Where Are the Antibiotics in Plants?

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Abstract: This action plan involves 10th grade biology students. They explore, identify, and collaborate to find and gain a better understanding of the four major plant groups. On day 1 students focus on a gymnosperm table comparing plant types using the scientific method. Day 2 students compare major plant groups. Day 3 students pre-test after viewing a plant reproduction PowerPoint. Day 4 students interpret characteristics about angiosperms, gymnosperm, bryophyte and ferns. Thereafter, on day 5 and 6 students collect and prepare to test many different types of plant samples for their ability to kill bacteria or stop bacterial growth. Students test various indigenous plants by first grounding them up. Then, they test for bacteria and fungus by testing plants on day 7-8 students will review micro-organisms and test and analyze for bacteria, yeast, fungus and other micro-organisms. Students evaluate their data and posttest.

Rationale: Students have an opportunity to develop a knowledge base about the four main plant groups. Thereafter, they study various plant samples in a micro biological lab which is a great way to develop biology laboratory skills before doing the more advanced stuff. Antibacterial efficacy equates to finding out about new antibacterial compounds from many natural sources right in our own backyards. Many of the biology students in our curriculum are more interested in scientific outcomes when they conduct hands-on observations.

"Where Are the Antibiotics in Plants?" is concerned about natural antibiotics. Humans have used the following kinds of remedies for hundreds of years: garlic, honey, Ginger, Echinacea, Goldenseal, Clove, Oregano. This study expands student awareness about many, (Not so obvious) indigenous plants and organic substances located in Citrus county Florida, i.e., fungi, beautyberry, magnolia, wisteria and more. Throughout the process of collecting specimens in nature students rely on the scientific method to test them for antibacterial qualities. The students will be inclined to develop a greater appreciation toward plant pathology, antibacterial qualities in plants as well as other plant characteristics.

Description of teaching unit or module(s), including expected outcomes: The teaching unit will span one week and focuses on the following Biology NGSSS:

- SC.912.L.14.53 - Discuss basic classification and characteristics of plants. Identify bryophytes, pteridophytes, gymnosperms, and angiosperms.
- SC.912.N.1.1- Science method to determine which plant substances tend to have anti-bacterial qualities
- SC.912.L.14.6- Pathogenic Agents

Learning outcomes are as follows:

Students will use the scientific method testing plant matter.

Students will classify plant variation.

Students will differentiate plant antibacterial qualities.

Student learning outcomes will be achieved through the completion of the following activities:

Where Are the Antibiotics in Plants?

Lesson 1: Students will explore, identify, and collaborate to find and gain a better understanding of the four major plant groups.

Lesson 2: Students will familiarize with the following terms: plant types, bryophytes, pteridophytes, ferns, gymnosperms, angiosperms, ferns, moss, lichen, classification, flower, pine, seed, leaves

Lesson 3: Teacher will present information about the major plant groups on the board and discuss while students' fill-in a comparison worksheet

Lesson 4: Students will go outside in their groups and take a class walk. They should use their cell phone cameras (or iPads or other device acceptable to the teacher) to take pictures of various plants to try and classify. Ask students to look for different types of leaves and blades. Ask students to select at least 10 various plants. (You can adjust this based on the various plants around your school campus).

Lesson 5: The teacher will instruct the students to go on computers and plant classification books to try and identify their photos of the plants they took on their walk. The point is to try and classify their plant into one of the four main groups.

Lesson 6: The teacher will have the students identify and describe the four major groups of plants on the category cards worksheet provided. Students will work in groups of two to four. Each group will select a plant category card and complete the information for that group on the worksheet provided. Teacher will circulate and provide feedback to students. Students will form expert groups by joining with the other small groups that selected their plant type and will create a poster with their plant characteristics, which will be displayed as a gallery. Students will view all four gallery posters and complete their worksheets (fill out the information on the remaining cards).

Data Collection Techniques and / or student assessments:

- Summative Assessment

Teacher will provide a summative assessment which will be the same pre-assessment given at the start of the lesson. This will determine if the students mastered the science content on the four major plant groups. The PowerPoint and answer key are *attached*.

Students can use their notes and gallery questions to complete test assessment questions (based on the teacher's discretion).

- Formative Assessment

Students will take a pre-lesson assessment (*Plant Repro Pre-Assessment Test Key - attached*), which will be graded after the lesson. Teacher will distribute a copy of the pre-assessment to each student at the beginning of the class. Teacher will encourage students to answer all the questions

Lesson 7 and 8: Hands on Lab, Using the ILIAD Project Kit students will test many different types of plant samples for their ability to kill bacteria or stop bacterial growth.

Where Are the Antibiotics in Plants?

Part 1. Testing Plants and Other Organisms that Need to be Ground Up

Part 2. Testing Bacteria and Fungus

Part 3: Prepping Bacteria, collecting samples and making agar plates

Part 4: Processing the Samples

Part 5: Testing for Bacteria, Yeast, Fungus and Other Micro-organisms

Use of equipment lockers and / or UF visit (either in the classroom or UF campus):

Eight each 20 to 200 pipetting tools and tips

CATALySIS summer institute elements specifically included (UF Connections)
Topics from Plants Get Sick Too! Workshops, Tours, and Lectures with Plant Pathology

Literature cited:

Reference 1: http://www.the-odin.com/the-iliad-project-kit-find-new-antibiotics-at-home/

Reference 2: https://www.ck12.org/c/biology/use-of-fungi/rwa/1-Up/?referrer=concept_details

Reference 3: http://www.cpalms.org/Public/PreviewResourceLesson/Preview/71695

Budget and budget justification:

Item	Vender/Source	Cost
Three ILIAD Project Kits - Find New Antibiotics at Home	https://www.the-odin.com/checkout	**$240.00**

Note: Contents of the Kit

- LB Agar and 14 plates
- 1 - Mortar and Pestle
- 5 - Transfer Pipettes
- 2 - Cell Spreaders
- 200 - Filter Paper Test Discs
- 1mL - Antibacterial Control (Labelled Kanamycin) Escherichia coli non-pathogenic Bacteria Stab
- 5 - 15mL Culture Tubes with Media
- 5 - Empty 15mL Culture Tubes
- 5 - Pairs of Nitrile Protective Gloves
- 50mL - Buffer
- 40 - Microcentrifuge Tubes to Store Samples
- 1 - Tweezers

PLANT EXPERIMENTS
CREATING OXYGEN

These plant experiments on creating oxygen are fun and easy to do. The air that we breathe is 21% oxygen. After we breathe in oxygen we exhale carbon dioxide. Carbon dioxide is needed by plants for them to live. In these experiments about plants you will see how a leaf creates oxygen that we breathe from sunlight.

MATERIALS

- Green leaf
- Clear glass
- Water
- Sunlight
- Small hand lens optional

DIRECTIONS

1. Cut a green leaf off of a plant and fill a glass with water.
2. Place the leaf in the glass and put glass containing the leaf in a sunny location.
3. Make a prediction what you will see in an hour. Write down your prediction on a piece of paper.
4. After an hour carefully look at the leaf and side of the glass.
5. You should be able to see lots of tiny bubbles that have formed on the edges of the plant and on the side of the glass. If you are having a hard time seeing the bubbles you might get a small hand lens to observe the edges of the leaf.

Try these plant experiments

1. Leave the plant in the sunlight for several more hours. Do the bubbles increase or decrease.
2. Take two glasses of water and place a fresh leaf in each one. Place one leaf in a dark area and the other in sunlight for two hours and then observe how much oxygen each leaf produced.

SCIENCE BEHIND THE EXPERIMENT

The bubbles you observed on the leaf and sides of the glass were oxygen. Leaves take in carbon dioxide and through the process of photosynthesis they create food for the plant.

Oxygen is a by product of this and goes into the air. The we breathe contains 21% oxygen produced by plants. Without plants we not have enough oxygen to live.

Anti-Bacterial Plants

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Students explore, identify, and collaborate to find and gain a better understanding of the four major plant groups.

Directions: On the Activity Cards below students will answer the questions as it relates to all four plant types.

ANGIOSPERM #1

a) What is an angiosperm?
b) What are two ways pollination will occur in flowering plants?
c) List two specific role of fruit?
d) Stalk supports?
e) function of the Stigma ?

GYMNOSPERM #2

a) gymnosperms are vascular plants T/ F
b) In gymnosperms, sporophyte generation is present T/F?
c) Ferns are gymnosperms?

BRYOPHYTE #3

a) Describe 3 main physical characteristics of bryophytes?

b) What are the 3 primary /main groups of bryophytes?

c) Explain how the transport of substances move/travels across bryophyte tissues?

FERNS #4

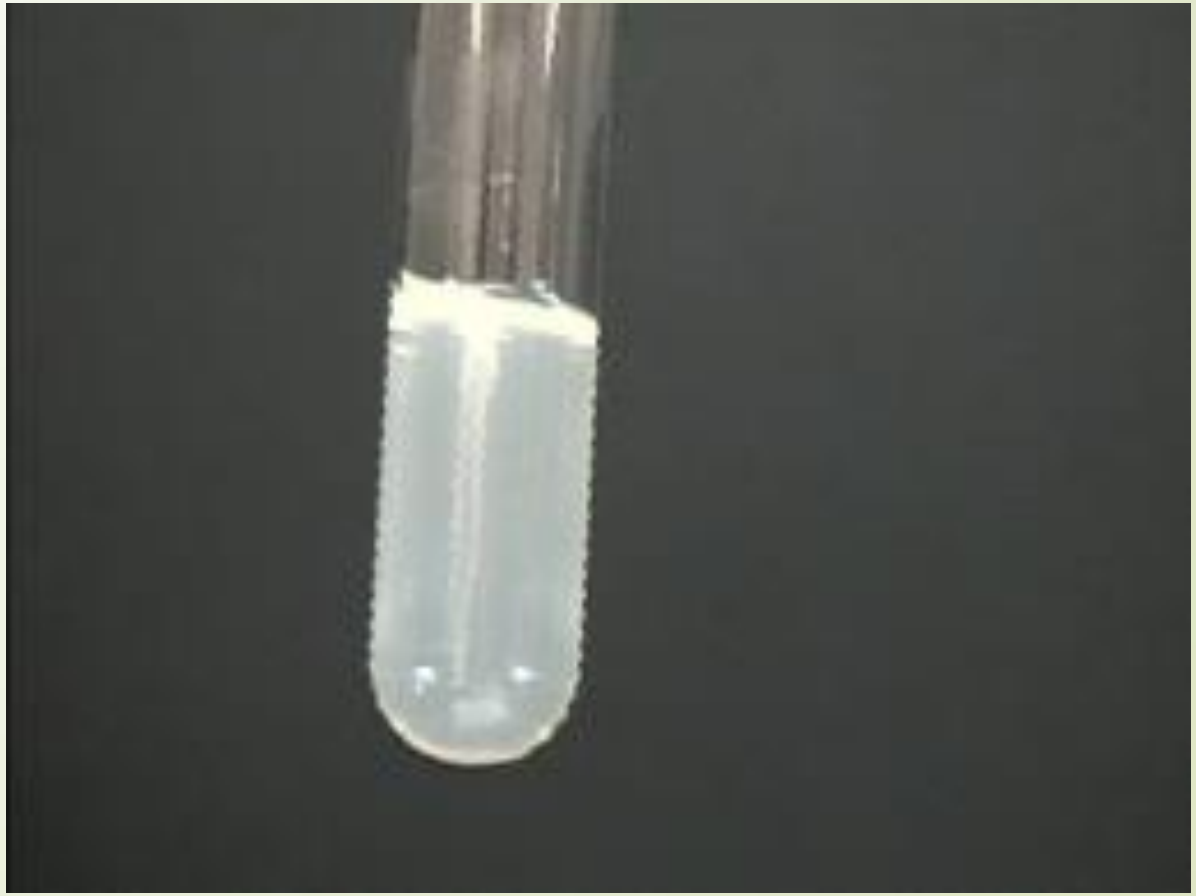
a) Where on ferns would you find spore cases?

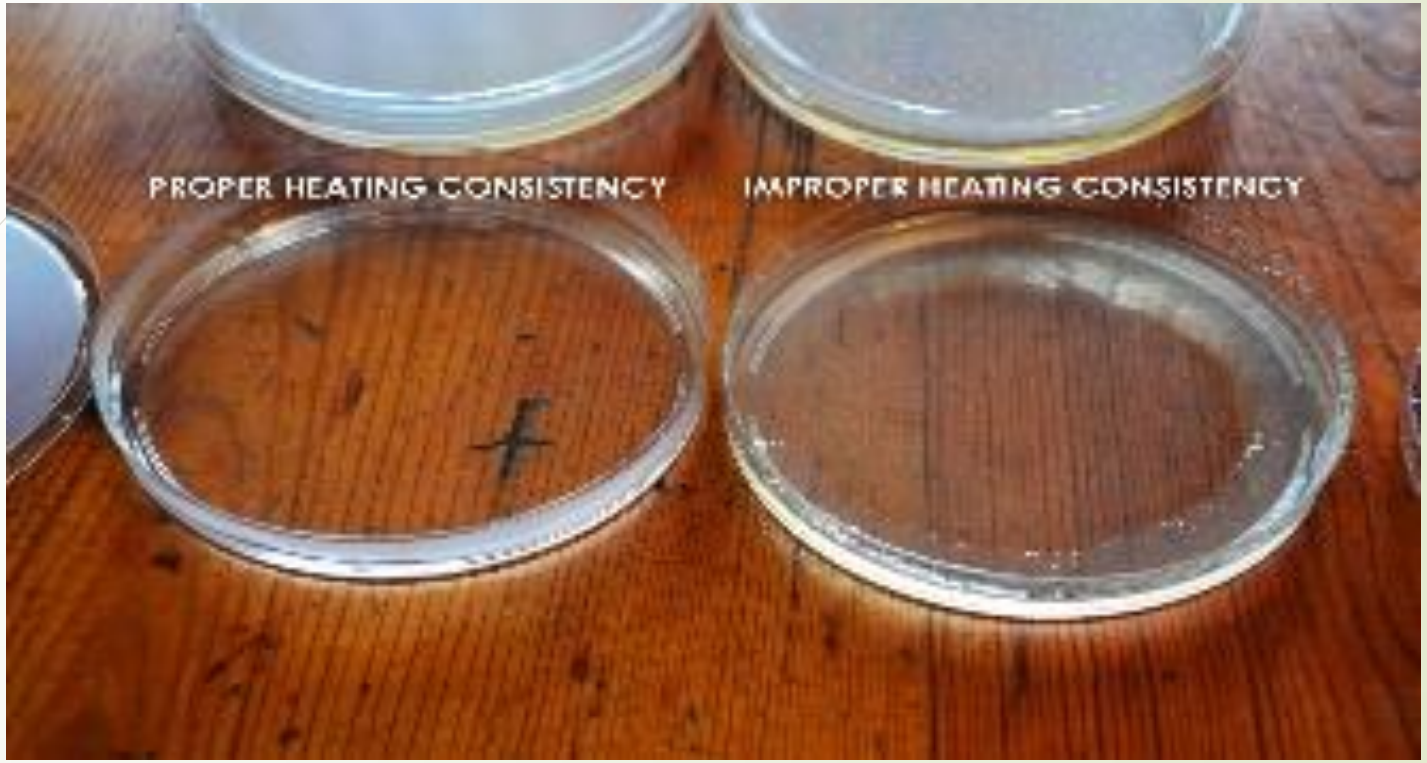
b) How does fern and moss differ from each other?

c) How many life cycles stages do ferns & moss have in all?

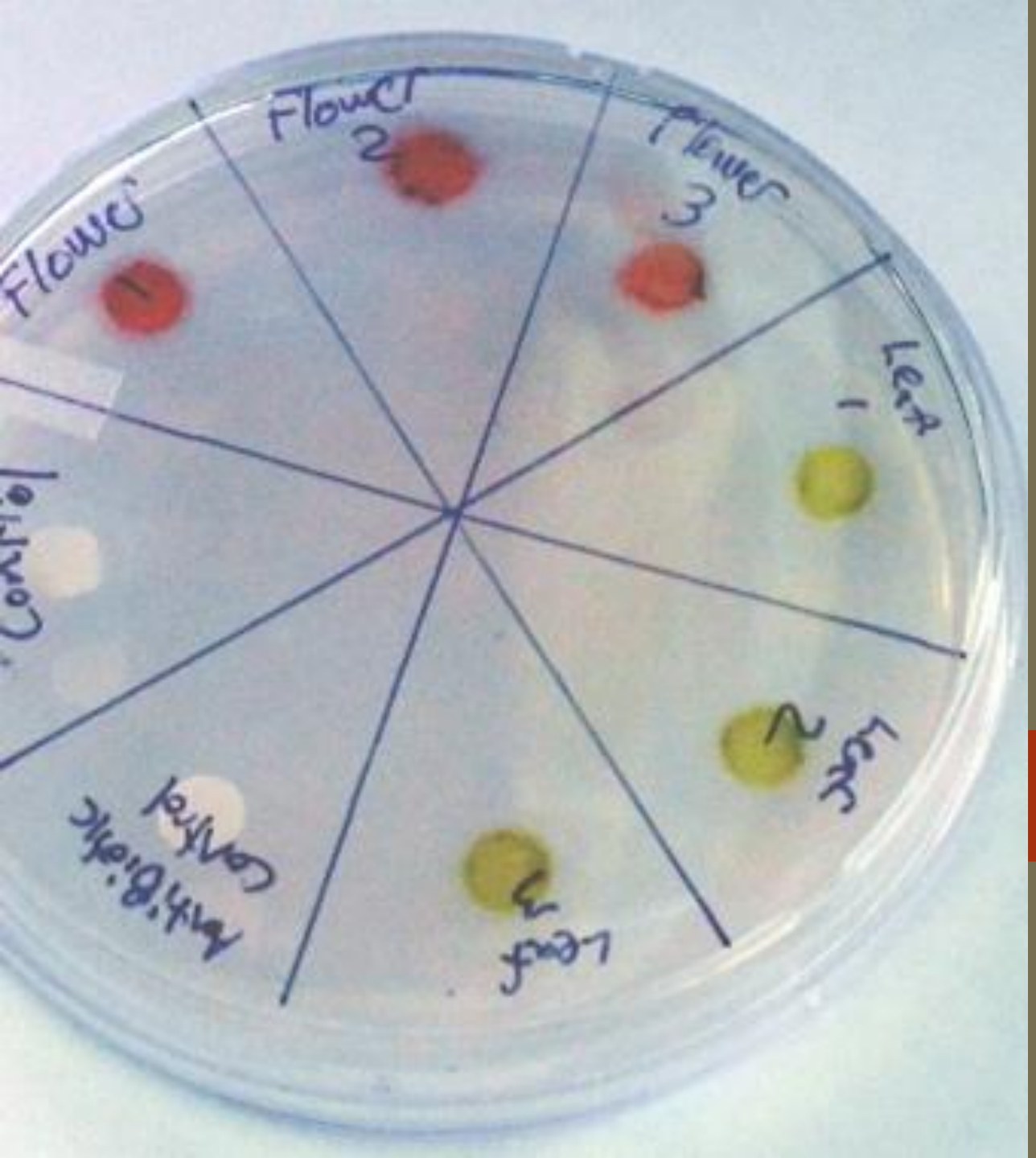
d) What are the two stages of life cycles of moss & fern called?

Students start an E-Coli culture in the lab before going into the field to collect their plant specimens.



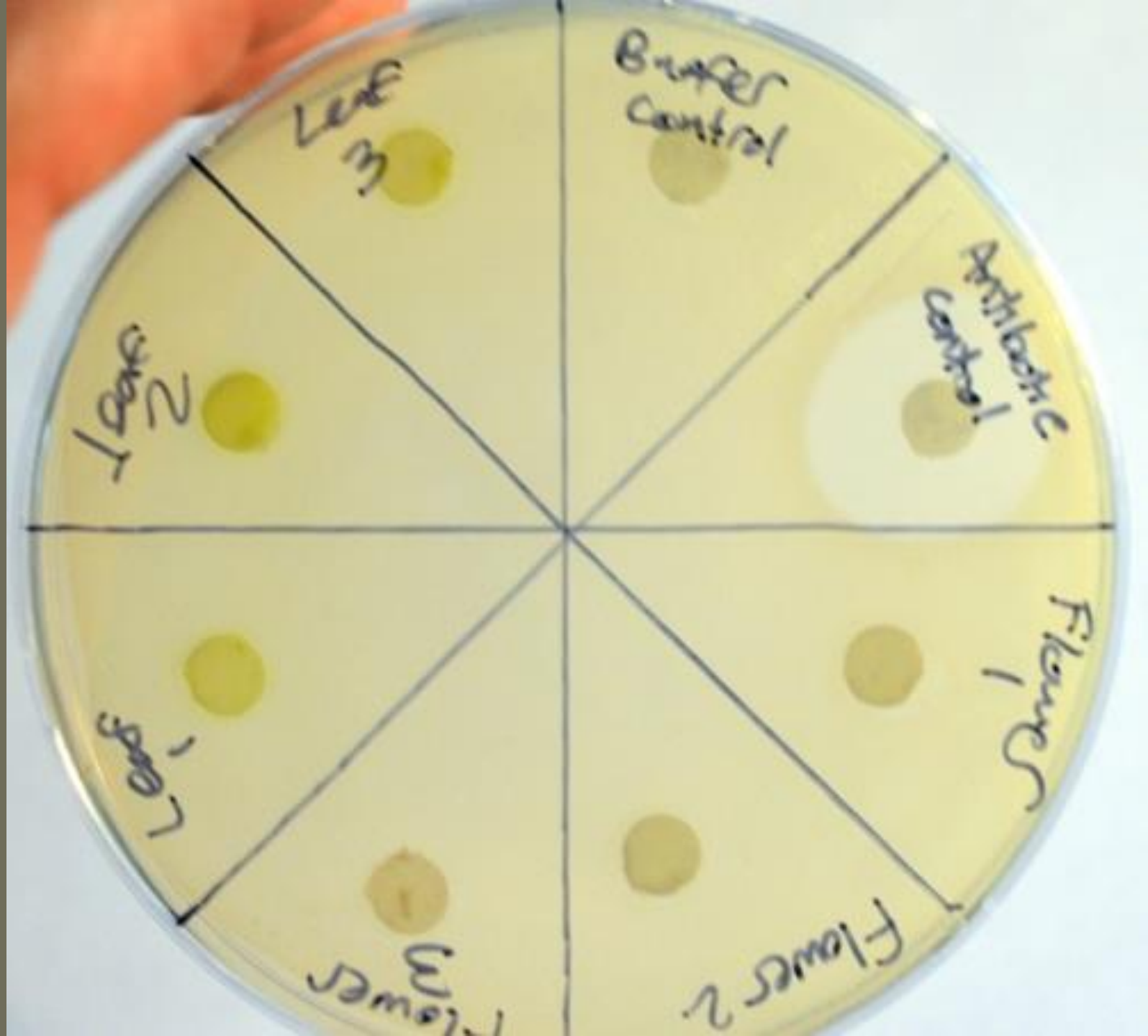


Students prepare plates and work with agar.



Students process samples and label plates.

Time to determine whether the effect is positive or negative



Questions

Ideas

Advice

Feedback