Fifth Grade: Mighty Microbes

Standard

5L4. Obtain, evaluate, and communicate information about how microorganisms benefit or harm larger organisms (Clarification statement: Possible microorganisms could include Tardigrades, Lactobacillus, Probiotics, Rotifers, Salmonella, Clostridium botulinum (Botox), E-coli, Algae, etc. Students are not expected to know these specific microorganisms. The list is provided to give teachers examples.)

4a. Construct an argument using scientific evidence to support a claim that microorganisms are beneficial.

4b. Construct an argument using scientific evidence to support a claim that microorganisms are harmful.

Teaching Tips

Preparation Note that the community science project included in this lesson requires 60 days from start to finish.

Directions for this lesson and design challenge (on next page) are written for adult use. Students will use the student lab report template from the appendix.

Phenomenon: Present the phenomenon video without explanation. Play video with sound ***off***.

What Do you Notice? Engage students in writing a tentative explanation (or making a labeled drawing) that tells what they observed (what is happening and how or why it occurred).

What Do you Wonder? Engage students in asking their own questions, which will form the basis for student research.

Student Research Consider placing each student question on a sticky note, grouping the questions in categories, and allowing students to research in small groups according to their interests. A curated collection of articles or videos is provided for research purposes using a jigsaw classroom approach in small groups, equal in number of members to the number of articles.

Teacher-Directed Activity Provide supplies to each small group. Take students to the schoolyard to scope out areas with different soils, so they can select places where they will plant cotton underwear horizontally, 3" deep. Students will measure the weight and dimensions of the underwear before burying it, documenting the process with photos and maps. Prompt students to make claims about what will happen to the underwear while buried and how microorganisms affect the process. ***Keep the initial claims and data!*** Dig up underwear and compare 60 days later. Use a microscope to observe microorganisms, if possible. Address any misconceptions about the role of microorganisms in decomposition by clarifying that bacteria are not just sortable into "good" and "bad" species. The same microorganism can have both beneficial and harmful effects on humans. For instance, bacteria that cause food spoilage and make people sick if they eat the food, but are also providing a 'service' by digesting and removing dead and decaying organisms from the environment, which helps people.

Revised Explanation Allow students to revise their initial explanations of the phenomena of the pumpkin and undies. After digging up the underwear, students will measure and weigh it to compare before and after data.
Provide this prompt for students to write a C-E-R (Claim – Evidence – Reasoning) argument:

- Claim: Restate your original claim describing the pumpkin and predicting what will happen to the underwear while buried.
- Evidence: Analyze before and after data to describe the change in the underwear as observed and measured. Tell whether the data provides evidence of the role of microorganisms in the decomposition process.
- Reasoning: Use the law of conservation of matter as the reasoning that connects the data to the claim. The law of conservation of matter says that matter is neither created nor destroyed; however, it can change forms.
- Revised Claim: If the evidence does not support the claim, revise the claim. Identify an impact on humans caused by microorganisms involved in the decomposition process.

Suggested CER Prompt: My initial claim was that _____ would happen to the underwear when it was buried, which is an indicator of [beneficial / harmful / no] action by microorganisms. When we dug it up, the underwear had [changed / not changed], as evidenced by my observation that: _____ and by this before and after data: _____. Because we know that matter is neither created nor destroyed but can change forms (law of conservation of matter) I conclude that this happened:_____ which (supports / does not support) my original claim. The role of microorganisms in this process was [beneficial to humans; harmful to humans; neither, or both].

Extension Students may investigate crime-solving based on the predictable progression of a human body through decay and decomposition stages. Solving Crimes with the Necrobiome (sensitive content/ preview before using)

5th Grade Community Science Project: Mighty Microbes

The Phenomenon

Decaying Pumpkin credit: James Knot
https://www.youtube.com/watch?v=0ReYKu__luA

What do you Notice? (tentative explanation)

Engage students in writing about what they noticed when observing the phenomenon. This will serve as their initial claim for a C-E-R (Claim - Evidence - Reasoning) argument. At the end of the lesson, allow students to use the C-E-R prompt (provided on the previous page) to revise and refine explanations so that they reflect the evidence gathered before and after the Undies challenge, and interpret evidence using reasoning based on knowledge of scientific principles.

What do you Wonder? (student questions)

Engage students in asking their own questions about the unexplained phenomenon. These questions will form the basis for student research. Distribute copies of the student lab report template in the appendix.

Curated Articles for Research Jigsaw www.jigsaw.org

- Recycling the Dead Science News for Students; Kathiann Kowalski; September 27, 2014
  https://www.sciencenewsforstudents.org/article/recycling-dead
- Healthy Soils are Black Gold; Science News for Students; Catherine Arnold; February 25, 2021
  https://www.sciencenewsforstudents.org/article/healthy-soils-life-giving-black-gold-ecosystem-agriculture
- Bacteria All Around Us; Science News for Students; Lindsey Conkle; October 4, 2018
  https://www.sciencenewsforstudents.org/article/bacteria-are-all-around-us-and-thats-okay
- Biodegradation; KidzSearch Safe Wiki
  https://wiki.kidzsearch.com/wiki/Biodegradation
- Decomposition: What Happens When Living Things Die?; TheK8School
  https://k8schoollessons.com/decomposition-what-happens-when-living-things-die/
- The Soil Food Web infographic; JessicasGarden.net
  https://jessicasgarden.net/wp-content/uploads//2011/02/soil-ffod-web.jpg
- What Happens in a Landfill?
  https://www.crd.bc.ca/docs/default-source/Partnerships-PDF/what-happens-in-a-landfill-.pdf?sfvrsn=ac1088c9_0#:~:text=Waste%20decomposes%20in%20a%20landfill,%2C%20temperature%2C%20and%20moisture%20available.
- The Myth of Biodegradation in Landfills; EcoProducts
  https://www.ecoproducts.com/images/pdfs/talking_points/Biodegradation.pdf

Community Science Project

The Soil Your Undies Challenge

Choose locations with different soils. Weigh and measure cotton underwear. Take photos before before burying it. Plant underwear 3" deep, horizontally. Mark spots. Wait 60 days. Dig up undies. Compare the size and weight. Use this form to report data and Track. Draw conclusions about the role of microorganisms.

Materials

- Cotton underwear (1 per group)
- Shovel or trowels (1 per group)
- Digital scale (0 - 2oz or 55g)
- Measuring tape (1 per group)
- Phone or camera to take pics
- Microscope to observe microorganisms

Revised or Refined Explanation

Prompt students to make a claim about the decomposition of buried cotton underwear and the pumpkin; to provide evidence (including data); and to explain their reasoning to connect the evidence to the claim. (See previous page).