

RESOURCE LIBRARY | ACTIVITY : 1 HR

# Microbe Eradication Complications

Students are introduced to the idea and implications of microbe eradication, using smallpox as an example. They read about health conditions that are caused by microbes or our attempts to eradicate microbes. Students also rank the value of eradication of the microbes and practice developing a subsequent claim and reasoning. Finally, they also analyze the design of two public service announcements (PSAs).

## GRADES

6, 7, 8

## SUBJECTS

*Biology, Health*

## CONTENTS

3 Links, 2 PDFs, 1 Resource

## OVERVIEW

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For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/microbe-eradication-complications/>

## In collaboration with

# DIRECTIONS

This activity is part of the Misunderstood Microbes unit.

## 1. Introduce the idea of eradicating microbes and consider the implications of eradication.

- Project the short article about the eradication of smallpox: *This Day in Geographic History: Smallpox Eradicated*. Read the article to the class; model active reading as you pause to discuss unfamiliar terms as needed.
- Lead a brief discussion about the implications of eradication. Guiding questions:
  - Eradication means to totally destroy the existence of something. What else can you think of that's been eradicated or should be eradicated? (Possible response: Other diseases (polio and rabies are considered nearly eradicated), some invasive species, students might also suggest large-scale goals, such as eradicating world hunger or poverty.)
  - Why do you think scientists focused on smallpox for eradication? (Possible response: Because smallpox had a high mortality rate, it did not have a cure, and it was highly contagious.)
  - Based on what you have learned about microbes in the past two activities, do you think eradication is always positive? (Possible responses: Yes, because so many microbes cause disease and infection in humans. No, because the vast majority of microbes are helpful to humans.)

## 2. In preparation for their project work in the Introduce a Microbe to the World! lesson, read about the connections between microbes, a disease or condition that afflicts humans, and our efforts to eradicate the microbe.

- Explain that students will work with a partner to learn about two to three diseases and microbes on The Microbiome and Disease site and take notes on Part C of the Microbes: Our Best Frenemies handout.
- Highlight how students will think about the relative need to eliminate each disease or health condition by ranking it on a scale of importance. Provide two contrasting examples for students to consider. Ask:
  - How important is it to eradicate acne for all people?
  - How important is it to eradicate cancer for all people?

- Introduce the ranking scale (critical, important, debatable, unimportant) and prompt students to articulate a reasoning statement for their eradication rankings.
- Work with the class to select or assign diseases; ensure that all 15 diseases on the list will be read by at least one partner group.

### **3. Create a class Microbe and Disease Eradication Spectrum for students to visualize their rankings of which diseases and microbes should be eradicated.**

- Draw a spectrum on the board that reflects the importance ranking for eradication that students used for their diseases:
  1. Critical
  2. Important
  3. Debatable
  4. Unimportant
- Have representatives from each partner group come up to the board and write their health condition/microbe where they think it should belong on the spectrum. For health conditions that were read about by more than one partner group, be sure they distinguish their rankings from each other.
- Elicit reasoning ideas from students for their rankings for particular health conditions/microbes, especially those with the *debatable* ranking.
  - As students share their reasoning, prompt them to share more about the biology of that particular microbe.
  - Note that many of the readings focus on the benefits and harmful aspects of microbes. If students are having trouble determining or reaching consensus for a ranking, have them present their viewpoints to the class and lead a brief discussion to show how microbes can be both beneficial and harmful.
  - Additionally, emphasize that studying microbiome and microbiology is an emerging field; press students to consider other possible uses or benefits that their microbe may have, that humans do not yet know about.
- Explain that this activity is preparing students for their project work in *Introduce a Microbe to the World!* lesson, during which they will decide if another type of microbe should be eradicated.

4. Show two sample PSAs related to the complications involved in trying to eradicate microbes, to help prepare students for their project work in the Misunderstood Microbes unit.

If needed, remind students of the project they will undertake in this unit:

- Students collaborate in small groups to create a public service announcement (PSA) with an online animation app (teacher's choice) to introduce a particular microbe to their community. Their PSA will include an evidence-based argument regarding the value of eradication of the microbe, based on its various impacts on the systems of the human body.
- Explain that they will watch and analyze two more sample PSAs.
- Direct students to the fifth and sixth design squares on the PSA Design Analyzer to analyze the following design elements:
  - Show the [Antibiotic Resistance](#) (short) PSA, prompting students to take notes on the fifth design square during and after watching.
  - Since this PSA is short (30 seconds), it may be helpful to show it a second time.
- Then show the [Threat of Antibiotic Resistance](#) (long) PSA, prompting students to take notes on the sixth design square during and after watching.
- Consider having students share out some of the design elements that they noticed in the sample videos, either in small groups or as a whole class.

## Extending the Learning

Show and have students discuss the [Why Would Anyone Get a Fecal Transplant? Watch a Brother and Sister Explain](#) video, as an example of efforts to combat diseases that are caused by human attempts to eradicate microbes.

## OBJECTIVES

## Subjects & Disciplines

### Biology

- Health

## Learning Objectives

Students will:

- Understand some of the ways that human efforts to eradicate microbes may actually cause disease or health conditions.
- Analyze the design of sample public service announcements (PSAs).

## Teaching Approach

- Project-based learning

## Teaching Methods

- Discussions
- Multimedia instruction
- Reading

## Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Information, Media, and Technology Skills
    - Information Literacy
    - Media Literacy
  - Learning and Innovation Skills
    - Communication and Collaboration
    - Creativity and Innovation
    - Critical Thinking and Problem Solving
- Science and Engineering Practices
  - Obtaining, evaluating, and communicating information

## National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS  
& LITERACY

- CCSS.ELA-LITERACY.RST.6-8.2:

Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

- **CCSS.ELA-LITERACY.RST.6-8.8:**

Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

- **CCSS.ELA-LITERACY.SL.7.2:**

Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.

## **NEXT GENERATION SCIENCE STANDARDS**

- **Crosscutting Concept 4:**

Systems and system models

- **Crosscutting Concepts: Cause and Effect:**

- **LS1.A: Structure and Function:**

In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.

- **MS. From Molecules to Organisms: Structures and Processes:**

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

- **Science and Engineering Practice 7:**

Engaging in argument from evidence

- **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

## **Preparation**

## **What You'll Need**

## **MATERIALS YOU PROVIDE**

- Printed handouts or digital access to student handouts

## **REQUIRED TECHNOLOGY**

- Internet Access: Required

- Tech Setup: 1 computer per classroom, 1 computer per pair, Monitor/screen, Projector, Speakers

## PHYSICAL SPACE

- Classroom

## SETUP

Review the 15 short readings on the [Microbiome and Disease](#) site and decide how to organize students to read two to three of the readings in pairs so that each disease is read about at least once.

## GROUPING

- Large-group instruction
- Large-group learning
- Small-group learning
- Small-group work

## BACKGROUND & VOCABULARY

### Background Information

Microbes are organisms that are too small to be seen by the human eye and include bacteria, archaea, protists, viruses, and fungi. Although most microbes' interactions with humans are neutral or beneficial, they also can make us sick by acting as infectious agents. Depending on the nature of their impacts on humans, the importance of eradicating particular microbes may vary.

### Prior Knowledge

["Relationship between structure and function", "Human body organization as complex system", "Systems thinking"]

### Recommended Prior Activities

- [Deep Dive into the Cell](#)
- [Harmful Microbes](#)

- [Helpful Microbes](#)
- [Introduction to Microbes and Human Body Systems](#)
- [Microbes Across the Tree of Life](#)
- [The Interconnected Systems of the Human Body](#)

# Vocabulary

Term	Part of Speech	Definition
eradicate	<i>verb</i>	to destroy or remove.
eradication	<i>noun</i>	total destruction.
implication	<i>noun</i>	suggestion or hint.
microbiology	<i>noun</i>	study of the structure, function, and behavior of microscopic organisms.
microbiome	<i>noun</i>	microorganisms and genetic material present in or on a specific environment.



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