

## The Rate of Breakdown of Hydrogen Peroxide

Jessica Stenzel

JessicaStenzel@my.unt.edu

Biol 1730.538

Due: 10-12-12

Ms. Garima Saxena

Lab Day: Friday ; Time: 8:00 a.m. – 10:50 a.m.

## **Abstract**

---

This experiment examined the breakdown of hydrogen peroxide and whether it occurred at the same rate in plant and animal cells. Four test tubes were prepared, each separately containing its own substance of either apple, potato, chicken breast, or beef liver extract. A dropper of hydrogen peroxide was then added to each test tube. The height of foam that appeared was then recorded (in millimeters) and compared to see which extracts had the longest layer of foam. The results showed that the chicken breast and the liver both grew a layer of foam, however, the chicken breast had a low rate of hydrogen peroxide breakdown and the liver had a very high rate. The apple and potato extract had none. This experiment showed that animals have a catalase but plants do not.

## **Introduction**

---

Enzymes are specialized macromolecules that speed up chemical reactions (Reece, 2011). They can help break down harmful chemicals into harmless substances. Fortunately, cells have an enzyme, catalase, which quickly breaks down hydrogen peroxide into water and oxygen, preventing cellular damage (Gunstream, 2012). When this reaction happens in a test tube, oxygen is released and it bubbles to the surface, which creates a layer of foam. This reaction is important to cells because hydrogen peroxide is produced as a result of many common cellular reactions. If the cells did not break down the hydrogen peroxide, they would cause serious damage. In order to examine this reaction, apple, potato, chicken breast, and beef liver will be used to determine the rate of catalase in the cells. It is important to have catalase in animal cells because without it, humans would die.

The hypothesis tested states that: *the breakdown of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) occurs at the same rate in all cells.*

## Materials and Methods

---

Four test tubes were filled with one drop of tissue extract and one dropper (1 ml) of water according to Table 1. Then, one dropper (1 ml) of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) was added to each tube. Immediately, the length of the foam layer was measured (in millimeters) and then recorded. Test tube 1 contained 1 drop of apple extract and 1 ml of water, test tube 2 contained 1 drop of potato extract and 1 ml of water, test tube 3 contained 1 drop of chicken breast extract and 1 ml of water, and test tube 4 contained 1 drop of beef liver and 1 ml of water.

### Preparation of Test Tubes

Test Tube 1	Test Tube 2	Test Tube 3	Test Tube 4
1 drop of apple extract 1 mL of water	1 drop of potato extract 1 mL of water	1 drop of chicken breast extract 1 mL of water	1 drop of beef liver extract 1 mL of water

**Table 1:** Volume of each substance used to prepare each test tube

## Results

---

The result of each test tube varied. In test tube 1, the apple had no reaction and therefore did not contain a catalase. In test tube 2, the potato reacted the same way as test tube 1. Test tube 3, however, reacted slowly but was definitely foaming slightly and therefore showed that chicken breast had a slow catalase. Test tube 4 reacted very highly to the H<sub>2</sub>O<sub>2</sub>, meaning the catalase was very fast. The measurement of foam is shown in Table 2. Based on these results, the breakdown of H<sub>2</sub>O<sub>2</sub> does not occur at the same rate in all cells.

### Thickness of Foam Layer in each Test Tube

Tube	Thickness of Foam Layer	Tube	Thickness of Foam Layer
1. Apple	0mm	3. Chicken Breast	1mm
2. Potato	0mm	4. Beef Liver	28mm

**Table 2:** Total length of foam layer after one dropper of H<sub>2</sub>O<sub>2</sub> was added

### Discussion

---

Due to the absence of foam in the test tubes containing the plants, the hypothesis is rejected. The animal cells, which were proven to contain catalase, even broke down the H<sub>2</sub>O<sub>2</sub> at different rates. This depended on the amount of enzymes in the liver of beef compared to the chicken breast. This experiment effectively addressed the hypotheses tested because it gave the conclusion that animals need catalase to break down H<sub>2</sub>O<sub>2</sub> and that plants have a lower cellular respiration.

## References

---

Gunstream, Stanley. *Explorations in Basic Biology*. Comp. Pearson Education, Inc. 12th ed. Boston: Pearson Learning Solutions, 2012. Print.

Reece, Jane B., Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, and Robert B. Jackson. "Enzymes Speed up Metabolic Reactions by Lowering Energy Barriers." *Campbell Biology*. 9th ed. San Francisco: Pearson Education, 2011. 152-57. Print.