer, and hot containers.
- Refrigerate yogurt once it is ready.
- Do not share utensils when tasting the yogurt.

What You Need:

- 1 medium or large cooler
- 1 large saucepan
- 1 large spoon for stirring
- 1 ladle
- hotplate or stove
- oven mitts
- 2 or 3 glass or plastic 1-L containers (e.g., pitchers, empty soda bottles, etc.)
- a kitchen thermometer
- approximately 16 250-mL glass or ceramic cups for the yogurt
- 2 – 4 L milk (Whole fat milk works best.)
- 1 small container of unsweetened, unflavoured yogurt with live bacterial cultures
- powdered milk (optional) (Use if you want your yogurt thicker. With a good starter, this usually isn't necessary.)
- refrigerator
- spoons and individual cups for tasting

What To Do:

1. Place the containers you will use to incubate your yogurt in a sink. Sterilize them by pouring boiling water into them from an electric kettle. Let the full containers sit for 5-10 minutes, and then carefully pour out the hot water.
2. Pour milk into large saucepan.
3. Place over medium heat and heat to 76–82° C (170-180° F). Stir the bottom of the milk as it heats.
4. Once the milk reaches 76–82° C (170-180° F), turn off the burner and continue to stir it for another 2-3 minutes, to prevent any of the milk from scorching at the bottom of the pot.
5. Once the milk cools to 40–43° C (105-110° F), stir the plain yogurt in its container until it is liquid, then add it to the pot of warm milk. Stir for a couple of minutes to help the yogurt dissolve in the milk. This will spread the bacteria throughout the milk and allow it to start to grow.

6. Add nonfat dry milk powder, if desired. Adding about 50–100 mL non-fat dry milk at this time will increase the nutritional content of the yogurt and make it thicker. This is especially helpful if you are using non-fat milk.
7. Carefully ladle the inoculated milk into the sterilized containers.
8. Put all the containers into the cooler. Fill the pitchers or large bottles with hot water from the tap and place them in the cooler as well. The heat from those containers will keep the yogurt warm. The temperature should be maintained and remain stable throughout the incubation process, so try to avoid opening the container at all until the yogurt is ready. The incubation takes anywhere from 4-8 hours (about 6 is ideal).

   Note: If the room is a bit cool, you might want to refill the large containers with hot water after 1 – 2 hours. Keep the cooler closed as much as possible to avoid letting the temperature of the yogurt containers drop. Also, avoid jostling the cooler. It sets best when it is still.

9. After about 6 – 8 hours, or a bit longer if the temperature in your cooler is below 39° C (100° F), the yogurt should be firm. Test by gently turning it to see if it keeps its shape.
   There will be some slightly yellowish, viscous liquid on the top. This is whey. You can either pour it off or just mix it into the yogurt when you eat it.
10. Cap or cover your yogurt and put it into your refrigerator. (It will keep for several days.)
11. Taste the yogurt you made.
12. If optional flavourings are available, try adding small amounts to create a flavour you like.

Discussion Questions:

1. Why did you heat up the milk before making the yogurt?

   _____

2. Why did you stop heating before the milk boiled?

   _____

3. If you hadn't sterilized the jars and cleaned the equipment before you used it, what might have happened?

   _____

4. What gives yogurt its characteristic sour taste?

   _____

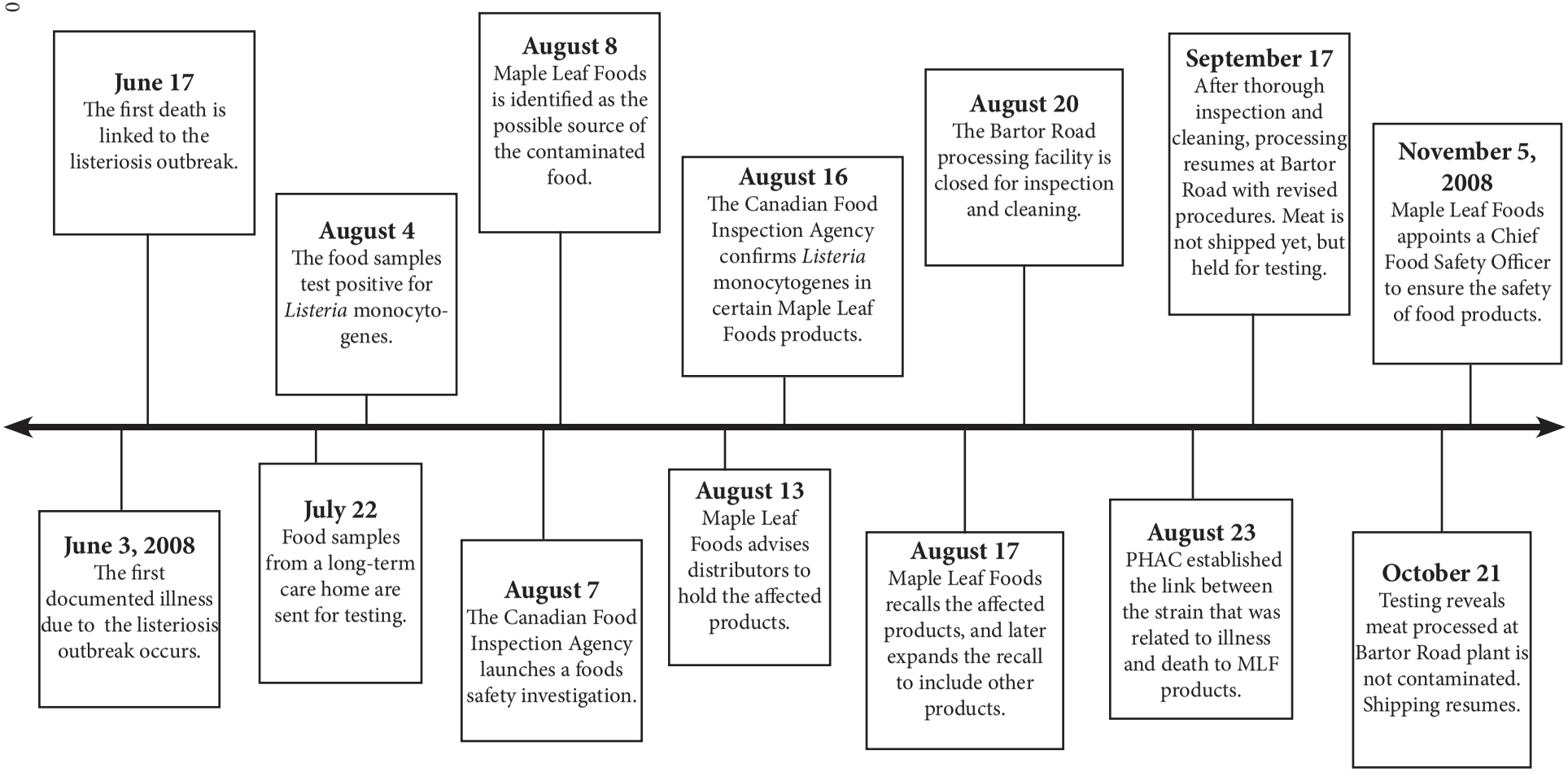
5. Why is the yogurt kept warm for 6-12 hours?

   _____

6. Why is it important to refrigerate the yogurt after the 6-12 hour waiting period?

   _____

Student Page F
Listeriosis: A Timeline



Student Page G
Design an Investigation Checklist

Use this checklist to help guide your investigation and design process. Use more paper to answer questions, if you need to. After you have completed each section, discuss your progress with your teacher and obtain approval to proceed.

A. Identify a problem and learn about it. ☐

1. What problem will you work to solve?

_____

2. What information will you gather? Where will you get the information?

Information	Source

B. Propose a solution. ☐

3. Conduct your research.

4. Based on your research, list possible solutions. Describe how effective each solution may be and what effects it may have on society or the environment.

Possible solution	Effects on society or the environment

5. Put a star beside the solution you think will work best.

C. Plan your solution. ☐

6. Describe what you will design and build to solve the problem.

_____

_____

7. List materials you will need. Where will you get them?

_____

_____

_____

_____

8. Describe how you will test your solution.

_____

_____

D. Test your solution. ☐

9. Describe the steps you took to test your solution.

_____

_____

_____

_____

E. Evaluate your solution. ☐

10. Did your solution solve the problem? How do you know?

_____

_____

_____

11. How could you change your solution to make it even better?

_____

_____

_____

Use this completed checklist and your notes to create a presentation that shows:

- what the problem was,
- how you learned about the problem,
- how you solved the problem,
- how effective your solution was.

Student Page H
Debate Outline

What is a debate?
A debate is a formal oral argument. In a debate, there are always two sides, each side speaking for or against an issue.

What happens during a debate?
There are rules about who gets to speak and when in a debate. Here is the easiest pattern to follow:

Who	Type of speech	Length of time
Opening (Constructive*)		
First Affirmative The first team member for the affirmative position (for) presents the team's reasons for agreeing with the statement, or resolution.	Constructive	3 minutes
First Negative The first team member for the negative position (against) presents the team's reasons for being against the resolution.	Constructive	3 minutes
Argument (Rebuttal**)		
Second Affirmative The second team member for the affirmative explains why specific points raised by the negative side are incorrect.	Rebuttal	2 minutes
Second Negative The second team member for the negative explains why specific points raised by the affirmative side are incorrect.	Rebuttal	2 minutes
Conclusion (Constructive and Rebuttal)		
Final Affirmative The final team member for the affirmative summarizes the team's main arguments and flaws in the negative argument.	Constructive and Rebuttal	3 minutes
Final Negative The final team member for the negative summarizes the team's main arguments and flaws in the affirmative argument.	Constructive and Rebuttal	3 minutes

* Constructive: you present your ideas and the evidence to support them
** Rebuttal: you try to disprove your opponent's ideas

How Can We Prepare for a Debate?
Research your topic, and use these tables to record what you learn and to help you plan your arguments.

Topic: _____
_____

Affirmative Negative (circle one)

Planning Our Constructive Debate

Arguments We Can Use	Support for Each Argument

Planning Our Rebuttal

Arguments the Opposing Side May Make	Evidence We Can Use in Rebuttal

Student Page I
Inquiry and Problem-Solving Rubric

Category	1	2	3	4
Initiating and Planning				
	The student:			
Uses an organized system to gather information.	gathers some relevant information	adopts a given system to organize information gathered	with support, plans an organized system and timelines to gather relevant information that will help solve a practical problem	plans an organized system and timelines to gather a variety of relevant information that will help solve a practical problem (e.g., surveys, observation, measurements)
Identifies possible solutions.	with assistance, identifies one or more possible solutions	with assistance, identifies some possible solutions and analyzes their potential to solve the problem	identifies possible solutions and with assistance analyzes their potential to solve the problem and their impact on society and the environment	identifies possible solutions and effectively and independently analyzes their potential to solve the problem and their impact on society and the environment
Follows the steps in a procedure.	with assistance, follows the main steps of a given process	follows a given process, maintains timelines with prompting	follows efficient process and timelines; with prompting, modifies approach as needed	follows efficient process and timelines, modifying approach as needed
Performing and Recording				
	The student:			
Designs, builds and tests a solution.	with assistance, builds a device or implements a process to solve the problem	designs and builds a device or process to solve the problem	designs; builds; and, with assistance, tests a device or process to solve the problem	designs, builds, and uses predetermined criteria to test a device or process to solve the problem
Records and organizes information.	with assistance, records information and test results	records information and test results	records information and test results in an organized, effective way	records information and test results in an organized, effective way, using a variety of strategies (e.g., graphs, tables, diagrams, lists)

Category	1	2	3	4
Analysing and Interpreting				
	The student:			
Selects a solution based on established criteria.	with assistance, selects a solution	selects a solution	selects a solution and provides reasons for their choice based on effectiveness	selects a solution and provides reasons for their choice based on effectiveness and STSE considerations
Evaluates the chosen solution.	identifies whether the solution solved the problem	explains how well the solution solved the problem	explains how well the solution solved the problem, citing evidence from data gathered	explains how well the solution solved the problem, citing evidence from data gathered; suggests possible changes to the criteria or the solution
Identifies and analyses effects of the solution on the problem, on society, and on the environment.	demonstrates an awareness that the chosen solution may have an effect on society or the environment	with assistance, identifies some effects of the chosen solution on the environment	identifies some effects of the chosen solution on society and the environment	identifies the effects of the chosen solution on society and the environment; suggests ways in which negative consequences could be minimized or eliminated
Communicating				
	The student:			
Describes the solution process in an organized way.	with assistance, describes the problem and how he or she solved it	describes the problem and how he or she solved it , using simple sentences	describes the problem and how he or she solved it, using words and visuals.	describes the problem and how he or she solved it, using labelled diagrams, tables, graphs, and descriptions effectively
Uses scientific and technological vocabulary accurately and effectively.	uses some simple science and technology vocabulary	with assistance, uses grade appropriate science and technology vocabulary effectively	uses grade appropriate science and technology vocabulary effectively	uses grade appropriate science and technology vocabulary effectively

Student Page J
Debate Rubric

Category	1	2	3	4
Knowledge and Understanding				
	The student:			
Organization and clarity: Viewpoints and responses are organized and outlined clearly.	unclear statements in many parts demonstrate limited understanding	clear statements demonstrate some understanding of issue	most statements and arguments are organized, clear, and demonstrate understanding	completely clear and orderly presentation demonstrates thorough understanding
Thinking and Investigation				
	The student:			
Use of arguments: Reasons are given to support viewpoints.	few or no relevant reasons given	some relevant reasons given	most viewpoints supported by relevant reasons	relevant reasons support every viewpoint expressed
Use of examples and facts: Examples and evidence are provided to support reasons.	few or no relevant supporting examples or evidence	some relevant examples or evidence given	many examples or evidence given; most are relevant	complete support provided through relevant supporting examples and evidence
Communication				
	The student:			
Presentation style: Tone of voice, use of gestures, and level of enthusiasm are convincing to the audience.	few style features re used; not effectively	few style features were used effectively	all style features were used; most effectively	all style features were used effectively
Use of rebuttal: Arguments made by the other teams are responded to and dealt with effectively.	no effective counter-arguments made	few effective counter-arguments made	some effective counter-arguments made	many effective counter-arguments made
Application				
	The student:			
Making connections: Assesses the impact of science and technology on people, other living things, and the environment.	few impacts are mentioned	some relevant impacts are introduced	relevant impacts are introduced and evidence for them is provided to support the viewpoint	relevant impacts from a variety of areas are introduced with evidence to support the viewpoint

Appendix - From "Be Safe"

Food and Hygiene

Work with food offers many opportunities for scientific and technological activities. Food is a unique material which has to be handled differently to all others. Use this topic to teach the importance of cleanliness and personal hygiene.

Before starting work with food, students should tie back long hair, wash their hands with soap and water, and cover any cuts or scratches on their hands with waterproof dressings (e.g., 'band-aids').

Preparation: Encourage students to wear clean kitchen aprons. Check that they rewash their hands after recess breaks and visits to the washroom.

A special cooking table is ideal. If a classroom table has to be used then it should be covered with a clean plastic sheet or disposable paper tablecloth. In either case, clean the table before use. A freshly made-up disinfecting soution, such as a 3% Lysol solution, is suitable for the purpose. The solution should not be handled by students.

Store any equipment used in food preparation, including cutlery, in secure, clean conditions. Ensure this equipment is used for food preparation and washing-up.

Ingredients: Particular foods can present certain problems. Red kidney beans should be cooked thoroughly to destroy the poisons in the outer coat. Avoid skin contact and eye contact with the juice of chili peppers. Some students exhibit allergy to peanuts and other nut products. Cover spices used for 'sniff tests' with cheese cloth or gauze. Cook eggs and raw meat thoroughly to avoid the risk of infection.

Activities involving hot oil or boiling sugar are inappropriate with younger students (K to 6).

Storage: Only store small quantities of food in school, using labeled, plastic containers (e.g., ice-cream or margarine tubs). Store perishable foods in a clean refrigerator at the correct temperature (5°C). If a freezer is used, it should be set to -18°C. A fridge-freezer thermometer is useful as a check and as a teaching aid. Do not re-freeze food.

Equipment: When using a microwave oven, always refer to the manufacturer's instructions.

When installing a stove, consider the fire risk to nearby combustible materials, e.g., curtains or displays, and the hazards associated with the movements of students.

Any use of stoves or ovenware by students must be appropriately supervised.

If a dishwasher is not available, use a sink for washing-up cooking utensils. A special dish pan is an effective alternative.

Tasting Foods: Investigations involving tasting should follow the same hygiene rules as for cooking.

Allow hot foods and drinks to cool sufficiently before tasting.

SAFETY CODE
for food hygiene

- Teach students the importance of personal hygiene, particularly during food preparation and tasting investigations.
- Ensure cooking surfaces and utensils are clean.
- Use separate equipment for preparation of raw food, raw food that will be cooked, and cooked foods (e.g., use colour-coded chopping boards).
- Use kitchen aprons, utensils, and washing-up equipment that are reserved exclusively for cooking.
- Do not use cooking stoves for other purposes.
- Situate stoves and microwave ovens carefully. Regularly maintain and test them according to the manufacturers' instructions.
- Be aware that some people have medical (e.g., allergies, diabetes), religious or cultural reasons for refusing to handle or eat certain foods (including food additives). You should take this into account and modify if appropriate.
- Store food correctly. Take note of the 'Best before' date.
- Dispose of surplus food materials through the kitchen waste system.
- Do not use cooking stoves for other purposes and do not store chemicals in a refrigerator used for food storage.

SAFETY NOTE # 2 : ALLERGIES

Student allergies are a major concern. Teachers should determine whether there are students with known allergies in their classes. Those allergies should be taken into consideration when students are handling substances (including foods), in addition to plants and animals. An increasing number of students have been shown to have extreme sensitivities to peanuts and other nuts, and nut products. These ingredients should be avoided and activities planned to be inclusive of all students.

Ourselves

Students are interested in, and should know something about, themselves. They will gain an understanding of biological variation through a study of individual differences. Although, in general, this is thought of as a 'safe' topic, there are some aspects where there are possible hazards.

Make sure that each student is physically fit for the activity that she or he is about to undertake. No student who is excused from the school's P.E. activities on medical grounds should be the subject for investigations which examine the effects of exercise on breathing or pulse rate, nor in the measurement of lung capacity.

Take care that students with medical problems (e.g., epilepsy, asthma) or on regular medication are not put at risk. Local regulations concerning the keeping and giving of any medicines must be strictly followed.

Teachers should ensure that they are aware of psychological and physical limitations, including effects of cultural and religious practices, that may affect a student's ability to perform activities.

Avoid situations which can lead to emotional stress. Investigations can change into competitions or some students may think they have been identified as 'abnormal'.

Family circumstances may cause some students to be sensitive about the subject of heredity and, therefore, this must always be approached with care.

Be aware that some students may dislike handling parts of animals, and others may object on cultural or ethical grounds. No pressure should ever be exerted on students to take part in these activities. Parts of animals should always be handled with sensitivity to their living origin.

SAFETY CODE

for investigating ourselves. . .

- Be sensitive to the differences between students.
- Avoid putting individuals into situations of physical or emotional stress.
- When foods are used for investigations into the sense of taste, ensure that all surfaces and utensils are clean and that students use their own spoons or cups. Emphasize that they should not share.
- Do not allow foods to become contamined. Teach students to wash their hands with soap and dry with paper towels before and after handling food.
- When doing work on sound or hearing, teach students that listening frequently to loud sounds can damage their hearing. If speaking tubes are being tested, warn students not to shout or blow down them.
- Disinfect mouthpieces, clinical thermometers, and any other shared objects put into the mouth, using a solution such as Dettol or Lysol. Whenever possible, avoid sharing and use disposable items, e.g., straws.
- Do not take samples of human blood because of the risk of infection.

. . . and other animals

- Always obtain organs (e.g., hearts, kidneys, etc.) fresh from a butcher, since the animals from which they have been taken will have been inspected and released as fit for human consumption.
- Use the material as soon as possible to minimize any risk of infection. Even so, care should be taken because of this possibility.
- After studying organs, carefully wipe all surfaces with a disinfectant solution. Wash hands thoroughly, using soap and warm water, after handling biological specimens.
- Dispose of the organ material following local regulations.

SAFETY NOTE # 7 : BASIC HYGIENE

All hand-to-mouth activities should be avoided in science classrooms. This includes no eating or drinking in the science classroom, except for tasting investigations where the precautions taken and instructions given should clearly indicate the special nature of the activity. If possible, an alternative venue, more suitable for tasting investigations should be used (e.g., school cafeteria). Basic hygiene also includes careful attention to hand washing after handling chemicals, soil and plants, animals or microbial material. Science classrooms should be equipped with supplies of soap, warm water, and paper towels so that hands can be dried hygienically.

Hazardous Plants

In their exploration of their environments, students will take an active interest in nature, including the plant community. Most plants are safe for students to handle and to investigate. However, because some are poisonous or may irritate the skin, it is safer to regard all plants (and parts thereof), as hazardous unless you have certain knowledge to the contrary. The particular vulnerability of students with asthma and allergies must also be borne in mind. For example, plants of the primrose family are known to be irritant. Poison ivy and poison oak are still a serious problem in some areas. Certain bulbs and corms of the Lily family can cause contact dermatitis.

SAFETY CODE

for using plants

- Instruct students to avoid touching their eyes when handling plants.
- Teach students to never taste any part of a plant unless absolutely certain that it is safe to do so, as instructed by their teacher.
- Warn students especially about attractive looking fruits and seeds which look edible, but might be poisonous.
- Never use seeds dressed with pesticides.
- Teach students to always wash hands after handling plants, bulbs, fruits, seeds or soils.

Some common hazardous plants and their effects are listed below.
The list includes some hazardous plants that can cause:

- stomach and intestinal irritation (1);
- poisoning (2);
- mouth and throat-lining irritation (3);
- skin irritation (4).

House Plants
Caladium (1, 3)
Castor Bean (1, 2)
Dieffenbachia (1, 3)
Elephant's Ear (1, 3)
Lantana (2)
Mistletoe (1,2)
Philodendron (1, 3)
Poinsettia (4)

A number of other hazardous plants, which are not native to Canada, are also grown indoors.

Vegetable Garden Plants
Potato - new shoots (2)
Rhubarb - leaf blade (2)

Flower Garden Plants
Autumn Crocus, meadow saffron (2)
Christmas Rose (1, 4)
Daffodil (1)
Foxglove - leaves and seeds (2)
Golden Chair (2)
Hyacinth (1)
Iris, blue flag (1)
Larkspur, delphinium (2)
Lily of the Valley (2)
Monkshood (2)
Morning Glory (2)
Narcissus (1)
Snowdrop (1)
Sweet Pea - in large amounts (2)

Horse Chestnut

Poison Ivy

Ornamental Plants
Daphne (1)
Mountain Laurel (2)
Rhododendron (2)
Wisteria (1)

Field Plants
Buttercup (1)
Death Camas (2)
False Hellebore (2)
Poison Hemlock (2)
Poison Ivy (4)
Pokeweed, inkberry (1, 2)
Snow-on-the-Mountain (4)
Thorn Apple, jimson weed (2)

Trees and Shrubs
Black Locust (1, 2)
Box (1, 2)
Cherry - twigs, leaves, and bark (2)
Elderberry, black elder (2)
Horse Chestnut (1, 2)
Privet (1)

Marsh Plants
Cowslip, marsh marigold (1)
Skunk Cabbage (1, 3)
Water Hemlock, cowbane (2)

Forest Plants
Baneberry (1, 2)
Bloodroot (1, 2)
Deadly Amanita (2)
Fly Agaric Mushroom (2)
Jack-in-the-Pulpit (1,3)
May Apple (1)
Poison Ivy (4)
Poison Oak (4)

Identification may require reference to a suitable text (e.g. Poisonous Plants of Canada) or web site (e.g. Agriculture Canada: Poisonous Plants Information System).