

Biology enzyme experiment

[Science](#), [Biology](#)



An enzyme is a biological catalyst. It speeds up a reaction by lowering the activation energy required to start the reaction. It speeds up a reaction, but remains unchanged unless certain limiting factors are introduced. It is composed of polymers of amino acids. An enzyme has an optimum pH and temperature. When an enzyme is at its optimum conditions, the rate of reaction is the fastest. In their globular structure, one or more polypeptide chains twist and fold, bringing together a small number of amino acids to form the active site, or the location on the enzyme where the substrate binds and the reaction takes place.

An enzyme has an active site, which has a unique shape into which only a substrate of the exact same unique shape can fit. When this substrate fits into the active site, it forms an enzyme-substrate complex. This means that an enzyme is specific. Renin is a protein (enzyme) released by special kidney cells when you have decreased salt (sodium levels) or low blood volume. Renin also plays a role in the release of aldosterone, a hormone that helps control the body's salt and water balance.

Rennin causes rapid clotting of milk by causing certain bonds to break in the soluble casein molecule (milk protein) converting it to the insoluble casein, thus producing "curdled" milk. There will be 3 different types of experiments which all have consisted of using the main ingredient, renin. The 3 factors I will be experimenting on which affect the activity of the enzyme (renin) are temperature, pH levels and substrate concentration. TEMPERATURE The aim of this of the experiment was to see how long it will take for 20ml milk to curdle at different temperatures when renin is mixed with it.

My hypothesis is that the higher the temperature of the milk the faster the time it takes for the milk to curdle. An increase in temperature results in more kinetic energy of the enzyme and the substrate. More kinetic energy results in more collisions between the enzyme and the substrate. In turn, the number of successful collisions increases and more enzyme-substrate complexes form. Therefore an increase in temperature increases the rate at which enzyme substrate complexes form. The obvious trend of the graph is that as the temperature of the milk was getting greater and greater, the time it took for the milk to curdle was shorter.

So the lower the temperature the longer it took to curdle. The higher the temperature the faster it took for the milk to curdle. In conclusion my hypothesis was correct, the higher the temperature of the milk the faster the time it takes for the milk to curdle. VARIABLES Independent variable - the temperature of the milk inside the test tube. Dependant variable - The time it takes for the milk to coagulate (by performing the 90 degrees test) Controlled Variables - The size of the test tube, amount of milk poured into each test tube, amount of renin mixed inside test tube, same weather condition.

METHOD - Make a bucket full of hot water. Dunk a 250ml beaker inside bucket and fill about 200ml. - Get half a tablet of renin and put it inside a small beaker with 5ml water in it. Smash up the renin while inside the beaker and let it dissolve. - Pour 20ml of milk into a test tube and place it into the beaker with hot water. - place a thermometer inside the test tube and when the thermometer shows your needed temperature of the milk. - When the

temperature is reached quickly pour the dissolved renin into the milk and time how long it takes for the milk to curdle. To check if the milk has curdled, do 90 degrees tilt test. (turn the test tube 90 degrees and if the milk doesn't drip out then the milk has curdled. - record both time taken and the temperature at which you had poured the renin into the test tube. - Do the exact same thing but vary the temperature of the water so there is a range. - Repeat experiment and take averages for accuracy. TEMPERATURE - 20ml of milk poured into test tube. Temperature of the milk (degrees Celsius) Time Taken (minutes and seconds) to coagulate 1815min and 20sec 2712min and 3sec 354min and 30 sec 31min and 45sec 601min and 25sec pH LEVELS The aim of this experiment is to see how different pH levels affect the time it takes for the milk to curdle. My hypothesis is that the more acidic the milk is the faster it takes for the milk to curdle when renin is added to it. As pH increases, enzyme activity increases until it reaches an optimal point in which enzymes denatures and as pH increases, enzyme activity decreases. Trends in this experiment don't make proper sense due to inaccurate measurements of the temperature of the milk and inaccurate measurement of pH level.

Though I can say that at pH level 7 and 11 the time taken for the milk to curdle were really low and close, at pH level 8 the time taken was high and at pH level 9 no result was taken maybe because the enzyme doesn't function the at this particular pH level. In conclusion my hypothesis was correct, the more acidic the milk the faster the time it takes for the milk to curdle. Due to inaccurate measurement, correct results might not have been

obtained thus impacted on our results. VARIABLES Independent variable - the pH level of the substrate

Dependant variable - The time it takes for the milk to curdle Controlled variable - The size of the test tube, amount of milk poured into each test tube, amount of renin mixed inside test tube, same weather condition, same temperature of the milk inside the test tube. METHOD - Get half a tablet of renin and put it inside a small beaker with 5ml water in it. Smash up the renin while inside the beaker and let it dissolve. - pour 10ml of milk into a beaker then pour the milk out into a test tube. - add 5ml of 0.1 moles of NaOH (sodium hydroxide) into a beaker. - To see the change in pH look at the universal indicator chart to see the Level of pH. - Then add the dissolved renin into the test tube. - To check if the milk has curdled, do 90 degrees tilt test. (turn the test tube 90 degrees and if the milk doesn't drip out then the milk has curdled. - Record both time and level of pH. - Do the exact same thing but add different amounts of 0.1 moles NaOH so there is a range in pH level. - Repeat experiment and take averages for accuracy. pH LEVELS - Ph LEVEL Time Taken (minutes and seconds) to coagulate 73min and 36sec 87min and 23sec 9----- (didn't achieve any result) 14min and 11sec

SUBSTRATE CONCENTRATION The aim of this experiment is to observe how distinguishing concentration levels will affect the time at which the milk will curdle. My hypothesis is that the more concentrated the milk the faster the milk will curdle when renin is added to it. As the substrate concentration increases, so will the enzyme activity and hence there will be a quick reaction. However, only up to a certain point (where, if you drew a graph of

the reaction, the line will level off) as all the active sites in the enzyme are occupied and the reaction cannot go any faster.

Here more enzymes will be needed to speed up the reaction. The trend in this graph is that when the concentration of milk is full then the time taken for the milk to curdle while under the influence of renin is really quick. As the substrate concentration decreases the time taken for the for the milk to curdle takes a longer duration. Therefore we can say that the higher the substrate concentration the faster the curdling time (up to a certain point) and the lower the substrate concentration the longer the time.

In conclusion my hypothesis was correct. Due to inaccurate measurement, correct results might not have been obtained thus impacted on our results.

VARIABLED Independent variable - The concentration level of the milk.

Dependant variable - The time it takes for the milk to curdle. Controlled

variable - The size of the test tube, same amount of renin mixed inside test tube, same weather condition, and same temperature of test tubes. The trends are that the more concentrated the milk was with renin in it, the faster it took for the milk to curdle.

The less the concentration the longer the time was for the milk to curdle. In conclusion my hypothesis was correct the more concentrated the milk, the faster the milk will curdle when renin is added to it. Method - Get half a tablet of renin and put it inside a small beaker with 5ml water in it. Smash up the renin while inside the beaker and let it dissolve (Do 4 of these) - Get 4 test tubes and fill one with just milk (20ml), the next filled with 15ml milk and 5ml water, next one with 10ml milk and 10ml of water and finally the

last one with 15ml of water and 5ml of milk. Next pour the dissolved renin inside each test tube. - To check if the milk has curdled, do 90 degrees tilt test. (turn the test tube 90 degrees and if the milk doesn't drip out then the milk has curdled. - Record both the ml of water put into each beaker and measure the time taken for milk/milk with water to curdle. - Repeat experiment and take averages for accuracy. SUBSTRATE CONCENTRATION (20ml water) CONCENTRATION LEVEL Time Taken (minutes and seconds) to curdle Full milk 2min and 20sec 5ml of milk 2min and 25sec 0ml of milk 2min and 40sec 15ml of milk 4min and 10sec DISCUSSION QUESTIONS 8)

Temperature and pH affect the enzyme, not the substrate. Explain how extremes of temperature and pH level could alter the activity of an enzyme. at a certain temperature, the enzymes stop working, and any further increase in temperature will not help the enzymes activity any more. In the body, this is often around 37?? C. So as you increase temperature, the activity of an enzyme will increase, until you reach the optimum value.

After that, any further increase in temperature will result in denaturation of the enzyme, and a steep drop in activity. There is an optimum pH for each and every enzyme. At a pH above this optimum, the enzyme's activity will be reduced and therefore the reaction rate will be lowered; at a pH below this optimum, the enzyme's activity again will be reduced and lower reaction rates result. 3)The control experiment is just milk inside a beaker with no change in temperature of mixed with renin. It shows that milk does not curdle on its own.)Experiment can be enhanced if it is completed by a team of 4 because people can throw in ideas on how approach this experiment and accurately work out a method and all the variables for the experiment

appropriately. Working in a group puts less stress on individuals because you don't have to rush and do everything yourself, team mates can assist when it is required or they can do their own part of the experiment therefore the rate at which the experiment is done is increased which leaves time to sit down and communicate with each other on how to improve the experiment if needed.

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Working by yourself can often be difficult but if team mates are enthusiastic they can encourage and motivate you which leads to a better working team environment. 5) My results were as expected. All my hypothesises supported my expectation. 6) I would be more accurate with my measurements by using more precise measuring equipment e. g. Measurement of pH levels. I would do more ranges e. g. more temperature ranges to there is a trend, more pH level and more substrate concentration.

I should make more people time one test tube and then take averages for extreme accuracy. I should use smaller beakers for smaller measurements for accuracy. I should repeat the experiment several times. I should use more precise measuring equipment e. g. using pipettes for pH experiment. 4)The variables I controlled were the temperature of the room by closing the windows and doors and not turning on any air conditioner, same size test tubes by just using the same test tube, same volume of milk for all experiment (except the substrate concentration experiment).

Same size amount of renin used for all experiments (half a tablet dissolved in water). In Conclusion my hypothesis for every experiment was correct. All the factors, substrate concentration, pH levels and temperature affect the function of the enzyme (renin) and the speed at which the milk will curdle is affected when there is a change in temperature, change in pH of the milk and the concentration of the milk when renin is added to it.

Repetitions of the experiment should take place we are more accurate. Use of better equipment next time should make our results more exact. CAUTION - take care when handling chemicals. Wipe up spills immediately. Dispose of chemicals as directed. Wash your hands after handling chemicals. Safety glasses and disposable gloves should be worn and a lab coat.