CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Mythri Ambatipudi

Project Number

J0501

Project Title

Break the AGE Barrier! Inhibit Advanced Glycation End-products to Combat Atherosclerosis, Cancer and Diabetic Disorders

Abstract

Objectives/Goals

Advanced Glycation End-products (AGEs) have been identified as the root cause of atherosclerosis, cancer, Alzheimer's and diabetic neuropathy, retinopathy and nephropathy. AGEs alter the structures and functions of vital proteins and lipids. The objective of this project is to identify conditions for AGE formation, identify solutions for inhibiting AGE formation and to provide a potential breakthrough cure for many life-threatening diseases. The objective is to test and compare the inhibitory effects of 9 natural additives containing phenols, anthocyanins, chelators and GLUT1 monopolizers on AGE formation.

Methods/Materials

AGE formation due to non-enzymatic endogenous (endo) and exogenous (exo) protein glycation (PG) and lipid peroxidation (LPO) was simulated with 4 in vitro tests (5 trials in each test) with and without equal concentrations of the 9 additives. PG tests used ribose, maltose, fructose, lactose and glucose sugars. Endo-PG tests were conducted at 37 deg. C with collagen and sugars. Exo-PG tests were conducted at 100, 80 and 60 deg. C with lysine and sugars. A home-made smartphone spectrophotometer (constructed with a DVD diffraction grating and injection molded plastic parts) and Beer Lambert's Law were used to compute solution absorbance. LPO tests used safflower oil (monounsaturated fatty acid-MUFA) and olive oil (polyunsaturated fatty acid-PUFA). Fenton's Reagent created reactive oxygen species in the oils. Iodometric titration was used to compute their peroxide values (PV). Changes in absorbance values, reaction rates, PV and IC(50) values (versus the control) were used to rank the additives.

Results

Ribose produced the most AGEs (55.2% more than maltose). Ascorbic acid inhibited PG the best (68% endo, 62.6% exo), followed by blueberry. PUFAs produced 73.9% more AGEs than MUFAs. Resveratrol inhibited LPO the best (58.5% endo, 64.2% exo), followed by carnosine and tocopherol. However, the anomalies, niacinamide for PG and blackcurrant for LPO, didn't inhibit or increased AGE formation in some cases. AGE formation increased at higher temperatures. PG increased and LPO decreased with increasing alkalinity.

Conclusions/Discussion

This project has identified a potential breakthrough treatment for AGE inhibition to combat cancer, atherosclerosis, Alzheimer's and other diabetic disorders. The AGE inhibitory properties of all the additives, except blackcurrant and niacinamide, have been identified.

Summary Statement

My project aims to identify several inexpensive AGE inhibitors, discover several critical factors for controlling AGE formation, and provide breakthrough remedies for several life-threatening diseases.

Help Received

My science teacher, Mrs. Makhijani provided valuable guidance. My parents purchased all the materials and provided encouragement.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nathan J. Bowman

Project Number
J0502

Project Title
Changing Vitamin C in Hottentot Figs

Abstract

Objectives/Goals
Does changing an environmental factor (watering with different solutions) change the vitamin C content in hottentot figs (ice plant)?

Methods/Materials
I grew seven hottentot fig plants in separate pots and gave them seven different liquids to survive and grow. The liquids were as follows: salt water, fresh water, dilute vinegar, baking soda, dilute orange juice, dilute milk, and dilute Diet Coke. I took samples of leaves every three days and measured the vitamin C content by counting the number of drops of iodine that it took to turn the sample of fig juice and starch from black to blue. I generated a standard curve to measure vitamin C levels using a 1000 mg vitamin C tablet.

Results
Salt water, Baking soda, orange juice, and diet coke increased the vitamin c content in the figs. Salt water increased the vitamin C levels the most consistently. Vinegar, milk, and fresh water reduced the vitamin C content over the ten day experiment.

Conclusions/Discussion
My data show that changing the environmental factor of watering when growing hottentot fig will in fact change the vitamin C content. In the 18th century, sailors grew hottentot figs on their ships when at sea for a long time to prevent scurvy, which occurs when one has too little vitamin C. The treatment of adding salt water to this plant therefore was very plausible because they were surrounded by salt water. The other treatments that raised the vitamin C content are not that plausible. I would probably improve my experiment by getting a stir plate to stir my liquids for me and prolonging the experiment to look for more changes in the levels of vitamin C over time.

Summary Statement
Watering hottentot figs with different solutions changes the vitamin C content in the leaves.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kayley A. Bryan

Project Number
J0503

Project Title
Digestion Rate of Starch Solution in Amylase Solution at Various Temperatures and Concentrations

Abstract

Objectives/Goals
THE GOAL OF THIS PROJECT IS TO INVESTIGATE AT WHICH TEMPERATURE AND CONCENTRATION WOULD AMYLASE ENZYME SOLUTION HAVE THE GREATEST DIGESTION RATE ON STARCH SOLUTION.

Methods/Materials
AMYLASE ENZYME SOLUTIONS (1%, 5% & 10%); STARCH SOLUTION (2%); WATER BATHS (ICE COLD, BODY TEMPERATURE, FEVER TEMPERATURE, BOILING WATER); BUFFER SOLUTION; TEST TUBES & RACK; IODINE INDICATOR SOLUTION; HEATING ELEMENT; 10-HOLE SPOT PLATES; DIGITAL TIMER; THERMOMETER

Results
THE RESULTS OF THE EXPERIMENT DID NOT SUPPORT MY HYPOTHESES. THE RESULTS INDICATED THAT BODY TEMPERATURE HAS THE GREATEST DIGESTION RATE WITH THE ICE COLD BATH TEMPERATURE HAS THE SECOND GREATEST DIGESTION RATE. THE RESULTS ALSO INDICATED THAT AMYLASE ENZYME AT 10% CONCENTRATION AND BODY TEMPERATURE HAS THE GREATEST DIGESTION RATE WITH THE ICE BATH AT THE SAME CONCENTRATION HAS THE SECOND GREATEST DIGESTION RATE.

Conclusions/Discussion
MY HYPOTHESES WERE NOT SUPPORTED BY THE TEST RESULTS. RESEARCH INDICATED THAT ADDING HEAT TO SOME ENZYMES MAKES THEM MORE EFFECTIVE HOWEVER WITH AMYLASE THE RESULTS INDICATED THAT AMYLASE IS MOST EFFECTIVE AT BODY TEMPERATURE AND ADDING HEAT MAKES THE ENZYME LESS EFFECTIVE. THE RESULTS ALSO SUGGEST THAT REDUCING THE TEMPERATURE DOES NOT MAKE THE ENZYME LESS EFFECTIVE.

Summary Statement
HOW THE TEMPERATURE AND CONCENTRATION OF AN ENZYME CAN CHANGE THE EFFECTIVENESS OF THE ENZYME ON THE SUBSTRATE.

Help Received
MOTHER AND GRANDFATHER HELPED WITH TIMING, PICTURES AND CREATING GRAPHS.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Lianna M. Daug

Project Number

J0504

Project Title

Using Ion Leakage to Assess Cell Membrane Damage Due to Freezing

Abstract

Objectives/Goals

The objective of this project is to study the effects of freezing on cells by using ion leakage to assess cell membrane damage. When beet root discs are frozen and thawed, will ion leakage, as measured by the electrical conductivity of the bathing solution, be affected by (1)the temperature at which the tissue is frozen, (2)the duration of freezing, and (3)the use of sucrose as cryoprotectant?

Methods/Materials

Beet root discs in beakers with distilled water were subjected to different temperatures for Phase 1 and different freezing times for Phase 2. In Phase 3, beets were presoaked in varying sucrose solutions before freezing. Electrical conductivity (EC) of bathing solution was measured at baseline and after freezing/thawing. The beakers were placed in a boiling water bath to completely disrupt cells and EC was measured after cooling, to reflect total EC. Percent ion leakage (PIL) was then calculated for each sample.

Results

Refrigeration led to lowest ion leakage (22%), followed by room temp (43%). Freezing at -20C had minimally higher ion leakage than -10C (79% vs 77%). PIL for 24 hrs vs 3 days vs 5 days were 77%, 83%, and 85% respectively, showing that there was higher ion leakage with longer freezing times. PIL for 0, 10%, and 20% sucrose setups were 77%, 14%, and 34% respectively. Sucrose proved to have significant cryoprotective effects with the 10% solution performing better than 20%.

Conclusions/Discussion

This project showed that ion leakage, as expressed by the electrical conductivity of the bathing solution, can be used to assess cell membrane damage due to freezing. Temperature and duration of freezing are factors that affect cell membrane damage. Sucrose has cryoprotective properties leading to decreased ion leakage from cells during the freeze/thawing process.

Summary Statement

My project is about using ion leakage to assess cell membrane damage due to freezing.

Help Received

My mother supervised the cutting of beet roots and the use of the boiling water bath.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
David M. Duncan

Project Number
J0505

Project Title
What's In the Meat We Eat? Detecting Antibiotics in Beef, Pork, and Chicken Using Bacillus stearothermophilus Microorga

Abstract

Objectives/Goals
My objective is to determine if trace amounts of antibiotics can be detected in meats sold in major California grocery store chains. I will test muscle tissue fluids from meat samples using the Bacillus stearothermophilus var. calidolactis microorganism as an indicator for the presence/absence of antibiotics. I will also analyze the concentration of antibiotics in the meat samples. I predict that antibiotics will be detected in some of the meats I test.

Methods/Materials
To test a sample of raw meat (beef, pork, and chicken) for antibiotics: I used the Bacillus stearothermophilus var. calidolactis microorganism that was injected into an agar-nutrient medium, combined it with a sample of meat fluid, and then incubated in it a block heater. If the heat-thriving bacteria did not multiply, this indicated the presence of antibiotics; if the bacteria did multiply, it indicated the absence of antibiotics. I also designed and built a photo color gradient scanner to analyze the concentration of antibiotics in each meat sample. I performed three trials per sample and used a negative control for each test.

Results
Twelve (12) out of the twenty-four (24) meat samples I tested tested positive for antibiotics; ten were negative; and two were inconclusive. For my concentration analysis: Five (5) meat samples tested positive for the maximum testable amount of antibiotics (100%); eight (8) samples showed no antibiotic concentration (0%); and two (2) samples tested at 50%. So using the microorganism as an indicator, antibiotics were, in fact, detected in the meats sold in certain grocery stores. Also, my scanner showed a range of concentrations of antibiotics.

Conclusions/Discussion
I accept my hypothesis that antibiotics would be detected in some of the meat samples from the major California grocery store chains. In fact, half of the meat samples tested positive for antibiotics. This shows that antibiotics are in the meat we eat.
The decreasing effectiveness of antibiotics due to overuse has become a major public health issue. Today 80% of all the antibiotics sold in the United States is added to feed for livestock -- for meat and poultry that will be sold in grocery stores throughout the country. Many of these antibiotics are the same ones prescribed for humans. This can lead to the development of antibiotic-resistant illnesses and infections -- and, ultimately, untreatable "superbugs."

Summary Statement
My project tests meats (beef, pork, and chicken) for antibiotics using the Bacillus stearothermophilus var. calidolactis microorganism -- to determine the presence/absence of antibiotics and to analyze the antibiotic concentration.

Help Received
My science teacher (Mr. Norm Brennan) supervised all the student projects for our school science fair; my father provided transportation to the grocery stores and assisted in ordering supplies.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Kendyl M. Lassley

Project Number

J0506

Project Title

A Comparative Study of Strawberries Grown in Soil vs. Hydroponics to Optimize Vitamin C Levels

Abstract

Objectives/Goals

The purpose of this science project is to determine which growing method, soil or hydroponics will allow strawberries to maintain the most Vitamin C. Strawberries are a healthy nutritious snack; loaded with 149% of daily vitamin C.Through research and experiment the goal is finding the most productive means of farming big beautiful strawberries, full of vitamins available to eat.Hydroponic gardening is an excellent way to maintain a garden year round. It also ensures that produce grown will not be subjected to pesticides.

Methods/Materials

I will be growing strawberries in soil and hydroponically to determine if growing strawberries in water will provide as much vitamin C as in soil. I will start by developing a hydroponics system and plant strawberry starters, then I will sterilize soil to make sure that soil does not contain any additives and then I will plant strawberry starters. I will water both with the same nutrients and record plant growing data. Then I will harvest fruit to test for Vitamin C content by using a titration solution.In the control group I will grow strawberries in soil and hydroponically using plain water, I will start by developing a hydroponics system and plant strawberry starters, then I will sterilize soil to make sure that soil does not contain any additives and then I will plant strawberry starters. I will not be adding any nutrients to this part of the experiment. I will observe and take notes on plant growth. Then I will harvest fruit to test for Vitamin C content by using a titration solution.

Results

The results of this investigation to determine the difference of growing strawberries in soil verses hydroponics while providing the most vitamin c show that all of the strawberries grown contained vitamin c, however the best growing method used was the hydroponic growing system with added nutrients.

Conclusions/Discussion

In conclusion, I have learned that all the methods I used to grow strawberries were effective at maintaining Vitamin C and producing fruit. However the Hydroponic growing system was the best method of growing and producing large healthy plants with more fruit at a more rapid rate. Hydroponics is an effective way of growing produce with limed land use and in all types of climates

Summary Statement

Observing the growth of strawberries in a hydroponic system and in soil to optimize Vitamin C levels, with nutrients and without.

Help Received

mother helped with photos

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Justin E. Lehman

Project Number

J0507

Project Title

Stimulating Axons to Heal Nerve Damage

Abstract

Objectives/Goals

The goal was to determine which growth factors, NGF and cAMP, stimulate the neurons to grow the longest axons, and the largest area of the growth cones.

Methods/Materials

PC12 cells, which are a tumor cell line from a rat pheochromocytoma, were maintained in culture. Cultured PC12 were grown in media that contained various growth factors either alone or in combination. Using an inverted microscope, digital photographs were taken every two days of the cells in culture. Each condition was grown on three separate culture dishes. The cells were grown over a period of 8 days. Every two days, through the microscope, ten pictures were taken per condition. From the pictures, the five largest axons were measured and the average was calculated. The length of the axons and the area of the growth cones were obtained by using ImageJ, which is a computer program that allows one to measure microscopic images. The data was entered into a standard spreadsheet to calculate averages and standard deviations. The results were graphed using a standard computer program.

Results

The PC12 cells grown without growth factors was the control and had the smallest average length of 3.2 microns. Secondly, cAMP had an outgrowth of 23.2 microns. Slightly less than cAMP, NGF had an outgrowth of 15.5 microns. NGF and cAMP combined produced the longest axon outgrowth at 41.3 microns. For the area of the growth cones, the control had an average of 17 microns. cAMP alone had an average area of 425 microns. NGF alone had an average area of 382 microns. Finally, NGF combined with cAMP had the greatest area of 1,022 microns.

Conclusions/Discussion

In conclusion, NGF and cAMP combined had the overall best results. Based on previous findings on how NGF and cAMP stimulates nerves, the data supports that the combination of the two growth factors created the longest outgrowth because they stimulated the neurons in two different ways. The purpose of conducting these experiments is to explore how we can regenerate damaged neurons to help individuals, such as people who have lost a limb. Stimulating nerves with growth factors to get them to a new location is the first step, getting them to make connections is the second step. There have not been many published articles on stimulating growth cones and this may be a new piece of the puzzle that could be explored further to help nerves make the proper connections.

Summary Statement

This project stimulated neuron axons and growth cones with growth factors, NGF and cAMP to see which condition resulted in the most growth.

Help Received

There was a lot put in to doing this project. Dr. Feinstein, my mentor, provided the lab and all the materials necessary to carry out the experiment. My parents provided some help proof reading and suggestions on editing of my poster board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Benjamin C. Liu

Project Number

J0508

Project Title

A Home-Made Micro-fabricated Lab-on-a-Chip Device for Urinalysis

Abstract

Objectives/Goals

There are two goals for my project: 1) Develop an easy and inexpensive method to fabricate microscale devices (with feature size as small as 10 µm) at home. 2) Develop a homemade lab-on-a-chip device to fractionate urine sediment particles based on particle size difference and study particle morphology to conduct analysis on patients# urine samples.

Methods/Materials

The microchannel device was designed based on the principle of particle retention using microfilter structures with different pore sizes (10~100µm) that sort and separate urine sediment particles based on size differences. As a urine sample flows through the channel, particles are separated by microfilter structures and sorted into different chambers. The purpose is to organize particles based on their size for easier and more accurate morphology analysis. The device, made of Polydimethylsiloxanes (PDMS), was fabricated at home using soft lithography and photolithographic techniques. Household appliances such as an oven and UV lamp were used during fabrication. Human urine samples were tested using my device under a microscope.

Results

A home-made fabrication method based on soft lithography was developed. The microchannel was designed using AutoCAD software to create a mask transparency. The mask was used to create a SU-8 mold using a UV lamp. PDMS microchannel devices were successfully fabricated using this mold in an oven. Microfilter structures as small as 10 µm were created.

Particles within the urine samples were trapped and sorted in different compartments of the microchannel by microfilters, resulting in better studies of the morphology of these particles, fewer misconceptions, and better analysis on patients# conditions. I was successful in sorting and separating various urine sediment particles (e.g. crystals, cells, casts, protein, and bacteria) based on their size difference, followed by morphology studies under a microscope in order to compare these particles in correlation to their patients# health condition.

Conclusions/Discussion

I discovered that it is possible to fabricate a cost-effective and efficient lab-on-a-chip device with 10µm features using household appliances. Using this method, I successfully designed, fabricated, and tested a microchannel device to sort and separate urine sediment particles based on particle size difference and study particle morphology for effective urinalysis.

Summary Statement

A homemade lab-on-a-chip device that fractionates urine sediment particles based on size differences and studies particle morphology was successfully developed for urinalysis.

Help Received

Father provided support and guidance. Used lab equipment at UC-Irvine under the supervision of Prof. Lee.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Angel Magana

Project Number
J0509

Project Title
Tie-Dye Milk: Bipolar Effect

Abstract

Objectives/Goals
My objective was to learn if the fat content in milk will change the bipolar effects of the soap.

Methods/Materials
Five varieties of milk and Dawn Soap were gathered together (regular whole milk, lactose free whole milk, 2% and nonfat milk and Silk a milk substitute). Also collected were a large dinner plate, food coloring, and cotton swabs. I poured one type of milk (repeated each time for all varieties of milk) on to the dinner plate to entirely cover the bottom of the plate, about a 1/4 of an inch thick. I then put one drop of every color of food coloring (red, green, yellow, and blue_ in the center of the plate, but I made sure none of the colors were touching. I then got a dry cotton swab and I kept one end dry and the other I dipped in Dawn soap. Then I placed the dry end in the milk to see if the dry end would effect the milk. After, I placed the cotton swab that was dipped in soap in the center of the plate and in the middle of the colors.

Results
The milk with the highest fat content,regular whole milk, produced the best swirling of color. The color quickly expanded and continued to expand after five minutes. The lactose free spread, but would not go over the dry spot it created. Nonfat and 2% milks spread out as well and the Silk slowly moved, but did not reach the edge of the plate.

Conclusions/Discussion
My conclusion is the soaps and the milk's bipolar characteristics makes the milk go everywhere when you put the soap on it. When the soap on the cotton swab is dropped into the milk the soap weakens the milks chemical bonds which causes them to go everywhere. Then the soap molecules chase the milk molecutes until it links up with the milk molecules and the food coloring shows this process.

Summary Statement
The purpose was to find out if the fat content of the milk would produce the best swirling of color.

Help Received
My teacher purchased the different varieties of milk and gathered the other materials for the project.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Mikayli A. Moore

Project Number

J0510

Project Title

The Effects of Growth Environment and Temperature on Carotene in Red Bell Peppers

Abstract

Objectives/Goals

The objective of this experiment was to determine if the Rf value of carotene in red bell peppers would be affected by either growth environment or temperature.

Methods/Materials

Paper chromatography was used to find out if the Rf value of carotene is consistent after growth environment and temperature effects on red bell pepper, using Whatman Grade I cellulose chromatography paper and acetone as the solvent. Carotene samples were extracted from random store bought peppers grown in the following environments: conventional, organic and hot house. Samples were extracted from peppers stored at room temperature, after frozen for 24 hours and microwaved for 1:30 minutes at 1250 watts.

Results

Overall three distinct chromatographic bands were isolated. Two bands appeared for conventional at room temperature, two again at microwaved, and three when frozen. For the organic, there was two bands at room temperature, and three when microwaved and frozen. For the hot house, there was three bands regardless of the temperature tested. Band One was determined to be lycopene and Bands 1.5 and Two carotenoids. The consistency of Band Two with a minimal averaged Rf value range of .98 to .99 carotene demonstrated that the presence carotene in the pepper will not be affected by growth environment or temperature.

Conclusions/Discussion

Carotene is a vital nutrient to the human body because it is converted to Vitamin A, which is known to benefit multiple systems and possibly fight against breast cancer. My hypothesis was partially correct. My results supported my hypothesis because I predicted that the Rf value of carotene would remain consistent after undergoing variations in the environment and temperature. This experiment demonstrated that regardless of growth environment or temperature, the presence of carotene remained in the red bell pepper, and therefore, consumers can buy the product of their choice without fear their health may be compromised.

Summary Statement

My project was to determine if the carotene content of red bell peppers would be affected by either growth environment or temperature.

Help Received

My science teacher, Mr. Vieira, who acted as a mentor and resource for general questions. My mom who helped me cite my sources APA style.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Camryn L. More

Project Number

J0511

Project Title

The Use of Homemade Protein Electrophoresis to Determine a Hypoallergenic Dog Breed

Abstract

Objectives/Goals

"Hypoallergenic" dog breeds have become popular as the rate of dog allergy has increased. No study has shown a particular breed to be hypoallergenic. I sought to determine if a certain breed of dog produces less allergen by using a homemade protein electrophoresis assay.

Methods/Materials

Hair and fur samples were gathered from several breeds of unwashed dogs. Protein extraction was accomplished by soaking the samples in distilled water overnight at room temperature. A commercial dog allergen extract was used as a control. Gel preparation was accomplished using unflavored gelatin in a glass dish with copper wire on opposite sides to conduct electrical current. Dog protein extract was loaded into wells cut in the gelatin. A buffered electrolyte solution made with sodium chloride and sodium bicarbonate was poured over the gel. Direct current was ran across the copper wires for 24 hours using seven 9-volt batteries connected in series. A Coomassie Blue stain was made using FD&C Blue #1, acetic acid and ethanol. Stain on kept on gel was for 8 hours and removed. The gel was examined for stained protein. A semi-quantitative analysis was performed to determine the protein concentration present in each sample of dog protein extract.

Results

The dog hair/fur sample with the most protein was the Welsh Corgi, followed by the Labradoodle, the Golden Retriever, the Labrador Mix, the Bijon-Frise, the miniature Schnauzer, the Jack Russell Terrier, and the Shepherd Retriever Mix. The dog hair/fur sample with the least amount of protein was the Shih Tzu.

Conclusions/Discussion

Using a completely homemade protein electrophoresis assay, I was able to determine the amount of protein in various samples of hair/fur obtained from various species of dogs. It is likely that these proteins represent dog allergens. The Welsh Corgi was found to have the most amount of protein, and therefore is not a good choice as a pet for a person with dog allergy. The Shih Tzu had the least amount of dog protein, and therefore may be a good choice as a pet for a person with dog allergy. Dog breeds that have classically been considered to be hypoallergenic, such as the Labradoodle, actually showed to have a higher amount of dog protein compared to many other dog breeds. Future studies are needed on a wider range of dog breeds, and to confirm with a IgE immunoblot that these proteins are allergens.

Summary Statement

By using a homemade protein electrophoresis assay, I determined the Shih Tzu to be the most hypoallergenic dog breed.

Help Received

My dad helped me perform the experiment.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Rajiv Movva

Project Number

J0512

Project Title

Preventing Excessive Blood Sugar Levels in Diabetes Patients: An Inhibition Mechanism of Alpha-Amylase with Flavonoids

Abstract

Objectives/Goals

Diabetes mellitus, a disease affecting carbohydrate metabolism, is characterized by an inability of the endocrine system to properly regulate the amount of glucose in the bloodstream. In 2011, 90-95% of the 26 million cases of diabetes in US were type 2. Type 2 diabetes is distinguished by the cells being partially desensitized to insulin. An enzyme known as alpha amylase is responsible for breaking up large starch molecules to their glucose monomers. FDA approved amylase inhibitors are available to help reduce sudden increases in blood glucose after carb-filled meals, however 50% of patients report side effects such as abdominal pain and nausea/vomiting. This project aims at finding the value of naturally occurring plant-based inhibitors of amylase that could be used in the place of prescription agents. I decided to focus on three flavonoids hesperidin, naringin, and quercetin that are widely present in fruits, vegetables, and spices.

Methods/Materials

For each of the trials, a starch solution at the concentration of 50mg/ml and amylase at a concentration of 1.25mg/ml were used. For each flavonoid, concentrations of 1.25, 2.5, and 5mg/ml were tested. The amylase activity was tested quantitatively using a titration with Benedict's reagent. The amount of solution required to form a precipitate in the Benedict's solution after 5 minutes was compared to the positive control group to determine inhibitory indices. For each group, tests were run in triplicates to assure reproducibility, with 36 tests in total.

Results

The hesperidin inhibited the enzyme by 30%, 51%, and 64% at the concentrations of 1.25, 2.5, and 5 mg/ml respectively. Similarly, the naringin inhibited the enzyme by 25%, 48%, and 61% respectively. Finally, the quercetin inhibited amylase by 32%, 53%, and 68% respectively.

Conclusions/Discussion

My results suggest that all three flavonoids are practicable inhibitors of alpha amylase, and quercetin and hesperidin worked the best. Based on my results, I have determined that around 2-3 servings of fruits/vegetables containing the flavonoids should be consumed (or equivalent amounts in spices) to attain 50% inhibition of amylase. Moving forward, these findings could help lead to the development of a rational treatment of type 2 diabetes and prediabetes in which flavonoid-rich fruits and vegetables are incorporated into one's diet.

Summary Statement

My project proved that flavonoids, compounds found in fruits, vegetables, and spices, are viable inhibitors of alpha amylase, and therefore they could be used to assist Type 2 Diabetes patients in controlling their blood glucose levels.

Help Received

I would like to thank my mother for helping make my board, Mrs. Kristen Morgensen of The Harker School for helping me attain my materials, and Mr. Akhil Mehta for providing guidance and support.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Rhiannon Palmieri

Project Number
J0513

Project Title
Quantifying Tooth Decay

Abstract

Objectives/Goals
The objective was to find out what in coke contributes to tooth decay the sugar or the acid.

Methods/Materials
Materials: Coca Cola, vinegar, water, 65 grams of sugar, measuring cup, scale, baby teeth, zip lock bags, 12 jars, hair dryer and spoon or tweezers

Method: Teeth were placed in jars containing either Water, sugar solution, acidic solution (with water and vinegar) or coke. Three jars of each solution for a total of 12 jars and 12 teeth. Teeth were removed, rinsed, dried and weighed every week.

Results
The teeth in coke lost an average of 0.05% of their weight. The teeth in the sugar solution lost 0.01% of their weight and the teeth in the acid solution lost 0.03% of their weight.

Conclusions/Discussion
In this experiment I set out to find out what component of coke causes tooth decay. Based on my observations the acidic solution caused the more damage to the teeth based on weight and observation than the sugar solution.

Summary Statement
Discovering what in coke dissolves teeth

Help Received
My parents helped me with lay out of the board, calculations and remembering to weigh the teeth

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Eesha Pamula

Project Number
J0514

Project Title
Effects of Cooking on Different Organic and Conventional Foods

Abstract

Objectives/Goals
The objective is to determine if the organic foods retain more macronutrients after cooking than the conventional foods. I believe that organic foods retain more than conventional foods because of less chemical substances used in their growth.

Methods/Materials
Two different foods were chosen for each macronutrient type (proteins, lipids and carbohydrates). The quantity of macronutrient is measured based on units of chemical substance (Biuret reagent for proteins, Sudan red for lipids, Benedict and Iodine solution for carbohydrates) needed to cause a color change in the food. The test is repeated three times before cooking and for three different lengths of cooking with both the organic and conventional foods.

Results
Before cooking, 50% of the tested organic foods showed higher nutrition than conventional foods. After cooking, 87.5% of the tested organic foods showed higher nutrition than conventional foods, the rest were equal. Tests showed 36% higher retention rate in organic Olive oil (lipids), 10% higher in organic Vitamin D Milk (proteins) and 9% higher in organic Wheat (carbohydrates).

Conclusions/Discussion
Not all organic foods are richer in macronutrients compared to conventional foods. However, Organic foods retain more nutrition than conventional foods upon cooking. The retention rate varies with the duration of cooking.

Summary Statement
My project studies the retention rate of macronutrients in different organic and conventional foods after cooking.

Help Received
Mother helped with purchasing the needed materials for the test.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Sophie Parsa; Ruby Rorty

Project Number

J0515

Project Title

Tree Relations: Investigating Tree Evolution Using Computer Science

Abstract

Objectives/Goals

Our project explores the evolutionary relationships between native and non-native trees using their rubisco sequence and the computer program Clustal Omega.

Methods/Materials

In this project, we explored relationships between California evergreens using their rubisco (ribulose-1,5-bisphosphate carboxylase/oxygenase) sequences, available on the GenBank database. Rubisco is a specialized protein involved in carbon fixation. We took the known sequences and used the computer program Clustal Omega to create a phylogram that displayed their evolutionary relationships and grouped them by theoretical common ancestor. Then, we identified non-native, sequenced evergreens similar to the ones we had used and hypothesized where on the phylogram they would fit based on their genera classification and physical characteristics. In order to better understand how sequences are compared on computer programs similar to Clustal Omega, we included on our board a Punnett square diagram showing the fundamentals of such an algorithm.

Results

Our post-hypothesis DNA phylogram mostly matched our hypothesis, with a few notable exceptions. Some of the trees that we expected to be together were not. Interestingly, the parts of our hypothesis that our DNA phylogram countered were shown as correct in our protein phylogram.

Conclusions/Discussion

This project led us to several interesting discoveries. When we started, we planned on only having DNA phylograms, but then realized that we needed to interrogate aligned protein phylograms as well. This is because mRNA comprises four nucleotides that are translated in groups of three into amino acids. However, each amino acid is encoded by multiple nucleotide triplets, which differ at the third position. As a result, changes can occur in the DNA sequence that may not be represented in the protein sequence. Because proteins perform the work inside the cell, only changes in the protein sequence affect function and potentially represent a significant difference between species. Our hypotheses were based on the genus classification Linnaeus created 300 years ago. While our post-hypotheses phylograms mostly supported Linneaus classification, they differed in some notable ways. These differences may represent new information about the relatedness of tree species based on genomic similarities rather than physical characteristics.

Summary Statement

We investigated the relationships between native and non-native trees using the computer program Clustal Omega.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Aadil M. Rehan

Project Number
J0516

Project Title
Do Ions Regulate Positional Information and Regeneration?

Abstract

Objectives/Goals

Planaria are flatworms with an amazing ability to regenerate lost body parts. I was intrigued by this trait and wondered about the factors that contribute to regeneration. The goal of this study is to understand and identify ways to regulate this power using positional information, which is a set of instructions that "governs" the process of regeneration.

Ion channels are essential for cellular communication. This study illustrates that the transference of positional information may be dependent on certain ion channels. Therefore, changing the concentration of the available ions in the planarian habitat may affect regeneration. In this study, regeneration was measured by blastema formation (mass of proliferative cells at the wound site) and eventual differentiation into a head or tail.

Methods/Materials

I investigated by cutting planaria into two segments (head and tail) and subjected them to living conditions with different concentrations of selected monovalent and divalent ions. The Montjuic salt solution, a standard media in labs for culturing planaria, was used. The Montjuic solution contains sodium, calcium, potassium, and magnesium in distilled water. Removing specific ions created variants of the solution. Decapitated brown planaria were placed in the solutions along with a whole worm (the control.) The changes in their development were observed and the findings were recorded.

Nine different solutions were used, with four petri dishes of each solution. Three cut planaria (head and tail) and one whole planaria was in each petri dish. The total sample size was 144 planaria.

Results

The results supported my hypothesis that ion channels are linked to planarian regeneration. Each group of ions (monovalent and divalent) had a distinct and specific effect on the planarian life cycle. The divalent ions appear to be necessary for survival, while the monovalent ions may be required for regeneration.

Conclusions/Discussion

I found it interesting that the two ions most closely linked to regeneration, potassium and sodium, are also essential for the transmission of stimuli from the neurons through the sodium/potassium pump.

I plan to continue this project with an even larger sample size, more complex ions and better equipment. As we better understand the process and power of regeneration, we hope this knowledge will be used to improve the quality of life of mankind and other living beings.

Summary Statement

The goal of my project was to investigate if certain ions had an effect on the transference of positional information, and to discern which of these ions had the greatest effect.

Help Received

My science teacher, Mrs. Roxanne Hunker, helped guide me in this project. MBI, Inc. provided me with chemicals I needed to make my solutions, and I purchased the planaria from Ward Scientific. My father supervised me for safety and when needed.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Sarah N. Saboorian

Project Number
J0517

Project Title
Is There a More Efficient Method to Make a Cheaper Gel Electrophoresis Kit and Is Gel Electrophoresis a Viable Way to Te

Abstract

Objectives/Goals
My goal for the kit was to make it cheap,normal-size, and easy to make and use.I predicted that an at home kit would be a viable way to test for breast cancer.

Methods/Materials
My materials were urine cups, saliva, alligator clips, 3 mini-pipettes, bromothymol blue dye, a clear square container, Tris-Glycine buffer, 10 9-volt batteries, 1 gallon of distilled water, agarose powder, a voltage meter, a block of wood, and a drill.Write a consent form, get samples of saliva from people with and without breast cancer, and have all participants sign. Brainstorm a prototype and buy materials. Make the comb out of wood and the agarose gel by boiling the powder with distilled water. Place the comb in the container. Pour the solution in the container selected to be your chamber and leave the comb. Have a 3rd party blind you from which ones are cancerous and make an according list. Attach the batteries together into a battery pack and measure the voltage. Once the gel is set, cut two sides out about two inches in from the edge of the container with a knife. Create the buffer by mixing the powder with water. Remove the comb from the gel and fill the sides with buffer. Pipe dye into each well then pipe the first sample into the first well on the left using a different mini-pipette. Clean pipette with water and pipe second sample into mini pipette and squirt into second well on the left. Repeat moving one well to the right each sample. Place electrodes, paperclips, in buffer. Wait for about an hour and take photos of the migration patterns. Try to identify which are cancerous. Check to see how many you got correct. Identify possible mistakes and run the test again.

Results
I was only able to identify 4 out of the 10 correctly. Out of those four only one was cancerous. As for the kit, I saved about $60 by making an at home kit.

Conclusions/Discussion
You can save about $60 on average if you make your own kit vs. buying one online. A homemade kit would be efficient if you wanted to learn more about electrophoresis and were willing to put time in. Using an at home kit is not a viable way to detect breast cancer at this time but is a possibility. Overall, there is a more efficient method to make a cheaper at-home electrophoresis kit, and it may beat out online kits, but the kit cannot detect breast cancer.

Summary Statement
The focus of my project was to create a cheaper, yet effective at home electrophoresis kit, as the need for one is growing, and to use that kit to test for breast cancer.

Help Received
Dad supervised; helped drill comb

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Pooja A. Sheladiya

Project Number
J0518

Project Title
Feeling Low? Turn Up the Turmeric!

Abstract

Objectives/Goals
The problem to be solved in the project was how turmeric affects the liver enzyme reaction rate.The hypothesis was the catalyst solution with the most turmeric,6g will cause the enzymes in the liver to react at a slower pace than the solution without turmeric because the turmeric helps reduce the reaction of the liver enzymes because of the proteins and other essential substances and elevated liver enzymes contribute to diseases.

Methods/Materials
First I created a hydrogen peroxide solution by adding 35mL of hydrogen peroxide to 500mL of water.Then I made holes into the filter and created a catalyst solution by blending up 100g of liver with 10mL of water.Afterwards I filled the test tube with the hydrogen peroxide solution and had a partner dip the filter into the catalyst solution and place into the tube.I quickly pushed the one hole stopper into the tube placing my thumb over the hole and flipped it upside down and recorded the time it took the filter disk to reach the top of the tube.I repeated the process over again except I then used a catalyst solution that had 3.5g of turmeric mixed into it and then 6g of turmeric.

Results
The average reaction rate of the liver enzymes in the solution without turmeric was 2.39secs which was the fastest average reaction rate. The slowest average reaction rate was in the solution with 6g of turmeric which was 3.08secs.The solution that had the second slowest reaction rate was the solution with 3.5g of turmeric at 2.78sec.

Conclusions/Discussion
The data collected throughout the experiment supports my hypothesis that the turmeric will slow down the reaction rate of the liver enzymes which is good because elevated enzymes can result in disease.My hypothesis is correct because the average reaction rate of the solution with 6g of turmeric was 3.08sec which is the slowest average time of all.It applies to the real world because turmeric is a commonly used spice all throughout India and in Indian families in general.It is known that turmeric can potentially cure pancreatic cancer, but it goes through the liver in order to reach the pancreas and be effective.Another way it can apply to the real world is turmeric is commonly used in Ayurveda practices and is used by many people.I know this because my grandpa was an Ayurveda doctor.

Summary Statement
Turmeric's affect on the reaction rate of liver enzymes.

Help Received
My science teacher, Ms. Fisher, overall helped me with the entire project. She helped me figure out the measurements and let me use her supplies such as the scale, measuring cups, test tubes, etc. She also gave me feedback on my work. Jay Shinde, Amy Gourlay, and Dinelli Jinadasa helped me put the filter inside

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Tori H.A. Takeshita

Project Number
J0519

Project Title
Burning Calories

Abstract

Objectives/Goals
The project is about finding the amount of calories stored in foods. .

Methods/Materials
o Two tin cans, one smaller than other ; o One wood dowel ; o One cork; o One needle ; o One graduated cylinder ; o Distilled water (162 mL for each trial); o Thermometer (Celsius, range 20-100); o one lighter; o Scale (calibrating in grams); o Roasted Almonds and Peanuts; o Pieces of popcorn; o Marshmallows; o Goldfish; o Dry pet food.

1. Use calorimeter
2. Weigh the food and record the weight.
3. Measure the amount of water to pour into the smaller can, it should be half full.
4. Measure the temperature of the water.
5. Place the food item onto the needle and place the needle into the cork.
6. Light the food item.

Results
The almonds contain 3682 cal or 36.38 Cal, the peanuts contain 2171 cal or 21.71 Cal, the goldfish crackers contain 661 cal or 6.61 Cal, the marshmallows contain 566 cal or 5.66 Cal, the popcorn contains 519 cal or 5.19 Cal, the dog food contains 354 cal or 3.54 Cal. The percent difference between peanuts and almonds is 61%. The percent difference between goldfish crackers and almonds is 18%. Between the marshmallows and almonds, the percent difference is 15%. The percent difference between popcorn and almonds is 13%. The percent difference between the dog food and almonds is 10%.

Conclusions/Discussion
The conclusion is that almonds contain the most calories out of the other samples that were used.

Summary Statement
How much energy is stored in different foods

Help Received
none

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Amelia R. Talkington

Project Number
J0520

Project Title
The Impact of Simulated Stomach Acid on Microorganism Growth in Organic and GMO Soybean/Yogurt Cultures

Abstract

Objectives/Goals
The goal of this study is to understand how the genetic modification to make soybeans Roundup Ready impacts how nutrients are absorbed in the human human gut - specially how microorganism growth in yogurt/organic soybean and yogurt/Roundup Ready (RR) soybean mixtures that have been through the stomach and the duodenum are different.

Methods/Materials
I grew organic and RR soybean sprouts. Then I created a control and two mixtures: 1) yogurt (control), 2) ground organic soybean sprouts and yogurt, and 3) ground RR soybean sprouts and yogurt. The amount of yogurt was the same in the mixtures and in the control. The amount of soybeans was the same in the soybean/yogurt mixtures. I added hydrochloric acid (HCl) to the yogurt until it reached the approximate pH of chyme. Then I added the same amount of HCl to the soybean/yogurt mixtures and recorded the pH of each mixture. Then I placed the containers into the incubator at body temperature for 45 minutes. At the end of that period, I added baking soda to the yogurt until the pH was 8 (approx. pH leaving the duodenum) and recorded the amount added. The I added the same amount of baking soda to each yogurt/soybean mixture and recorded the pH. Finally, I dropped small loops of the yogurt (control) mixture onto 5 grids of an MRS agar plate and repeated the same process on 9 other plates. Then I repeated the procedure to create 10 plates with the organic soybean.yogurt mixture and 10 plates with the RR/yogurt mixture. Then I placed the plates in the incubator. I measured and photographed the microorganism growth daily for 8 days.

Results
The RR soybean/yogurt mixture was more acidic than the organic soybean/yogurt mixture after the baking soda was added . The microorganisms that grew on the RR soybean/yogurt mixture and organic soybean/yogurt mixture appeared similar. The microorganisms grew more rapidly on the organic soybean/yogurt plates than on the RR soybean/yogurt plates and there were more of them.

Conclusions/Discussion
The pH difference warrants more study, since some researchers believe the body is more disease prone when the body fluid/food mixture entering the intestine is more acidic. The differences in the microorganism growth rates between the organic soybean/yogurt and Roundup Ready soybean/yogurt samples warrants more study, since some researchers believe genetically modified foods can stunt the growth of beneficial microorganisms in the gut.

Summary Statement
The impact of stomach conditions on microorganism growth in organic & GMO/yogurt cultures

Help Received
Teachers, advisor, parent helped with chemicals, photos, data entry, sample disposal

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Pandora P. Vamvakas

Project Number
J0521

Project Title
Calorie Meter

Abstract

Objectives/Goals
my goal was to find out wich nut has more callories per gram.

Methods/Materials
This project helped me to understand calorie meter; what it does; how it works; and, understanding calories.
Materials:
5 Whole almonds; 5 shelled peanuts; 5 whole cashews; 1 lighter or matches; 1 candle stick; 600ml water; 1 kitchen scale that measures in grams; 1 jug or large container; 1 can opener; 1 test tube; 1 large metal can (like coffee can); 1 drill or hammer; 1 nail; 1 rubber holder around test tube; 1 safety water bowl; 1 thermometer that measures in celsius; 1 needle; 1 cork. etc.

Results
Almonds produced the most calories per gram.

Conclusions/Discussion
My hypothesis was correct; almonds do produced the most calories per gram. The reason I believe it did is because the almonds looked and felt more solid.
Cashews produced the least calories per gram. Peonuts ranked in the middle.
There is a difference between chemical calories and dietary calories. A dietary calorie is one thousand times bigger than a chemical calorie; so, I had to devide by one thousand as shown in the graphs.

Summary Statement
My goal was to find out which nut has more claories per gram.

Help Received
My father provided me with the materials and showed me how to do calcualtions. My mom helped me with my poster. My brother assisted me in some of the labs.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Michael D. Wu

Project Number
J0522

Project Title
A Physical and Chemical Analysis of the Nutritional and Caloric Content of GM vs. non-GM Papayas

Abstract

Objectives/Goals
The objective of this experiment was to determine the nutritional and caloric differences in GM vs. non-GM papayas. With population set to drastically expand by 2050, and GM crops as the projected future of agriculture, research must be done to verify whether they meet certain requirements such as adequate nutritional levels and caloric content.

Methods/Materials
To conduct the calorimetric experiment, an insulated homemade food calorimeter was made to test the energy content of the different papayas. The papaya was dried and a controlled amount of starter-wood and lighter fluid was added so that the papaya would become more flammable. The papaya/starter-wood/lighter fluid was burned and the energy content was measured by the temperature it raised 150mL of water. The formula Q=M*C*(delta)T was used to quantify the data.
To test Vitamin C, Lugol's Iodine and UV Spectroscopy was used. A redox reaction using Lugol's was used on a Vitamin C standard solution and then the papaya samples themselves. A ratio was then used to quantify the data. For UV Spectroscopy, papaya samples were run in a UV Spectrophometer. Beer-Lambert's Law was used to quantify the data.
To test simple sugar content, a redox titration using Benedict#s Quantitative Reagent and Sodium Carbonate was used on a glucose standard solution and papaya. A ratio was used to quantify the data. Carotene levels were also qualitatively tested by using Ascending Layer Chromatography.
To minimize testing error, six papayas were chosen. Three were the same non-GM Hawaiian brand, bought at the same store; other three are the same GM Hawaiian brand, bought at the same store.

Results
GM papayas had 68% more calories than non-GM papayas, averaging 48.57 and 28.92 calories per 100g of dried papaya. Lugol#s Reagent showed that GM papayas had 10% less Vitamin C than non-GM , averaging 75.98mg and 68.41mg per 100g of papaya. UV Spectroscopy was performed after 2 weeks of storage resulting in a decrease of Vitamin C levels. Non-GM papayas and GM papayas had 54.33mg and 57.32mg of Vitamin C per 100g of papaya. GM papayas had 7.20g of sugar, whereas non GM papayas had 6.55g of sugar, a 10% difference. GM and non GM papayas showed no difference in Carotene levels through ALC.

Summary Statement
The focus of this experiment was to determine the nutritional and caloric differences between genetically modified and non-genetically modified papayas.

Help Received
Used UV Spectroscopy Lab at University of California Irvine under supervision of Dr. Fishamn; parents helped obtain materials and edit drafts; Alexander Huszagh, PHD student at UCI, helped provide guidance