



E d u c a t i o n a n d R e s e a r c h : T e s t i n g H y p o t h e s e s

Lesson Plan—Predicting the Growth of Microorganisms

Summary

This lab is designed to give students a “hands-on” experience to help answer the question: How can you determine where in your environment you might find microorganisms?

Key Concepts

- Microbes are very small and have been around a long time
- Microbes are everywhere; they are extremely abundant and diverse

Objectives

Students will

- Use sterile techniques to *collect* a sample
- *Observe* the growth of microorganisms on a nutrient agar plate
- *Demonstrate* their understanding of a controlled experiment
- *Record* their findings

Materials

- Podcast—*Bacteria Outnumber Cells in Human Body*: (NPR; July 01, 2006)
<http://www.npr.org/templates/story/story.php?storyId=5527426>
- YouTube video—*Growing Bacteria - Petri Dish*: (Steve Spangler Science; Feb 26, 2009)
<http://www.youtube.com/watch?v=6-chXVgu8Z0>
- *Predicting the Growth of Microorganisms* student handout and results worksheet
- For each student pair
 - 2 sterile nutrient agar plates (petri dishes; available from biological supply houses)
 - Clear tape to seal your petri dishes
 - 2 sterile swabs
 - Sterile water

Procedure

1. Begin by having students listen to the podcast on microbes, if possible.
2. Ask students where they think they will find the most microbes around their school environment. Student pairs should work together to determine and record their hypothesis for the experiment.
3. Each pair of students should choose a different environment to test for the presence of microorganisms. Environments can include any accessible area, including the school environment, salt or fresh water tanks, ocean or fresh water pond, etc.

4. Review proper sterile technique and safety considerations (see additional information below) with the students, and have them take a sample from their chosen environment and inoculate a sterile petri dish.
5. After the sterile dishes have been inoculated, they should be sealed with tape and labelled appropriately.
6. Discuss the importance of having a control sample, and have each pair of students set up a control dish for comparison using sterile water.
7. Incubate the dishes at room temperature for several days or in an incubator at 37° C for 1–2 days, depending on the class schedule. Do not open the dishes.
8. Have the students record their observations of the growth. They should include a drawing and descriptive information about size of colony, color, shape, etc.

Assessment

- **Performance**—Did student actively participate in discussion session? Did student successfully complete his/her experiment?
- **Product**—Did student thoughtfully complete the student worksheet, including hypothesis, procedures, results, analysis and conclusion?

Extension

Students can research ways in which bacteria are now being used to help solve our energy and environmental problems, clean up oil spills, etc. They can work in groups and share their results with the class.

Additional Resources

Nutrient Agar Plates Preparation & Equipment Use:

(Adapted from <http://www.sciencestuff.com/nav/instructions/agar3.htm>)

Background Information:

- Agar is pronounced “aw-ger” (sounds like fogger without the f). Agar is a gelling agent extracted from red seaweed. Nutrient agar is a commonly used food medium for microbial cultures. Nutrient agar contains:
 - beef extract (provides carbohydrates, nitrogen, vitamins, salts)
 - peptone (helps control pH)
 - agar (a carbohydrate used as a solidifying agent)
 - distilled water (an agent for distributing food materials to growing colonies of micro-organisms)
- *Storage:* Stack agar plates upside down in the refrigerator. Do Not Freeze! The purpose of placing the plates upside down is to prevent condensation from dripping down onto the agar surface which could then facilitate movement of organisms between colonies.

Setting Up Your Lab Area:

1. Set up your lab in an un cluttered area.
2. Keep air movement to a minimum. Air movement can bring unwanted airborne bacteria or molds into your petri dish when you have it open. Do not have a fan, air conditioner, or heater blowing air near your work area. Even the movement of other people can move the air around you. Hold your breath while inoculating the agar or wear a nose and mouth mask, if possible.
3. Keep your lab notepad close to record procedures and data.

Preparing the Plates

1. If plates have been refrigerated, set them out and allow them to warm to room temperature.
2. Carefully open sterilized swab (do not allow the swab to touch any surface other than the collection area and the agar) and swipe along the surface of the environment to be sampled.
3. Uncover each agar plate just long enough to inoculate the medium. Hold the petri dish lid directly over the petri dish (or tilt the lid just enough to allow the loop inside) while inoculating the medium to help prevent contamination from airborne particles. Do not allow the swab to touch the sides of the petri dish.
4. Do not dip the swab in the agar; let it glide over the surface.
5. Make a pattern of inoculation lines (parallel lines, tic-tac-toe, zig-zag, initials, etc.) to help determine that what is growing is what you put there and not an airborne contaminant.
6. Place the cover back on the plate immediately.

Incubation:

1. Place each petri dish inside a zip lock bag to prevent drying out and to control odors.
2. Turn the plates upside down and put them in a warm place. The ideal temperature for incubation is 32° C or 90° F.
3. Bacterial growth should start to become visible in about 2–3 days.