8th Grade Module 2: Evolving Germs

This handbook has information for the following people:

UC Volunteers

UC VOLUNTEER ROLE:
You are there as a guide for the 8th grade students. You will help guide the students through the module and their notebooks. You will be working with a group of 3-6 students. Help by asking questions that help the students think rather than telling them the answers. Some of your responsibilities will includes:

- Making sure the students stay focused on their experiments
- Guiding the students thinking, but not giving them the answers
- Allowing the students to come up with different experiment ideas, but making sure the experiments are still addressing the question being asked.
- Ensuring the students are writing down everything they are doing in their student notebooks (these will be considered homework for the students if they are not finished in class)

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California Science Standards Addressed for 8th Grade:
Disciplinary Core Ideas:

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others.
- In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.
- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.

Science and Engineering Practices

- Analyze and interpret data to determine similarities and differences in findings.
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

Activity Schedule:

Day1: (Monday- Volunteers)

Schedule:

1. Introduction of UC Volunteers and SciTrek
2. Present 3 example plates to class
3. Record observations in notebook
4. Talk about experimental questions and controls (discuss variables vs. constants)
5. Start thinking of questions to test
6. Developing an experimental question
7. Experimental set up/planning day (testable questions they'd like to investigate)
8. Plate Control Plates

Materials:

1. 3 example plates (Per Class)

Introduction*:* Introduce the SciTrek concept to the students. Today they will do an activity that introduces them to the general topic of microorganisms, bacteria and fungi. Also, SciTrek is about how science works, and they will be doing experiments to investigate questions they design. Emphasize that there is no right answer for most of what they do next week.

Demo plates:

- There are 3 plates total. Bacteria will not be able to grow on plates that have ampicillin, an antibiotic. This is to get the kids to start thinking about what in the plates affect how the bacteria grow.

Bacteria
A. + ampicillin
B. + fluconazole
C. Control (just LB agar)

*It is important to state **WHY** we want controls. Discussion on what is a control and why it is necessary. The best way to convey this concept is through compelling examples. We've all heard about controls, the scientific method, etc; SciTrek is about learning these through direct experience. The UC lead will then guide the class how to do the control plating.*

How to Plate the Control: The students will be making their own controls for their experiments.

1. Take one agar plate for the bacteria and label (see "How to Label Your Plates")
2. Take a plastic swab and dip it in ethanol and shake it to dry.
3. Take the sterile swab and dip it into the bacterial culture and gently streak the bacteria labeled agar plates. Streaking in a zig-zag manner
4. The best way to zig-zag the streaks is to make a W on the plate

5. Rotate plate 90º and streak another 4 streaks in a zig zag.
6. Place controls in plastic box provided and put in incubator overnight
7. MAKE SURE EVERYTHING IS LABELED PROPERLY ON THE BOTTOM!
8. Collect plates from students and put in the incubator overnight

- Before the students plate their controls, you should go through how to plate with them, by practicing on jello plates. Make sure that each student has a chance to practice plating and is confident in plating.

Some notes on plating:

- Make sure that the swab is completely dry of ethanol before dipping it into the bacteria
- In order to make sure the plates stay as sterile as possible, only open the lid enough to accurately plate the bacteria
- Make sure the students do not pierce the agar plates.
- Make sure the plates are labeled **BEFORE** you plate the bacteria

How to Label your Plates:

- Write on the bottom edge of the plate:
  - B for the bacteria plates
  - 0, 1, 2, or 3 depending on if it is the control, exp 1, exp 2, or exp 3
  - Period
  - Teacher's name
  - Group Number
- For example, if I was plating my bacteria control and I was in group 2 of Ms. Smith's 4th period class, I would write on the outer bottom edge of my plate: B0, 4, Smith, 2

Materials:

Trays include:

1. 1x B1 plate
2. Bacteria culture tubes
3. inoculation loops
4. cup with ethanol
5. materials needed for experiment

Notes to keep in mind:

<u>Developing an Experimental Question:</u>

- Students come up with what they plan to do for their experiment (which they will plate out)
- What are they looking to get out of their question?
- Good and Bad examples

<u>**Day 2:**</u> (Tuesday-no volunteers)

Schedule:

1. Fill out steps for the general procedure
2. Vocab review using quizlet link
3. Discovery Activity (picture on screen in front of classroom)
    a. write down observations and questions

Notes to keep in mind:

- The students' procedure should be step-by-step instructions for their plan for Exp 1. The procedure may change as they continue their experiments, however it's important they take note of how their procedure has changed throughout their experiment.
- This is an important lesson in doing an experiment and the importance of <u>writing everything down</u>.
- When talking to them about their procedure, <u>make sure they know **why**</u> they are writing everything they are doing down (so that other scientists can understand what they did and reproduce their results).

<u>**Day 3:**</u> (Wednesday- volunteers)

Schedule:

1. Record control results using charts
2. Write hypothesis for Exp 1
3. Plate Exp 1

Notes to keep in mind:

- The hypothesis for the experiment should encompass what they hope to do for all three experiments. While they may not be fully aware of what exactly each experiment is doing, they should have a general idea. They are writing down the answer to the class question.

- When recording the results from the control experiment, students will be matching up the control plates to percent covered examples available in each groups' box. Have each student make their observation on the percent covered individually, then have them come together and discuss it. This allows students to form their own opinion, then defend it. The group should eventually come up with a compromise that all of them agree on.

- When plating Exp 1, students should first retrieve their prepared plates if they used a liquid. Students would then streak the bacteria onto the plates prepared by us. <u>Do not let the students decide to do a liquid variable at the last minute.</u> Liquid plates are prepared in a certain way so that the liquid is a homogenous mixture across the agar. If the students are using a solid variable, they should first plate the bacteria, then make sure that the solid is even across the surface of the agar, all while trying to minimize the plate's exposure to air.

Materials:
Trays include:
1. 1x B2 plate,
2. Bacteria culture tubes
3. inoculation loops
4. cup with ethanol
5. materials needed for new experiment

<u>Day 4:</u> (Thursday- no volunteers)

Schedule:
1. Moth Activity: follow procedures in student handbook
    a. Fill out tables and answer the questions.

Materials:
1. white circle pieces
2. newspaper circle pieces
3. white paper background
4. newspaper background
5. forceps

<u>Day 5:</u> (Friday-volunteers)

Schedule:
1. Record Exp 1 results using charts
2. Answer questions for Exp 2
3. Write hypothesis for Exp 2
4. Plate Exp 2

Materials:
Trays include:
1. 1x B2 plate
2. Bacteria culture tubes
3. inoculation loops
4. cup with ethanol
5. materials needed for new experiment

Notes to keep in mind:
- Control should remain the <u>same for all experiments</u>
- Foy Day 5, Question 1: the question should still be related to hypothesis from Exp 1.
- For Day 5, Question 2: Based on results from Exp 1, how would you change the procedure for Exp 2.
    - <u>Make sure students are writing everything down!</u>
- For Day 5 Hypothesis: It may change, or may stay the same as Exp 1. It just depends on how the question has changed for Exp 2.

<u>Day 6:</u> (Monday- volunteers)

Schedule:

1. Record Exp 2 results using charts
2. Answer questions for Exp 3
3. Write hypothesis for Exp 3
4. Plate Exp 3
5. Answer analysis question

Materials:

Trays include:

1. 1x B2 plate
2. Bacteria culture tubes
3. inoculation loops
4. cup with ethanol
5. materials needed for new experiment

Notes to keep in mind:

- Control should remain the <u>same for all experiments</u>
- By now, students should have a good understand of what they're testing for.
- They have had the first two experiments to play around and explore different options, but this experiment should be a way for them to fully validate their point.
- They should be able to explain to you why they are doing this and should be able to have a prediction for what their final conclusion should be.
- You should be discussing this with them and questioning them on their thought process.

<u>Day 7:</u> (Tuesday- no volunteers)

Schedule:

1. Simulation Game
    a. Fill out tables and answer questions

<u>Day 8:</u> (Wednesday- volunteers)

Schedule:

1. Record Exp 3 results using charts
2. Fill out conclusions data chart + graph on last page
3. Answer final questions
4. Watch antibiotic video
5. Complete posters
6. Tie in module to class standards

Notes to keep in mind:

- Students should be able to draw a conclusion from their experiment. It's okay if their experiment didn't work, or if there was no correlation between the different experiments. While these are not ideal results, failing is an important part of the scientific process and is something that they should learn from.

- They should be able to identify what happened with their results, and formulate a reason for it.

- They should also be able to come up with a few ideas to change their experiment so they can improve on their results. This is especially an important part if they did not get ideal results. This allows the students to hypothesize on a new experiment, much like following the steps of the scientific method.

- The Antibiotic video and discussion is an important part of this module, as it deals with natural selection and antibiotic resistance. It gives real world application to something they have just completed. This will be a discussion had as a class and the lead for your period will lead the discussion, but make sure that your group is paying attention and fully participating.

- The final part of this module will be the tie into standards. This is important because it focuses the experiment back on the main point. The scitrek lead will be leading this part of the experiment as well.

<u>Day 9:</u> (Thursday- no volunteers)

Schedule:

1. Present posters

NOTE: The presentation of the posters is a critical part of the SciTrek program. The dialog between the presenters and the classroom students and SciTrek volunteers is very much a part of how science works. Meaning, presenting evidence to support a conclusion in a public setting, having your peers consider that evidence, and getting feedback about your work, all form an integral part of science. Students need to realize SciTrek is about the ideas, evidence, etc.

- Offer some guidance related to poster presentations: students face the classroom and speak loud enough for everyone to here. Posters could be positioned on the board, and student point to particular items. If students in the back would not be able to see posters, perhaps use the iPAD to have discussed features displayed.