**Teacher's Guide**

**THE "TENANTS" MY BODY NEEDS**

It is a pleasure to collaborate with you in this biology activity, which will offer many young students a first glimpse into the world of bacteria- a world which we rarely see but is always present. The goal of this video is that the students realize the omniscient presence of bacteria, that they disassociate the concept of bacteria from sicknesses and instead, that they re-direct it towards the important role they play on health, industry, and on our own evolution.

**Activity1**

In the first activity, we ask students to visualize and provide examples of the areas of their home where there are most bacteria, and of the areas of the body with the most bacteria living on them.

**Activity 2**

To do this activity, it is important to have a ruler, a notebook, a pen, and the photograph that the teacher will provide.

When you are ready, determine which is the human cell and which is the bacterial cell. Now use the ruler and measure the diameter of both cells and note your results in the notebook. Determine which is the largest cell and by how much. It could be double, triple, or even 5 times larger so measure them attentively.

Then, go to http://learn.genetics.utah.edu/content/cells/scale/ and zoom in until you find the human and the bacterial cell and write down the difference of their sizes. Next, compare it with the difference noted in the previous step.

**Activity 3**

This activity is made up of three parts. I have added a supplementary presentation, entitled "Where Are My Bacteria?", with detailed student instructions of how to do the first 2 parts.

**Part 1**

For the first part of the experiment, we need to "scratch the dishes," which is a term used by scientists to inoculate bacteria from a sample into a nutritious gel that promotes bacterial growth. In order to do this, you need to form groups of 4 students and assign one of the following roles to each participant:

The Boy/Samplee, who will be the student whose hands will be analyzed [sampled] during this activity. The Swabber, who will be the person taking samples with sterile swabs. The Supervisor, who will be the person who ensures that the correct Petri dish is being used and who labels the Petri dishes with the necessary information. Finally, the Sterilizer, the student who washes and disinfects the hands of the Boy/Samplee, with sterile gloves.

First, your teacher will give you three Petri dishes with agar soya. This is a medium created for bacteria to reproduce and form colonies so that we can observe them. The supervisor needs to label them and strictly oversee their handling.

Second- Start with the pre-labeled Petri dish, labeled as “unwashed.” The swabber should gently rub a cotton swab on the surface of the boy's/samplee’s palm. Do not stop holding the swab part in his hand or it will become contaminated!

Third- the supervisor should open the “unwashed” Petri dish containing ready-made agar.

Fourth- the Swabber should gently rub the sample of the cotton swab taken from the hand, on all the agar. Be careful not to apply too much pressure when doing this, otherwise the agar will tear.

As a fifth and second-to-last step, the Supervisor should close the Petri dish.

**Finally,** the fourth member of the group- the Sterilizer- should carefully wash the hand of the Boy/Samplee with water and soap for 5 seconds. The Swabber and the Supervisor should repeat steps 4-6 for this hand, making sure to scratch the dish labeled “washed with soap.” Similarly, the Sterilizer must apply hand sanitizer to the other hand of the “sample” student. In other words, to the hand that was not washed in the previous step. Let the hand dry in the air until all the gel has evaporated. Repeat steps 4-6 for this hand, except this time be sure to scratch the plate labelled “Sterilized with gel.”

It is very easy to make mistakes and contaminate our samples or leave them in an environment that is not as enabling for our bacteria to reproduce. Because of this, I recommend following these 3 considerations:

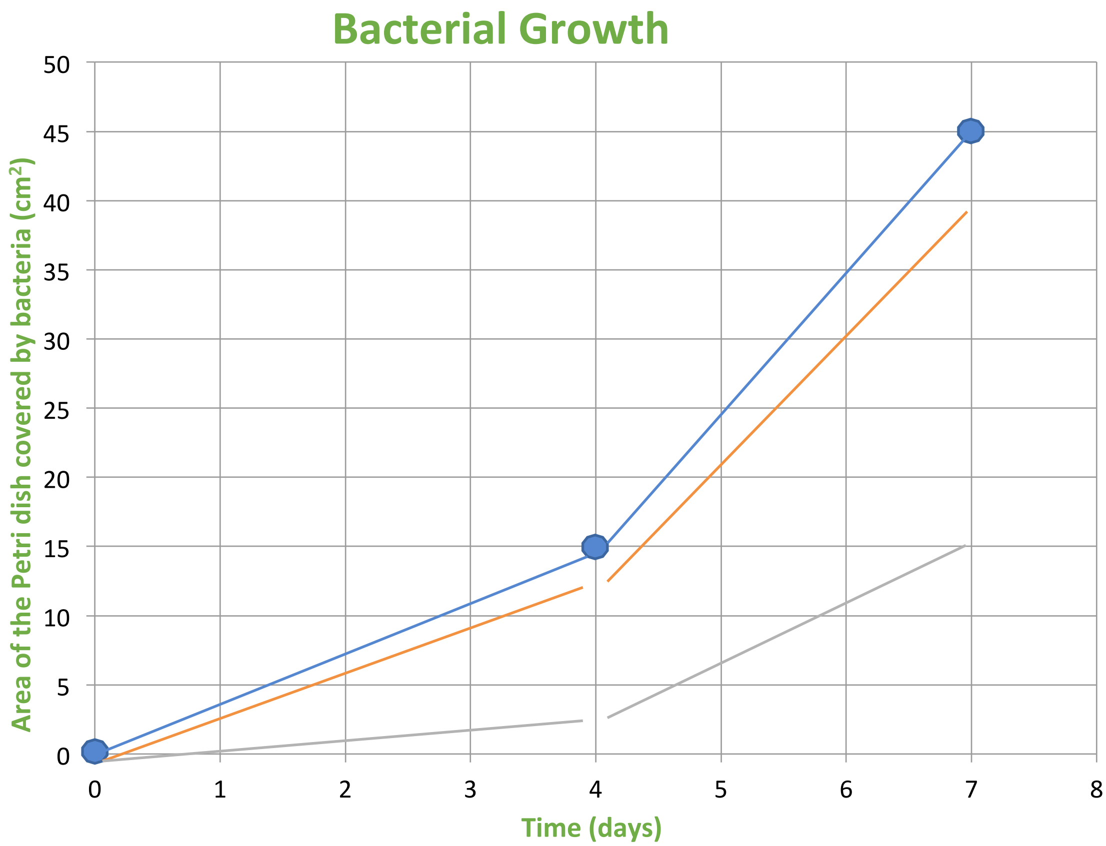
Number one – Use tape around the union of the Petri dish, without covering it, as the bacteria will need to have oxigen available to them. Number two- never handle closed samples without teacher supervision. And number three- samples should be left in a clean area, away from direct sunlight exposure, and preferably between a temperature of 22 ° C to 37 ° C.

**Part 2**

The second part of the experiment consists of the collection of data. Take a photo over graph paper, from the same distance away from each Petri box, without opening them, on days 2, 4, and 6. Next, analyze your photos with computer software that allows you to enlarge the images as much as possible without compromising their resolution. I recommend ImageJ. It is an excellent choice (Appendix 5). Be sure to save your information on the computer, by teams, with the correct labels so as not to mix them up and to include all the necessary data, such as the date in which photos were taken and who the members of the team were.

Fill in the table your teacher gave you, after analyzing the images of your Petri dish with the areas covered by bacteria (in centimeters squared) (Appendix 3). Record any comment or observation of the sample, like the color or the shape of the colonies. Using a different color for each day that goes by, trace the area covered by the bacterial colonies on the three samples as a function of the days. Choose a different color for each line, and remember to label which color corresponds to which day. Create a drawing like this for each of the 3 samples. This way, we can visualize the growth of our bacterial colonies. We will call these drawings "growth diagrams."

| Sample | Area covered by bacteria ($cm^2$) | | | Comments & observations |
|---|---|---|---|---|
| | **Day 2** | **Day 4** | **Day 6** | |
| Unwashed hand | **0** | **15** | **45** | **Comments about the bacterial coverage on the dishes, or apparent color/texture color/textura of the microorganisms, etc.** |
| Washed hand | **0** | **3** | **15** | |
| Disinfected hand | **0** | **12** | **40** | |




**Part 3**

The third part of the experiment involves student reflections about the data they collected over 6 days. This should happen at the very beginning of the second class for this video lesson.

In the video, find the slide corresponding to this part of the activity (Activity 4) and ask students to get together with their classmates to share and compare their results, and to answer the following questions:

1. Which sample had the most bacterial growth? Was this the result you expected?
2. Did any bacteria grow on the hand that was used with antibacterial gel? If so, do you agree with the slogan used by many brands that states that it "kills 99% of bacteria?"
3. What do you think would happen if you were to scratch the plates with bacterial samples from other common surfaces, such as the door handle, kitchen tables, or the handrails in a subway station? Discuss what you would expect based on your results.

**Lesson Evaluation tool:**

I suggest that the students hand in the attached document, called "Where are my bacteria?" with all the information gathered after the 6 day practice. I also suggest that they attach photographs of their bacterial cultures on the Petri dishes, as well as a summary with their conclusions.