



Education and Research: Testing Hypotheses

## Lesson Plan—Microbes and Climate

### Summary

This activity is meant to provide students with an understanding of how microbes play a role in the climate system, from the formation of the atmosphere to current climate dynamics to the role of microbes in climate change. This activity can be done within a unit on microbes, microbial oceanography or as a stand-alone activity connected to climate change. The activity is meant to be completed in one class period (60 minute minimum), but could be extended.

### Key Concepts

- Over the whole earth, organisms are growing, dying, decaying, and new organisms are being produced by the old ones
- Interactions between organisms may be for nourishment, reproduction, or protection and may benefit one of the organisms or both of them
- The cycles continue indefinitely because organisms are decomposed after death to return food materials to the environment

### Objectives

Students will:

- **Identify** connections between microbes and the climate system
- **Describe** the relationship between microbes and climate
- **Create** a PowerPoint about a specific microbe and its connection to the climate system
- **Communicate** basic microbe ecology to a greater audience

### Materials

- Computer with access to the Internet; one computer per student group if possible
- Reading materials:
  - Excerpt from *Global Environmental Change: Microbial Contributions, Microbial Solutions from the American Society for Microbiology*
  - *Climate Change Could Impact Vital Functions of Microbes*, ScienceDaily (June 8, 2008), <http://www.sciencedaily.com/releases/2008/06/080603085922.htm>
  - *Microbes as Climate Engineers*, ScienceDaily (Jan. 30, 2008), <http://www.sciencedaily.com/releases/2008/01/080129125446.htm>
- *Microbes and Climate Activity* student handout
- Flash drive (optional, but helpful)

### Procedure

1. As students enter the classroom, direct them to answer the question on the board or overhead: “*What would the world be like without microbes?*”

2. Give students a few minutes to record their thoughts on this question. As they finish, put the excerpt from *Global Environmental Change Microbial Contributions, Microbial Solutions* on the overhead or projector for all students to read.
3. Ask students to read the excerpt and then add any additional thoughts based on the reading to their response to the initial question. After all students have completed, ask a few volunteers to share both their initial thoughts and revisions after the reading.
4. Introduce and pass out the *Microbe and Climate Activity* sheets. Depending on your class size, have students work in partners or small groups. You can assign microbes to groups or let students pick their own microbe (each student group should work on a different microbe). Additional microbes can be added to the activity if necessary.
5. Give students some time (a minimum of 30 minutes) to research their microbe to find connections to the environment, and specifically to climate.
6. Using information they have found on the Internet, students should create a one page PowerPoint slide that includes:
  - a. The scientific name of their microbe
  - b. A color picture, with citation
  - c. Information on why the microbe is important to the climate system (explained in their own words)
7. Students can either email or give their PowerPoint slides to the teacher via a flash drive. Collect all students PowerPoints and use a projector (or TV) to present them to the class.
8. Have each student group give a short presentation on what their microbe is and how it connects to the global climate system. Students in the audience can take notes on how each microbe connects to the climate system.
9. Hand out or post (on overhead) the *Microbes As Climate Engineers* article (ScienceDaily, Jan. 30, 2008). Have students read silently, or read the article together as a class.
10. Initiate a class discussion on microbes and their affect on climate, using the following questions as jumping off points:
  - a. How might microbial activities positively and negatively impact climate change?
  - b. How might understanding microbial organisms' roles in the climate system help us with global climate change?
  - c. Should microbes be as worried about global climate change as we are? Why or Why not?
11. Conclude class with exit slips. Have students complete exit slips with at least two new things that they learned about how microbes related to the climate system. If you have time, you can have students report out orally.

### **Extension**

Homework Assignment (Optional)—Have students read *Climate Change Could Impact Vital Functions of Microbes* (ScienceDaily, June 8, 2008). They should think about the following question as they read, and write their answer afterward:

- How might microbes be negatively affected by climate change?

## Assessment

- **Performance**—Did student participate in introductory question (written work and oral sharing)? Did student participate in group research, and in the creation and presentation of the PowerPoint? Did student participate in group discussion and complete exit slip (and homework extension, if assigned)?
- **Products**—Did the response to the introductory question show evidence of thought? Did the PowerPoint slide include all of the required information? Did the PowerPoint slide provide information on the microbe's connection to climate? Did student report new learning on exit slip?

## Additional Resources

Marine Microbe Celebrates 20<sup>th</sup> Anniversary (NPR story & audio file)

<http://www.npr.org/templates/story/story.php?storyId=91483930>

Genomes of Tiny Microbes Yield Clues to Global Climate Change

<http://www.lbl.gov/Science-Articles/Archive/JGI-microbe-clues.html>

Coral Reefs and Climate Change: Microbes Could Be the Link to Coral Death

<http://www.sciencedaily.com/releases/2008/04/080401200446.htm>