Topic 3: Cells – 3d. Bacteria and YOU Lab

Resources:

Miller, K., Levine J. (2004). *Biology.* Boston, MA: Pearson Prentice Hall.

DeNoon, D. J. Human Skin Alive with Bacteria, *Web*MD, [Internet]. 28 May 2009. Available from: http://www.webmd.com/skin-problems-and-treatments/news/20090528/human-skin-alive-with-bacteria

Building on:

A biology unit that discusses cells must include the similarities and differences between *prokaryotic and eukaryotic cells*. It is easy to obtain cheek cells to view under the microscope along with eukaryotic plants cells such as elodea or onion cells. Prokaryotic cells are a little more elusive. Students certainly know about *bacteria* and the fact that some bacteria cause infection and disease, but that is about as far as it goes. This lab provides the opportunity for students to not just collect bacteria, but to collect their own bacteria. Students can see that they actually harbor a lot of bacteria and the type of bacteria differs by location and it differs somewhat from one person to the next.

Lab safety should be emphasized in this lab. The fact that visible colonies of bacteria appear after only 48 hours from single bacteria leads to a discussion of *growth rate*, *binary fission, food spoilage,* and *disease.*

This lab can be referenced later in the year when the class covers the *immune system.*

Links to Chemistry and Physics:

Form and function
Rate of change

Stories:

We each have living on and in us more bacteria than there are human cells! Bacteria are incredibly small. Some of them harm us and some of them help us. Any bacteria can cause illness in the wrong location. *Staphylococcus aureus* is present on the skin of most people, but in the blood stream it can cause toxic shock syndrome. The benefit of bacteria is witnessed when a person must go on high doses of antibiotic for an illness like strep throat. They usually experience diarrhea and may also get a fungal infection like thrush in the mouth or a yeast infection like diaper rash (often seen in babies when treated with antibiotics). Some bacteria help to regulate your digestion and others fight off competitors on your skin and elsewhere.

The types of resident bacteria (those that live with a person) depend on the person's body chemistry. Because body chemistry changes with age, so do the types of bacteria. Your armpits are a perfect location for bacteria; they

are warm, moist, and you provide the bacteria with food in the form of dead skin cells and sweat. When you use antiperspirants, you are trying to cut down on the sweat, eliminating a lot of moisture, which cuts down on the bacteria, which in turn cuts down on the odor. Ask the students if they know of any 5-year-olds that use deodorant/antiperspirants? Young children don't need deodorants because the composition of their body sweat is not conducive to the bacterial growth of odor-causing bacteria. When do students start using deodorant? Deodorant use begins when people start to go through puberty. Puberty causes body chemistry changes, which changes the composition of body sweat, and causes a change in the resident bacterial types found on different parts of the body (like the armpits).

Students are always interested in things that directly involve them. This lab gives them the opportunity to observe bacterial colonies representing bacteria they don't normally see. It could be completed as a "Catch Your Own Bacteria" lab where they collect bacteria from doorknobs and desktops, but many have done this in middle school and they are fascinated with the bacteria that they carry around with them everyday (their very own flora and fauna). While the lab has them collect bacteria from their lips (kissing?), nose (sneezing?), and teeth (brushing?), the bacteria could easily be collected from other locations such as under fingernails or armpits.

The emphasis here is threefold:

1. The speed with which bacteria can reproduce under ideal conditions (food, moisture, and warm temperature)
2. The variation in the number and kinds (based on differences is the colony shape and color) of bacteria found in different locations
3. The variation or lack of variation from one student to the next

Materials:

- Petri dishes containing nutrient agar
- Scotch tape
- Cotton swabs
- Markers
- An incubator or a warm place—even at room temp you should have growth after 48 hrs.

Instructions for the Lab:

Agar containing dishes can be bought, but it is cheaper to buy sterile disposable Petri dishes and powdered nutrient agar. You can use your own dishes if you have access to a hot plate/microwave for boiling the agar and an autoclave for sterilization. If not, you can still buy sterile disposable Petri dishes and bottles of sterile nutrient agar that can be melted and poured.

It is important to emphasize safe laboratory technique. Students must throw the cotton swabs away after use. They should also tape the inoculated dishes shut with two small pieces to tape on each side of the dish. This prevents the dishes from coming open when the results are viewed.

After the lab, collect the dishes and autoclave them before disposal if possible. If no autoclave is available, then bag them up in a garbage bag and place them in the larger wastebasket. Under no circumstance should students take the agar dishes out of the classroom.

See the lab on the next page.

Bacteria and YOU Lab

Introduction: It is said that bacteria are everywhere, but is that true? Are bacteria more prevalent in some places than others? Does everyone carry the same bacteria?

Procedure:

1. Obtain a Petri dish containing nutrient agar; label the bottom of the dish (the smaller side) with your name and class period. Use a marker on the bottom of the dish to divide it into four equal sections. Label the sections 1, 2, 3, 4. Section 4 will be your control and you will do nothing to section 4.
2. For section 1, take a piece of Scotch tape and apply it to your lips (even if you are wearing lipstick or lip gloss); peel off the tape and using only light pressure, press the tape to the surface of the agar in section 1. Peel the tape off and throw it away.
3. For section 2, take a cotton swab and carefully place it up your nose, twist it against the inside of your nose and then gently wipe it in section 2 of your dish (be sure not to break the surface of the agar). Throw the cotton swab away.
4. For section 3, get a new cotton swab and use it to go over the surface of your teeth at the gum line; now gently wipe the swab in section 3 of your dish. Throw the cotton swab away.
5. Use two pieces of scotch tape to tape your Petri dish shut, turn it upside down and give it to your teacher to be incubated. The dishes will be incubated at approx. 30 ^{o}C for 48 hours. After incubation, **DO NOT OPEN** your Petri dish. You should be able to see the bacteria clearly through the top of the dish.
6. First, you should draw your dish. Second, you need to fill out an evidence table indicating the total number of bacteria and the number of different kinds of bacteria that you placed on the dish when you set up the lab 48 hours ago.

Hypothesis: From which source do you expect to get the most bacteria and why?

Analysis Questions:

1. Hypothesize why you had the most bacteria in a section _____.

2. Hypothesize why you had the most different kinds of bacteria in each section _____.

3. Why could you not see the bacteria on the day of the lab setup, but they are now visible on the plate?

4. Why does each colony on the plate represent one bacterium from the initial lab setup?

5. What kind of substances must be present in the agar for these bacteria to reproduce?

6. Were the results consistent throughout your class? Why or why not? Explain.

Conclusion: