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LABS Inquiry Lesson Plan – 2001/2002

Title: Bacteria Gathering

Lesson Summary: Students are taught about agar and grow their own selection of bacteria collected from selected areas on school grounds.

General Goal: For students to discover that bacteria (and fungus) are everywhere and that they are usually too small to see unless they are grown in abundance.

Duration: 3 class periods (longer is optional)

Specific Learning Objectives:
Students will be able to:

1. Describe what agar is and pour agar plates.
2. Discuss the size of bacteria, give the definition of a colony and tell why they are able to grow to visible proportions in their new environment.
3. Discover the diversity of bacteria even in our local setting.
4. Describe how organisms accomplish basic life functions at various levels of organization and structures. (State science objective).
5. Describe how a given environmental change affects an ecosystem. (State science objective)

Prerequisite knowledge:

Students will be taught how to pour agar plates, what agar is made of, aseptic technique, and safety issues involved in working with bacteria. They do not need any previous knowledge of bacteria itself, although I do provide a definition for a colony of bacteria. However, it could be an additional aspect to the inquiry lesson to allow the students to discover the concept of a colony of bacteria.

Background Information:

I begin this lab by describing their goal: To learn how to prepare agar plates and to collect bacteria from various areas in the school. We then prepare the plates. Students are given two Petri dishes per team, a permanent marker, a beaker, a hot plate, access to water, paper towels, and a plastic bottle of prepared agar. They have to melt the agar in a hot water bath (it helps to chop it up a bit with a stirring rod), and pour their plates. While the plates are solidifying, we gather back together as a class and discuss the next step.

Each team must discuss and decide upon eight areas. Bacteria will be gathered from these areas, using Q-tips, gloves, and zip-loc bags. Each Petri dish is divided into

four quadrants using permanent marker on the bottom plate. Students must show me the list of areas before they leave my room. I look for specificity: Where on the student phone? What button exactly? They must be polite if entering a teacher's room. They cannot swab people without permission. I try to make sure they're not all going to the same places so that we get a wide variety. They are released to collect. They have 20 minutes to complete this task.

Preparation for Lesson

Per team materials: Two Petri dishes (glass or plastic)
Hot plate
Beaker
Stirring rod
Paper towels
Access to water
Prepared agar (I use Ward's)
Permanent marker
Gloves
Q-tips
Zip loc bags
Tape

This can be done in two days if you have short bells: Pour on day one, collect on day two. Since I have block scheduling, we can accomplish it all in one day. An incubator is nice, but not necessary. After collecting of the bacteria is complete, the Petri dishes should be taped shut and stored upside-down. Placed in an incubator overnight at 32 degrees Celsius, you will see results by the next day. Two days later in an incubator is phenomenal. You can also incubate on the desktop, but it will take two days, and then four days.
My students have to write the lab up as we go - I give them the procedure in sections (pouring and collecting). They have to draw the results of their collecting. They are truly amazed and very involved in this activity. STUDENTS MUST NOT OPEN THE PETRI DISHES. High levels of pathogens can accumulate to a dangerous level. At the end of the activity, immerse the plates in bleach and discard.

Instructional Strategy
1. Engagement: It's gross! It's bacteria! Nothing else is needed.
2. Exploration: Students discover on their own where bacteria are lurking. I do not give them hints. Often, the dirtiest places have the least and the clean places have the most. This leads to many teachable moments and much enthusiasm from students.

3. Begin with pouring the plates, follow with the collection of bacteria, and close with growth results. Results on plates lead to much discussion including a discussion of the fungus that always shows up there too.
4. Students write a conclusion based on how their ideas about bacteria have changed after this lab.

Assessment
Assessment is done based on lab write-up and conclusion. Sometimes I quiz students about aseptic technique and agar pouring aspects of this lab as well.

Comments
Students honestly LOVE this. They really become animated by the results. Even when I didn't have an incubator and had to wait, it made no difference. It's my favorite.

Additional Adapatations
Others who have conducted this activity have mentioned the following extentions:

1. After plates are incubated and growth has appeared, apply discs of filter paper soaked in various antiseptic agents (Lysol, Listerine, Clorox, for example) and apply them to the agar surface. Alternatively, collect bacteria with these discs already in place.
2. Clean areas to be sampled PRIOR to sampling from them. For instance, compare a dirty area with a recently cleaned area. Compare efficiency of various cleaners. Students could design their own experiments and variables.
3. Some people found it easier to pour the plates themselves instead of allowing students to do it. This is an option if time is in short supply, you are working with kids who may not be able to handle it or you don’t have enough hot plates. However, I have found that students get more out of the activity if they pour their own plates. They have more ownership in the lab, in my opinion.