

BIOLOGY LAB: CATALASE

Observing an Enzyme

INTRODUCTION:

What would happen to your cells if they made a poisonous chemical? You might think that they would die. In fact, your cells are always making poisonous chemicals. They do not die because your cells use enzymes to break down these poisonous chemicals into harmless substances. **Enzymes** are proteins that speed up the rate of reactions that would otherwise happen more slowly. The enzyme is not altered by the reaction. You have hundreds of different enzymes in each of your cells. Each of these enzymes is responsible for one particular reaction that occurs in the cell.

In this lab, you will study an enzyme that is found in the cells of many living tissues. The name of the enzyme is catalase (KAT-uh-LAYSS); it speeds up a reaction which breaks down **hydrogen peroxide**, a toxic chemical, into 2 harmless substances--**water and oxygen**. The reaction is as follows:



This reaction is important to cells because hydrogen peroxide (H_2O_2) is produced as a byproduct of many normal cellular reactions. If the cells did not break down the hydrogen peroxide, toxic levels would accumulate and destroy the cell.

In this lab, you will study the catalase found in beef or chicken liver cells. Even though catalase is an enzyme found in many cells, it is found in high levels in liver cells because the liver often functions to break down toxins present in the blood. It might seem strange to use dead cells to study the function of enzymes. This is possible because when a cell dies, the enzymes remain intact and active for several weeks, as long as the tissue is kept refrigerated.

PRELAB REVIEW:

Recall that the substrate is the molecule that the enzyme acts on, the products are the molecules produced by the reaction and enzymes are "reusable."

Under certain conditions enzymes are **denatured**. An enzyme is denatured when the protein molecule loses its proper 3-dimensional shape and can no longer function. Some things that can denature an enzyme are high temperatures, extremes of pH, heavy metals, and alcohol.

MATERIALS:

- *8 Test tubes
- *10-ml Graduated cylinder
- *Fresh liver, chicken meat, and Potato
- *3% Hydrogen peroxide solution
- *Distilled water
- *Stirring rod

- *Test Tube rack
- *Tweezers
- *Waste cup
- *1 Beaker (to hold test tubes)
- *Petri dish

FOR THE CLASS:

- *Thermometers
- *Ice water bath (0°C)
- *water bath #1 (36°C)
- *water bath #2 (80°C)
- *Boiling water bath (100°C)

PROCEDURE:

****You are responsible for cleaning your group's lab supplies, lab table, and sink. Liquids may be poured down the sink, but solids (ex: potato cells, apple cells, paper towels) must be thrown away in the trash!!!****

Part I

Setting up the control.

NOTE: Be sure to clean your stirring rod (and test tubes) between steps.

1. Place 1 dropper full of liquid liver into a clean test tube.
2. Place **2 ml** of the 3% hydrogen peroxide solution into a graduated cylinder.
3. Add the hydrogen peroxide to the test tube and carefully observe the rate of reaction (how rapidly the solution bubbles/ its speed).
4. 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/no bubbles, 1=slow, ..., 5= very fast). **Assume that the reaction in step 3 proceeded at a rate of "4."**

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