

Collin McCann
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P.4
Med. Biology

An Experiment to Determine Where Catalase is Found on Different Substances

Introduction:

The researchers are experimenting with this lab to determine where catalase is found on tissue, how catalase reacts to substrates, and the reaction rate in which it is found. The team believes the experiment will help discover catalase in animal tissue and the concentration in which it formulates.

Hypothesis:

If the researchers find that the tissue bubbles and breaks down in the hydrogen peroxide, then they will be able to determine the amount (concentration) of catalase and be able to tell where the catalase is coming from in the tissue, because the hydrogen peroxide is a substrate capable of breaking down with the catalase liver (Hydrolysis), creating products, oxygen (O₂) and water (H₂O).

Materials:

1. 2ml of 3% Hydrogen Peroxide (per test)
2. Tissue (Other than liver)
3. 4 Clean Test-Tubes
4. Stirring Rod
5. Forceps
6. Scissors

Procedures; Experiment 1:

1. Place 2 ml of the 3% hydrogen peroxide solution into a clean test tube.
2. Using forceps and scissors cut a small piece of liver and add it to the test tube. Push it into the hydrogen peroxide with a stirring rod. Observe the bubbles. What gas is being released? (consider the equation) _____ Throughout this investigation you will estimate the rate of the reaction (how rapidly the solution bubbles) on a scale of 0-5 (0=no reaction, 1=slow, 5= very fast). This is very subjective, but assume that the reaction in step 2 proceeded at a rate of "4" Recall that a reaction that absorbs heat is endothermic; a reaction that gives off heat is exothermic. This is the control.
3. Now, feel the temperature of the test tube with your hand. Has it gotten warmer or colder _____ Is the reaction endothermic or exothermic? _____

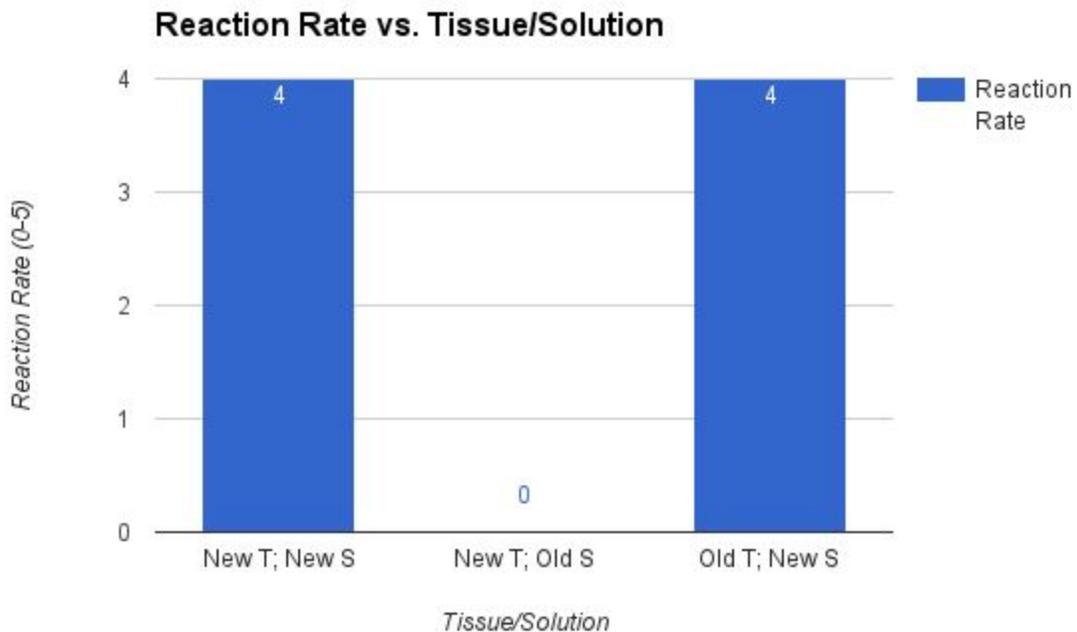
- Pour off the liquid into a second test tube. Assuming the reaction is complete. What is this liquid composed of (consider the equation again)? _____
- What do you think would happen if you added more liver to the liquid in the second test tube? _____ Test this and record the reaction rate. Reaction Rate _____ (0 – 5)
- Add another 2 ml of hydrogen peroxide to the liver remaining in the first test tube. What is the reaction rate? _____
- Now that you have completed your test, Is catalase reusable? Explain how you know.

Procedures; Experiment 2:

- Place 2 ml of hydrogen peroxide in each of 4 clean test tubes and then add each of the three test substances to the tubes.
- As you add each test substance, record the reaction rate (0-5) for each tube.
- Based on your observations, which tissues contained catalase?
- Do some contain more catalase than others? How can you tell?

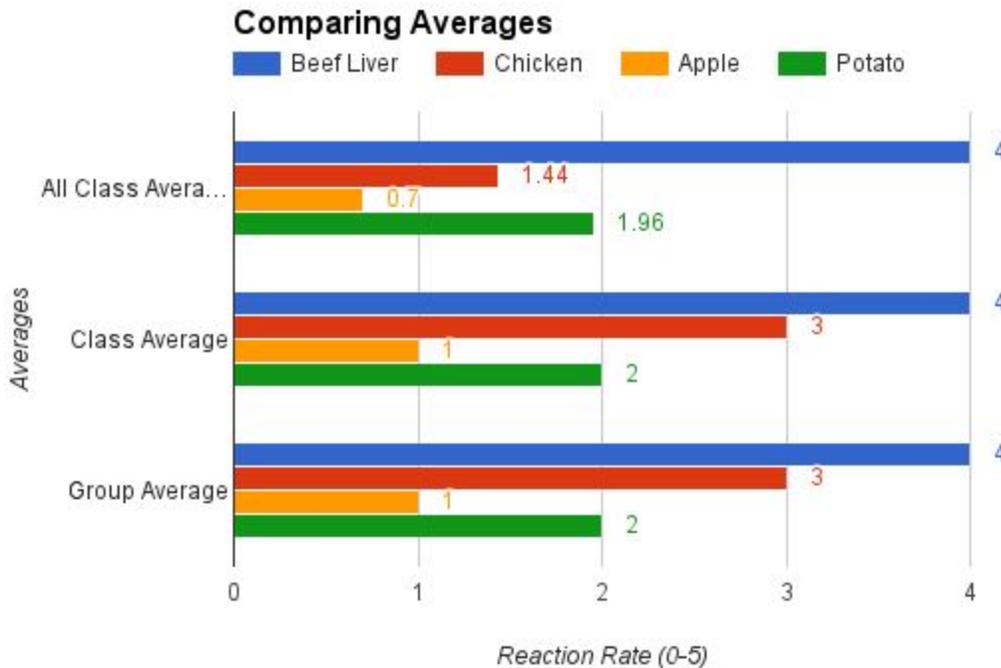
Analysis:

Experiment 1:



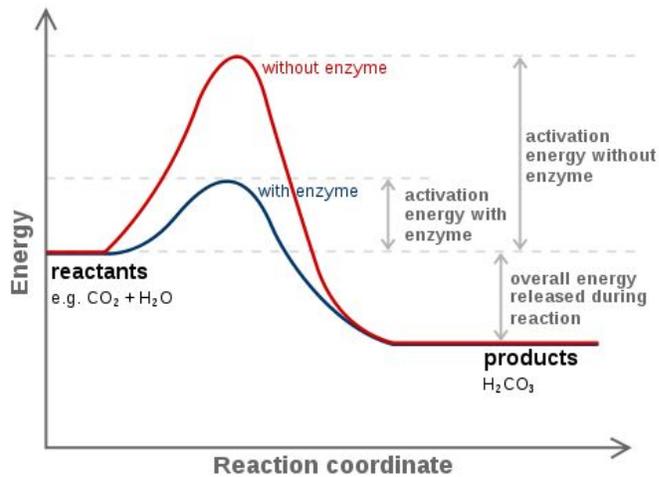
Experiment 1s graph shows that catalase (The tissue) is reusable, but the substrate (H₂O₂ - Hydrogen Peroxide) can only be used once, and once the reaction is used, water is left over and oxygen is released in the bubbles.

Experiment 2:



Experiment 2s graph shows that beef liver (control substance) is a constant of 4 for all averages for their reaction rate, with the variable being chicken, varying from 1.44 to 3, with 0 being not changing, and 5 being change rapidly fast. The researchers completed this experiment to examine the differences of catalase between substances, where with more energy there is more catalase to break down the H₂O₂ bonds.

Catalase and hydrogen peroxide complete the enzyme cycle, with catalase being enzymes and hydrogen peroxide being the substrate (Catalase + Hydrogen Peroxide → H₂O + O₂). Additionally, this can be shown again by the fact that the liver, or catalase, can be reused over and over whilst hydrogen peroxide can only be used once after releasing its products, oxygen and water. The amount of temperature and acidity affects the reaction rate of the catalase making it either faster or slower based on how close the amount is to it's optimal amount, being 37°C for temperature, and 7pH for acidity.



As this graph shows, with an enzyme less energy is required for it to react, and to produce a product. Without an enzyme, more energy is required for it to react, and to produce a similar product.

Enzymes are important to control human chemical reactions, and control how fast they produce their products. Without them, humans would die from lack of protein and energy. (1)

Conclusion:

The researchers began this lab to test if there is catalase found on all tissues, in different concentrations, and to theorize where enzymes help with the human bodily functions. To begin, the team's hypothesis was, if the liver broke down in the H_2O_2 , a known substrate, then they could determine if different types of liver had catalase enzymes in them. The researchers had believed that if bubbles formed, based on the rate of the reaction, they would be able to tell if there was more or less catalase to break down the H_2O_2 into its own main components, H_2O (Water) and O_2 (Oxygen).

As the results state, there is more or less catalase in the different types of liver, and they all reacted differently based upon their concentration of catalase. This supported their theorem, as beef liver had a constant reaction rate of 4, while the other substances had lesser reactions, with potato coming in second in the total class average; while chicken came in second on the class average and group averaging. The researchers have learned that enzymes are important in the human bodily process to control human chemical processes, and the rate in which they produce their product.

Conclusion (Cont.):

The researchers believe they have done an excellent job, but because the tests were subjective, they were up to the interpretation of one's own mind, meaning it could have been different for every single test. Another thing that may have gone off the tracks, if an unknown substance was still lying within the test tube, left by the other set of researchers, would greatly affect the results. Additionally, if oils from the researcher's hands had touched the substances, it could have blocked the catalase from dispersing in the hydrogen peroxide. Overall, the team was careful in their actions, and had even retested to confirm their theory. In the future, to prevent oils from possibly attracting with the catalase, surgical gloves shall be worn.

The research team believe this lab is connected to humanities' daily lives, enzymes are within all humans, and they break down proteins for the body to use. In addition, the rate in which the catalase is deteriorated may also play a role in human lives, if the substance has a quick reaction, then in the human body, it will also break up the substrates quicker than another substance. Medically speaking, catalase, in conjunction with a substrate, can be used in a medical procedure to diagnose someone for an energy deficiency or a protein deficiency and other illnesses.

References

(1) Museum, S. (n.d.). Why are enzymes important? Retrieved September 27, 2016, from <http://www.sciencemuseum.org.uk/whoami/findoutmore/yourbody/whatdoyourcellsdo/whatisacellmadeof/whyareenzymesimportant>