

Isolation of Microbes from the Environment

Target Grade Level: 5th

Created and Adapted by:
Carl Rosier



UNIVERSITY OF MONTANA GK-12 PROGRAM

1. CONTRIBUTOR'S NAME: CARL ROSIER

2. NAME OF INQUIRY: ISOLATION OF MICROBES FROM THE ENVIRONMENT

3. GOALS AND OBJECTIVES:

a. Inquiry Questions:

1. Where do microorganisms grow?
2. Are there areas where microorganisms will not grow?
3. How does the surface of an area influence microorganism growth?

b. Ecological Theme(s):

1. Microorganisms are everywhere in the environment.
2. Certain surfaces will maintain greater diversity of microorganisms (i.e. Soil vs. Bathrooms).

c. General Goal:

1. Demonstrate that microorganisms are everywhere.
2. Introduce students to microorganisms.
3. Introduce the potential benefits of microorganisms (i.e. not all bacteria are pathogenic).

d. Specific Objectives:

- Academic: Students learn about microorganisms and how they are a necessary part of life.
- Experimental: Students are able to develop their own experiment by taking environmental sample from areas where they think microbes will be growing as well as areas where they think no microbes are growing.

e. Grade Level: 5th

f. Duration/Time Required:

→ Prep time: 3-4 hours to sterilize the materials needed, as well as pouring agar plates. However microorganisms are available through Carolina Biological Supply (Listed as Nutrient Agar Media Kit (Long-life) cost is about \$25.00 for 20 plates.

→ Implementing Exercise During Class: 1 hour including lecture time.

→ Assessment: 30 minutes

4. ECOLOGICAL AND SCIENCE CONTEXT:

a. Background (for Teachers): This exercise will help the student understand that microorganisms are virtually everywhere. Most students will have the perception that bacteria are agents of disease (germs). However, this is not the case microorganisms are used to make yogurt, cheese, antibiotics, as well as ethanol which could one day be a renewable fuel source. Furthermore, there are several web sites that provide excellent pictures and information about microorganisms (see reference section for list of sites). This inquiry will enable the students to understand that microorganisms are everywhere. They will also begin to understand that while some microorganisms are harmful many are quite useful to human endeavors.

b. Background (to present to Students): The teacher can introduce the idea of microorganisms, by asking their students " what do you know about microorganisms?" Most, if not all, will discuss how microorganisms cause disease. Here the teacher can

explain some of the positive benefits microorganisms provide. The teacher can then explain what microorganisms are and that they exist in almost every environment (deep ocean vents to Mount Everest). The instructor can then ask if the students can think of any environment where microorganisms do not exist. The instructor can then ask the students how microorganisms are different from other forms of life.

5. **MOTIVATION AND INCENTIVE FOR LEARNING:** This is a fun hands on activity that will enable the student to isolate microorganisms from any area they chose. At the end of the experiment/assessment the students will be able to see the quantity and variety of microorganisms they isolated. Also the students will begin to understand how environmental factors influence microorganism growth.

6. **VOCABULARY:**

- **Microbiologist:** is someone who studies organisms such as bacteria and fungi
- **Microorganism:** A microorganism, or microbe, is any organism too small to be seen by the naked eye. Bacteria, viruses, protozoa, and some fungi and algae are microorganisms.
- **Bacteria:** are single-celled organisms that live in and around us. Bacteria may be helpful, but in certain conditions may cause illnesses such as strep throat, most inner ear infections, and bacterial pneumonia. Some bacteria can aid in pollution control by consuming or breaking down organic matter in sewage or by similarly acting on oil spills or other water pollutants
- **Fungi:** are neither animals nor plants and are classified in a kingdom of their own. Fungi include molds, yeasts, mushrooms, and puffballs.
- **Agar:** A gelatinous solidifying agent used as a culturing medium for microbial analysis or isolation.
- **Petri Dish:** A shallow, circular, glass or plastic dish with a loose-fitting cover over the top and sides, typically used for culturing bacteria and other microorganisms.

7. **SAFETY INFORMATION:** Culturing microorganisms can lead to the isolation of pathogenic organisms. Once the students have sealed the plates and incubated them they should remain closed in order to prevent the potential spread of pathogens. This step is a precaution mainly the chances of culturing a human pathogen are quite low (<1%). I found it useful to take digital pictures of the cultures and print them on a color printer. This way the student can view their cultures without the worry of spreading disease.

8. **MATERIALS LIST (including any handouts or transparency masters):**

1. Nutrient agar plates
2. Cotton swabs (sterilized)
3. Water (sterilized)
4. Area for plate incubation (72° F)

9. METHODS/PROCEDURE FOR STUDENTS:

a. Pre-investigation work: the purpose of this inquiry is to introduce students to microorganisms. Basic knowledge of microorganisms should be provided by lectures or interactive web site before beginning the experiment. The instructor can lead a variety of discussions “what are microorganisms” “how microorganisms are useful”to“what environments are suitable for microorganism growth”.

b. Investigation work: Students can work alone, pairs or groups of no more than 5 individuals. For our investigation each student was given two plates, two sterile swabs, and two test tubes of sterile water. They were instructed to take samples from areas they thought would have high and low bacterial diversity. Once they have taken their samples the plates are sealed and incubated.

Once the sampling is complete students are asked to write out their predictions and/or draw pictures of what they think will grow on their plates. At the end of the experiment the student should have a good understanding that bacteria grow everywhere even in places where they thought no bacteria could exist. Also students should understand that there are helpful bacteria and not so helpful bacteria.

10. ASSESSMENT:

Younger students can draw pictures of bacteria or write out hypothesis of why they chose the areas they did for sampling. Older students could begin to design other experiments involving microorganism isolation or possibly identification.

11. EXTENSION IDEAS: This experiment could be repeated using different temperatures to culture (grow) the agar plates. Different temperature ranges select different types of organisms. Students could investigate how temperature shapes microorganism diversity.

12. SCALABILITY: This experiment could be scaled up by having student attempt to isolate specific colonies of bacteria and identify them using staining procedures.

13. REFERENCES:

1. The Microbe Zoo (digital learning center for microbial ecology)
<http://commtechlab.msu.edu/sites/dlc.me/>
2. Microbiology News (news articles on microbes and good links)
<http://www.suite101.com/welcome.cfm/microbiology#top5>
3. The Microbial Underground's Guide to Microbiology on the Net
(an excellent site) <http://microbios1.mds.qmw.ac.uk/underground/microbio.html>

14. LIST OF EXPERTS AND CONSULTANTS

NONE

15. EVALUATION/REFLECTION BY FELLOWS AND TEACHERS OF HOW IT WENT: This investigation went very well. The students were very excited and surprised to see what grew on their plates. Also giving them a digital picture gave them the opportunity to share this project with their parents.

Isolation of Microbes from the Environment Worksheet

Carl Rosier- Target Range

Objective:

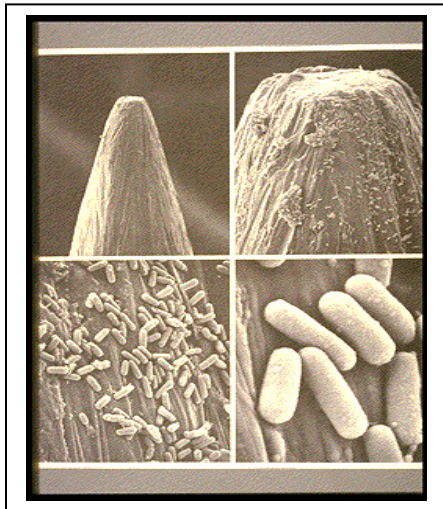
1. Design your own experiment.
2. Take sample from an area you think has a lot of bacteria.
3. Take a sample from an area that does not have a lot of bacteria.

Methods:

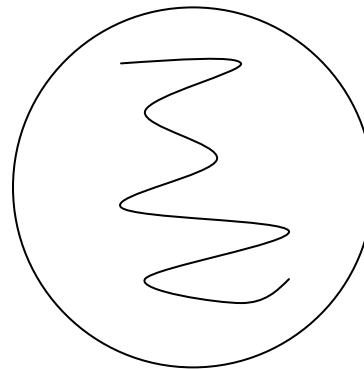
- ❖ You will have one plate to work with.
- ❖ Inoculate the plate by wetting a cotton swab in sterile water then **gently** wiping it across a surface where you think bacteria exists.
- ❖ Then you will **gently** wipe that sample across your plate being careful not to leave the cover off the plate to long.
- ❖ **ALSO DO NOT DIG INTO THE AGAR IT IS REALLY SOFT**
- ❖ Write your name on the back of the plate along with where you got your sample from.
- ❖ Tape down lid
- ❖ Each of your plates will be taken back too my lab and incubated in a warm oven set at 72° F, for at least one week.

❖ Examples of places where you could take samples

1. Your teeth
2. Bottom of shoe
3. Door knob



Write your name
and where you got
your sample on the
back of the plate



Streak sample
on in a zigzag
fashion

Things to Think about

1. Why does the cotton swab need to be wet?
2. Why should you not leave the plate without its cover for along period of time?