Soil Microbe Identification: An Innovative Approach To Teaching Microbiology Labs

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INTRO:

- The labs that are currently used in this course are “cookbook” labs in which the procedures are designed to yield expected results. This approach is suitable for some techniques such as Gram staining so that students can learn to master basic skills, but it leaves them with no appreciation for the scientific process.
- Using soil as a source for microbes can cut down on the cost of supplies and allow for teamwork without the risk of potential biohazards as compared to previous methods using body swabs.
- Biology 2060 is a prerequisite for many nursing, dental, and veterinary programs. Implementing a lab more focused on issues in the medical field (in this case antibiotic resistant pathogens) may help to inspire students and allow for them to feel they are contributing to current discoveries.

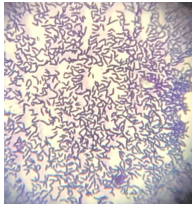
METHODS:

- Using a series of tests to be performed through the semester, students gain experience with differential and metabolic testing, as well as an appreciation for the scientific process that comes along with identifying an unknown microorganism.
- Students gain experience using the scientific database, Global Infectious Disease and Epidemiology Network (GIDEON) as well as the dichotomous key, Bergey’s Manual to identify microbes grown from soil collected from an area of their choosing.

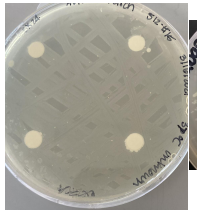
RESULTS:

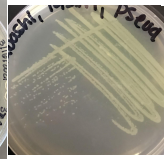
- Initially using Bergey’s Manual alone was not effective in identifying microbes. By using GIDEON we can identify the most likely microbe based on the outcome of the metabolic tests run.
- By using a chloroform fumigation test, cross streak, or fungal plug, we may be able to identify species with antimicrobial properties. This is the one part of the project that is yet to be determined pending potential costs and whether it is appropriate for an elementary microbiology class.
- In the first trial run, the bacteria grown from the soil were identified as sample 1: *Acinetobacter lwolfii* (79% match), sample 2: no match with high enough percentage (less than 60% match), sample 3: *Acinetobacter parvus* (>99% match), sample 5: *Bacillus megabacterium* (98% match).

To better engage students in microbiology, creating a lab that may help further medical discoveries as well as allow them to explore their environment is necessary.



The picture on the left is a gram stain of unknown #5, and the right shows a gram stain of unknown #2. This is a technique currently used during the lab portion of the class, and can drastically affect the identification process.





On the left is a chloroform fumigation extraction done that shows no microbial antagonism.So far, no species have been identified with a positive result. Pseudomonas fluorescens (right) is used as the control in this experiment so that we have a definite comparison.

Sample/Test	1	2	3	5	Pseudomonas
Bile Esculin	-	-	+	+	-
Catalase	+	+	+	+	+
Citrate	-	-	-	-	-
Dextrose	+	+	+	+	+
Gram	-	+	-	+	-
H2S (SIM)	-	-	-	-	-
Indole (SIM)	-	-	-	-	-
Lactose	+	+	+	+	+
Mannitol Salt	-	-	-	-	-
Motility (SIM)	-	-	-	-	-
MR-VP	-	-	-	-	-
Oxidase	-	-	-	-	+
Trehalose	+	+	+	+	+
UREA	-	-	-	+	+

Each microbe is subject to a series of 14 metabolic tests to help narrow down what the most likely identification is. In addition, students are asked to classify the appearance of the whole colony and the morphology and arrangement of the bacteria.

CONCLUSION:

- This project is in the final stages and nearing completion. Initial trials have shown a few flaws in the experiment as a whole (ie: using only Bergey’s Manual, using fungal plugs only to test microbial antagonism, etc.). Currently, the experiment series is being completed for the third time, and the lab workbook is being written for use in future semesters.
- The hope is to find some species with significant microbial antagonism that can be submitted for further research, with the end goal of finding a better treatment for infections or for antibiotic resistant pathogens.

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