

Lesson Plan for Microbiology (Week 1)

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What are microbes and where can I find them?

Introduction to microorganisms (“microbes”) and microbial diversity

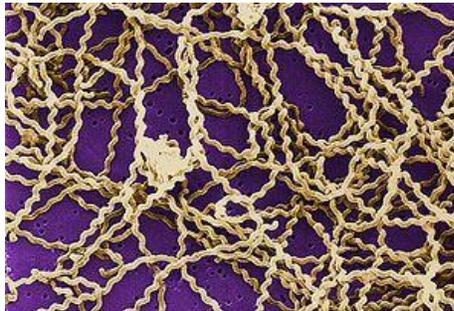
Introduction and Background Info

Microbiology is the study of microscopic organisms (a.k.a. microbes) like bacteria and fungi. A handful of microbes can cause diseases like cholera, but the vast majority of microbes can be very useful. Some microbes are used to produce alcohol, vinegar, and dairy products. Others produce antibiotics and drugs, while some can be used to remove toxic compounds from the environment. There is even research on the use of microbes to treat cancer.

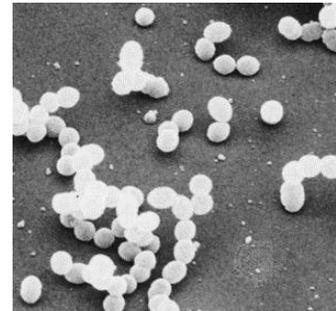
Bacteria are typically very small (much smaller than a typical cell in your body) and come in a few characteristic shapes. Typically, bacteria are shaped like rods, spirals, or spheres (“cocci”).



Rod-Shaped Bacteria



Spiral-Shaped Bacteria



Round “Coccus-Shaped” Bacteria

Bacteria can be found everywhere on Earth, including inside the guts of animals, the deep ocean, and Antarctica. Bacteria are found everywhere because different bacteria like different habitats. Some bacteria like it extremely hot while others like it extremely cold. In this lesson plan, students will swab the classroom for bacteria and grow it on agar plates. This will show the students where microbes can be found around us, even though we can’t normally see them.

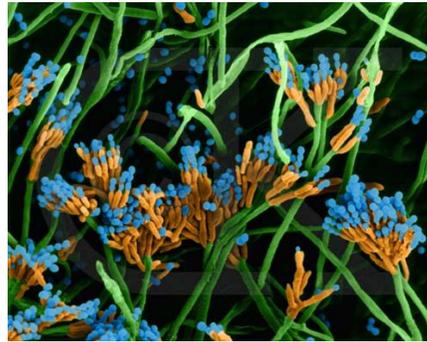


Bacteria grown on an agar plate

Fungi are another type of microbe. Despite their size, fungi are more like us than bacteria. This is because fungus, plant and animal cells have a nucleus (“eukaryotes”) while bacteria cells do not have a nucleus (“prokaryotes”). Fungi include mushrooms, truffles, smuts, molds, and yeasts. Some fungi will cause diseases or ruin old bread (bread mold!), while many others are very beneficial, providing things like food and antibiotics (penicillin). As they grow, some fungi form multicellular filaments called “hyphae” (green in the Penicillin diagram). Fungi eat by breaking down food in the environment and then absorbing it through their hyphae. Fungi can eat organic material like wood, live on other organisms (parasites), or live cooperatively with other organisms.



Bread Mold



Penicillin



Mushrooms

Student Objectives

- Students will be introduced to microbiology by learning about bacteria and fungi.
- Students will learn about the basic characteristics of bacteria and fungi. How are they different?
- Students will learn where bacteria and fungi can be found.
- Students will swab bacteria from anywhere and plate it on an agar plate. This is basic laboratory microbiology and will reveal where normally invisible bacteria can be found. *Mentors should explain to the students that the agar plates will grow mostly bacteria, not fungi. This is because fungi have different nutritional requirements than bacteria.*

Topics

Microbiology: The study of microscopic organisms (a.k.a. microbes) like bacteria and fungi.

Bacteria: single-celled organisms that can be found everywhere on Earth. In the human body, there are about 10 times more bacterial cells than human cells!

Fungi: Eukaryotic (cells have a nucleus) organisms that are more like animals and plants than bacteria. Fungi include mushrooms, truffles, smuts, molds, and yeasts.

Overview of Lesson Process

- Ask students what they know about microbes. What are they? What do they look like? How small are they? Where can we find them?
- Introduce bacteria and fungi. Ask students where they think these microbes can be found, what they do, and if they can think of times they’ve seen/used microbes (like mold on bread).
- Have students brainstorm places around the classroom to swab for bacteria.
- After the students spread bacteria on their plates, ask them what they think will happen. What do they expect to grow on the plate, and what will it look like?

Materials

LB Agar EZMix Powder* (L7533-6X500ML Sigma-Aldrich)	~\$33.00 (~\$0.17/plate)
Sterile Polystyrene Petri Dish, case of 500 (08-757-12 Fisher), 2 per group	~\$45.00 (~\$0.10/plate)
Sterile Cotton Tipped Applicators, case of 100 2-packs (14-959-91 Fisher)	~\$10.00 (~\$0.10/package)
Ultrafine-Tip Permanent Markers (supplied by mentors)	\$0
Ziploc bags	~\$3.00 (~\$0.03/bag)
Total Initial Cost	~\$91.00
Total Cost Per Group At School	~\$0.80

Mentors make LB Agar plates before visiting school.

Store these in a cooler or refrigerator. Can be stored for a couple weeks in the cold. If parafilm is used to wrap plates while in storage, the plates can be stored longer. Throw away any plates that have growth on them.

*Alternatively, ready-to-use petri dishes can be purchase from online vendors such as Amazon.

Procedures

Phase I: Growing bacteria (this week)

1. Give 2 agar plates and 1 package of 2 applicators per group and allow the students to decide which two places they would like to swab.
2. Write down their names and respective locations on each plate (on the side that has the agar).
3. Open the applicator package by the end that is not going to swab bacteria. Give the students an applicator when they reach the location they want to swab.
4. Spread the bacteria on the plate. Make sure to not puncture the agar (do not press down very hard). For younger students, mentors may need to help perform this step.
5. Turn the plate upside down so that the side with the agar is facing up. Place plates in a bag.
6. Collect all bagged plates from students, and store in BEAM locker until the following week.

Phase II: Checking on growth (next week)

1. After one week, bring plates back to the appropriate schools.
2. Check the plates to compare growth (see next lesson).
3. At the end of the lesson, collect all plates and return to UCLA for disposal. Although we will be growing innocuous bacteria already found around the classroom, it is good practice to autoclave the plates before throwing them in the trash. A mentor with lab access to an autoclave should be able to take care of autoclaving and throwing away used plates.

Resources

Tips for preparing agar plates: http://www.sciencebuddies.org/science-fair-projects/project_ideas/MicroBio_Agar.shtml

Background info on bacteria: <http://www.ucmp.berkeley.edu/bacteria/bacterialh.html>

Background info on fungi: http://www.emc.maricopa.edu/faculty/farabee/biobk/biobookdiversity_4.html