

# AP Biology Enzyme Activity Lab Report

**Primary Investigators** ~ Abe, Daniel, Thomas, Owen, Joe, Jack, and Isaac

**Dates** ~ November 17 - December 2, 2021

## **Introduction, Part 1: Literature Review**

Enzymes are a biological means of speeding up or inducing reactions. Each enzyme works with a specific set of molecules called its substrates. The substrates of an enzyme and how it affects them are based on the shape of the active site of the enzyme (Khan Academy). In this lab, we used an enzyme called peroxidase, an enzyme that breaks down two hydrogen peroxide molecules into two water molecules and one oxygen molecule (College Board, 2015). Many factors can change the rate at which an enzyme causes a reaction such as the temperature or the pH of a solution. The main way a reaction is slowed is by some factor causing the enzyme to become denatured, or to change the shape of its active site. This makes it so that the enzyme cannot properly perform its role in the reaction(Khan Academy). Generally, lower temperatures slow down enzyme-based reactions while increased temperatures increase the speed, but in extremely high temperatures enzymes can be denatured.

## **Introduction, Part 2: Hypothesis**

In this lab, we hoped to find to what extent a moderate change in temperature affects the rate of a peroxidase reaction. We wanted to know if a moderate increase in temperature would be enough to denature peroxidase and if a moderate decrease would slow down the reaction noticeably. We hypothesized that if the temperature was moderately increased or decreased, then the reaction would speed up or slow down respectively because a moderate increase is likely not enough to denature peroxidase and a moderate decrease is likely enough to cause a noticeable decrease in speed.

## **Methodology/Procedure**

Our first step was to prepare twelve test tubes in pairs of two. The first of each pair contained 7ml of distilled water, 0.3ml of 0.1% hydrogen peroxide, and 0.2ml of guaiacol. The second tube of each pair contained 6ml of distilled water and 1.5ml of peroxidase. We then mixed each of the tubes. Our next step was to prepare a beaker of hot water at about 100°F and another filled with ice lowering the temperature to about 30°F. We decided which tubes would go where randomly. To begin the experiment we started a stopwatch and mixed each pair of tubes simultaneously and after 1 minute put two tubes into each environment. We then took pictures of the tubes every minute for 5 minutes and then took a picture shortly after for the final results.

## **Results, Part 1: Data**

Our numerical data is based on the numbers shown in fig. 1 below. We looked at each picture we had taken over the 5 minutes and decided which number it most closely resembled and recorded it in a table as shown in fig. 2 below. A darker solution, and therefore a higher number, shows that more reaction has occurred.

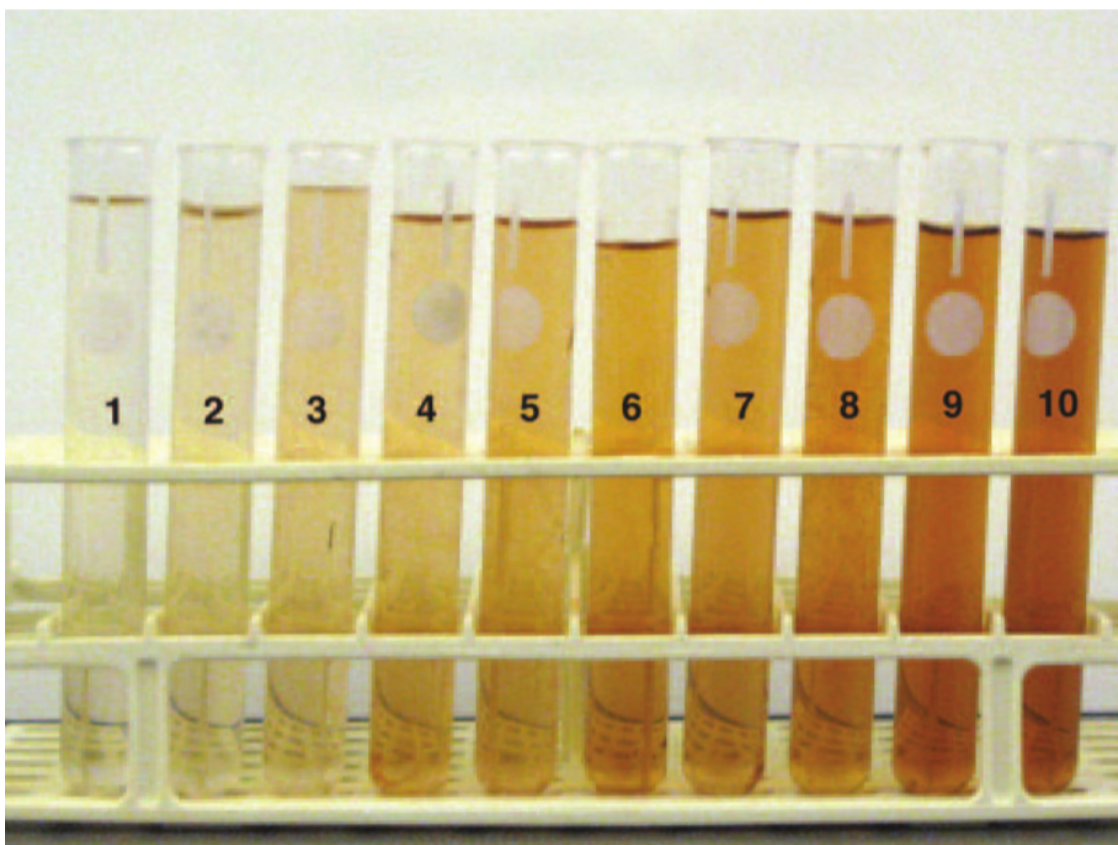


Figure 1, showing the different shades numbered, The College Board (2015)

Time After Placement in Temperature	Room Temperature (Around 70°F)	Hot Water (About 100°F)	Ice (About 32°F)
1 min	2	3	2
2 min	3	4	3
3 min	4	4	4
4 min	5	5	5
5 min	6	6	6
final	6	7	6

Figure 2, Our data table for our results

### Results, Part 2: Analysis

Our data shows that somewhat colder temperatures did not slow the rate of the reaction much while somewhat hotter temperatures increased the rate of reaction slightly.

## Discussion

Our results show that peroxidase will not become denatured at around 100°F as we predicted in our hypothesis. This is shown by the fact that the rate of reaction increased rather than decreased as would be expected of a denatured enzyme. Our results also disprove the part of our hypothesis that states that the reaction will be noticeably slowed by the colder temperature. We found that around 32°F a peroxidase reaction is not noticeably slowed because the data for the cold reaction matched up with the data for the room temperature one.

## Acknowledgments

I would like to thank my lab partners for helping me with the lab as well as Megan for setting up all of our materials and our AP Bio class for coming up with the idea to create a lab about temperature.

## Literature Cited

"Enzymes Review (Article)." *Khan Academy*, Khan Academy, <https://www.khanacademy.org/science/ap-biology/cellular-energetics/environmental-impacts-on-enzyme-function/a/hs-enzymes-review>.

Mader, S. S. and Windelspecht, M. (2013). *Biology (11th Ed.)*. McGraw-Hill: New York, NY.  
The College Board (2015). Big Idea 4: Interactions. Investigation 13, enzyme activity.

## Grading Rubric

	Exemplary	Proficient
<b>Complexity:</b> <b>Content</b>	All components are complete. <ul style="list-style-type: none"><li>· Title</li><li>· Primary Investigators</li><li>· Date</li><li>· Introduction, Part 1: Literature Review</li><li>· Introduction, Part 1: Hypothesis</li><li>· Methodology</li><li>· Results, Part 1: Data</li><li>· Results, Part 2: Analysis</li><li>· Discussion</li><li>· Acknowledgements</li><li>· Literature Cited</li></ul> <b>Introduction sections</b> demonstrate deep understanding of the lab's purpose.	All components are complete. <ul style="list-style-type: none"><li>· Title</li><li>· Primary Investigators</li><li>· Date</li><li>· Introduction, Part 1: Literature Review</li><li>· Introduction, Part 1: Hypothesis</li><li>· Methodology</li><li>· Results, Part 1: Data</li><li>· Results, Part 2: Analysis</li><li>· Discussion</li><li>· Acknowledgements</li><li>· Literature Cited</li></ul> <b>Introduction sections</b> demonstrate understanding of the lab's purpose. <b>Results and discussion</b>

	<b>Results and discussion sections</b> use evidence and reasoning to convincingly support claims.	<b>sections</b> use evidence and reasoning to support claims.
<b>Complexity: Connections</b>	<b>Introduction and discussion sections</b> combine disparate components into a meaningful whole, completely addressing the topic of environmental influences on enzyme activity.	<b>Introduction and discussion sections</b> combine disparate components into a meaningful whole, partially addressing the topic of environmental influences on enzyme activity.
<b>Authenticity</b>	All written components and diagrams are original. <b>Acknowledgements and literature cited sections</b> attribute the ideas, help, and collaboration of others.	All written components are original. <b>Acknowledgements and literature cited sections</b> attribute the ideas, help, and collaboration of others.
<b>Craftsmanship</b>	Report is typed. Each section is clearly labeled. Formatting is consistent, clear, and polished. Writing is free from spelling and grammatical errors. Writing and diagrams are so clear, another researcher could replicate the experiment. <b>Teacher feedback is used to make revisions.</b>	Report is typed. Each section is clearly labeled. Formatting is consistent. Writing is free from spelling and grammatical errors.