CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Nichole J. Baffone

Project Number
J0401

Project Title
Very Vitamin C

Abstract

Objectives/Goals
To determine the vitamin C content of different types of orange juice.

Methods/Materials
Samples of three different kinds of orange juice:
a. Home-made fresh-squeezed
b. Premium not-from-concentrate juice (e.g. Tropicana# or Florida's Natural#)
c. Reconstituted orange juice made from frozen concentrate
Juicer for extracting juice from oranges, Cheesecloth, Vitamin C tablets, Distilled water, Transfer pipettes, Masking tape, Permanent marker, Small funnel, Chemical safety goggles, Lab apron, Rubber (latex) gloves, Iodine solution, Soluble starch, 50, 250, and 500 ml graduated cylinders, 50 mL Erlenmeyer flask, 50 mL buret Ring stand, Buret clamp, Plastic transfer pipettes, Electronic kitchen balance, Glass jars

Results
My data showed that my hypothesis was correct; the fresh orange juice contained the most Vitamin C. For each sample of orange juice I did three tests. The test results for fresh orange juice were: 10.8 mL, 11.6 mL, and 12 mL. My test results for store bought orange juice were: 6.2mL, 6.5mL, and 6.3mL. My results for frozen orange juice were: 6.9 mL, 7 mL, and 6.9 mL. With my test results I proceeded to figure out the Vitamin C percentage in my samples. I used a mathematical equation to calculate the Vitamin C content.
The equation that calculated the proportion is:
X/s=20mg/v
Where x equals amount of orange juice sample
V= average amount of iodine solution to titrate each type of juice
S= 18.9 or average amount of iodine solution to titrate the standard or control
All I had to do was insert the values to get the results. This calculation shows that fresh orange juice had the most Vitamin C with 10.84%. The premium orange juice contained 6.70% and the frozen juice had 7.33% vitamin c. The fresh squeezed orange juice had much more Vitamin C than the others.

Conclusions/Discussion
From the results of my experiment, I conclude that my hypothesis was correct. Fresh orange juice clearly had more vitamin C than the frozen and premium juice. My result for the second day went as I expected for one thing. All orange juices vitamin C percentages went down except for one- the fresh orange juice. The fresh orange juice gained 3.23 mg of vitamin C. In a further study I would perhaps see how much

Summary Statement
To determine the vitamin C content of different types of orange juice.

Help Received
Mother helped with proofreading report, Father supervised actual experiment, Teacher Mrs. Wolfe for helping with the math equation, Science buddies website and Simi Valley Library for research materials.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Andrea N. Betts

Project Number
J0402

Project Title
What Is the Effect of Various Oxygen Inhibitors on the Discoloration of an Apple?

Abstract

Objectives/Goals
My hypothesis is that the lemon juice and lime juice will reduce the oxidation process the most.I based my hypothesis on finding that lemons and limes have particularly high concentrations of citric acid, an antioxidant.

Methods/Materials
6 1/2" slices were cut from one apple. Each slice was soaked for 10 seconds in 1 of 7 different liquids known for reducing oxidation process in apples. Pictures were taken every hour for 5 hours. Pictures were measured for saturation and brightness using PhotoShop Elements 6. Data was calculated to determine results.

Results
The scale of brightness measures 0% to 360%. In the first hour, the brightness score for lemon started at 73% and it decreased quickly down into the range of 50%. Lime started at 73% and decreased more quickly than lemon. 7-Up started at 71% and gradually got darker. Fruit Fresh started at 65% and got darker, but at a little faster rate than 7-Up. Orange started at 71% and gradually decreased. Water was my control group, which started at 71% and quickly decreased. The results of the saturation test done on each apple wedge show findings similar to those on the brightness test.

Conclusions/Discussion
My conclusion is that whatever substance you put on the apple the effect will be similar. After doing this experiment twice, my hypothesis was proven wrong. Although the lemon juice and lime juice did score higher some hours, there was not a significant difference between them and the other substances used. As research shows, when you cut an apple open you are exposing the enzymes to oxygen. If you can find a way to dilute the enzymes it can decrease the oxidation process. Oxidation is the process in which the apple turns brown. In my visual observations I saw some difference in the darkness between the apples, although it was not as dramatic as I expected. With the computer analysis, I measured the actual brightness and darkness in the picture of each apple wedge at set time intervals. It showed that all the apples had close to the same or the same effect.

Summary Statement
I am doing this project to find the best oxygen inhibitor to prevent an apple from discoloration after it is cut.

Help Received
Father helped make graphs; Mother helped cut apples; project supervised by teacher- Mark Sherwood

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Charles P. Boyd

Project Number
J0403

Project Title
Molecular Migration of Plant Pigments

Abstract

Objectives/Goals
The objective of my project was to determine if some plant species with similarly colored flowers use the same pigment molecules which exhibit varying rates of migration through agarose gel during electrophoresis.

Methods/Materials
The procedures for conducting both Experiment I and II were identical, with the exception of using six different plant pigments for each experiment. Flower petals were crushed, strained through a nylon filter, and 70% isopropyl alcohol was added for evaporation purposes. A 1% agarose solution was combined with a buffer and distilled water to create the gel base with reservoirs for the tray. When the gel base solidified, the tray was submerged under a diluted buffer into the electrophoresis chamber. The reconstituted pigment samples were loaded into the reservoirs. The chamber cover was snapped down onto the electrode terminals with the power source set to 70 volts. The migration rates of the pigment molecules were then recorded every 15 minutes for one hour during electrophoresis.

Results
In Experiment I, the plant pigments from the Skippy Blue Viola and the Crown Blue Pansy, flowers of the same genus, exhibited almost identical migration rates in agarose gel at timed intervals. Although there was a variance between the final measurements taken in Experiment II, all six African Violet cultivars had colored pigment bands of varying intensity that extended the full 5 cm on the agarose gel.

Conclusions/Discussion
The data in Experiment I suggests that some plant species with similarly colored flowers use the same pigment molecule when run through gel electrophoresis. It is difficult to determine if the variance in migration rates in Experiment II was due to different pigment molecule structures or combinations of the same pigments. Additional research on the organization of plants' chemical superstructures is required before scientists can address the molecular evolution between plant species and their phylogenetic relationships in order to unravel the evolutionary lines that connect or separate them.

Summary Statement
My project utilizes electrophoresis to measure the migration rates of pigment molecules extracted from similarly colored flowers as a means of examining the phylogenetic relationships between plant species in molecular evolution.

Help Received
My science teacher, Brendan Gummerson, offered his electrophoresis apparatus; my mother assisted me in assembling the materials for my experiments, as well as helped in measuring the layout of my board.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
William S. Boyd

Project Number
J0404

Project Title
Extracting DNA from Fruit in Stages of Ripeness

Abstract

Objectives/Goals
The objective of my project was to determine if ripe fruit yields the most extractable DNA utilizing underripe, ripe and overripe bananas, kiwis and strawberries.

Methods/Materials
In preparing to extract DNA from bananas, kiwis and strawberries, a buffer consisting of distilled water, pure table salt, dishwashing liquid containing sodium lauryl sulfate, and pineapple juice was added to the diced fruit that was slowly blended in a food processor. The fruit matter was then mixed with a chilled buffer and drained through a nylon filter. The filtered buffer or DNA solution was placed in a graduated test tube. Utilizing a graduated eyedropper, 91% isopropyl alcohol was deposited on top of the DNA solution. When the two liquids met, three distinct layers were formed. A drop of Methylene Blue Dye was placed in the test tube where measurements of the blue-stained middle layer containing the filaments of DNA were recorded.

Results
The results of the experiments where kiwis and strawberries were utilized support the hypothesis that fruit which is ripe will yield the most extractable DNA. However, the experiment utilizing bananas resulted in having underripe bananas yield the most extractable DNA when compared with ripe and overripe bananas.

Conclusions/Discussion
The nutritional value of fruit decreases as it ripens because the cells that bind the nutrients break down and begin the process of decomposition. Because DNA is stored in cells, the amount of extractable DNA in fruit is decreased as cells are destroyed in the ripening process. This emphasizes the importance of educating consumers as to when it is optimal to consume individual fruits based on which stage of ripeness yields the most extractable DNA.

Summary Statement
My project utilizes underripe, ripe and overripe bananas, kiwis and strawberries to test if ripe fruit yields the most extractable DNA, therefore, determining when it is optimally nutritious to consume fruit.

Help Received
My mother assisted me in assembling the necessary materials for my experiment, as well as taught me how to use a food processor. In addition, she assisted me in measuring the layout of my board.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
William Cabison; Laliphat Metsutnan

Project Number
J0405

Project Title
It's Enzyme Time!

Abstract

Objectives/Goals
Many enzymes are essential to the vital biological processes and reactions that take place inside our body. However, enzymes catalyze reactions in very specific types of environments. The researchers have tested how the following variables affect the rate in which the enzyme catalase catalyzes the chemical reaction where hydrogen peroxide decomposes into water and oxygen: 1) the concentration of the enzyme present, 2) temperature, 3) inhibition by metal ions, and 4) pH.

Methods/Materials
This experiment was done by measuring the amount of time (seconds) it will take for a paper filter disc dipped in a solution of catalase to rise in a 1% hydrogen peroxide solution, affected by each of the variables mentioned above. By writing and forming an equation, the time it took for the disc to rise in the hydrogen peroxide was converted to the velocity of oxygen production in the catalyzed reaction measured in moles per second. When more oxygen is produced, the reaction is catalyzed at a faster velocity.

Results
Data gathered from this experiment suggest that the optimum velocity in which catalase catalyzes reactions is when 1) the concentration of the enzyme is the greatest, 2) the temperature of the environment is between 20 and 30 degrees Celsius, 3) the least amount of copper(II) sulfate is added to the catalase solution, and 4) the pH is between 4.5 and 5.

Conclusions/Discussion
In this experiment, the researchers have found that their hypothesis was partially incorrect. Also, the data also follow proven chemical principles, since there is only a specific range in which the optimum catalase activity could be reached. By forming the conversion equation, in our studies, we have created a new method in which the assay for enzyme activity can be calculated through an indirect observation. If this experiment were to be repeated, we would also want to test with the various enzymes found in the fruits and vegetables we eat every day. Particularly, we would search for the enzymes that are applicable to rules of the Michaelis-Menten equation. Also, if possible, we would research for a more efficient way of describing the velocity of oxygen production (mol/sec).

Summary Statement
This project tests how the catalytic rate of the enzyme catalase is affected by the concentration of the enzyme present, temperature, inhibition by metal ions, and pH.

Help Received
Our teachers provided us with equipment, our parents bought the supplies, and our science teachers helped proofread our written report.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Katelyn F. Campbell

Project Number
J0406

Project Title
Vitamin C Content: Analysis of Drinks by Titration

Abstract

Objectives/Goals
My goals are to see how much Vitamin C is in certain orange drinks how much Vitamin C they lose, and to determine how healthy certain orange drinks really are. I predict that non-refrigerated orange juice will have less Vitamin C than refrigerated orange juice.

Methods/Materials
My materials are Tang, Sunny D, Sunkist, concentrated orange juice, fresh orange juice, Iodine, starch, 2 eyedroppers, 10 1000mL pitchers, the counter, a flask, the refrigerator, and a graduated cylinder. The first thing I do is pour 750mL of each liquid and put them into separate pitchers. Then I put 25mL of one drink into the flask, and I put ten drops of starch in the flask and swirl. After that I put a few drops of iodine in the flask and swirl. I keep putting iodine in the flask and swirling until the liquid turns a blue-blackish color. Last of all, I record the number of drops of iodine and do the next liquid.

Results
Cold concentrated orange juice started with 139.2 drops, ended with 11.1 drops, and lost 128.1 drops. Cold Sunkist started with 10 drops, ended with 1.3 drops, and lost 8.7 drops. Cold fresh orange juice started with 133.5 drops, ended with 10 drops, and lost 123.5 drops. Cold Tang started out with 124.8 drops, ended with 8.2 drops, and lost 116.6 drops. Cold Sunny D started with 114.4 drops, ended with 9.7 drops, and lost 104.7 drops. Concentrated orange juice started with 153.3 drops, ended with 9.2 drops, and lost 144.1 drops. Sunkist started with 12.6 drops ended with 1 drop, and lost 11.6 drops. Fresh orange juice started with 148.2 drops, ended with 8.3 drops, and lost 139.9 drops. Tang started with 113.6 drops, ended with 2.4 drops, and lost 111.2 drops. Sunny D started with 138.7 drops, ended with 9.6 drops, and lost 129.1 drops. The ending amount of drops and the amount of drops lost helps me figure out how much Vitamin C is left in the drink.

Conclusions/Discussion
The non-refrigerated concentrated orange juice lost the most Vitamin C over three days. It had a total loss of 144.1 drops. The Sunkist had the lowest amount of vitamin C to begin with, at the end, and lost. It had a total loss of 11.6 drops. This information helps me understand what drink is the healthiest, which lost the most Vitamin C, and which one has the most Vitamin C. This expands our knowledge on orange drinks by helping us learn if the wrappers on these drinks are lying about how healthy it is.

Summary Statement
My project is about trying to determine how much Vitamin C is in certain orange drinks, how much Vitamin C they lost, and how healthy certain orange drinks are.

Help Received
Mom helped glue papers on; Dad helped me get my supplies; My teacher helped me edit my papers.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Edward G. Deeb, III

Project Number
J0407

Project Title
Lactase vs. Lactose

Abstract

Objectives/Goals
Determine if the amount of lactase has an effect on the process of breaking down sugar molecules in milk.

Methods/Materials
Procedural Method: 1.-3. Gather and label test tubes and put in racks. 4. In test tubes 1 and 2 pour 20 mL of whole milk. 5. Place 5g of lactase in test tube 2. 6. Pour 20 mL of distilled water into test tube 3 and put in 5g of lactase. 7. Pour 20 mL of corn syrup into test tube 4. 8.-9. Test tubes sit overnight and use chemstrips to detect sugar. 10. Fill a large beaker halfway with water, heat top. 11. Heat water to almost boiling on the burner. 12. Place all test tubes into the water bath. 13. Add 5 mL of Benedict#s solution to each test tube. 14. Record any color changes. 15. Repeat the project using 2g of lactase.

Materials: 1. Balance; 2. 9 Beakers; 3. Benedict's solution; 4.Camera; 5. Goggles; 6. 9 graduated cylinders; 7. Grease pencil; 8. Burner; 9. Lactase; 10. 9 medicine droppers; 11. Whole milk; 12. 16 test tubes; 13. 4 test tube racks; 14. A pair of mittens; 15. Water; 16. Distilled water; 17. White corn syrup.

Results
The Amount of Lactose Detected-5g of Lactase

Chem Strips

Test Tube	Content(s)	Lactose mg/mL
1	20mL Whole Milk	100
2	20 mL Whole Milk-5g of Lactase	250
3	20mL Distilled Water-5g of Lactase	Negative
4	20mL Corn Syrup	250

Benedict's Solution

Test Tube	Content(s)	Color
1	20mL Whole Milk	Orange
2	20 mL Whole Milk-5g of Lactase	Yellow
3	20mL Distilled Water-5g of Lactas	Negative
4	20mL Corn Syrup	Brown

Summary Statement
Does the amount of Lactase have an effect on the process of breaking down sugar molecules (Lactose) in milk?

Help Received
- My science teacher, Mrs. Westhart, for providing support with my idea for the project, allowing me to borrow supplies, and she answered any questions I had. My parents for buying me what supplies I needed.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Rima R. Deshpande

Project Number
J0408

Project Title
Got Milk? How Do Fat Content, Exposure to Air, and Movement Affect the Shelf Life of Milk?

Abstract

Objectives/Goals
After returning from a 10 day vacation, I realized that milk from only one of the two containers with the same expiry date had gone bad. One container was opened for use many times, the other only once. This posed two questions, (1) does milk go bad faster when exposed to air and movement?, and (2) do different types of milk respond differently to storage and handling? My goal was to find out how air exposure, movement, and fat content affect the shelf life of milk. I hypothesized that milk that is exposed often to air and movement, and has the highest fat content will go bad the fastest.

Methods/Materials
I tested the effects of these variables on fat free, low fat, whole, and soy milk for changes in pH and optical density (OD), indicative of bacterial growth and milk break-down. I took 2 containers of each type of milk with the same expiry date, kept one stationery and used the other daily for 10 days. I measured the pH and OD of milk from the daily-use-container every day, and that from the stationery container on day 10. I compared the pH and OD of milk from the exposed and moved containers to that from unexposed and stationary ones on day 10.

Results
I found that milk of any type exposed to air and frequent movement showed greater decrease in pH and increase in OD. Also, when used daily, the fat free milk showed the largest and most rapid pH decrease by day 10. Soy milk (second highest fat content) showed the smallest and most gradual pH decrease. Similarly, milk types with low fat content showed larger increases in OD while those with high fat content showed smaller increased in OD by day 10.

Conclusions/Discussion
The results showed that as hypothesized, greater air exposure and more frequent movement of milk do correlate with pH decrease and OD increase, suggestive of bacterial growth leading to milk-spoiling. However, contrary to my hypothesis, milk with the lowest fat content went bad the fastest, as measured by pH reduction and OD increase. Interestingly, plant-derived soy milk showed the least and slowest pH decrease and OD increase, when compared with animal-derived milk types. Better understanding of these factors affecting the shelf life of milk may allow consumers to improve the storage and handling conditions to maximize the usable life of drinking milk.

Summary Statement
This project is a study of how air exposure, movement, and fat content affect the shelf life of drinking milk; future optimization of these factors may allow us to maximize the usable life of drinking milk.

Help Received
Parents provided guidance; Amgen provided laboratory supplies and equipment.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Kyle J. Funk

Project Number
J0409

Project Title
Vitamin "C"itrus

Abstract

Objectives/Goals
My objective was to learn if oranges have the most vitamin C out of the citrus fruits I tested.

Methods/Materials
I used cornstarch and iodine to test different citrus fruits to figure out which one had the most vitamin C. The cornstarch was cooked and put in jars with the fruit juices. I put one drop of iodine at a time into the jars and counted how many drops. When the color of the juice mixture changed to a dark purple-blue the equivalency point was reached and the amount of vitamin C was the same as the amount of iodine. I did this three times.

Results
The orange proved to contain the most vitamin C in all three trails. It had a lot more than the lemon, tangerine, and grapefruit. Limes were also a good source of vitamin C.

Conclusions/Discussion
I take vitamin C every morning, so I wanted to learn why taking vitamin C helps make me healthy. I also wanted to know what fruits I could eat that would give me the most vitamin C.

Summary Statement
To find out the best citrus source for vitamin C.

Help Received
My mom gave me ideas for designing my board and helped me with the measuring and cooking.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Irfan S. Habib

Project Number
J0410

Project Title
Vitamin C Content: Analysis of Food by Titration

Abstract

Objectives/Goals
Which fruit & vegetable juices contain the most amount of Vitamin C?
Does temperature affect vitamin C and does it have antioxidant properties?
Does the amount of vitamin C change when orange juice is kept in an open or closed container over time?
Does the amount of vitamin C in oranges increase or decrease after the fruit is picked?

Methods/Materials
Standard vitamin C solution was titrated with iodine(starch used as indicator) until endpoint.Titrations were done to determine concentration of vitamin C in various fruits and vegetables. Following equation was used to find the content of vitamin C in all solutions tested:

.?mg of vitamin C / # of iodine drops =
25mg of Vitamin C / # of drops of iodine.

Similar titrations were done to determine if vitamin C content differs after picking oranges from citrus tree. Temperature effect was investigated by titrating boiled,then frozen orange juice. The anti-oxidant properties were tested by cutting an apple in half, sprinkling crushed vitamin C tablet on 1/2, then observing both halves to see if the apple's enzymatic surface browning was affected.

Results
The grocery bought orange juice had 24 mg of vitamin C; apple juice had 34 mg. This was inaccurate since vitamin C is added in processed juices; however, pure juices gave better results. For example, strawberry juice had 23 mg, orange had 20 mg and green pepper juice had 17 mg etc. Boiling orange juice almost destroyed the vitamin C, and it diminished when stored in open container. 1st day: tree-picked oranges had 18 mg vitamin C. 20th day: it went down to 16 mg. Vitamin C sprinkled on the cut apple prevented surface browning after 1 day.

Conclusions/Discussion
My hypothesis was wrong. Strawberry juice had most Vitamin C. Cauliflower, orange and green pepper juice had similar amounts, Pear and Plum juice had the least. Temperature does affect vitamin C content-boiling almost destroyed it, but freezing had little effect. Vitamin C is readily oxidized so it prevents other chemicals from being oxidized. It is very sensitive to oxygen, light and heat. The vitamin C from oranges picked from the citrus tree decreased after a few weeks.

Summary Statement
Finding Vitamin C in fruit and vegetable juices and investigating its properties and sensitivity.

Help Received
Mother explained the chemistry background; sister helped type the report.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Erich N. Herzig

Project Number
J0411

Project Title
Extraction of Strawberry DNA: How Does Processing of Strawberries Affect the Amount of DNA Extracted?

Abstract

Objectives/Goals
How does the processing of strawberries affect the amount of DNA extracted?

Methods/Materials
Four batches of strawberries were treated differently prior to extracting DNA: Control at room temperature, Freezing overnight, Boil with distilled water, and Baked at low temperature.

For each portion of strawberries I did same procedure to extract DNA: mash and blend strawberries in food processor. Heat the strawberry mixture. To the strawberry blend add detergent enzyme buffer mixture. Strain mixture of lysed cells through nylon filter. Take filtered solution and place into a test tube, add ice chilled rubbing alcohol. Sludge forms. This sludge layer is the extracted DNA. Add one drop of blue dye. Measure quantity of DNA.

The DNA was then placed in a agarose gel, and electrophoresis performed. This DNA was compared to a known sample of cut DNA ladder.

Results
There were slight differences in the amount of DNA extracted from each sample of strawberries. The Boiled and Frozen treated strawberries yielded more DNA than the non treated room temperature strawberries. The Baked strawberries had the least amount of DNA.

Conclusions/Discussion
Boiling and Freezing the strawberries may have improved the yield of DNA in solution by helping break down the cell membrane allowing more DNA into solution. With the Boiled sample having the most DNA possibly from the heating of cells to 212 F for only 5 minutes may have broken down the DNAse enzymes without harming the DNA.

The Baked Strawberries at 170 F may have stimulated the DNAse enzymes causing the DNA to be broken down, or the one hour time at this temperature may have been too much and DNA may have broken down as strawberries slowly cooked.

Summary Statement
DNA was extracted from strawberries that had been pre treated with different conditions: room temperature, freezing, boiling, and baking.

Help Received
My father helped with initial project planning.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Christopher D. Johnson

Project Number
J0412

Project Title
Is Saliva More than Just Spit?

Abstract

Objectives/Goals
The objective of this project was to determine if the pH of any common breakfast drink will stop the breaking down action of starch into maltose by the enzyme salivary amylase found in saliva.

Methods/Materials
Nine test tubes were set up in test tube racks. A pea-sized amount of cornstarch was placed into each one. Then five milligrams of water and four milligrams of saliva were added as well into each test tube. Then moving from test tube one to test tube eight the following liquids were added: water, apple juice, orange juice, milk, tea, coffee, 1M of NaOH, and 1M of HCL. No beverage was added to the final test tube as it served as a control. After sitting for an hour, a Benedict's Test was completed on each tube to determine if sugar was present. Due to apple juice and orange juice having sugar present in the beverage previous to the experiment, a retest was done. Two test tubes and another tube as the control were set up. In the test tubes was a pea-sized amount of cornstarch, five milligrams of water, and four milligrams of saliva. Then, to the first two test tubes, NaOH and HCl were mixed to create a solution at a pH of five#that of both apple juice and orange juice. Another Benedict#s Solution test was completed to determine if the sugar in apple juice and orange juice had affected the amount of sugar produced from the reaction of starch breaking down into maltose.

Results
No breakfast beverage in the experiment had stopped the production of maltose. Several drinks showed that they resulted in lower amounts of sugar having been produced than others. Only the solutions with extreme pH levels (1 and 11) had stopped the reaction completely by having denatured the salivary amylase. The warmer drinks (tea and coffee) had seemed to speed up the reaction due to creating a warmer environment, and causing the enzyme run reaction to go faster, thus producing more sugar as supported by the Benedict's Solution test color result. If a drink were to be too hot, the enzyme would be denatured.

Conclusions/Discussion
This experiment resulted in the rejection of my hypothesis. No common breakfast beverage tested stopped the breaking down action of starch into maltose by salivary amylase. Only a solution with very high temperature and/or one with an extreme pH level, either low or high, will denature the enzyme and prevent the reaction from occurring.

Summary Statement
This project is to find out if any breakfast drinks will inhibit the breaking down action of starch into maltose, thus reducing the amount of natural sugars in the digestive system..

Help Received
Used lab equipment at Central high School under the supervision of B. Johnson.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Ramakrishnan Kumaran

Project Number
J0413

Project Title
Vitamin C: Mortal in Heat, Immortal in Cold

Abstract

Objectives/Goals
To determine vitamin C stability in citrus fruits stored at room temperature (28 degrees Celsius) for two weeks.

Methods/Materials
10 percent tangerine (Citrus reticulata) juice was titrated against iodine solution with starch as an indicator: starch indicates the endpoint of reaction between vitamin C and iodine by changing the color of the solution from colorless to a bluish-purple solution. Tangerines were stored in oven with light on to maintain a constant temperature of 28 degrees Celsius.

Results
Reduction of Vitamin C concentration was observed in tangerines stored at room temperature for two weeks. Vitamin C dropped steeply during the first two days, but declined more gradually during the next eleven days.

Conclusions/Discussion
The observed decrease in Vitamin C concentration in tangerines stored at room temperature possibly occurred due to increased fructose production, thereby leading to Vitamin C decomposition. The above investigation can be improved by reading core temperatures of fruit-samples for accuracy, and testing a single tangerine over a period of time instead of testing several individual fruit samples. Similar tests can be performed on a variety of fresh produce, to understand the effect of room temperature on destruction/depletion of essential nutrients in fruits and vegetables.

Summary Statement
This project tested whether or not the Vitamin C content in citrus fruits (tangerines) declined over the course of two weeks when stored at room temperature.

Help Received
Parents helped create board and proofread articles; our neighbor helped by contributing fruits for conducting the study; teachers offered their tireless support, encouragement and valuable thoughts.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Amulya M.R. Kunduru

Project Number
J0414

Project Title
Lemon Juice or a Sugar Solution as an Apple Preservative?

Abstract

Objectives/Goals
The objective of my experiment is to see whether a sugar solution or lemon juice works better to preserve cut gala apples. To do this I will cut six gala apples into four slices each. I will put eight slices in a clear, plastic container. This will serve as my control sample that will be compared against the other two treatments. Eight more slices will be dipped in a bowl filled with four tablespoons of lemon juice. These slices will go in a clear container labeled "Lemon Juice". The remaining eight slices will be dipped in a bowl filled with four tablespoons of sugar and a quarter cup of water and will go in a container labeled "Sugar". All three containers will stay in the refrigerator for fourteen days. They will be observe every day and observations will be taken in a notebook.

Methods/Materials
The materials that will be used for this experiment are: six gala apples, a knife, adult supervision, lemon juice(four tablespoons), sugar(four tablespoons), a measuring cup, fourteen days of time, three clear containers, tape, a sharpie, two bowls, a refrigerator, and water(quarter cup).

Results
My hypothesis was proven right in this experiment. I thought that lemon juice would work as a better preservative for gala apples rather than a sugar-solution because apples contain vitamin C, or ascorbic acid, which can prevent the polyphenol oxidation reaction, or the browning of the apples. My experiment has proved that it is better to preserve apples with the use of lemon juice rather than a sugar-substance.

Conclusions/Discussion
My data has shown me that it is better to treat apples in lemon juice rather than in a sugar-substance because the lemon juice helps keep the apples healthy and fresh. I noticed that as the days progressed, the control, lemon juice and sugar-substance apples were affected by the polyphenol oxidation reaction by an increase of about five percent. Only on some days did the apples stay the same health wise. Overall, my hypothesis was proven right. I originally thought that lemon juice worked as a better preservative than apples treated with a sugar-substance because lemon juice contains vitamin C which helps prevent the polyphenol oxidation reaction. A sugar-substance would not have been as effective because sugar is only meant to sweeten food. The only way that sugar could act as a preservative is to partially exclude air in the tissues of the apples

Summary Statement
The goal of my experiment is to see whether lemon juice or a sugar solution works best to preserve cut gasla apples.

Help Received
My father helped me cut the apples used in this experiment.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Krissa J. Lindsay

Project Number
J0415

Project Title
Bad Breath DNA

Abstract

Objectives/Goals
To see which onion has the most DNA

Methods/Materials
onions, measuring cups, test tubes, bowls, alcohol

Results
Yellow Onion had the most DNA

Conclusions/Discussion
Hypothesis was correct

Summary Statement
Does a stronger tasting onion have more DNA

Help Received
Father over saw experiment

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Lauren A. O'Connell

Project Number
J0416

Project Title
The Fruit Loop: Carbohydrates, Glucose, and the Glycemic Index

Abstract

Objectives/Goals
Objective is to determine which fruit yields the highest amount of glucose in the saliva immediately after chewing. My hypothesis is that the fruits with the highest amount of carbohydrates per serving will yield the highest amount of glucose. This project was designed to investigate which fruits might be the best choice for a diabetic seeking to maintain stable glucose levels.

Methods/Materials
I chose fruits with varying degrees of carbohydrates. I cleansed my mouth and tested my saliva to determine a negative result and then chewed a 1/2 T serving of fruit. I placed a Diastix strip in my mouth and waited 5 secs. The test strip was then compared to the color-coded levels to determine the amount of glucose in my saliva. Results were recorded and graphed.

Results
Bananas and pears, which were highest in carbohydrates, did not yield the highest glucose levels. Pears were among the lowest producers of glucose. Blackberries, with a much lower level of carbohydrates, produced a result at the highest end of the scale. Avocados continuously yielded a negative result. No glucose was being produced in the saliva during my test of avocados. After obtaining such puzzling results, I researched carbohydrates and glucose levels in relation to these fruits and discovered information regarding the Glycemic Index: how quickly a food converts to glucose. Since carbohydrate levels were not directly correlating to my results as I had originally hypothesized, I graphed my results in order of Glycemic Index ratings and found a direct correlation: a high glycemic index resulted in high levels of glucose in the saliva.

Conclusions/Discussion
In addition to the amount of carbohydrates per serving, the glycemic index score of a food plays a large part in determining the amount of glucose that was produced in my saliva due to the speed at which the carbs converted to glucose. This translates into how quickly or slowly a food will convert to glucose in the bloodstream. The glycemic index rating, not only the amount of carbohydrates in a food, should be taken into consideration when determining the type of food to consume in order to maintain a stable blood glucose level. Knowing how slowly or quickly a meal will convert to glucose allows diabetics to more effectively manage the timing of their insulin injections as well as the amount of insulin they must inject.

Summary Statement
This project will measure the amount of glucose in saliva immediately after chewing in order to determine what might be the "safest" fruit for a diabetic, or person managing their blood glucose levels, to consume.

Help Received
Mother helped with purchase of supplies and creating graphs.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Jake C. Porath

Project Number
J0417

Project Title
What Type of Nut (Peanuts, Cashews, Pecans, or Almonds) Gives Our Bodies the Most Energy?

Abstract

Objectives/Goals
As a student athlete, I am interested in what foods will give me the most energy during competition. This is why I decided to choose a Science Fair project that would teach me about energy in food. The project I researched was what type of nut (peanut, cashew, pecan or almond) gives our bodies the most energy.

Methods/Materials
From my experiment research, I learned that energy is measured in calories. The more energy a food releases in our bodies when we digest it the greater amount of calories it has. A calorie is the amount of energy it takes to raise the temperature of 1 gram of water 1 degree Celsius.
For each trial of my experiment, one gram of each nut was burned and the heat energy was calculated by measuring the change in temperature of 200 milliliters (230 grams) of water in a homemade calorimeter. The increase in the temperature (in degrees Celsius) times the mass of the water (in grams) gives us the amount of energy captured by the calorimeter, in calories.

Four trials were conducted for each nut and the results were averaged together.

Results
My experiment findings showed that the burning of 1 gram of peanuts increased the temperature of 200 milliliters (230 grams) of water on avergae 10.0 degrees Celsius or had 2.3 kilocalories, almonds increased the water temperature 5.0 degrees Celsius or had 1.2 kilocalories, pecans increased the water temperature 15.5 degrees Celsius or had 3.5 kilocalories and cashews increased the water temperature 13.0 degrees Celsius or had 3.0 kilocalories.

The increase in water temperature (degrees Celsius) times the mass of the water (grams) gave me the amount of energy captured by the calorimeter, in calories.

We can write this in the form of an equation: Heat captured, Calories = (Water mass, Grams) x (Water heat capacity, 1cal/g degree Celsius) x (Water temperature increase, degrees Celsius)

Conclusions/Discussion
My experiment findings showed that the burning of 1 gram of pecans increased the temperature of 200 milliliters (230 grams) of water more than the other nuts that were tested. Therefore, pecans had more chemical energy than the other nuts that were tested(3,500 calories or 3.5 kilocalories).

Summary Statement
The measurement in calories of how much energy is stored in different types of nuts.

Help Received
My father helped me burn the nuts.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Jaycee C. Raymond

Project Number
J0418

Project Title
Vitamin C Amounts in Alfalfa Sprouts

Abstract

Objectives/Goals
The purpose of my experiment is to test if the amount of vitamin C in alfalfa sprouts changes over a period of time. Also, I want to find out if the amount of vitamin C differs between homegrown and store bought alfalfa sprouts.

Hypothesis #1 - I think that my experiment will show that the amount of vitamin C in alfalfa sprouts will decrease over a period of time.
Hypothesis #2 - I think that homegrown alfalfa sprouts will prove to have a higher amount of vitamin C than store bought alfalfa sprouts.

Methods/Materials
Sprout juice from both homegrown and store bought alfalfa sprouts was measured and combined with a starch solution. A titration was performed with an iodine indicator solution demonstrating the relative concentration of vitamin C present.

Results
Results of testing hypothesis #1:
The number of drops of iodine used decreased each test date over a period of 23 days. This indicates that the vitamin C content of the sprouts decreased consistently over time.
Results of testing hypothesis #2:
Test 1 shows the vitamin C content of homegrown sprouts is higher than the store bought sprouts. Test 2 shows the vitamin C content of the store bought sprouts is higher than the homegrown sprouts.

Conclusions/Discussion
Hypothesis #1 was correct. The results show that vitamin C content in alfalfa sprouts does decrease over time. By the time the sprouts are three weeks old, they contain almost half the vitamin C content that they had at one week old.
Hypothesis #2 was not shown to be correct. The test results for Hypothesis #2, vitamin C content in homegrown versus store bought sprouts can not be considered reliable. In test 1, I believe my error in the testing procedure produced unreliable results. I should have performed this test multiple times to validate the results. Test 2 showed the store bought sprouts to be higher in vitamin C than homegrown sprouts, but I believe these results are skewed due to the age of the homegrown sprouts at the time of test 2. The homegrown sprouts were over three weeks old at the time of this test. The store bought sprouts were newly purchased.

Summary Statement
I tested if the amount of vitamin C in alfalfa sprouts changes over a period of time and I compared the vitamin C content of homegrown to store bought alfalfa sprouts.

Help Received
Ms.Skiles, the science instructor at my school, loaned me all of the lab equipment necessary for my project, including glass beakers, flasks, stir rods, graduated cylinders, and safety equipment. My mother taught me how to make graphs on the computer and how to find research information.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Taimur M. Rehan

Project Number
J0419

Project Title
GMO Detection through Visual Selection: Year II

Abstract

Objectives/Goals
Last year, I tried to develop a nontoxic, visual selection method for identifying transgenic organisms using a reporter gene assay. I was able to accomplish this with moderate success. This year, my goal was to identify the optimal amount of X-gal in the media that would allow gene activity to be easily detected in Drosophila melanogaster. I also crossbred transgenic and wild-type fruit flies to see if I could apply my assay method to monitor for the presence of the transgenic Lac Operon in the F2 generation.

Methods/Materials
The Lac Z gene produces the enzyme Beta-Galactosidase. In the presence of a substrate X-gal, a blue color is formed when B-galactosidase is produced. In fruit flies, the organism has to be killed and stained with X-gal to determine if there was gene activity. This prevents in-vivo research. I found that the in-vivo larval stage of Drosophila could be used to detect blue color in transgenics through my method. I observed over 300 fruit flies. Lac z positive and wild-type fruit flies were raised with varying concentrations of X-gal in their diet (2ppm-4ppm). Two generations of flies (F1 and F2) were observed for gene activity. Wild type flies (WW) and Lac Z positive P784 (l+l+) flies were crossed to verify which of the offspring was homozygous for the transgenic trait.

Results
Wild type flies (WW) were devoid of the beta gal gene, and so had no blue larvae. The F1 generation of wild type flies crossed with the Lac z (l+l+) positive genotype also did not show blue colored larvae due to the dominance of the wild type allele. However, the F2 generation showed an almost Mendellian pattern of inheritance with approximately 20% of the offspring showing signs of blue color. When I mated the Lac z (l+l+) pairs, all of the surviving larvae in F1 generation were beta gal positive, but some did not make it through the later stages. The P784 (l+l+) flies did not breed well. The mortality rate of larvae was high, but all were positive for blue color.

Conclusions/Discussion
Using my methods, the live transgenic larvae could be selected through visual means. The larvae (first instar stage) were ideal for detection of Lac z activity, as the body is translucent and enables one to see the blue color. By using my new assay, I was able to detect which of the offspring were Lac Z positive.

Summary Statement
The goals of my project were to discover the optimal amount of X-Gal necessary to visually identify in-vivo transgenic gene activity in D. melanogaster, and to apply my assay method to detect transgenics among hybrids in the F2 generation.

Help Received
Thanks to my family for their support. Thanks to the Dpt. of Developmental and Cell Biology/UC Irvine for providing me with the transgenic fruit flies. Thanks to my science teacher for her guidance.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Lucas J. Rizkalla

Project Number
J0420

Project Title
Determining Different Sizes of Molecules in Plant Derived Dyes Using Gel Electrophoresis

Abstract

Objectives/Goals
My objective was to compare the difference in sizes of color molecules in two different brands of food coloring dye. My goal is to show which color molecules are the smallest and largest. I will prove that the two brands don't use the same mixture of color molecules to produce their dye.

Methods/Materials
To make the electrophoresis chamber,I used a plastic box, steel wire, wire cutters, and wooden sticks to make the comb. To make the agarose gel,I used measuring spoons, measuring cup, bowl, baking soda, bottled water, agar powder, a microwave, and a butter knife. The materials that I needed are nine volt batteries, alligator clip leads, food coloring dye of two different brands, a plastic syringe, and a ruler.
I made an agarose gel and placed it in the chamber with my comb where it hardened leaving holes for the dye. First, I needed to connect five nine volt batteries with steel wires at the top and bottom of the box using alligator clip leads. This provided the electrical current needed for the migration and separation of the dye. To work, the positive electrode was opposite of the dye wells. Then I put the same three colors from two different brands of dye in the wells. I monitored the process every 10-15 min. At the end of the experiment, I compared the distances that each color molecule traveled from two different brands.

Results
I identified and compared the distances traveled by the color molecules. The dye that showed excellent separation and migration was the green dye. To make green you need to combine blue with yellow. After observing the greens, I noticed that one brand had more blue rather than yellow in it (Albertson's). However, the Betty Crocker brand used more yellow and just slightly used blue. Using the process of electrophoresis helped to identify what color molecules each brand used to make their dye. I also determined that the smallest color molecule was yellow because it traveled the furthest. The largest color molecule was blue because it traveled the shortest distance.

Conclusions/Discussion
I determined from this experiment that not all dyes are made from the same color molecules. I also discovered that the yellow color molecule is likely the smallest and the blue color molecule is likely the largest.

Summary Statement
I attempted to determine the difference in sizes of color molecules between two different brands of dye using gel electrophoresis.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Mady K. Snyder

Project Number
J0421

Project Title
Peace Love and Rockin Rolls: Will the Juice from Fermented Apples and Grapes Make Bread Dough Rise?

Abstract

Objectives/Goals
The objective of this project was to test whether the juice of fermented organic grapes and fermented organic apples would create enough natural yeast to cause rise in bread dough. In addition, the goal was to see if the fruit with the highest sugar and yeast content would cause greater rise in the bread dough.

Methods/Materials
Three trials of each fruit were tested. The control group consisted of a fruitless mixture in which flour and water were exposed to air to gather natural yeast and also allowed to ferment. Organic grapes and organic apples were finely chopped and placed in airtight container for five days to ferment. After five days, the fruit was removed from the mixture and the remaining liquid was fed for two days with flour. On the third day the flour/fermented fruit juice mixture was added to ingredients of a bread dough recipe and placed in calibrated beakers on a heating pad. The rise of the bread dough was measured.

Results
Both the organic fermented apple liquid and fermented grape liquid caused a rise in the bread dough. The fermented apple liquid caused a rise of an average of 75 percent higher after being combined with the bread dough ingredients. The fermented grape liquid, when added to the bread dough ingredients, rose on an average of 90 percent higher than it's original state. The bread dough using the fermented grape liquid rose 25 percent higher than the bread dough using the femented apple liquid.

Conclusions/Discussion
Yeast can be found in the air and on the surface of fruits and flower nectars. Both the organic Fuji apples and the organic red grapes have a high sugar and yeast content on the surface of the fruit and within the fruit. However, the organic grapes had a higher sugar content and a higher yeast content on the surface of the fruit and within the fruit. It was hypothozed that the fruit with the higher sugar content would cause the highest rise in the bread dough. The grape liquid caused the higher rise in the bread dough.

Summary Statement
The juice from fermented apples and grapes was tested to see if the natural yeast produced would cause rise in bread dough when substituted for commercial yeast.

Help Received
Mother helped prepare board.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Zainab M. Umarji

Project Number
J0422

Project Title
Enzymes: Nature Helpers

Abstract

Objectives/Goals
The purpose of my experiment is to learn about enzymes and what they do in the human body.

Methods/Materials
Materials
1. Apple sauce. 2.Balance for weighing the apple sauce.
3.Pectinase. 4.Paper coffee filters
5.Plastic spoons 6.Two 2 mL syringes
7.Two small funnels 8.Two 100 mL baby bottles
9.Water bath 10.Distilled water 11.Timer or clock
Add 2 mL of pectinase to one jar of apple sauce and add 2 mL of water to another jar of apple sauce. Stir at the exact time and with the same speed. Repeat method several times to get accurate results.
Do the method with light stirring,heavy stirring,and without stirring. The purpose of the light stirring is just to mix the enzymes around a little bit. The purpose of the heavy stirring is to fully mix the enzymes with the apple sauce and do the experiment without stirring so the enzymes can mix with the apple sauce by themselves. These methods were used for more accurate results.
Place two jars of apple sauce in a hot water bath for ten minutes. Repeat the method mentioned earlier. Record observations.

Results
My results showed that adding pectinase to the apple sauce produced juice very quickly. The results also showed me that not only does the pectinase react quickly but it produces much more juice as well. The jars placed in the hot water bath had the most interesting results. Some of the experiments proved denaturing of the enzyme while others proved how heat can be a catalyst.

Conclusions/Discussion
The pectinase reacted quickly with the apple sauce and made more juice than the control(water) which proves that my hypothesis is correct. To learn more about the effect of enzymes, I interviewed Dr.Mohamed Umarji Pharm. D. I learned from him how the knowledge of enzymes can lead to better health. He mentioned that depending on the disease, medicines may add to the effect of enzymes or may decrease the effect of enzymes. Shockingly, I found out that taking certain medications and drinking grape fruit juice is very dangerous. Even more shocking to me was the reason for this effect. Grape fruit juice blocks the enzymes that remove medications from the body. Because these medicines are not removed from the body, the medicine becomes concentrated in the body leading to dangerous side effects.

Summary Statement
My project is about how bacterial enzymes react in the human body.

Help Received
My father helped me do my experiments and allowed me to interview him. My mother helped me decorate my board and my science teacher for encouraging me to do my project.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Jacqueline J. Wang

Project Number
J0423

Project Title
Molecular Analysis of Blood Typing Compared with Traditional Serological Typing

Abstract

Objectives/Goals
The goal of this project is to perform molecular analysis on human cheek cells for ABO blood typing. The objective is to determine if molecular analysis will offer a less invasive method to identify blood type than serological testing while discovering if any differences in blood type data occur as a result of the experiment. It is hypothesized that extracting human cheek cells for molecular analysis of blood type will be less traumatic to patients as compared with using a syringe in serological testing and will reveal the same or more detailed data about a subject#s blood type.

Methods/Materials
The results of blood type tests were gathered from 19 subjects. Each subject swished 0.9% saline solution around in the mouth to loosen cheek cells. A molecular analysis was performed on the subjects# cheek cells for ABO Blood Typing. DNA was extracted, purified, and isolated from the cells. Many copies of the DNA sequence were created through Polymerase Chain Reaction(PCR). A Gel Electrophoresis was run to verify that the PCR was working. Restriction enzymes were added to cut sequence to the target fragment. Another gel electrophoresis was run to read fragment length of DNA base pairs to find the alleles (version of ABO gene) present. The results of the molecular analysis were then compared with the traditional blood test data obtained.

Results
Of the 19 samples tested, at least 12 gave clear results as two bands (2 blood type alleles) for each subject showed in gels. Molecular analysis detected the same allele that showed up in the blood test, but also revealed an additional blood type allele that was not identified by the serological test. The molecular analysis revealed the second ABO blood type allele which confirms prior studies by other researchers concluding that blood type is an inherited trait as humans receive one allele from one parent and another allele from the other parent.

Conclusions/Discussion
My data supported my hypothesis as molecular analysis proved to be less invasive, more accurate, and detected the presence of an additional ABO blood type allele that was not revealed in the serological blood test data. This new procedure can easily be applied to a standard high-school lab course to detect each student#s blood type. The eventual goal is to obtain FDA approval for hospital usage in blood transfusions to reduce immune reactions.

Summary Statement
The goal of this project is to extract human cheek cells to perform a molecular analysis of ABO blood typing and compare the results to serological typing (blood test) data.

Help Received
Used lab equipment at the Schmahl Science Workshop under the supervision of Sarah Perry. Sarah Thaler advised on science experiment procedures. Lorna Claerbout of the Harker Science Research Club provided instruction on science project tasks.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Jnaneshwar T. Weibel

Project Number
J0424

Project Title
Next of Kin: Comparing Nucleotide Sequences of Native Plants

Abstract

Objectives/Goals
The purpose of this project was to find differences in the nucleotide sequences of a highly conserved chloroplast gene of different native plant species. This involved extracting DNA from native plants, and amplifying using polymerase chain reaction (PCR) and then sequencing the gene that codes for the enzyme RuBisCo (Ribulose 1.5 Bisphosphate Carboxylase/Oxygenase). This data was included with other native plant sequences available on GenBank to test the hypothesis that the unique and essential RuBisCo gene nucleotide sequence would be more similar between two species of native ferns (Pteridophyta) than that of flowering plants (angiosperms). This is expected because ferns evolved about 385 million years ago, that is 250 million years before flowering plants.

Methods/Materials
DNA was extracted from plant leaves using different methods: leaf grinding alone; adding sand during grinding; and using the Qiagen DNEasy protocol (QDEP). Extracted DNA was amplified by PCR and run through gel electrophoresis. Successful samples were purified using Qiagen QIAquick protocol, followed by gel electrophoresis and spectrophotometer readings. PCR was rerun to increase concentrations and samples were sent to SDSU for sequencing. These two nucleotide sequences were included with sequences of other native species downloaded from GenBank to run summary statistics. All data were input to Blast and Clustal W2 software to produce a phylogram of relationships.

Results
Data from GenBank showed that the two fern species compared --P. scoulari (leather fern) and P. glycorrhyza (licorice fern) # were most similar with only 11 differences of the 1322 base pairs (99.17% similar). Lupinus albifrons (silver bush lupine) was most different from the ferns with 254 and 258 nucleotide base differences respectively. PCR was successful only on two of the six plants extracted using the QDEP: Erysimum concinnum (curly wallflower, a rare plant) and Lupinus rivularus (streambank lupine).

Conclusions/Discussion
The resulting phylogram of all data shows a more recent evolution in flowering plants than in fern species consistent with the hypothesis. The success of the QDEP is likely due to the fact that it removes polysaccharides that interfere with PCR. The successful samples were from younger leaves, which may have improved DNA extraction. The two successful PCR sequences are being prepared for submission to GenBank.

Summary Statement
The purpose of this project is to compare nucleotide sequences of a unique and essential chloroplast gene in different native plant species and to contribute new local and rare plant sequence data to GenBank.

Help Received
I was mentored by Dr. Jianmin Zhong who provided his laboratory at Humboldt State University. I also consulted with Dr. Jacob Varkey and Anthony Baker. My mother learned along with me and my parents criticized my writing. Botanists Laura Julian and David Imper helped me identify native plants.