

Overview

This activity is part of the CPTS Food Safety Unit. Bacteria is at the source of most food safety issues. Understanding bacteria and the conditions that affect their growth help students understand why certain behaviors to ensure food safety make sense - such as cooking meats at high temperatures or storing moist food (such as leftovers and produce) in the fridge. In this activity, students will conduct a virtual lab using an already built simulation model that show how temperature affect the growth of bacteria. Students will run the simulation using different temperature values to qualitatively describe the rules for how temperature affects the growth of bacteria. They will then manipulate the setup code to alter the minimum temperature, optimal temperature, and maximum temperature based on our knowledge of how different species of bacteria respond to temperature.

Pre-requisite StarLogo TNG knowledge/skills

1. Navigating Spaceland
2. Clicking on Setup and Forever buttons to run the program

Learning goals

1. Get students curious and engaged as they use a simulation model.
2. Every model is based on assumptions and may include real-world data.

Materials

- Computer connected to a LCD projector
- StarLogo TNG installed on student computers or on USB flash drives
- 1 copy for the student activity sheet for each student or pair of students (preferred printed format so students can record their data and answer questions in writing)

Preparation

1. Copy StarLogo TNG onto the student computers or onto USB flash drives
2. Make the “bacteria and temp.sltn” project file available to students - either on flash drive, server, or desktop. Note the location.
3. Decide whether to have students work in pairs, singly, or some combination
4. Work through the student activity sheet to become familiar with the experiment that students are conducting using the model

Procedure

1. Ask students what they know about how temperature affects bacteria.
2. Show students how to open the project file containing the bacteria and temperature model. Point out the currentTemp slider and that the unit is in Celsius degrees. Set the temperature to about 38 degrees. Click setup and forever to run it. Ask students to observe what’s happening as the simulation runs. If students have done the bacteria model building activity, they may notice that the bacteria behave pretty much the same. While the model is still running, decrease the temperature slowly, but not below 7 degrees. Ask students to observe what’s happening. The growth rate should slow down

and the line graph should reflect this by showing a less steep curve. Tell students that they will be investigating how temperature affects bacteria growth.

3. Students follow directions on activity sheet to pick various temperature data points and describe what happens when they run each simulation.

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Wrap Up

1. How do different temperature values affect the growth of the bacteria?
 - a. Below 7 degrees, the bacteria stop moving and growing.
 - b. Between 7 and 38 degrees, the bacteria growth rate increases linearly
 - c. At 38 degrees, the bacteria growth is at the highest growth rate
 - d. Between 38 and 46 degrees, bacteria growth slows drastically
 - e. Above 46 degrees, bacteria dies
2. What is unrealistic about the model? What should happen instead?
 - a. It's unrealistic to have all bacteria die at the same time when the temperature goes above 46 degrees. A more realistic model would be to program the bacteria to have some chance of dying at these high temperatures and increasing that chance as temperature increases until death is certain.