Action of Catalase in Different Tissues

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Abstract

Enzymes are protein molecules that speed up a chemical reaction by lowering the activation energy. In this experiment, the action of catalase was tested on different types of tissue extracts. There were four different test tubes: one with apple extract, one with potato extract, one with chicken breast extract, and one with liver extract. Once water and hydrogen peroxide was added to each extract, the thickness of foam was measured immediately. The experiment was repeated twice for any experimental errors. The results shows that the rate of chemical reactions between the four extracts were different. The action of catalase in breaking down hydrogen peroxide was faster in liver cells.

Keywords: enzymes, catalase, hydrogen peroxide

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Introduction

All living cells need enzymes to survive. An enzyme is a protein molecule, each containing a specific amino acid that acts a biological catalyst (Ophardt, 2003). A catalyst is a substance which speeds up a chemical reaction; therefore, enzymes speed up a chemical reaction (Clark, 2002). An enzyme does so by reducing its activation energy, the initial amount of energy needed to start a chemical reaction (Reece and Urry etc. 2008). Without enzymes, processes of life would be too slow and cells would die.

Enzymes all contain an active site where the activity of an enzyme occurs. Only one substrate, the reactant an enzyme is acted upon, can fit into the shape of the active site. The specificity of an enzyme is due to a compatible fit between the shape of its active site and the shape of the substrate. Thus, shape plays a major role in determining which chemical reaction will occur. Enzymes are held together by weak hydrogen bonds that actually forms the shape of the enzyme-substrate complexes. Factors such as temperature and pH levels can break the hydrogen bonds, altering the shape or inactivating the chemical reaction.

Enzymes are important in that they break down some of the most harmful by-product of some cellular reactions. For example, hydrogen peroxide (H_2O_2) is a dangerous by-product of respiration and is made in all living cells. It is mostly found in the liver in the human body. An enzyme called catalase breaks down hydrogen peroxide into water and oxygen.

In experiment number 3, we are comparing the action of catalase in different tissues by testing this hypothesis: The breakdown of hydrogen peroxide occurs at the same rate in all cells. The purpose of the experiment was to test the action of catalase on different types of tissue

extracts. When hydrogen peroxide was added to the extracts, the thickness of foam produced was measured. The foam that was produced indicates that catalase is breaking down hydrogen peroxide.

Materials and Methods

In experiment 3, the materials used were a glass marking pen, medicine droppers, four test tubes, a test tube rack, four 50 mL beakers of each extract, a mortar and pestle, sand, a scalpel, dropping bottles of 3% hydrogen peroxide and tap water, and 0.5 centimeters of biologicals of apple, chicken breast, potato, and beef liver.

First and foremost, this assignment needs a preparation of tissue extracts from an apple, chicken breast, a potato, and beef liver. However, for this experiment, the lab instructor has provided the extracts in beakers.

Four test tubes were prepared with one drop of tissue extract of apple (test tube 1), potato (test tube 2), chicken breast (test tube 3), and beef liver (test tube 4). Then, each test tube was mixed with 1 dropper of water. Starting off with the tissue extract of the apple, or test tube 1, one dropper of hydrogen peroxide was added into the tube. Immediately following the mixture, a measurement of the foam layer should be measured. This procedure should be repeated for all four test tubes, with an accurate measurement of the foam layer in millimeters. Record the width of the foam layer in millimeters into the lab manual. This experimental procedure was repeated twice to reduce any experimental errors. After the experiment was complete, the area should be cleaned up. All test tubes containing the extracts should be dumped into a bin, not the sink. When the experiment is done, wash all glassware used.

Results

The apple, potato, and chicken breast tissue extract showed minimal-to-none thickness of foam layer compared to the beef liver tissue extract. These results express that the breakdown of hydrogen peroxide is not present in the apple and potato. Additionally, catalase reacted infectively in the chicken breast extract. In comparison to the beef liver extract, the breakdown of hydrogen peroxide occurs faster in liver cells. Thus, proving the hypothesis to be false and should be rejected. The breakdown of hydrogen peroxide occurs at a different rate in different types of cells.

Tube	Thickness of Foam Layer in millimeters	
	Trial 1	Trial 2
1 - Apple	0	0
2 - Potato	0	0
3 - Chicken Breast	0	1
4 - Liver	32	35

Table 1: Thickness of foam layer in millimeters for each extract.

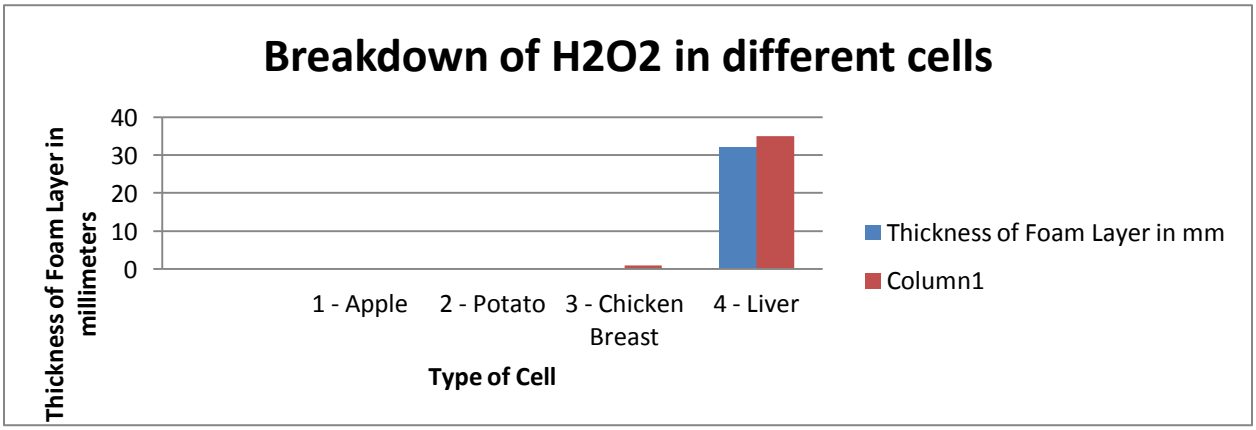

Figure 1: Bar graph of the breakdown of hydrogen peroxide in different extracts.

Discussion

Catalase activity in liver cells breakdown hydrogen peroxide faster than apple, potato, and chicken breast cells. These results offer a conclusion that animal tissues exhibit greater catalase activity than plant cells. Catalase activity occurs more in animal cells because lipid molecules are more prevalent to have more hydrogen peroxide needed to be broken down. Therefore, the hypothesis: the breakdown of H_2O_2 occurs at the same rate in all cells, is false.

A variation occurred between trial one and trial two with chicken breast cells and liver cells. Some of the cells are at the bottom of the glassware and the cells were extracted at different parts of the beakers. For the next trial, I would mix the extracts gently inside the beaker before extracting the cells. To keep variations from occurring, I would extract at the bottom of the beaker. This would reduce faulty data. Every experiment needs a control group; however, a control group was not needed in this experiment. Sand and water were prepared in tubes but were not necessary because hydrogen peroxide does not react to sand and water.

Conclusion

In this lab, the experiment indicated that catalase breaks down hydrogen peroxide faster in liver cells than other cells. Therefore, the conclusion is: The breakdown of H_2O_2 occurs at the different rates in different kinds of cells.

References

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