

Kelly Myer Polacek
Lesson Plan

Please note: In Bacteriology 221, students are given an unknown species of bacteria at the beginning of the quarter. Throughout the quarter, they perform numerous tests on the bacteria and use their results and a dichotomous key to determine the species of their unknown. This is worth 10% of their grade in the class. It is assumed that students have an “investment” in or a personal attachment to their unknown species. Questions that ask them to think about “what it would be like for their bacteria” or statements like “some bacteria have the capability to” should motivate the students because of their investment/attachment. Hopefully the students are thinking “Oh, maybe mine does. I can’t wait to find out!”

I. OBJECTIVE

Given three important pieces of information about the mechanism of the enzyme lysine decarboxylase, and given directions of proper procedures, students will determine if their unknown species of bacteria can decarboxylate lysine.

II. MATERIALS

4 lysine decarboxylase broth per pair, 4 lysine decarboxylase base broths per pair, mineral oil

III. PROCEDURE

Anticipatory Set:

Think about the process of fermentation. (covert active participation) (relevant to students’ background in course) What are the products of fermentation? Take a moment and discuss the process and products of fermentation with your partner. (overt active participation)

I heard a lot of you mention “acid”. You are right. Acid is a product of fermentation and collects in the medium. Do you think this is a hospitable environment for your bacteria? (covert active participation) (relevant to the students’ background) Some bacteria have the ability to raise the pH of the medium by hydrolyzing another molecule, the amino acid lysine.

Objective:

Today we will learn three important characteristics about the enzyme lysine decarboxylase.

Purpose:

Lysine decarboxylase activity is one of the steps in your dichotomous key. After today’s lab, you will be one step closer to determining the species of your unknown bacteria.

Input:

Think about the functional groups and structure of an amino acid. (covert active participation) When I hold up my hand, everyone tell me the kind of functional group you are thinking of (overt active participation – choral response).

Students shout “carboxyl group” and “amino group”

You’re right. Those are two important functional groups found on all amino acids. (focus on the learning response). Take a moment in your notes and draw the structure of an amino acid. (covert active participation) Raise your hand if you can come to the front and draw the structure of an amino acid on the board. (motivation – anxiety). Nicole, please draw us an amino acid.

Nicole draws the following:

Thank you, Nicole. Is Nicole right?

Students nod.

Check your drawing against the one Nicole drew on the board. (modeling of previous learning) (motivation – knowledge of results)

The enzyme lysine decarboxylase removes the carboxyl group from the amino acid lysine.

Erase the carboxyl group on Nicole’s amino acid:

Write on the board:

1. remove COOH

The carboxyl group is often referred to as a carboxylic acid. When the bacteria removes this carboxyl group, it raises the pH of the medium.

Write on board:

2. raises pH

This is a cool characteristic, because if the bacteria has been fermenting and the medium becomes acidic, the bacteria, if it is capable, can begin to decarboxylate lysine and raise the pH, making the environment more pleasant.

One other important feature about the enzyme lysine decarboxylase is that it is only activated at a low pH. In order for this enzyme to work, the environment must be acidic.

Write on board:

3. acid activated

Check for understanding:

When you think you know these three characteristics of the lysine decarboxylase stand up. (covert active participation). *Once all students are standing:* Share with your partner these three characteristics of the enzyme lysine decarboxylase. (overt active participation) When you are finished sharing, please sit down

Students share and sit.

Modeling:

Matt, what are the three important characteristics of the enzyme lysine decarboxylase?

Matt says: It removes the carboxyl group from the amino acid, the pH raises because of this and the enzyme only works in acidic conditions.

Guided Practice:

All of your materials are here on the table. Using the directions in your lab manual, discuss with your committee the procedure you are about to do. When you are ready, collect your materials and begin the procedure.

Closure:

On a clean sheet on paper in you lab notebook, write what you have learned today. Be sure to include the procedure you just performed.

Independent Practice:

In your lab notebooks tonight, answer questions one through three of exercise 26C on page 115 of your lab manual.

IV. Evaluation

Students will have self-evaluation when they return to lab the following period, that is, given the results they see, they must determine if their unknown can decarboxylate lysine. Additionally, they will be tested on the three important characteristics of the enzyme lysine decarboxylase sometime within the next two weeks.

Modeling works well in this class. It is better for students to see that their peers have mastered the material rather than mastered material always coming from the instructor.