CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Helena M. Attebury

Project Number
J0501

Project Title
Is the Fish Sold in Grocery Stores as Red Snapper Correctly Labeled?

Abstract

Objectives/Goals
My objective was to find out if grocery shoppers are getting what they#ve paid for behind the fish counter. I wanted to find out if the fish in grocery stores labeled as Red Snapper was actually Red Snapper.

Methods/Materials
I used fillets of Red Snapper from four different grocery stores and use a chelex and proteinase K solution to digest the samples to be genetically sequenced.

Results
All of the samples turned out to be a different fish than Red Snapper. The 50% of samples that were usable were all from the genus Sebastes, which is rockfish, instead of Lutjanus, which is Red Snapper. None of the samples were Red Snapper.

Conclusions/Discussion
The fish sold to customers in grocery stores is not Red Snapper. All of the fillets were types of rockfish. The season in which the fillets were purchased may have had an effect on how many of the samples were correctly labeled and environmental problems such as the BP gulf oil spill, where Red Snapper is normally caught, could have drastically affected the market for Red Snapper.

Summary Statement
After running genetic tests on fillets of Red Snapper purchased at grocery stores, it was found that none of the fish sold as Red Snapper were correctly labeled, they were all other species of fish.

Help Received
I received help from Thomas F. Schultz PhD, and Mark Attebury.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Nanita J. Balagopal

Project Number
J0502

Project Title
Vitamin C Fever

Abstract

Objectives/Goals
The objective of my project was to find out if heat or refrigeration affects the amount of Vitamin C in freshly-squeezed orange juice. My hypothesis was that heating orange juice will reduce the amount of Vitamin C, compared to refrigerated juice.

Methods/Materials
One ounce of freshly squeezed Washington Navel orange juice was placed into cups. The juices were placed at three different temperatures, 37 ºF, 70 ºF & 100 ºF for 6 hours respectively. A total of 4 trials at each of these temperatures were conducted. After 6 hours, 10 drops of starch solution, was added into each of these cups, followed by the addition of 2% Iodine in drops until the end point was reached. The end point is reached when the final solution turns into a deep blue color. The vitamin C content is measured by counting the number of drops of iodine it takes to reach the end point.

Results
The average number of drops for the juices placed at 37°F, 70°F & 100°F were 31.25, 28.5 and 27.25 respectively. The results indicate that the refrigerated orange juice had the most Vitamin C content and the heated orange juice had the least.

Conclusions/Discussion
My hypothesis was accurate. Heated orange juice had the least amount of Vitamin C content compared to the refrigerated juice. This study is significant because it is not only important to take in Vitamin C in the form of orange juice, but drinking it cold is going to make you healthier.

Summary Statement
How Heat and Refigeration Affects Vitamin C Content in Orange Juice

Help Received
My mom helped by getting the supplies and monitoring the 6 hour heating and cooling experiments while I was at school.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Glenda Chen

Project Number
J0503

Project Title
"C-ing" the Hot Potato: Measuring Vitamin C through Iodine Titration

Abstract

Objectives/Goals
The project was to determine whether lowering the power and extending the microwave cooking time has an effect on vitamin C remaining in cooked red yams. It was thought that the lowest power setting would preserve the most vitamin C.

Methods/Materials
One yam was left uncooked as the control. Four others were microwaved at 100%, 70%, 50%, and 30% power settings, with the time adjusted in an inverse proportion. Three liquid samples of each yam were made and titrated using an iodine, vinegar, and water solution.

Results
Overall, the amount of vitamin C did increase as the power decreased. In the 100% power group, 3.73 mg of vitamin C was detected, followed by 4.16 mg in the 70% power group, 4.35 mg in the 50% power group, and 4.65 mg in the 30% power group. The lowest amount of vitamin C was consistently detected in the raw yam, which is contrary to the fact that cooking destroys vitamin C.

Conclusions/Discussion
Lowering the power setting does preserve more vitamin C, as was hypothesized. It was also found that iodine titration is not a reliable method to detect all of the vitamin C present in raw yams.

Summary Statement
Changing microwave oven settings to fully cook a yam does affect the remaining vitamin C content.

Help Received
Father helped dissolve iodine stock solution in his lab.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Vasiliki S. Courelli

Project Number
J0504

Project Title
Breaking the Code of Life with Force & Fire: How Extraction Temperature and Mechanical Manipulation Affect DNA Shearing

Abstract

Objectives/Goals
The purpose of this science project is to investigate the shearing that occurs in DNA as a result of the incubation temperature of the specimen from which it is extracted and as a result of mechanical manipulation. When DNA extraction protocols require immersing the specimen in hot water, how hot should the water be? When DNA is collected, stored, and retrieved with pipettes, what degree of shearing does the force of suction through the pipette impose on the DNA? If DNA shearing is required, would pipettes be a tool to achieve it?

Methods/Materials
Commercial wheat germ was used as the specimen from which DNA was extracted. A widely used DNA extraction protocol was employed common for home use that requires wheat germ to be manipulated in hot water, with the addition of commercial dishwashing liquid detergent, and very cold isopropyl alcohol. The temperature of the hot water in which wheat germ was initially immersed was varied and the degree of shearing of the collected DNA was evaluated. Similarly, application of mechanical manipulation vs. no application of mechanical manipulation was assessed as it affects DNA shearing. The degree of shearing was evaluated visually, via optical microscope, and computationally, via gel electrophoresis. The distance that DNA traveled in the gel was used as a quantitative measure of the degree of DNA shearing. DNA shearing was evaluated visually by assessing "stringiness" of DNA samples observed through an optical microscope.

Results
Incubation temperature of the specimen DNA is extracted from plays an important role in DNA shearing. As the temperature increases, the degree of shearing increases too. The degree of shearing, however, increased faster with the application of mechanical manipulation on the DNA sample. It is worth noting that in the range of 90C-100C the applied mechanical manipulation did not increase the degree of DNA shearing. A plausible explanation might be that at that temperature range, protein denaturation had already caused substantial shearing that the subsequent mechanical manipulation did not break the DNA substantially.

Conclusions/Discussion
The results suggested that increase in incubation temperature increases DNA shearing. The application of mechanical manipulation increases DNA shearing also. A combination of the two makes shearing more pronounced up to a certain level when both procedures produce the same degree of DNA shearing.

Summary Statement
The purpose of this science project is to evaluate the shearing occurring in DNA when it is manipulated mechanically or when it is extracted through protocols that require incubation of the specimen from which it is extracted.

Help Received
I would like to thank my parents for giving me courage when my experiments did not work, discussing with me what might have gone wrong, and giving me the money to buy the material and the equipment that I needed, and my Science Teacher for his understanding with all the challenges I faced.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Stella R. Crall

Project Number
J0505

Project Title
Fresh, Frozen, or Off the Tree, Which Has More Vitamin C?

Abstract

Objectives/Goals
This project focuses on whether the amount of Vitamin C diminishes over time in different types of orange juice. The juices I will be testing are freshly squeezed orange juice from a tree, store-bought in a container, and frozen orange juice. I will also be testing a Vitamin C solution (made from a tablet) as my control.

Methods/Materials
For the first step, I needed to make one gallon of indophenol solution. (Indophenol is a Vitamin C indicator.) Then I tested Vitamin C tablets in a solution to use as a control sample. Before I started to test the juice I needed to pick the 6 fresh oranges to make the fresh orange juice, buy fresh squeezed pre-packaged orange juice, and make orange juice from a frozen concentrate package. For each type of juice I needed to measure out 10 ml of the indophenol solution and 10 ml of water. I then used a medicine dropper to add the juice to the indophenol solution and to the water, counting the drops until the two liquids became the same color. Then I repeated this process each day for the next 10 days and made a graph to show exactly how much Vitamin C decreased during the test period and the difference in the amount of Vitamin C between the different types of juices.

Results
The fresh orange juice had the most Vitamin C over the 10 days but it also diminished the most during that time. The frozen lost the least even though it had the least amount of Vitamin C to begin with. Vitamin C in container juice did diminish over time, more than the fresh squeezed and less than the frozen.

Conclusions/Discussion
My hypothesis was that the frozen orange juice would have the least amount of Vitamin C lost over the 10 days because when the juice was frozen it froze the Vitamin C. When I thawed the juice, I thought the Vitamin C would stay in the juice longer. My hypothesis was correct; the frozen juice lost the least amount of Vitamin C. I did notice that one day I did not shake the juice before testing and that made the Vitamin C content significantly less. If I were to test this again, I would see if shaking the orange juice before testing would make a difference.

Summary Statement
This project tests the amount of Vitamin C lost over time in different types of orange juice.

Help Received
My dad helped me mix the solutions.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Patricia E. De Asis

Project Number
J0506

Project Title
What's in Your Milk?

Abstract

Objectives/Goals
The objective of this experiment was to determine whether whole cow, reduced fat cow, goat, human, or almond milk contained the most casein proteins. My hypothesis was that the whole milk will contain the most casein proteins compared to the other types of milk tested since it has little or no essential nutrient removed after being processed.

Methods/Materials
To perform this experiment, I first measured out the initial pH of the whole milk with a pH meter. Then I poured the milk into a pot and heated to 70 degrees Celsius on a hot plate. I poured 60 ml of the warm milk into five different Tupperware containers and added 1 teaspoon of vinegar onto each Tupperware container mixing it for two minutes. After allowing the milk to sit for two minutes, I then separated the casein and whey by pouring the substance through a coffee filter strainer. The casein proteins precipitated into white curds and the remaining liquid is whey. Then I measured the pH meter of the whey and transferred the white curds onto foam plates. After, 24 hours I measured the mass of casein proteins using a scale and the casein removal process was repeated for the four other types of milk, and five trials were done for each.

Results
With the final data, the reduced-fat cow milk contained the most casein proteins. On average, the reduced-fat cow milk contained 10.4792 grams of casein proteins. However, the whole cow milk did have a fairly close average with 10.3886 grams. The next type of milk that had the most casein proteins was the almond milk with the average of 4.3632 grams. On the other hand, human milk had one of the lowest amounts of casein proteins with an average of 2.9458. Lastly, the goat milk contained the least amount of casein proteins with an average of 0.7524.

Conclusions/Discussion
My hypothesis that the whole cow milk would contain the most casein proteins was rejected by the data collected. The reduced-fat cow milk contained the most casein proteins out of all the types of milk tested. However, whole cow milk did have a fairly close resulting data with the reduced-fat cow milk. Therefore, despite the fact that the reduced-fat cow milk did contain the most casein proteins, research still shows that whole milk is the best alternative for human milk as a source of proteins for infants and toddlers.

Summary Statement
This project was conducted to understand the amount of casein proteins in different types of milk.

Help Received
Mother helped put together board; Science teacher helped and supervised during experiment; classmates edited papers.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Naomi L. Epps

Project Number
J0507

Project Title
Breaking the Bond: The Optimum Temperature for Lactase Activity

Abstract

Objectives/Goals
My objectives are to find the temperature at which the enzyme lactase has the fastest rate of reaction breaking the glycosidic bond in lactose ("milk sugar") resulting in glucose and galactose. This is called the "optimum temperature" for lactase activity. In addition, I want to find the temperature at which lactase is destroyed (denatured) by heat.

Methods/Materials
Using a glucose meter, I measured glucose concentrations in milk samples, 10 minutes after adding a controlled amount of lactase (2,555 FCC units of Nature's Way Lactase made from aspergillus fungus) to a controlled amount of non-fat milk (300 ml). I varied the temperature of the milk/lactase samples from 35 degrees F to 180 degrees F. I tested each sample 6 times in rapid succession, at temperatures throughout this range and I calculated the standard error. In total, I took 108 glucose concentration measurements.

Results
My data shows that heat speeds up the reaction rate of lactase activity as it breaks the glycosidic bond in the double-sugar, lactose, resulting in the two single-sugars of glucose and galactose. The reaction rate increases from 35 degrees F up to the range of 125 to 135 degrees F where it drops off dramatically. So by definition, 125 to 135 degrees F is the "optimum temperature" (range) for lactase activity. At temperatures higher than this range, the enzyme quickly becomes denatured and therefore unable to break down the milk sugar.

Conclusions/Discussion
It should be noted that this data is specific to this particular fungal enzyme in the particular substrate (non-fat milk) tested. However, given the findings, since the human body's internal temperature is about 99 degrees F, it may be more efficient to add lactase to milk at 125 degrees F rather than ingesting lactase as a dietary supplement. Also, it is important not to heat this lactase beyond 125 degrees F because it will quickly lose its effectiveness. In other words, don't add this lactase to your hot chocolate if you are lactose intolerant because it won't break down the milk sugar!

Summary Statement
My project is to determine the "optimum temperature" for a commercially made lactase enzyme to break down milk sugar and to consider the implications for lactose intolerant people.

Help Received
My sister, Wendy, taught me the chemistry, my brother, Brenden showed me the glucose meter, my mom helped with the experiment, my dad helped with the calculations, my sister, Melody, and friend, Mimi, helped with Excel, my sister, Helena, proofread, and my teacher, Ms. SB, helped with APA format.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Ryan C. Fong

Project Number
J0508

Project Title
Determination of Similarities and Differences of Family Members using a DNA Profile

Abstract

Objectives/Goals

My objective is to determine if DNA profiles will allow me to compare the differences and similarities of my family members. Many family members and friends have told me that I physically look like my father and my little brother physically looks like my mother. My other friends say that I look like my mother and my brother looks like my father. DNA analyses using saliva were performed and fifteen different genes were evaluated. Based on the separate genes of the DNA, I used specific locus on the genes to evaluate my similarities and differences to my parents and my brother.

Methods/Materials

Collect saliva samples using swabs. Perform in duplicate (2 swabs per person).
Prior to collecting samples, do not eat or drink for 30 minutes.
Saturate the swab with cheek cells and saliva. Make sure to rub firmly against the inside of the cheek as well as under the tongue and behind the lips.
Allow one hour to dry.
Epicentre Biotechnologies QuickExtract DNA test kits were used. Place sample into tube containing DNA extraction solution. Mix for 15 seconds.
Incubate sample at 98ºC for 2 minutes.
Analyze sample on the Applied Biosystem Genetic Analyzer, which produces a DNA electropherogram.

Results

There were a total of fifteen different genes evaluated. These fifteen genes analyzed for are different for every person. Each person has these genes but may express at different locations on the genes, called the locus or loci.
I evaluated the similar locus/loci from in each subject. Comparing the similar locus/loci to my mother, we share sixty-five percent of the genes analyzed for. My father and I share seventy-six percent of the genes analyzed for and my brother and I share eighty-seven percent.
A comparison of my brother to my mother and father are quite different. My brother and my mother share fifty-eight percent of the genes analyzed for and sixty-eight percent with my father.

Conclusions/Discussion

This experiment would lead me to conclude that I am most similar to my brother, followed by my father, then my mother. Although I have many similarities to my father of the genes analyzed, it has yet to be determined what each of these genes does in the body. Most of these genes may indicate how cells are made. Also if more genes are analyzed, the results may differ.

Summary Statement

Determination of Similarities and Differences of Family Members using a DNA Profile

Help Received

Used laboratory supplies and equipment under the supervision of Dr. Leonard Fong at Agricultural & Priority Pollutants Laboratory in Clovis, California. My father helped me print the poster board.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Hari Garg

Project Number
J0509

Project Title
Can Fibronectin Affect Cell Spread and Inhibit the Spread of Cancer? A Confocal Image Analysis

Abstract

Objectives/Goals
The objective of this project is to determine the effect of concentration of fibronectin substrate on the amount of focal adhesions expressed by the cell and on the cell spread.

Methods/Materials
Fibronectin concentration (0,l,2,3,4, 8 µg/ml)were prepared. A stable lines of CHO cells with green fluorescent protein were placed in these microwells. 6 independent trials were conducted using 6 different concentrations of fibronectin.
Olympus Fluoview Confocal Microscope was used to capture images.
The cell spread data was analyzed with the Olympus Fluoview viewer software.
Image J was used to analyze the number and area of focal adhesions.

Results
Cell Spread: CHO cells placed in microwell with no Fibronectin, showed no spread and remained the size of 10 µm each. Cells placed in 1 µg/ml showed an average spread of 41.43 µm with a 2 standard error of 17.99µm. Cells placed in higher concentrations showed increasing spread.
Focal Adhesions: With no fibronectin, only 3 focal adhesions existed with total focal adhesion area of 10 square µm. Increasing the concentration of fibronectin, the number of focal adhesions increased to 199 and their total area grew to 625.28 square µm.

Conclusions/Discussion
The amount of focal adhesions and cell spread increased with the increase in concentration of fibronectin. One of the unique finding reported through my analysis, that has never been reported before, was that the increase in focal adhesion area was not proportional and was much larger than the increase in concentration of substrate material. For example, 4 times increased concentration of fibronectin resulted in an 8 times increased area of focal adhesions.
This is an important finding because drug designers may create compounds to reduce fibronectin concentration in the vicinity of tumor and therefore inhibit metastasis (spread of cancer).

Summary Statement
This project determined the effect of changing the concentration of fibronectin on the amount of cell spread thereby identifying a factor that can inhibit spread of cancer.

Help Received
Mrs. Driscoll, my science teacher was my advisor. She reviewed and edited my project report. Confocal images were captured at UCI lab. Olympus Fluoview provided free licence to use software.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kerry Anne Haggerty

Project Number
J0510

Project Title
The Effect of Fat and Protein on Milk Foam

Abstract

Objectives/Goals
The objective of this experiment is to investigate the relationship between fat and protein in milk foam and determine the amount of egg white that is needed to compensate for the fat in whole milk and achieve the same foam height as non-fat milk.

Methods/Materials
Eight different liquid combinations of 3 tsp. were tested including distilled water, skim milk, whole milk, and five mixtures of whole milk and egg white starting with a ratio of 2.5 to 0.5 tsp. and increasing the egg white by 0.25 tsp. every sample. I shook each combination for 40 sec. and measured the foam height at 0, 3, 6, 9, 12, 15, 20, and 30 min. I ran three trials of each sample.

Results
Neither distilled water nor whole milk produced foam. Skim milk produced the most foam of all the samples. Contrary to my hypothesis, the formula 1.75 tsp. whole milk and 1.25 tsp. egg white created less foam than skim milk, however, it stabilized in a similar way as skim milk. Although the formula 1.5 tsp. whole milk and 1.5 tsp. egg white did not produce as much foam as skim milk, it stabilized to a significantly higher foam height.

Conclusions/Discussion
My hypothesis that the formula with 1.75 tsp. whole milk and 1.25 tsp. egg white would produce the same foam height as skim milk was incorrect, although that formula stabilized similarly to skim milk. It is not possible to compensate fully for the fat in whole milk using egg white. Experimenting with other additives like lecithin would provide interesting information.

Summary Statement
The experiment investigated fat and protein in creating milk foam to determine whether egg white can compensate for the fat in whole milk and the amount needed to achieve the same foam height as non-fat milk.

Help Received
In class, I learned about the scientific method. My science teacher helped me develop a procedure for my experiment. My parents helped me purchase the materials.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Katherine N. Jabba

Project Number
J0511

Project Title
What's Finer? Refined or Unrefined Sugar? The Effect of Sugar Type in the Yeast Metabolism Process

Abstract

Objectives/Goals
Yeast is used in bread-making. For yeast to produce carbon dioxide, it must be mixed with sugar and water. The objective is to determine if the type of sugar has an effect on the amount of carbon dioxide the yeast produce. The experiments were conducted in two phases. The Phase 1 hypothesis was to determine if unrefined sugar would produce more carbon dioxide in 20 minutes. For Phase 2, the experiment was conducted for 2 hour duration to determine if the rate of carbon dioxide production would change over a longer time period.

Methods/Materials
This project tested refined (granulated) sugar, and unrefined (turbinado) sugar mixture. As a control, yeast and water with no sugar was tested. An apparatus was built using a reaction vessel to hold the mixture of yeast, sugar and water, an aerator pump to aerate the yeast-sugar-water mixture, an inverted cylinder to measure the amount of carbon dioxide produced, and tubing to connect the apparatus parts.

Results
In Phase 1, the unrefined sugar produced twice as much carbon dioxide. In Phase 2, the refined sugar produced 198 more milliliters of carbon dioxide than the unrefined sugar in two hours, about 10% more. The experiment also proved that the yeast does not produce carbon dioxide without sugar.

Conclusions/Discussion
The results of the Phase 1 experiment supported the hypothesis, but the results of Phase 2 experiment did not support the hypothesis. The refined sugar produced about 10% more carbon dioxide consistently throughout the two hour testing period during Phase 2. The reason for the result variation between the phases of experimentation is unknown but could be due to a batch variation between bags of unrefined sugar. This information can be used to determine the preferred type of sugar for bread-making.

Summary Statement
This project compares the amount of carbon dioxide produced by refined (granulated) sugar and unrefined (turbinado) sugar in the yeast metabolism process.

Help Received
My father, Ronald Jabba, assisted me in setting up the apparatus and proofreading my report. He also allowed me to use the aerator pump and thermometer from his laboratory at work. My science teacher, Mrs. Toegemann, assisted me in finding a project topic and guiding me through the scientific method

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Saumya R. Keremane

Project Number
J0512

Project Title
Biochemical Analysis of Color Development in Citrus: Year 2

Abstract

Objectives/Goals
Pigments such as lycopene, beta carotene, and phytoene provide immense health benefits. A better understanding of the mechanisms of carotenoid biosynthesis may lead to the rapid development of improved crop varieties. The goal of this project is to understand the biochemical basis of color development in citrus fruits.

Methods/Materials
Four varieties of citrus with different flesh colors were selected for the study: Oroblanco grapefruit (white), Moro blood orange (red), Star Ruby grapefruit (pink), and Washington Navel orange (orange). The sequences of phytoene desaturase and lycopene beta cyclase genes involved in carotenoid biosynthetic pathway were obtained for inital primer design based on the Arabidopsis genome database (TAIR) and the EST database of citrus. Fruit albedo and juice sac RNAs were reverse transcribed, coding regions of the two genes were amplified by PCR, cloned and sequenced. SYBR green based quantitative PCR was used to analyze expression levels of these two genes. Transcripts of phospholipase-D (Ankyrin), a house keeping gene were used for normalization.

Results
Alignment of the coding region sequences of both phytoene desaturase and lycopene beta cyclase genes showed amino acid differences in eleven positions each. Real time qPCR assays showed that in dark pigmented Moro blood orange and Star Ruby grapefruit, expression of both phytoene desaturase and lycopene beta cyclase was at least five-fold higher than the expression in Washington navel orange and Oroblanco grapefruit.

Conclusions/Discussion
Blood oranges are known to have originated as somatic mutants of sweet orange; sequence variability and differential gene regulation involved in the carotenoid biosynthetic pathway may cause small, yet crucial differences leading to changes in fruit color pigments. The study reveals a considerable increase in the gene expression levels of two major enzymes in the carotenoid biosynthetic pathway in the dark colored fruits of Moro blood orange and Star Ruby Grapefruit. The significance of the observed amino acid differences requires further elucidation.

Summary Statement
Citrus fruits with darker pigments had up-regulation of the carotenoid biosynthetic pathway genes, and single nucleotide polymorphisms leading to amino acid differences.

Help Received
Research was done in the United States Department of Agriculture, National Clonal Germplasm Repository for Citrus and Dates, Riverside, CA. I thank Dr. Richard Lee and members of the laboratory for generously providing facilities and guidance.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Shivani Lamba

Project Number
J0513

Project Title
Cheese Pleez!

Abstract

Objectives/Goals
My goal is to determine how the concentration of fat(fat free, 2%, whole milk - 3.5%, and heavy whipping cream - 36%) affects the amount of coagulation in milk by adding an acetic acid.

Methods/Materials
To conduct this experiment, 1000 mL of fat free, 2%, whole milk, and heavy whipping cream, 200 mL of vinegar, 5 small strainers, 1 measuring cup, and a stove with 4 burners were used.

To investigate the problem, 200mL of fat free milk was poured into a bowl. When the milk started to boil,10mL of vinegar was added to the bowl. After 10 minutes, the liquid was strained. The extraneous solid was left to drain the excess whey in the strainer for 15 minutes. Then the mass of the cheese was measured on the balance scale. These procedures were completed five times each with different concentrations of fat in milk: 2% milk, whole milk, and heavy whipping cream. The cheese was measured in grams.

Results
Fat free milk curdled an average of 24 grams of extraneous solid. The amount of cheese produced from the 2% milk was 22.6 grams. The whole milk coagulated an average of 19.8 grams. The heavy whipping cream did not curdle.(0 grams)

Conclusions/Discussion
I tested how the concentration of fat affected the amount of curdling in milk. I suggested that the heavy whipping cream (36% fat) would curdle the least because in a higher concentration of fat, there are less casein micelles.

Casein micelles are molecules that hold casein proteins. In the micelle, the casein proteins are held together by CCP-colloidal calcium phosphate. Calcium is hydrophobic, so it does not dissolve in water. However, when an acid is added to the milk, the calcium in the casein begin to dissociate into the solution. When a little bit of calcium dissociates, the caseins alphas1 and alphas2 begin to coagulate. When about half the calcium is dissociated, the casein beta starts to coagulate. Then, when the milk reaches its isoelectric point, when all the calcium is dissociated, the last casein, kappa, starts to coagulate. Fat content is inversely proportional to protein content, and protein content is directly proportional to casein content, hence directly proportional to calcium content. That was why the heavy whipping cream curdled the least.

Summary Statement
Milk undergoes a process known as coagulation, in which caesin micelles first dissociate into solution and finally aggregate through the means of acidification and heat; as a result, a new precipitate, cheese, is created.

Help Received
Brother helped with research, Mother helped with experiment

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Hagop R. Margossian

Project Number

J0514

Project Title

Enzyme Catalyzed Reactions: What Affects Their Rates, What Inhibits It?

Abstract

Objectives/Goals

My goal was to evaluate the reaction rate of enzyme catalyzed reactions such as the breakdown of hydrogen peroxide into oxygen and water(2H202------>H20+02) under different subsstrate temperatures and different enzyme catalase concentrations. I also wanted to see the effects of copper sulfate inhibitor on the rate of reaction.

Methods/Materials

To measure enzyme activity in breaking down the hydrogen peroxide, I observed the release of oxygen, which is proportional to the rate of reaction. I did this by first immersing a filter disk in catalase extract(filtered from potato tubers), and then placing the disk into a beaker with 3% hydrogen peroxide. The oxygen released from the breakdown, caused the disk to rise and float. The time, from the initial placement, to the final rise, is inversely proportional to the reaction rate. I conducted over 75 trials, with variations(5 trials per variation), of temperature, enzyme concentration, and inhibitor concentration.

Results

The rate of reaction increased by increasing temperature of the substrate, and by increasing enzyme catalase concentration. I also noticed decrease reaction rate by increase of copper sulfate concentrations, until the reaction rate stopped at 0.05g of copper sulfate solution.

Conclusions/Discussion

Study of the variables of temperature, enzyme concentration, helped to achieve optimum level of enzyme activity. Adding inhibitors also demonstrated the competittive effect of certain metal ion solutions on enzyme activity. This emphasized the importance of these variables to control enzyme reactions which could be used in food processing, health care and other applications.

Summary Statement

Evaluating enzyme activity under different substrate temperatures, enzyme concentrations, and inhibitor concentrations.

Help Received

Father helped to supervise and order the supplies and instruments; Mother helped with board.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Marlen Miranda

Project Number
J0515

Project Title
What Material Can Help Neutralize the Stomach Acid (HCl)?

Abstract

Objectives/Goals
The purpose of the experiment is to determine which materials neutralize the stomach acid. The materials that will be used to neutralize the Hydrochloric Acid are Tums, Rolaids, Antacid CVS Brand, lemon juice, and Baking Soda.

Methods/Materials
Crush one antacid tablet using a mortar and pestle.
Weigh the crushed tablet.Add exactly 100mL of 0.09 M HCl to the flask and gently swirl the flask. 3 drops of methyl orange indicator solution to the flask. Titrate the solution with your standardized NaOH until the indicator just turns yellow-green.Record the volume of NaOH solution.Repeat steps 1-6 five more times using the same brand of antacid tablet. Repeat steps 1-7 using (Tums, Rolaids, Cvs Brand Antacid,Baking Soda, and Lemon).

Results
The three antacid tablets had slightly the same results. The three antacid tablets left residues in the solution. It was a difference of 0.001mols of HCl/ 1.0 g antacid. Lemon Juice was not applicable. Baking Soda had 0.155 mols of HCl/ 1.0 g antacid and didn#t left residue.

Conclusions/Discussion
The best antacid was the Baking Soda followed by Tums, CVS Brand, and Rolaids at last the Lemon juice.

Summary Statement
The purpose of the experiment is to determine which materials neutralize the stomach acid.

Help Received
Mrs. Dickerson gave her time; Saint Augustine High School provided lab and materials; Luis Miranda Jr. helped on ideas; Mrs.McHale helped supervised

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Anchit Narain

Project Number
J0516

Project Title
Enzyme Catalyzed Reactions: What Affects Their Rates?

Abstract

Objectives/Goals
To test the enzyme count in raw and cooked vegetables as a means to determine which of the two is healthier for human consumption.

Methods/Materials
1. Five 100 mL beakers were labeled with their specific temperatures of 0, 10, 20, 30 and 40°C and each contained 80 mL of 1% Hydrogen Peroxide. In a blender, 50 grams of fresh peeled potato, 50 mL cold water and crushed ice were blended together to act as a sufficient 100% enzyme solution. Five other 100mL beakers were labeled with the same temperatures and contained 100mL of the fresh peeled potato catalase. These beakers were either heated or cooled to reach their specific temperatures.

2. The catalase was experimented at the five different temperatures. 5 cut cotton disks, each 1cm in diameter were individually dipped in the catalase mixture for two seconds and then transferred into the 1% hydrogen peroxide beakers. The time taken for each cotton disk to rise to the top of the beaker was recorded on a chart. This was done for each of the five disks (at each temperature).

Results
As the temperature increased, so did the speed with which the cotton moved to the top of the beaker.However,beyond a certain temperature, the heat started to break down the enzymes, thus denaturing them. At 40 Deg.C, there were no movement as the enzyme had denatured. The rate of reaction increased from the 80% potato catalase mixture during the 100% catalase mixture trial. Also, hydrogen peroxide concentration contrasted the results. At 10% H2O2, the chemical reactions were too fast to record. At 1% H2O2, the enzyme denatured at 40°C, began to slow down at higher temperatures, and the speeds were between 8-23 seconds. This supported my hypothesis because after 20°C, the fastest period of acceleration, the speed began to decline.

Conclusions/Discussion
In conclusion, I state that the ideal cooking temperature to keep the most enzymes intact is 20°C. However, this would mean that that eating raw food is healthier than eating cooked food. Temperature and the concentration of the substrate molecules affect enzyme acceleration. The hypothesis that too much additional temperature could harm enzymes is therefore correct. To lead a healthier lifestyle, eat raw vegetables as they keep the most enzymes intact.

Summary Statement
The project describes the effect of temperature on enzyme activity

Help Received
Used lab equipment at Granite Ridge Intermediate School under supervision of Ms. Lindstrom; Father helped upload application form

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Diana M. Pasternak

Project Number

J0517

Project Title

Evaluation of Monoclonal Antibodies for HER-2 Neu Status in Breast Cancer

Abstract

Objectives/Goals

An invasive type of breast cancer, identified by the amplification of the HER-2 neu gene, affects 20 to 30% of newly diagnosed patients. I evaluated Monoclonal Antibodies for HER-2 neu status in breast cancer. I predicted the Rabbit Monoclonal Antibody (RMab) without heat pretreatment applied to tissue biopsies would produce faster and clearer results. FDA approved testing using a heat pretreatment often damages the breast tissue leading to inaccurate results; and therefore, patients will not receive the proper treatment of Herceptin Therapy.

Methods/Materials

Materials include breast cancer biopsies, microscope slides, the FDA approved Mouse Monoclonal Antibody HER-24 (MMab) and a new generation of RMab SP4 and EP4. I performed the FDA recommended Immunohistochemical protocol which is a special staining process performed on formalin-fixed, paraffin-embedded breast tissue biopsies. Tissue biopsies were subjected to heat and non-heat pretreatments.

Results

The FDA test results are ranked as 0 (negative) to 4 (strongly positive) which appears as a chicken-wire pattern of intense staining and uniformity. After testing 12 breast cancer tissues, the RMab and MMab produced acceptable results with heat pretreatment. The RMab SP4 and EP4 produced good results without heat; however, the RMab SP4 with heat pretreatment yielded unacceptable cytoplasmic staining. The RMab EP4 produced a good signal with both heat and non-heat pretreatments.

Conclusions/Discussion

The results indicate that the RMab EP4 without heat pretreatment applied to tissue biopsies produced clearer and faster results to detect the overexpression of HER-2 neu. My hypothesis was correct because heat pretreatment can sometimes destroy or damage the tissues. The advantage of this experiment is that the RMab can detect these proteins without having to apply heat. Accurate detection of the overexpression of the HER-2 neu gene will benefit cancer patients because it responds to a treatment with a new target therapy called Herceptin.

Summary Statement

The purpose of my study was to compare Mouse and Rabbit Monoclonal Antibodies for the Immunohistochemical Identification of HER-2 neu status in breast cancer patients.

Help Received

Dr. Alfonso Heras, President and CEO of Bio SB, Inc. helped with the interpretation of data, and I performed the experiments in his research laboratory. Lab assistance provided by employee, Gretchen King.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sonam H. Patel

Project Number
J0518

Project Title
Catalytic Conquest: Exploring the Effect of Temperature, H(2)0(2) Concentration, and Alcohol on Catalase Kinetics

Abstract

Objectives/Goals

1. Adding more substrate will increase the volume of oxygen linearly, so the rate of oxygen production / concentration of peroxide should remain constant.

2. The higher the temperature, until the optimum temperature is reached, the faster the reaction will proceed. I believe the optimum will be lower than human body temperature. An increase in temperature increases the activity of molecules and increases the likelihood of interaction.

3. Alcohol will inhibit catalase activity since it competes for the same binding site as peroxide.

Methods/Materials

1. Blend 100 grams of sweet potato mixed with 150 mL of water and blended it into a house hold blender, final concentration of .50 g/mL of catalase. Aliquots of 2.5 mL were used as the source of catalase for all experiments, placed in three-valve flask(E). Varying amounts of peroxide added through syringe(C). Oxygen volume measured in mL through syringe (G).
2. Flask placed in water bath, placed on top of heating plate. Thermometers recorded water bath and internal catalase / peroxide temperature. 2.0 mL of peroxide added to flask through C. Oxygen generated during the reaction was measured over time in set periods(10 seconds)in the syringe. Starting temperature was 20 C, from which water bath temperature was raised or lowered.
3. Alcohol added through same syringe as peroxide(C)in varying amounts, 1.0 mL, 1.5 mL, 2.0 mL. Amount of peroxide(2.0 mL)and catalase (2.5 mL of .5g/mL) was kept constant.
Syringe,Thermometer,Rubber Stopper,Hydrogen Peroxide,Ethanol,Water bath,Heat Plate

Results

1. With varying amounts of H2O2 at room temperature, we found that with more substrate amount, the oxygen production was higher.
2. The rate of O2 production is higher at 25 degrees and 35-37 degrees.
3. Alcohol inhibits the catalytic activity, therefore, not much O2 is produced.

Conclusions/Discussion

In line with my hypothesis, the higher the temperature, the faster the reaction progress, until it pasts a certain temperature. Secondly, increasing the concentration of peroxide did not increase the rate of oxygen production per unit peroxide added. Lastly, alcohol has an inhibitory effect on catalase activity.

Summary Statement

My project is on how different variables, such as hydrogen peroxide, temperature, and alcohol, affect the rate and volume of oxygen produced in a catalytic reaction.

Help Received

Parents helped with research and materials; Brother helped with the experiment; Cousin reviewed write-up

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kruthi Renduchintala

Project Number

J0519

Project Title

The Effect of Enzyme Concentration on the Reaction Rate

Abstract

Objectives/Goals

Enzymes are organic catalysts that speed up reactions by decreasing the activation energy needed to start the chemical reaction. Therefore, my hypothesis is that as the enzyme concentration increases, the speed of the chemical reaction will also increase. Using the 0% enzyme concentration should lead to the disk not rising because of the lack of reaction between the distilled water and hydrogen peroxide.

Methods/Materials

The manipulated variable is the enzyme concentration, while the responding variable is the amount of time it takes for the paper disk to rise to the top of the hydrogen peroxide solution. First, extract the catalase enzyme from the potato. Then dip a construction paper disk into different solutions that consist of either 2.5 ml, 5 ml, 7.5 ml, or 10 ml enzyme and enough distilled water to have a final volume of 10 ml. Afterwards, place the paper disk into a solution of hydrogen peroxide. Using a stopwatch, measure the time it takes for the paper disk to rise to the top of the hydrogen peroxide solution. This measurement is a way of recording the speed and efficiency of the rate of reaction. For each enzyme solution, take results from ten trials.

Results

The results show that as the enzyme concentration increases, the time for the disk to rise decreases. The distilled water, or 0% enzyme concentration, leads to no chemical reaction at all. According to the statistical results, or standard deviations, the results of this experiment are reliable.

Conclusions/Discussion

The highest catalase enzyme concentration was able to speed up the reactions by quickening the process of the disk rising. When absorbed in an enzyme concentration, the disk would rise, but when dipped into the 0 ml enzyme concentration, or distilled water, there was no reaction between the water and hydrogen peroxide, causing the disk to sink. This experiment can prove that increasing the amount of the enzyme concentration results in a faster reaction.

Summary Statement

This experiment focuses on how catalase enzyme concentration affects the reaction rate while using a substrate of hydrogen peroxide.

Help Received

Project reviewed by teacher.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Daniel Reyes

Project Number
J0520

Project Title
Maximizing DNA Isolation

Abstract

Objectives/Goals
The objective of my project is to determine a formula and procedure to maximize the isolation of DNA by variation of enzymes, sodium chloride and alcohol concentrations.

Methods/Materials
DNA was extracted from strawberries using a typical formula and then a process of iteration was conducted in which different concentrations of enzymes, sodium chloride and alcohol where evaluated and measured in order to derive the formula which would maximize the isolation of DNA.

Results
After testing five unique variations, my final results showed that by changing the amount of enzymes from 1gr to 0.125gr and using 91% concentrated alcohol I was able to maximize the isolation of DNA. My isolated DNA increased from 30% visibility using the typical formula to 60% visibility using my developed formula.

Conclusions/Discussion
One of the most important steps in my project was the measurement of DNA. I initially measured DNA visibility using naked eye and normal light. In order to increase the accuracy of my measurements I built my own Spectrophotometer which gave me a more accurate image of my DNA from which I was able to measure DNA visibility more accurately and was able to confirm the results of my formula.

Summary Statement
My project successfully developed a procedure and formula for Maximizing the Isolation of DNA by studying the variation of enzymes, sodium chloride and alcohol concentrations.

Help Received
Mother helped type report and keep journal up to date; Dad helped cut the material to build my Spectrophotometer; My uncle Genaro Hernandez gave me friendly advise on how could I measure my extracted DNA.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Nikash D. Shankar

Project Number
J0521

Project Title
Striking a Blow for Alzheimer's Disease: Role of ApoE Mediated Inflammatory Pathways on Tau Phosphorylation

Abstract

Objectives/Goals
In the past Alzheimer's research was focused on Amyloid B, but now it has also encompassed ApoE mediated phosphorylation of Tau. The purpose of my project is to study the inflammatory pathways mediated by ApoE4 and reduce phosphorylation of Tau, and find a potential therapeutic target for Alzheimer's Disease. The objectives of this study were to determine: 1) the effect of treatment with Lithium Chloride on Phosphorylated GSK-3B-Ser9 and Phosphorylated Tau in neuro2a cells transfected with ApoE4 and ApoE3 in a time- and dose-dependent manner; 2) the effect of the difference in inhibition of GSK-3B pathway in cells transfected with ApoE3 and ApoE4.

Methods/Materials
Neuro2a cells were cultured in EMEM+10%FBS+1%Pen-strep, plated into 6 well plates, then transfected with ApoE4 and ApoE3 plasmids. Non-transfected cells were used as controls. After 24 hours of transfection, the cells were treated with Lithium Chloride (1mM, 5mM, 10mM), 10µM TDZD (positive control), and distilled water (negative control). After 1 and 2 hours, the cells were lysed and protein was extracted. Western Blot Assay was used to determine the levels of Total and Phosphorylated Tau, and Phosphorylated GSK-3B. Additionally, protein concentrations were measured using the Bradford Assay.

Results
Phosphorylated GSK-3B-Ser9 was detected following the Lithium Chloride and TDZD. This effect was only observed for Lithium Chloride in a dose dependent manner for ApoE4 transfected cells. For ApoE3 transfected cells, the Phosphorylated GSK-3B-Ser9 was most detected in the 1mM, less in 5mM, and least in 10mM of Lithium Chloride in 2 hour time exposure. The Phosphorylated GSK-3B-Ser9 bands were stronger for cells transfected with ApoE3 than ApoE4. Total and Phosphorylated Tau was not detected in any cell lysates possibly due to minimal amounts of protein present and protein degradation. Additionally protein levels were detected to be low in each of the cell lysates in 0.018-0.109 mg/ml.

Conclusions/Discussion
This study has identified that Lithium Chloride inhibited the ApoE4 mediated GSK-3B pathway and Tau phosphorylation, by indirect observation. The inhibition of GSK-3B pathway was more potent in cells transfected with ApoE3 than ApoE4. Inhibition of this pathway could be a possible therapeutic target for ApoE induced inflammation in Alzheimer's. The next step is to study the effect of targets on different ApoE mediated inflammatory pathways and Tau.

Summary Statement
This project investigated the role of Lithium Chloride in inhibiting GSK-3B pathway and thereby reducing the phosphorylation of tau and found that GSK-3B pathway could possibly be a potential therapeutic target.

Help Received
I worked under supervision of my mentor, Dr. Birrell using lab equipment from Schmahl Science Workshop. I received guidance from Drs. Vossel and Huang of Gladstone Institute.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Isabella A. Smith

Project Number
J0522

Project Title
Tracing the Footprints: Exploring Whale DNA

Abstract

Objectives/Goals
The purpose of my experiment was to determine the closest terrestrial tetrapod relative of a modern blue whale (Balaenoptera musculus).

Methods/Materials
For this project, the required materials were a log book, and a computer with high speed internet. The query sequnce and gi (genome information) number were obtained from a database known as GenBank. The information was then programmed into a second database called Blast. Several codes and modifications were added/made to the query, which was submitted to create a list of organisms. The organisms were 70% identical or more to the specific blue whale protein, cytochrome c oxidase, that I selected and submitted. I took the 90th and 80th percentile of the organisms and created a cladogram stemming from the common ancestor that gave rise to the whale. I decoded the Latin names and noted taxonomy for these organisms in my log book. I determined the habitat and body plans of these animals and compared them to the blue whales.

Results
The closest terrestrial tetrapod to the blue whale was the hippopotamus at 97% identical protein sequence to the blue whale. Other interesting results included several types of deer, dolphins, penguins, water buffalos, sheep, bears, and even flying foxes. I mapped my results as a large cladogram. In general, the animals are attracted to water, have a lot of thick fat, and are larger than average, traits also seen in a blue whale.

Conclusions/Discussion
Specifically, to prevent any misinterpretation I used mitochondrial proteins, whose genes do not recombine. This would prevent any genetic events from interfering with my results. I observed my tree for a very long time and there were many interesting phyla there. I was extremely satisfied with my experiment. My hypothesis was correct; the hippopotamus is the blue whale#s closest tetra pod relative. If I redid the experiment, I would get the same results unless I changed the search query or the tree map format. There can only be differences with the change of one of the two things above, or if the whales mutate/evolve. When I tested my hypothesis I used genome databases. I have learned about the blue whale#s evolution and that it is closely related to many animals you might not expect.

Summary Statement
My project was about the evolution of whales and its closest relatives.

Help Received
My mother and Stepfather helped purchase supplies. Miss Woodruff, my teacher's assistant, helped me paste things on the display board.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Akshay K. Srivastava

Project Number
J0523

Project Title
The Effects of 1,3,7-Trimethylxanthine on Planarians and Its Pertinence to Stem Cell Research

Abstract

Objectives/Goals
My objective was to discover the effects of caffeine on a regenerating planarian, my replacement for a growing child. I also wanted to know the dosage of caffeine that would cause a reaction in the planarians, so I tested four different solutions of caffeine: zero percent (control), five percent, ten percent, and forty percent. Based on my research, I hypothesized that a five percent, or greater, caffeine solution would help the planarians' growth.

Methods/Materials
In order to conduct my experiment, the variables had to be kept consistent. For example, I confirmed that the planarians in each of the four containers had the same average length when I bisected them. Also, there were the same amounts of fluid in each container. After bisecting the planarians and placing them in their respective solutions, I observed and measured them every other day. These observations were continued for two weeks, the normal regenerative span of a planarian.

Results
I found that the planarians in the 10 percent and 40 percent solutions experienced a short period of accelerated growth, but had little growth after that. Also, these planarians' activity levels were very low. The control group and the five percent solution planarians, on the other hand, had consistent growth were longer than the other planarians by an average of six-tenths of a millimeter.

Conclusions/Discussion
I concluded that my hypothesis was incorrect, but further research explained why. It was found that neoblasts stimulated by caffeine do not form blastemas, which are essential for planarian regeneration. Additional research also spawned information about the many applications of planarians. Through this extensive study; I was familiarized with the many uses of stem cells in regenerative medicine, and the planarian's valuable role in testing these theories.

Summary Statement
My project observes the effects of caffeine on regenerating planarians.

Help Received
Parents helped obtain supplies; Versha Srivastava(medical student) gave expert advice; Father helped tape boards together; Ashwani Srivastava(medical student) helped identify appropriate caffeine solutions.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Megan P. Tcheng

Project Number
J0524

Project Title
Enzyme Catalyzed Reactions: How Does Temperature Affect Their Rates?

Abstract

Objectives/Goals
Catalase is a very common enzyme found in most animal and plant cells. It speeds up the breakdown of hydrogen peroxide into water and oxygen. I was curious if I could extract the enzyme from your average, run-of-the-mill tuber: a potato, and if temperature changes its rate of activity.

Methods/Materials
Catalase enzyme was extracted by pureeing whole potatoes and straining out the pulp. Filter disks were then saturated with the catalase enzyme and immersed in different temperatures of hydrogen peroxide (H(2)O(2)). The time it took the saturated disk to rise to the surface of the peroxide was measured at temperature intervals of 5 degrees, ranging from 5 to 60 degrees Celsius. Three tests were performed at each temperature and the average time was calculated. In my experiment, catalase speeds up the breakdown of hydrogen peroxide into water (H(2)O(2)) and oxygen, the latter of which gets trapped in the fibers of the filter disks, giving the disk buoyancy. The time it took for each disk to reach the surface of the solution was used to judge enzyme activity, with faster times showing a greater release of oxygen.

Results
Between 5 degrees and 45 degrees Celsius, the time it took for the disk to rise to the top of the solution consistently decreased as the temperature of the hydrogen peroxide was increased, but not at a constant rate. At the colder temperatures, the increase in the rate of return was greatest, but as the peroxide temperature increased, the time differences lessened. At 50 degrees, the reaction rate slowed down markedly until, at 55 degrees, the reaction halted completely. I believe this happened because the enzyme was placed in a temperature to hot and it was denatured (destroyed).

Conclusions/Discussion
My results clearly show that catalase activity increases with increases in temperature until the enzyme becomes denatured (destroyed) and it no longer functions as a catalyst.

Summary Statement
My project explores how temperature affects enzyme activity, using catalase and the hydrolysis of hydrogen peroxide.

Help Received
Father helped me take times during experiment

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Steven M. Wang

Project Number

J0525

Project Title

Nanophotothermolysis: IPL Treatment with Targeted AuNP for Colorectal Cancer Therapy Modeled by Monte Carlo Simulations

Abstract

Objectives/Goals

Chemotherapy causes harmful side effects by destroying healthy cells in addition to cancerous ones. Attaching cancer seeking ligands to nanoparticles can direct drugs to cancer sites to boost drug efficacy and reduce toxicity. Since the folate receptor is upregulated in cancer with limited distribution in normal cells, folate conjugated gold nanoparticles (AuNP) can be synthesized for cancer targeting. AuNP also have a unique surface plasmon resonance property which converts light photons to heat for cancer cell destruction in a new process called nanophotothermolysis. I hypothesize that IPL treatment will be effective in destroying significantly more colon cancer cells than normal fibroblast cells when incubated with optimal sized folate conjugated AuNP.

Methods/Materials

I created a computer modeling algorithm with Monte Carlo Simulations to determine optimal AuNP kinetics for endocytosis by testing 9 parameters in 1000 simulation runs. I synthesized gold nanospheres with inversely proportional amounts of sodium citrate to HAuCl4 in 13nm, 26nm, 52nm and 104nm sizes. After characterizing uptake of nanospheres in Rat-2 fibroblast cells using UV-Vis spectra and TEM, I prepared samples for ICP-MS. I developed a method to create optimal sized folate-AuNP . I applied IPL treatment to GPC-16 cells and Rat-2 fibroblast cells with folate-AuNP using a filtered xenon flash lamp of wavelengths between 400 to 1100 nm and fluence of 6 joules/cm2. I prepared Trypan blue cell viability assays measuring cell counts with a hemocytometer and recorded the results.

Results

In silico molecular docking and bending energy modeling predicted AuNP size dependent endocytosis with optimal uptake of nanoparticles size in the 40-60nm range. In vitro analysis with UV-Vis spectra and ICP-MS measured greatest gold concentration uptake of gold AuNP with diameters of 52 nm. IPL treatment targeting cancers cells with overexpression of folate receptors destroyed 80% cancers cells with folate conjugated AuNp and only 20% of the normal fibroblast cells.

Conclusions/Discussion

A new energy transfer model simulating size dependent endocytosis accurately predicted optimal size range and correlated with in vitro results. The combination of folate conjugated AuNP with nanophotothermolysis treatment effectively destroyed cancer cells with little effect on normal cells demonstrating great potential for targeted cancer therapy.

Summary Statement

I created a new molecular modeling algorithm, developed a one-step synthesis for folate-AuNP incubated with normal and cancer cells, and measured the effect of nanophotothermolysis on cancer cell viability.

Help Received

Dr. Ron Birrell and Mark Kent advice on cell culture techniques/chemicals, David Shimmin, Nanocraft grant/advice on TEM cell prep, Dr. Thomas Fister, EAG lab grant/advice on ICP-MS sample prep, Joseph Muskin, University of Illinois Nano-CEMMS advice on AuNP synthesis and my parents.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Mallika N. Yeleswarapu

Project Number
J0526

Project Title
Too Salty? Optimizing Salt Concentration for DNA Extraction

Abstract

Objectives/Goals
The process of extracting DNA from a cell is very important in biotechnology. The extraction process involves three main steps: break open the cells, release the DNA from the nuclei, and precipitate the DNA. Salt, among many factors, plays a key role in the DNA extraction process. The objective of this project is to find out which amount of salt (0g, 0.25g, 0.5g, 0.75g, or 1g) will result in the optimum amount of strawberry DNA through extraction. Based on my research, I hypothesized that 0.25g of salt will yield the most amount of DNA compared to the other amounts.

Methods/Materials
I prepared the detergent-salt solution using detergent, water and salt. I mashed strawberries with detergent-salt solution in a Ziploc bag. I heated and cooled the mixture in hot and cold baths. I filtered the mixture and collected the filtrate. I added isopropyl alcohol (2x filtrate) to 15mL of filtrate, slowly down the side of the test-tube. I spooled out the DNA that precipitated into the alcohol layer. I weighed the DNA. I repeated the procedure for each of the measured salt weights in 3 trials.

Results
Observations showed that the optimum amount of salt to extract the most DNA from 50g of strawberries is 0.75g. The final salt concentration in the extraction liquid is equal to 320 mM. The average weight of precipitated DNA increased steadily with the salt weight until it reached its peak at 0.75g of salt. Then, the amount of extracted DNA dropped at 1g of salt.

Conclusions/Discussion
DNA is a double helix with negatively charged phosphate groups in the backbone. The salt neutralizes these charges and lets DNA strands clump together when isopropyl alcohol is added. When released from a cell, DNA typically breaks up into countless fragments. In solution, these strands have a slight negative electric charge. Salt ions are attracted to the negative charges on DNA, effectively neutralizing them, and this allows the many separate fragments of DNA to come together. So by controlling the salt concentration, biologists can make DNA fragments either disperse or clump together, and there lies the secret of separating DNA from cells. I hypothesized that 0.25g of salt (107 mM) would yield the most DNA. My hypothesis was incorrect. This experiment showed that the salt concentration has an effect on the yield of DNA from strawberries and it can be optimized. More trials will give better accuracy to the findings.

Summary Statement
My project focused on optimizing salt concentration to receive the most amount of DNA using strawberries.

Help Received
I would like to thank my science teacher, Mrs. Murthy for providing the guidance and encouragement throughout this project. I also would like to thank my parents for helping and supporting me.