Topic 8: Body Systems – 8b. Immune System
8b2. Hand Wash Lab

Resources:

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

Graves, P. Hand Hygiene: Can We Learn a Lesson from the OR? [Internet]. National Commission on Correctional Health. 2007. Available from: http://www.ncchc.org/pubs/CC/hand_hygiene.html

Reynolds, E., Schular, G., Christian, J., Hurst, W. Food, Hands and Bacteria - Stop the Population Explosion: Wash Your Hands! [Internet]. University of Georgia. Aug. 2000. Available from: http://www.foodscience.caes.uga.edu/extension/documents/FoodHandsBacteria-UGA.pdf

Types of Bacteria: Friendly Bacteria on the Skin [Internet]. 2000. Available from: http://www.typesofbacteria.co.uk/friendly-bacteria-skin.html

Building on:

The first line of *nonspecific immune defense* is our *skin.* Our skin protects us with *lysozymes* in our sweat and acts as a *physical barrier* to invading pathogens. Our skin is also home to many *microorganisms.* Our hands are of particular interest because we utilize our hands for many functions, several of which bypass the skin barrier: rubbing our eyes, licking our fingers, picking our noses, etc. Hand washing is intended to cut down on the *transmission of pathogens* from our skin into our bodies. This lab will examine the effectiveness of hand washing and the relationships between us and the microorganisms that live on our skin.

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, ideal growing conditions, microscopic predator-prey relationship,* and the *abundance of potential pathogens.*

Links to Chemistry and Physics:

Function of soap
Growth rate

Stories:

Our skin is the largest organ of our body. It has many functions, but one is to protect us from pathogens. The outer layer of our skin, the stratum corneum, is made up of loosely packed dead cells. This provides a good environment for bacteria. Fortunately, those bacteria are blocked from entering our body by the live skin cells below the stratum corneum, however, a cut or a rub of the eye can change all of that.

There are two main types of bacteria on your skin: the resident bacteria that live with you most of the time, and the transient bacteria that you pick up going about your daily business of opening doors, switching on lights, shaking hands with other people, etc. The transient bacteria live primarily on the surface of the stratum corneum and are easily removed by proper hand washing. The resident bacteria live deeper in the stratum corneum and are more difficult to remove.

Proper hand washing should include soap, clean water, and a source of friction (either the other hand or a cloth). This will remove most of the transient bacteria, and most pathogens are transients. It is virtually impossible to remove all of the resident bacteria with hand washing alone, which is why health care professionals use gloves. The gloves have no stratum corneum and cannot harbor resident bacteria; all of the bacteria on the gloves would be transient and can be killed by washing with soap and antiseptics.

Resident bacteria are not all bad; in fact, your resident bacteria carry on a commensal relationship with you. You provide them with a warm, moist, nutritious environment and they keep the number of transient bacteria in check. Resident bacteria, like *Staphylococcus epidermidis*, produce bacteriocins that help to kill off other bacteria such as *Staphylococcus aureus*, implicated in toxic shock syndrome. Be warned, however, even your resident bacteria can turn on you when you have a stressed immune system. Likewise, the resident bacteria belonging to one person can be pathogenic to another person.

Materials for the Lab:

- Sterile Petri dishes with agar (See the Bacteria and You Lab under Cells.)
- Sink with running water
- Soap
- Hand dryer, paper towels
- Incubator (Dishes can be left out at room temperature, but may need to incubate longer.)

Instructions for the Teacher:

It is important that students tape the dishes shut (just a small piece of tape on opposite sides of the dish) so that the dishes cannot accidently open after incubation.

At the end of the lab, dispose of the dishes either by autoclaving them and then putting them in the garbage, or by wrapping them up in a couple of garbage bags before putting them in the class waste container. It is important to protect the custodial staff as well as other students.

Biology
Hand Wash Lab

Introduction: You are aware that you have been taught to wash your hands often, especially before eating and after; well, you know. . . . .

Purpose: In this lab, you are going to assess the value of that hand-washing advice and the methods that bring the most benefit from hand washing.

Procedure:

1. Take two sterile agar Petri dishes and label each with your name. Label one dish "dirty" and the other dish "clean."
2. Carefully open the "dirty" dish and touch it all over with light pressure from your fingertips. (Do not push down hard enough to break the agar.)
3. Wash your hands and dry them using your usual method and timing. Carefully record the details of your method (soap, just water, antibacterial gel, air dry, dry on jeans, use a paper towel, etc.). Now take the "clean" dish and touch it all over using your fingertips as you did in step 2.
4. Tape your dishes shut with two small pieces of Scotch tape; turn the dishes upside down and place them in an incubator.
5. After 48 hours, remove the dishes and record your results in the Evidence Table. You should record the results of five other people in your class.
6. You determine the total number of bacteria originally placed on a dish by counting the number of colonies that have grown from those bacteria. The number of different kinds of bacteria can be determined by the number of different kinds of colonies that are visible on the dish.
7. Answer the analysis questions.

Evidence Table

	Dirty Hands		Clean Hands	
Name of Contributor	# of Kinds of Bacteria	Total # of Bacteria	# of Kinds of Bacteria	Total # of Bacteria

Analysis Questions:

1. Using your data and that of five other classmates, what pattern do you see concerning hand washing and bacterial growth?

2. Explain why the number of colonies on the dish after 48 hours are equal to the number of bacteria that were originally placed on the dish.

3. Based on the pattern you see, which type of dish had the largest number of bacteria? Hypothesize why this happened.

4. Based on the pattern you see ,which type of dish had the most variety of bacteria? Hypothesize why this happened.

5. Which do you think is more important to your good health, the total number of bacteria or the number of different kinds of bacteria present? Defend your answer.

6. What is the difference between transient and resident bacteria?