CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Haya Belbese

Project Number

J0501

Project Title

The Road to the Cure of Alzheimer's

Abstract

Objectives

So the objective of this project is to test the effect of BA 42 and lead on neuronal cells and the astrocytes cells. Astrocytes are the most abundant glial cells and are vital for the proper function of the central nervous system (CNS). This project will also use 4 natural remedies and Vitamin E to test their effects on defending the neuronal cells and the astrocytes cells.

Methods

Protective action of several natural compounds (turmeric, vitamin E, walnut, ginger, olive leaf) were studied in the culture neuroblastoma Shsy5y cells after the addition of glia astrocytes cells, lead and beta-amyloid 42 added at different concentrations to the culture medium. Cells were incubated with beta-amyloid 42, lead and natural products for 24 hours, and cell viability and cell death were evaluated by MTS assay.

Results

As the results have shown, the higher concentration of the beta-amyloid lowered the cell viability of the Astrocytes and Shsy5y cells. The highest number of viable cells were the ones treated with walnut. Following the walnut, the olive tree leaf was able to protect the cells as well, but not as much as the walnut. Surprisingly, the higher concentration of beta-amyloid, the higher cell viability for the cells treated with turmeric. The vitamin E, and ginger had little to no effect on protecting the cells.

Conclusions

In conclusion, walnut and olive leaf were able to increase cell viability more than the glial cells (Astrocytes) alone. These 2 natural remedies can play a big factor in slowing down the Alzheimer's progress and hopefully even stop its devastating effect.

Summary Statement

This study aims to look at natural substances and their influence on reducing the risk to developing Alzheimer s

Help Received

I got training on how to use certain lab equipment

Name(s)

Konish Bhattacharya

Project Number

J0502

Project Title

Green Synthesis of Silver Nanoparticles Using Asparagus Extract and Their Use as Antibacterial Agent

Abstract

Objectives

In this project silver nanoparticles have been synthesized from silver nitrate using Asparagus extract containing the flavonoid, quercetin (a green synthesis). The objective was to test whether a plant derived flavonoid can be used to synthesize silver nanoparticle from silver nitrate solution and could be employed to kill harmful bacteria.

Methods

Asparagus stems, silver nitrate 0.01 M aqueous solution, distilled water, quercetin, petri dish for bacteria colony.

In direct sunlight four different concentration of asparagus extract (2 mL, 4mL, 6mL, 8mL) was added in separate cups each containing 20mL of 0.01 M silver nitrate aqueous solution and noted the change of color of solution over time. Same experiment was repeated in ambient light.

In the laboratory, a drop of silver Nanoparticles made with 4mL asparagus extract and 20mL of 0.01 silver nitrate aqueous solution was placed on two petri dishes containing E.Coli and S. Epidermidis bacteria.

Results

In this experiment the color of silver nitrate solution changed once asparagus extract was added, which means silver nanoparticles were being produced. The bacteria test result showed these nanoparticles cleared both the E.coli and S. Epidermidis colonies which means the silver nanoparticles were effective as an antibacterial agent.

Conclusions

In my experiment use of asparagus as a source of quercetin which acts as a reducing agent to produce silver nanoparticles, is a novel approach. This is an environmentally friendly process. These silver nanoparticles exhibited strong anti-bacterial properties against both Gram-negative and Gram-Positive bacteria. Bacteria are unable to develop immunity to silver. Thus, silver nanoparticles can be more effective than conventional antibiotics. The nanoparticles could be used in making antibiotic bandages for wounds.

Summary Statement

Synthesis and examination of antibacterial effect of silver nanoparticles.

Help Received

Jenny Stenger-Smith in the laboratory of Prof. Mascharak at UCSC provided the chemicals and help in the bacterial studies.

Name(s)

Gordon Chen; Jacob Huang

Project Number

J0503

Project Title

Inhibiting Rabies at the Molecular Level

Abstract

Objectives

The goal for our project was to find the best ligands to successfully inhibit the p75 neurotrophin receptor, which is one of the receptors that rabies uses to take over the cell. We wanted to find the docking scores of each docking simulation to the p75 neurotrophin receptor and see if the score is enough to ensure a successful bond. We hypothesized that a few ligands that could successfully dock.

Methods

We used Schrodinger Suites as our docking tool. First, we imported the structure of our receptor, p75 neurotrophin receptor, into Maestro, the interface for Schrodinger applications. We then prepared the cell receptor by passing it through Schrodinger Protein Preparation Wizard, which refines the structure by assigning formal charges, enumerating bond orders, adding hydrogens, etc. After using Schrodinger LigPrep to prepare a library of ligands, we docked the ligands into the cell membrane receptors using Schrodinger Glide. To get the final results, we used Epik state penalties and GlideScore to find the docking score, which ultimately determines the best ligand to dock to the cell receptor. Glide automatically created a spreadsheet of all the resulting data.

Results

In our data spreadsheet, we have the ligands listed in order from the best (lowest) docking score to the worst (highest). The ligands schrod_806203_1 and schrod_621088_3 have the lowest docking scores, -5.855 and -5.613 respectively. Thus, they have the highest binding affinity. Approximately 0.2% of our library of ligands satisfied our requirements of having a docking score less than -5.

Conclusions

Scientists can now create a new ligand based on the structure of the ligands with the highest binding affinity to the rabies virus receptor. With better ligands, better molecular treatments can be created and developed.

Summary Statement

We used protein ligand binding to determine the best ligand to inhibit the rabies virus.

Help Received

Mrs. Peng helped us get the trial license for Schrodinger Suites. Online training videos by Schrodinger helped us with the project. We did everything else by ourselves.

Name(s)

Conner Chu

Project Number

J0504

Project Title

Wave Rave: A Competitive ELISA for the Quantitative Analysis of Vitamin B12 before and after Micro-Radiation Exposure

Abstract

Objectives

The goal of this project is to determine the effects of electromagnetic micro radiation on Vitamin B12 levels in foods after heating them in the microwave.

Methods

RIDASCREEN FAST Vitamin B12 kit, various food samples, RidaSoft Win.Net software. Prepared liquid and solid samples (with and without heating in the microwave). Performed procedure for competitive ELISA (antigen-antibody reactions). Measured absorbance rates of samples photometrically at 450 nm.

Results

After exposure to micro radiation, both rice and baby oatmeal decreased in Vitamin B12 concentration while the milk increased in B12 levels. The B12 levels in chicken broth were initially high, so the photometric readings were not affected by the micro radiation.

Conclusions

The data reveals that Vitamin B12 concentrations changed in milk, rice, oatmeal, but not broth after being microwaved. With these results, people may decide to microwave foods for shorter amounts of time if aware that microwaving foods can deplete their nutrients. Frozen food manufacturers may want to consider how the results might impact their industry. Possible variations of this experiment can test different nutrients like calcium or test different amounts of exposure time to micro radiation to determine the best microwave time for certain foods with minimal depletion of nutrients.

Summary Statement

I quantitatively determined, using competitive enzyme immunoassay, the effects of micro-radiation on different foods' Vitamin B12 levels and found that most food samples were impacted by the microwaving process.

Help Received

I received materials and some guidance from Mr. Ross Walden, Regional Manager of R-Biopharm. My project was reviewed by a science teacher, and I compared it to other experiments in this field found on the internet.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Arianne Daw

Project Number

J0505

Project Title

How Do Genetics Affect the Way People Respond to Drugs?

Abstract

Objectives

The purpose of my project is to figure out why some people have a better response to drugs than others.

Methods

Materials: Laptop, Writing Utensils, Notecards, PharmGKB.org, NCBI SNP database

I tested my hypothesis by using the PharmGKB website to find alleles associated with alternate responses to the drugs. I then used the NCBI SNP database to find out whether the SNP is in an exon, intron, or near the gene.

Results

I found that some people had an increased or decreased response to the drugs, based on their genetic makeup. I discovered that the SNPs and different alleles played a part in the drug responses.

Conclusions

I realized that not everyone has the same response to a certain drug. Because of the differences in out DNA, such and SNPs, some have an increased response to drugs, while others have a decreased response. Although some mutations do not occur in the coding part of the gene, they may still have an effect on the response to the drug.

Summary Statement

I showed that differences in genetics affected the responses people have to drugs.

Help Received

I conducted the research and experiment myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Kirin Debnath

Project Number

J0506

Project Title

Making Better Bread by Modifying a Yeast

Abstract

Objectives

This project tests the hypothesis that yeast (Saccharomyces cerevisiae) lacking mitochondria will make larger and fluffier bread.

Methods

Materials: Conical Tubes, Glycerol (YPGE) Petri dishes, Glucose (YPD) Petri dishes, Balloons, Yeast Extract-Peptone-Dextrose Media (YPD), Ethidium Bromide, Wild-type yeast, Flour, Water, Sugar.
Equipment: 30C incubator, 30C shaker, spectrophotometer, delta vision imager, conventional oven.
Methods: To remove mitochondria, wild type yeast was treated with ethidium bromide to remove and block mitochondrial function. After ethidium bromide treatment for 18 hours, yeast were cultured on glucose plates and colonies were grown out. Individual colonies were then plated on glycerol to identify colonies that cannot grow due to lack of mitochondria. These yeast strains are known as Rho0. Then, equal amounts of control wild type and Rho0 yeast were mixed with 50g of dough mixture (flour, water, and sugar) and left to rise for 18-20 hours at 30C. Next, the volume of the dough was measured. Finally, the bread created from wild type and Rho0 yeast was baked in an oven (at 375F for 25 minutes) and the area of bread slices was calculated.

Results

The slice area of bread made from wild type yeast measured 11.60+/- 2.83 sq.cm (average +/- standard deviation), whereas the slice area of bread from Rho0 yeast measured 20.30 +/- 4.41 sq.cm. Thus, Rho0 yeast leads to bread that is 75% larger than bread made from controls. In addition, I observed that Rho0 bread had many more holes, which bread makers refer to as a better crumb .

Conclusions

In conclusion, Rho0 bread lacking mitochondria does make larger, and fluffier bread. I predicted this because previous work has shown that Rho0 yeast exhibit increased fermentation which leads to increased carbon dioxide production which makes the holes in fluffy bread.

Summary Statement

Yeast lacking mitochondria, called Rho0, make larger, fluffier bread due to Rho0 yeast having increased fermentation.

Help Received

I used Dr. Jayanta Debnath s lab at USCF. Dr. Ariadne Vlahakis a postdoc taught me the techniques to culture yeast and supervised me when I created Rho0 strains. She also helped me with the statistical analysis of my bread slice data.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Cesar Duarte

Project Number

J0507

Project Title

Where Is the C?

Abstract

Objectives

My goal in my project is to see which plant had the highest level of vitamin C.

Methods

Test five different plants of juice 31.25 mL/ 1oz mixed with 125 mL. of water and the same measurements of the vitamin C reference sample which I prepared with cornstarch for the test. I used an eye dropper to add (iodine) to oxidize each one. Record the total quantity of drops of iodine used in each juice sample until the blue color persists.

Results

My results in the test ended with papaya having the highest amount of vitamin C with 31.06 mg per ounce compared to other plant juices.

Conclusions

I have proven my hypothesis correct that papayas (31.06 mg) have the highest amount of vitamin C, but I found that the results broccoli had (30.09 mg) was close to the results papaya had leaving a 0.16 mg difference. The results in my data chart helped me prove that papaya has the highest vitamin C resource.

Summary Statement

My project is about which plant contains the highest resource of vitamin C.

Help Received

I designed this project by myself but received support from my science teacher, my home room science teacher, and the information I reasearched on the internet

Name(s)

Ishan Ghosh

Project Number

J0508

Project Title

Evaluating Effectiveness of Select Natural Remedies: Anticoagulating Properties on Bovine Plasma: An in vitro Study

Abstract

Objectives

Does select natural remedies possess anticoagulating properties and how they compare with untreated samples in an in vitro study?

The primary objective of this in vitro study was to evaluate if select natural remedies bromelain, nattokinase, and serrapeptase, have an effect on the clotting time of bovine plasma.

Methods

125 mL citrated bovine plasma
One bromelain tablet 600 GDU
One serrapeptase capsule 40,000 SPU
One nattokinase capsule 2,000 FUs
50 ACTT tubes
50 vacu tubes
Anhydrous calcium chloride
10 3-mL plastic synergies

1. Prepare three different concentrations (2,3,and 4mg) of bromelain, nattokinase, and serrapeptase. Measure 2mg of naproxen sodium. Place each concentration into separate Vacu tubes.
2. Add 2 mg of bromelain with 2 mg of nattokinase, 2 mg of bromelain with 2 mg of serrapeptase, and 2 mg of serrapeptase with 2 mg of nattokinase for combination and place them in separate Vacu tubes
3. Place frozen citrated bovine plasma in water bath (920-960F) for 30 minutes. Transfer 2mL of bovine plasma into each Vacu tube and in control.
4. Put ACTT tubes in water bath (920-960F) for 15 minutes.
5. After 15 minutes transfer Vacu tube contents to ACTT tubes and add one granule of anhydrous calcium chloride to each tube then place ACTT tubes back in water bath. Check every 60 seconds until 120 seconds then check every 10 seconds.
6. Tilt to see if clotting had started. Call time when bovine plasma transforms from liquid to semi-sloid gello
7. Repeat steps 1 through 6 an additional two more times.

Summary Statement

I saw how select natural remedies affect the amount of time it takes to clot bovine plasma in vitro, and my hypothesis was proven correct that it did increase the clotting time.

Help Received

I came upon with the project idea and all of the materials that were used. My parents helped me fund the project and drive me to Canyon Animal Hospital. Dr. Mohit Ghandi helped me better understand the biological parts fo this project. Dr. Greshon Alauf of Canyon Animal Hospital let me use their lab at

Name(s)

Roma Kundu; Samaya Katikireddy

Project Number

J0509

Project Title

Variation of DNA Yield from Different Plant Species: GMO vs Organic vs Non-GMO

Abstract

Objectives

Our objective is due to altered protein and DNA sequence in GMO vs Organic/NonGMO plant, there will be change in yield of the DNA extracted and measured.

Methods

Different types of plant types/species were used in this experiment, such as Potato, banana and strawberries in form of GMO, Non-GMO and Organic. Four samples of 10gm of each type of plant species were collected for DNA extraction. Standard DNA extraction kit Innovative science by Aldon Corporation was used. After DNA extraction, the precipitation was measured with a ruler under UV Neon light. Microsoft Excel was used to calculate mean and ANOVA was used to test if there is significant statistical difference in the yield of extracted DNA .

Results

1.Organic potato showed highest yield as compared to all other plant species and types used in this experiment.
2.GMO potato yielded less DNA as compared to its Organic counterpart.
3.Comparable amount of extracted DNA were observed from GMO Potato, Organic Strawberry, Non-GMO Strawberry, Non- GMO Banana and Organic banana.
4.DNA was present in all types of plant species tested and looked the same.

Conclusions

1.In our study we found that the DNA yield of organic potatoes was more than that of the GMO potatoes.
2.The DNA yield of the non-GMO species showed no significant difference from its Organic counterpart. Therefore, Organic foods have a higher DNA yield than GMO, and non-GMO foods have a similar yield to Organic food.
3.Anova showed no statistically significant difference in the DNA yield in GMO, non-GMO and Organic foods.
4.Our analysis was done by measuring visual thickness of DNA precipitation with UV neon lamp. Another method is extracting precipitated DNA by a centrifuging machine and measure with Spectrophotometer. More samples could be compared with GMO for additional validation.
5.The future direction is to conduct protein expression analysis using rt PCR or ELISA immunoassay. Further study the Health effects like allergic and immunologic response of protein expressed in GMO vs Non-GMO to human and livestock.

Summary Statement

VARIATION OF DNA YIELD FROM DIFFERENT PLANT SPECIES GMO vs NON-GMO vs ORGANIC.

Help Received

Mrs Ginger Byrd- Project Advisor.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Julianne Lin

Project Number

J0510

Project Title

How to Maximize Iron Absorption from Food

Abstract

Objectives

The objective of this experiment is to determine how different stomach pH levels affect the rate iron is dissolved from an iron-rich food.

Methods

Almond meal, hydrochloric acid, water, LaMotte Iron Test Kit, test tubes, timer with splits. Added almond meal to three different stomach pH models with iron reagents. Measured and compared the time it took iron to dissolve from the almond meal and reach varying levels of iron concentration in three different pH stomach models.

Results

Iron from the almond meal dissolved at different rates in various stomach acidic conditions. The lowest pH model showed the most iron dissolved from almond meal in the least amount of time. The highest pH model showed the slowest rate for iron to dissolve.

Conclusions

After measuring iron concentration levels in different stomach acidic models, it was concluded that iron dissolves best in an empty stomach condition with the lowest pH level. Iron is dissolved faster and can be more efficiently absorbed in a more acidic stomach condition than in a less acidic condition like a full stomach.

Summary Statement

I showed that iron is best absorbed in an empty stomach condition rather than a full stomach condition.

Help Received

My mom helped me purchase the materials for this project and gave me feedback on my experimental design. I performed all the trials of the experiments myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Chelsey Luc; Michelle Zheng

Project Number

J0511

Project Title

How Do Different Types of Flour in Sourdough Starter Affect the Resulting Bread?

Abstract

Objectives

The objective of this study is to determine how different types of flour in sourdough starter affect the resulting bread.

Methods

5 different types of flour (rye, whole wheat, unbleached all-purpose, bleached all-purpose, and a blend of both rye and unbleached all-purpose); Make starters by mixing flour and water, each type flour prepared in triplicate (Total 15 starters); feed daily for a week until mature; Make dough with each different type of starter and bake into bread. Observe the difference in activity, odor, and viscosity based on appearance during the feeding; Observe the difference in hole density between the loaves of bread, Evaluate the final taste, aroma, and texture of the resulting bread.

Results

During the feeding process, no noticeable changes were observed in colors for all types of flour. Sour odor were developed at similar rate with no significant differences in the level of sourness. The starter texture of both all-purpose flour (unbleached and bleached) were thinner with no large trapped bubbles compared to the other three.

For the final bread, each type of bread loaf had similar taste and aroma, however, the texture differed in that both all-purpose flours (unbleached and bleached) had a dense texture with several tunnel-like large air pockets, while the other three types were fluffier with no large collapsed large air pockets.

Conclusions

With repeating trials of the triplicate experimental design, this study shows that the differences in the starting flour for sourdough starter have an effect on the final result.

Summary Statement

By using five different types of flour to make sourdough starters for baking bread, we found the differences in flour used have an effect on the final result.

Help Received

None. We designed and performed the experiments ourselves.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Timothy Marshburn

Project Number

J0512

Project Title

Tricking the Brain Into Smelling Differently

Abstract

Objectives

My question was, How can the way the brain interprets the scent of cinnamon change after the nose is exposed to a strong scent before hand? My hypothesis was, Based on my research, test subjects will report smelling a different scent other than the scent of cinnamon while smelling cinnamon after their noses are introduced to the scents of vinegar, peppermint, oranges, and lemon. For my experiment, I tested four independent variables: peppermint essential oil, vinegar, lemon, and orange juice. My dependent variable was how many people smelled the cassia cinnamon essential oil differently than what it actually smells like. For the actual testing of the experiment, I tested one test subject at a time. I blindfolded the test subject, had them sit down in a chair, and I had them smell one of the IV s (not knowing what each IV was). One second after smelling the IV, I had them smell the cinnamon. I then asked them what they smelled when they smelled the second scent . I recorded their answer down, and I repeated this three more times, going through the rest of the IV s. For the results, 18 out of 30 people reported smelling cinnamon differently after smelling peppermint essential oil, 16 out of 30 for the orange juice, 15 people for the vinegar, and 14 people for the lemon. The reason for this may be because when the olfactory bulb, the smell sorting part of the brain, took in one of the independent variable scents, the smell triggered a memory in the amygdala and hippocampus. When the test subject then smelled the cinnamon, the olfactory bulb may have still been processing the previous scent, confusing the two scents and any scents that may have been related to the triggered memory, which made the test subject smell a new scent from the cinnamon. One revision to the experiment could be to use plastic containers to store the different objects emitting the scents.

Methods

Human consent form for each child (thirty count) for parent/legal guardian of child to sign, thirty children ages 12-14, 5 drops of cassia cinnamon Essential Oil (Essential Oils are used for diffusers), 5 drops of peppermint Essential Oil (Essential Oils are used for diffusers),1 tablespoon of vinegar, ¼ cup of orange juice, one half of a lemon, ¼ cup measure, tablespoon measuring instrument, five Ziploc plastic sandwich bags (Ziploc is prefered, but any brand of plastic sandwich bags will do as long as there are no tears/leaks in the plastic, it is waterproof, and it can be sealed close), a pair of latex gloves, 2 chairs, pencil with eraser, paper (as many sheets as you need to record answers), 2 cotton balls, and a blindfold.

Results

After testing thirty test subjects, eighteen reported smelling cinnamon differently after smelling peppermint, sixteen reported smelling cinnamon differently after smelling orange juice, fifteen reported smelling

Summary Statement

I tricked about more than half of thirty test subjects (human) into smelling the scent of cassia cinnamon differently than what it actually smells like.

Help Received

Jennifer Marshburn (mom) who helped to edit my research paper, Robert Marshburn (dad) who drove me to all of my science fair business, my grandmother who also drove me to places, and Mrs. Bridget Biernacki who convinced me to apply for the Greater San Diego Science and Engineering Fair.

Name(s)

Lea Nepomuceno

Project Number

J0513

Project Title

Different Percentages of L-Ascorbic Acid Affecting the Percutaneous Absorption of Frozen Pig Skin Tissue

Abstract

Objectives

Vitamin C has numerous benefits to human bodies such as reducing the risk of chronic diseases and battling high blood pressure, however one of the most well-known is being critical to skin cancer prevention. My objective was to find the l-ascorbic acid % which results in a 5.5 PH level when absorbed by the skin. I hypothesized that the 15% formula would work the best since it was the most commonly used percent in skin products. In my testing I used l-ascorbic acid powder and distilled water as a base in order to make the formulas, and then applied the formula to pig skin tissue. Every hour I tested the skin for PH level for 7 hours. The results showed the 15% formula produced the desired 5.5 PH level. The 10% formula produced a 4.9 PH (11.5% below a 5.5 PH) level and the 20% formula produced a 6.1 PH level (10.3% above the desired PH level). The pig skin samples with the 10% formula applied had very soft skin which showed that there was not enough absorption, the pig skin samples with 20% formula applied had very dry skin which showed that it was irritated by the formula, however the pig skin samples with 15% formula was firm which demonstrated perfect absorption.

Methods

fresh pig skin tissue,PH strips, Notebook, L-ascorbic acid powder, PH skin meter
8 by 12 plastic tray with dividers, Teaspoon measure cups, Knife, Distilled Water, Three glass beaker, Funnel, Amber glass dropper,Glove, Plastic spoons
Labels, Timer

Results

Not all pig skin samples had the same PH levels per every check due to the various textures of the pig skin. However the averages of the PH levels resulted with very similar averages. The 15% l-ascorbic acid formula resulted to be the best-performing l-ascorbic acid formula in my experiment. The 10% formula left the pig skin tissue with a lack of absorption which was shown when the skin tissue had a Ph level below 5.5 (4.9) , the 20% l-ascorbic acid formula dried the pig skin tissue out which was shown when the PH level of the pig skin tissue was above 5.5 (6.1), and the 15% l-ascorbic acid formula formula left just-right results were the skin was well absorbed but to an extent to were it didn t dry out the pig skin tissue and the PH level of the skin was exactly 5.5.

Conclusions

My goal was to find the most effective l-ascorbic acid formula on pig skin tissue. I tested a 10% l-ascorbic acid solution, a 15% l-ascorbic acid solution, and a 20% l-ascorbic acid solution. Based on my research on l-

Summary Statement

My project is about the benefits of different percentages of l-ascorbic acid (10%,15%,20%), and it's effects onto pig skin tissue.

Help Received

My dad helped me cut the pig skin tissue and my mom helped me to calibrate the PH meter. I performed the rest of the experiment alone.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Samagra Pandey

Project Number

J0514

Project Title

Effect of a Yeast Suspension's Aeration Length on its Metabolic Rate

Abstract

Objectives

The objective of this study is to record and analyze differences in the metabolic rate of yeast with varying levels of dissolved oxygen in the yeast suspension.

Methods

A gas collection apparatus was used, which included a 3 liter tub, an inverted graduated cylinder, a squirt bottle, and clear plastic tubing. The carbon dioxide output of the yeast was the amount of displaced water in the inverted graduated cylinder. An aerator pump and airstone facilitated aeration of the yeast suspension. Stoichiometric ratios between carbon dioxide and ATP in the balanced cellular respiration and fermentation equations allowed for the conversion of the carbon dioxide output to the ATP production rate, which is an estimate of the metabolic rate

Results

Aeration lengths of 0 minutes, 5 minutes, 8 minutes, 10 minutes, and 12 minutes were used. The first condition was anaerobic, or lacking oxygen in the microenvironment, while the others were aerobic. The 0 minute samples had the highest carbon dioxide output, whereas all conditions had similar metabolic rates.

Conclusions

Repeated trials with all five conditions revealed that the aeration length of a yeast suspension did not have a significant impact on the metabolic rate of the yeast. Thus, the aerobic and anaerobic pathways have the same rate of energy output in yeast. By extension, us performing cellular respiration does not impede our metabolic rate, and therefore our health.

Summary Statement

I showed that the amount of dissolved oxygen in the microenvironment of yeast does not affect its metabolic rate.

Help Received

I designed and set up the experiment by myself, but my father held the inverted graduated cylinder during testing.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Tristan Pfleger

Project Number

J0515

Project Title

Are Minke Whales or Mice More Closely Related to Humans?

Abstract

Objectives

Abstract

Scientists use different sources of genetic material to determine the evolutionary relationship between species. They utilize RNA transcripts from the nucleus or mitochondria which act as code for important proteins in living organisms. In my research of understanding how many sources of RNA are required to generate phylogenetic trees that agree on lineage for the same sets of species, I ve used three cytochrome c oxidase subunits from the mitochondria and four nuclear transcription factor y subunits, both from a Minke whale. Using the BLAST search tool and GenBank from the National Center for Biotechnology Information (NCBI) website, I created phylogenetic trees to determine how closely related minke whales are to other mammals (specifically rodents and humans). I included comparisons for zebrafish and plants for reference. All changeable options were set to default, with the exception of the Max Target Sequence, which was set to fifty rather than one hundred. Performed using the blastp algorithm.

I ve found that in both the nuclear and the cytochrome c oxidase subunits from the minke whale, five out of the seven trees show that rodents and humans are more closely related than Minke whales and humans. The other two trees show that the Minke whale and rodents are closer related, which is untrue. More of the trees are in agreement that rodents are more closely related to humans, which I believe to be correct. This proves that rodents and humans are more closely related than humans and Minke Whales are.

Methods

Materials: A Computer-To use GenBank and BLAST search tool.
Procedures: Open GenBank. Search Minke Whale under genomes. Click "proteins" and find the seven (cytochrome c 1-3, nuclear trans factor y 1-4). Take accession number and input into BLAST, keep all parameters default but change Max Sequence to 50. Click SMARTBLAST and from there select all additional and best hits, then click view full multiple alignment. Click view phylogenic trees.

Results

The results of my experiment are that mice are more closely related to humans. I derived this answer from consulting the seven phylogenetic trees I procured. Out of the seven, five agreed that mice were more closely related to humans. One stated that mice and Minke whales were closer, and the other said humans

Summary Statement

I have found that mice are more closely related to humans than Minke Whales through observance of phylogenetic trees.

Help Received

Giacomo Bernadi, Professor of Ecology and Evolutionary Biology at UC Santa Cruz. Helped me understand BLAST and GenBank. My science teacher also helped me understand these sites as well as molecular biology.

Name(s)

Disha Ramanujam

Project Number

J0516

Project Title

Which Has More DNA Degradation: Organic or Non-Organic Plant Produce?

Abstract

Objectives

The goal of this project is to investigate whether Organic produce or Non-organic produce has more DNA degradation under the same conditions. This is to determine if the chemical treatments used on Non-Organic crops have an effect on the produce s DNA.

Methods

Agarose Gel Electrophoresis process was used to visualize DNA double-strand breaks.The DNA extraction began with macerating spinach and celery down to a powder by a bead beater and the powders were mixed with 1% PVP buffer to make sure maceration wouldn t cause additional DNA Damage. RNase A and Proteinase K were pipetted into the solutions and were incubated. The solutions were purified, and the remnant DNA was mixed with glycerin dye and inserted into the Agarose Gel. Since DNA has an overall negative charge, a positive charge is put at the end of the gel so the DNA will move towards that end.

Results

Results showed that non-organic spinach produce has a lower rate of DNA degradation than organic spinach under the same conditions and over the same period of time.

Conclusions

After observing that non-organic plant produce has less DNA degradation compared with organic produce under the same conditions, we can infer that the chemical treatments used on non-organic produce might have an effect on the DNA. Other reasons for the decreased DNA degradation in non-organic plant produce are not fully discovered. Some of the causes could be changes in enzymic activity, changes in apoptosis (cell suicide) rates, etc which can be part of continuing research. Findings from these experiments potentially could also be stepping stone towards future research for understanding any detrimental effect on humans by consuming plant produce with damaged DNA and to establish healthier and more environmentally friendly alternatives for treatment of plant produce.

Summary Statement

Using the process of Agarose Gel Electrophoresis, I observed that Organic Spinach has more DNA degradation than Inorganic Spinach under the same conditions.

Help Received

Thankful to Dr. Brian Dorsey for mentoring and giving access to his laboratory

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Kylie Rameson

Project Number

J0517

Project Title

How Temperature Affects the Expression of a Jellyfish Glow Gene

Abstract

Objectives

The objective of my study was to determine if temperature had an effect on the amount of light produced by E-Coli bacteria genetically modified to produce Green Florescent Protein.

Methods

I inserted the jellyfish glow gene into E-Coli bacteria and then changed the temperature of the bacteria. I measured the change in light produced with a photometer.

Results

The results of this experiment showed that the more temperature is increased, the more light is produced by the bacteria.

Conclusions

As the temperature increases, the amount of light produced increases. Scientists could use this method to know the temperature of genetically modified organisms without having to touch them. They would only have to measure the amount of light produced.

Summary Statement

I showed that as temperature is increased, the amount of light produced from a genetically modified bacteria also increases.

Help Received

Cary Reich, Laura Ulvaeus

Name(s)

Flynn Rorty

Project Number

J0518

Project Title

Starch Struck: The Effect of Dietary Amylase on Starch Digestion

Abstract

Objectives

The goal of my project was to conduct testing to see if high amylase foods, such as pineapple or guava, are as good at aiding starch digestion as purchased amylase pills.

Methods

A serial dilution of a 1% cornstarch solution was used to generate a standard curve. Starch was detected in triplicate samples by pipeting diluent with diluted tincture of iodine, mixing and adding to a 6-well plate. Color development was measured by scanning on our home printer\scanner. Data was imported into ImageJ and pixel intensity measured and plotted to generate a standard curve. To test if dietary amylase digested starch, a variety of fruits were solubilized and incubated with rice solution at 37o C for different time periods. Commercially purchased amylase pills were powdered and amylase solution was incubated with the rice solution at 37o C. As a positive control, 1 ml of saliva was donated by me and my mother. At each time point, test solution and diluted tincture of iodine were combined, mixed, added to a 6-well plate and scanned. Results were graphed.

Results

Guava was found to have the highest active amylase compared to pineapple, blueberries, human saliva and even amylase pills. My mother's saliva broke down less starch than mine, indicating that the activity of saliva amylases decrease with age.

Conclusions

My results show that eating guava with high starch foods, a simple method to control the release sugars from foods, is very effective because it digested more starch then synthetic amylase pills. Not only can amylase help diabetics keep their blood glucose levels consistent, it can help athletes who want to control their blood glucose levels over a long work-out. My results also suggest that older people may benefit from eating foods high in amylase because amylase levels decrease in older people.

Summary Statement

I showed that some fruits contain enough amylase to aid starch digestion.

Help Received

I designed and conducted the experiments myself. Professor Lindsay Hinck (University of California, Santa Cruz) explained the concept of standard curves to me.

Name(s)

William Ian Lyle Sahagun

Project Number

J0519

Project Title

Investigating the Inhibitory Effect of Psidium guajava Leaf Extract on Carbohydrate Digestive Enzymes

Abstract

Objectives

The objective of this experiment is to determine if the extract from Psidium guajava leaves inhibits the activity of invertase, lactase, amylase, and amyloglucosidase (enzymes that act on carbohydrates). My hypothesis is that if the guava leaf extract (derived by making a decoction) is mixed with a carbohydrate digestive enzyme plus its corresponding substrate, then it will result in a lower rate of increase in glucose amount than the control (water).

Methods

The materials used in this investigation are guava leaves, water, invertase, sugar, lactase, whole milk (untreated with lactase), amylase, amyloglucosidase, bread flour, cornstarch, potato flakes, rice flour, and tapioca starch. To conduct this experiment, identical volumes of guava leaf decoction and water are put into cups. Equal amounts of an enzyme plus the carbohydrate it acts on are added to each cup to make a solution. The control and guava leaf decoction experiments are run simultaneously. A glucose meter measures the glucose content after specific time intervals have passed.

The data points from 8 trials were averaged, then the rates of increase was computed for both solutions. From there, the percentage of inhibition was calculated.

Results

For invertase, there was no significant inhibitory effect since the percentage of inhibition was only 3.71%. For lactase, there was also no inhibitory effect since the percentage of inhibition was -0.67%. For amylase, there was an inhibitory effect since the percentage of inhibition was 80.80% for bread flour and a range of 78.26% - 98.03% for other starches. For amyloglucosidase, the results are still pending since the experiment is ongoing.

Conclusions

The findings of this experiment are promising. The guava leaf decoction did not significantly inhibit the effect of invertase and lactase, but it inhibited amylase. However, further studies are needed, since I am still in the process of testing amyloglucosidase. Also, I did not yet test (I will attempt to if I have enough time) if the inhibitory effects of the guava leaf will be the same if my setup is tested at stomach acidity (a pH of 1.5 - 3.5) and at the human body temperature (37 degrees Centigrade). If the inhibitory effects stay the same, then this would help people with diabetes/prediabetes, and obesity.

Summary Statement

I found out that the guava leaf extract inhibits the activity of amylase, but neither invertase nor lactase (amyloglucosidase is pending).

Help Received

Arthur Levine and Maria Teresa Alonso from Huerta del Valle let me pick fresh organic guava leaves from their community garden. My sister helped me understand the scientific studies on guava leaves and my mom is my lab partner when things needed to be done simultaneously. I did everything else myself.

Name(s)

Nikita Senthil

Project Number

J0520

Project Title

Feed the Diatoms: The Effect of Iron Filings on the Oxygen Production of Thalassiosira Diatoms

Abstract

Objectives

The objective of this experiment was to discover the effect of different masses of iron filings on the oxygen production of Thalassiosira diatoms (defined as the concentration of dissolved oxygen in the seawater solution containing the iron and diatoms, measured in milligrams per liter).

Methods

The jars containing seawater were maintained at 21°C; then, the diatom solutions and the respective masses of iron filings were added to each jar. Two hours later, the Azide-Winkler Method was conducted with the help of a portable dissolved oxygen concentration water testing kit. In this step, sodium thiosulfate titrant was utilized to observe the amount of dissolved oxygen in each jar in milligrams per liter. The entire process was repeated two more times for a total of three trials.

Results

On average, when the mass of iron filings was the greatest (20 grams), the amount of dissolved oxygen in the seawater solution containing the diatoms and iron was the greatest (2.02 milligrams per liter), followed by the smaller mass of 10 grams (1.62 milligrams per liter), with the control group yielding the least dissolved oxygen (1.53 milligrams per liter).

Conclusions

Based on the data collected, it can be concluded that increased amounts of iron also increase the amount of oxygen produced by diatoms, fully supporting the hypothesis. A potential implication of these results is that iron fertilization, or artificially increasing the amount of iron in areas of the ocean deficient in iron, may be a feasible option to combat global warming.

Summary Statement

This experiment found that increasing the amount of iron present in seawater also increases the oxygen production of diatoms in the seawater.

Help Received

I designed and conducted the experiment myself in the lab space provided by my science teacher, who also guided me throughout the process.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Nala Stewart

Project Number

J0521

Project Title

Skunk Attack!

Abstract

Objectives

The objective of my science project to find home remedies that will eliminate skunk smell when a pet gets sprayed by a skunk. My research determined that hydrogen peroxide, baking soda, and dish soap reduce/ eliminated the skunk smell.

Methods

Tested various remedies which included (3) drops of skunk essence on (6) rages, the following remedies were used on each rag against the skunk essence: baking soda/hydrogen peroxide/dish soap, vinegar, lemon juice, and tomato sauce. I also used (12) human test subject to determine the intensity of smell of each rag.

Results

My hypothesis was correct, using 1 quart of 3% hydrogen peroxide, 1/4 cup of baking soda (sodium bicarbonate) and a teaspoon of Dawn liquid detergent, reduce/eliminate the smell all together after 5 minutes of setting the solution on your pet or item of choice, rinse the solution and your item should be free of skunk essence.

Conclusions

In my research, I tested my hypothesis (hydrogen peroxide, baking soda, dish soap) against several common of the shelf home remedies such as lemon juice, tomato sauce, vinegar. The above remedies did not work well against the skunk essence because they did not contain the oxidizing agents that eliminate the thiols (skunk essence). Since hydrogen peroxide, baking soda, and dish soap contains two different oxidizing agents and a surfactant (H2O2) it was able to eliminate the smell.

Summary Statement

Skunk Attack - I develop a home remedy that will eliminate skunk essence!

Help Received

none. I did the research and made the solution myself after several test attempts. I used human test subject to determine intensity smell.

Name(s)

An Truong; Tu Truong

Project Number

J0522

Project Title

Effect of pH on Teeth Staining

Abstract

Objectives

The purpose is to assess the effects of various pH levels prior to drinking tea with respect to teeth staining.

Methods

Extracted teeth were collected, sterilized, and bleached. Distilled water was mixed with sulfuric acid and sodium hydroxide to create pH 4, 7, and 9 solutions; pH levels were confirmed using litmus paper. The teeth were placed into each pH solution for 15, 450, and 1350 minutes and then subsequently submerged in Lipton black tea for the respective amount of time. Three volunteers used the VITA Shade Guide to determine the color shades of the teeth, before and after being exposed to tea. The changes in color shades were calculated and compared for each of the different pH levels and durations of submersion.

Results

The acidic solution had the highest degree of discoloration followed by the alkaline solution and neutral solution. The longer the teeth were exposed to pH solutions and tea, the greater the discoloration.

Conclusions

The pH of the mouth prior to consuming dark-colored food or drinks is an important factor in discoloring teeth. The more acidic or alkaline the environment, the greater the risk of tooth discoloration. To minimize tooth staining, the mouth is best kept in a neutral environment.

Summary Statement

We determined that an acidic environment leads to the greatest degree of tooth discolorations when subsequently exposed to tea, followed by an alkaline and then neutral environment.

Help Received

Materials, supervision, and questions were answered and provided by Dr. Thy Nguyen, DDS and Chemistry Lab Technician Dung Khong.

Name(s)

Isabelle Whetsel

Project Number

J0523

Project Title

Glorious Gluten: An Experiment Measuring the Amount of Gluten in Different Flours

Abstract

Objectives

This experiment was created to measure the level of gluten in different flours. It was expected that the Bread flour would have the most gluten and the Gluten Free flour would have the least, by a large margin, because Bread flour is typically high in gluten and Gluten-Free should have none.

Methods

Multiple flours were tested, they were mixed with water to make a dough, kneaded for five minutes each, and then rinsed, so as to let the excessive flour wash away. Each type of flour had 5 trials, and the weight was recorded of each dough before and after it was washed, this was used to calculate the percentage of gluten per flour.

Results

The Bread flour had the highest gluten percentage at .32%, while the Almond Flour had the lowest at .003%.

Conclusions

The conclusion is that Almond flour has less gluten than Gluten Free Flour, this is interesting to learn because, as its name suggests, Gluten Free Flour should not have any gluten in it. Instead, Almond flour has significantly less gluten, probably due to the fact that it is a nut flour, and nuts do not have gluten. This mis-branding is very dangerous for people who are gluten allergic or have Celiac disease

Summary Statement

Measuring the amount of gluten in different flours.

Help Received

Emily Hoffman helped with editing and forms as well as guiding throughout the process. Anne Louit helped with materials, testing, and board production.