CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Ronit B. Abramson

Project Number

S1501

Project Title

Further Investigation of Diatoms as Biological Indicators of Pharmaceutical Runoff

Abstract

Objectives/Goals

This research is intended to study possible physiological changes in diatom structure as a result of the presences of antibacterial pharmaceuticals in their aquatic environment. The purpose of this work is to determine the potential for diatoms as biological indicators of antibiotics in water.

Methods/Materials

Five species were isolated from two different wild sites and cultured in COMBO Media (Kilham, et. al, 1998). Each of the five species was then exposed three antibiotics (tetracycline, ampicillin, kanamycin) in five different concentrations: 200 microgram/ml, 67 microgram/ml, 22 microgram/ml, 7 microgram/ml, and 0 microgram/ml (control). After a seven-day exposure, the organics were cleaned from the cells using hydrochloric acid. The silica frustules, or cell walls, were visualized using scanning electron microscopy to observe morphological changes in the cells grown in antibiotic exposures.

Results

When exposed to 200µg/ml of ampicillin, all of the nitzschia palea cells visualized using scanning electron microscopy showed stretches on the frustules surface where the usually regular rows of punctae, small pores, were noticeably absent. These findings were later confirmed through replication. Mayamea atomus, a species with a less detailed valve structure, did not show any change in morphology when exposed to 200µg/ml ampicillin, 200µg/ml of tetracycline, or 200µg/ml of kanamycin. The antibiotics did not appear to affect the median groove elliptical-shaped characteristic appearance of this species. Striae, rows of pores, were also visible in radiating curves from the center of the cell.

Conclusions/Discussion

Ampicillin is designed to inhibitor of the enzyme transpeptidase, a protein needed for cell wall synthesis. Although intended to affect only prokaryotes, certain proteins within the eukaryotic diatom cell have close evolutionary relationships with prokaryotic cells and therefore might unintentionally affected by pharmaceutical molecules. The large affected areas indicate that the changes are likely caused by protein malfunctions. These effects could cause morphological changes by inhibiting the silica deposition process associated with the growth and development of the cell.

Summary Statement

Distinct structural changes occur in some diatom species cells when grown in aquatic environments containing antibiotics; therefore, they have the potential to sever as biological indicators of these products.

Help Received

Used lab equipment at Scripps Institution of Oceanography under supervision of Dr. Mark Hildebrand; Wendy Slijk (science fair advisor); Elizabeth Ruck and Claire Serieyssol provided knowledge for selection of a freshwater media; Mark Edlund and Teofil Nakob assisted species identification

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Lacey A. Benefiel

Project Number
S1502

Project Title
Mortality Rates of Capsicum frutescen Based Pesticides on Different Gender and Aged Acheta domesticus

Abstract

Objectives/Goals
The purpose of my experiment was to observe whether the age and gender of crickets affects the mortality rate, while comparing chile pequin to chile de arbol peppers as environmentally friendly pesticides. This information would be useful to consumers who use pepper pesticides so they would know what dosage it would take to eliminate the entire population of pests.

Methods/Materials
The two pesticides that I used during my experimentation, chile pequin and chile de arbol, were used at a 40.81 g/L concentration. This has proved to be the most effective pesticide concentration during the past three years of my research. I first compared the rate of death of young nymph crickets to the adult crickets to see if it varied between them while comparing both pesticides. I then compared the death rates of adult males to the adult females to see if either gender showed more resistance to either pesticide. Once my experimentation was completed, I statistically analyzed my data.

Results
I found that the chile de arbol showed a significant difference in the mortality rates when comparing females to males and nymphs to adults. Both the nymphs and females were more tolerant of chile de arbol, whereas the adults and males were weaker. When looking at the results for chile pequin, I found no variance between mortality rates. When comparing the two pesticides directly, I found that chile pequin killed all age and gender groups more efficiently than the chile de arbol.

Conclusions/Discussion
From my results, I can conclude that female and nymph crickets are more tolerant to most pepper pesticides than male and adult crickets, which therefor affects the overall mortality rate. I can also conclude that chile pequin is the best overall pesticide, killing the cricket population most efficiently.

Summary Statement
Adding on to my past years' results, I studied the effects of gender and age on crickets mortality rates while comparing chile pequin and chile de arbol as pepper pesticides.

Help Received
Mother helped with board layout, Father helped buy supplies, Dr. Tribbey, former college professor, helped with statistical analysis, Used lab equipment from Mr.Whittington's classroom at Sanger High.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Brenna A. Callero

Project Number
S1503

Project Title
Don't Move a Mussel!

Abstract

Objectives/Goals
The objective of this project is to create an eco-friendly, anti-corrosion and anti-biofouling coating to deter and control bio invasive Quagga Mussels from adhering to substrate surfaces and contaminating fresh water sources. This project is the result of extensive field research whereby coatings were created from plant and mineral extracts and applied to substrate surfaces and field tested. A second objective was to determine whether bees and wasps can be trained to detect quagga mussels attached to water recreational vehicles at lakeside checkpoints thus providing an economical on-site investigative method for park rangers to prevent cross contamination of waterways.

Methods/Materials
This researcher made plant extracts, believed to be selectively toxic to the Dreissena species based on their biology; then added them to an eco-friendly, sticky coating thus creating boosted anti-corrosive,bio-friendly coatings. These boosted coatings would not only deter quagga mussel adhesion to substrate
surfaces, but would have the added benefit of efficiently preventing corrosion of those surfaces. Finally, training bees and wasps to recognize the scent of the quagga mussel was tested using blocks of dessicated quagga mussels.

Results
The data gathered to date is supportive of original hypothesis in that bio-friendly sticky coatings to which natural extracts are added do have a deterring effect on quagga mussel veliger attachment; and show anti-corrosion capabilities of target treated substrate surfaces. Furthermore, trained wasps can be used for early detection of quagga mussel around recreational equipment assisting authorities in mitigating quagga mussel cross-contamination of water supplies.

Conclusions/Discussion
Initial observations of the experiment show promise of proving my preliminary hypothesis that certain plants have deterring molluscidal potential. Specifically, the organic mixtures on the coupons placed in Lake Skinner appear to deter and repel quagga attachment activity. Further research is ongoing with test coupons set in several lakes in Riverside and Ventura Counties and data is being analyzed. Laboratory studies are underway in order to substantiate field study data conclusions.

Summary Statement
Improve upon anti-corrosion coatings using eco-friendly botanicals and minerals in an attempt to prevent Quagga Mussel biofouling of substrate surfaces.

Help Received
California Department of Fish and Game grant of permits and use of boating equipment allowing me to study the quagga. Parents for transportation to lake areas.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Debra C. Chang

Project Number
S1504

Project Title
Effects of Varying Zinc Concentrations on Bioluminescence in Cypridina hilgendorfii

Abstract

Objectives/Goals
This study determined the effect of varying zinc concentrations on the bioluminescence of Cypridina hilgendorfii, a marine shrimp. The results were compared to my previous year's project that determined the effect of phosphate on this crustacean. The result of the present experiment may be used to find the concentration of a common water pollutant, the metal zinc.

Methods/Materials
Preserved Cypridina were introduced into zinc sulfate solutions in concentrations of 0.05 g/ 100 mL, 0.1 g/ 100 mL and 0.15 g/100 mL. The Control Group solution was undosed distilled water. For the dosed solutions, 0.05 g of ground Cypridina and 2 mL of zinc solution were placed in a cuvette. Four trials were done per concentration. Digital photographs were taken of each solution in a darkroom, exposing the film at 10, 15 and 20 seconds.

Results
The results were quantified using AnalySIS software. The program calculated the percentage of the picture that was black. This percentage was subtracted from 100% to determine the percentage of the rest of the picture, which was light in the white-to-blue spectrum. This light frequency was determined for each picture.

Conclusions/Discussion
With increased concentrations of zinc sulfate, the light frequency also increased. These results contrasted with the results from the previous year's study, where increasing sodium phosphate caused a diminishment of light. Future research can be done to discover why zinc enhanced the bioluminescent reaction while phosphate hindered it. Several possible explanations are presented. Using the significant effect on the amount of light being emitted, it is possible Cypridina can be used as a bioluminescent indicator of water quality.

Summary Statement
This project examines the effect of zinc, a common water pollutant, in varying concentrations on the bioluminescence of Cypridina hilgendorfii by targeting the reaction that produces light.

Help Received
Thanks to: Mr. Fogle, for letting me use the school darkroom, Mr. Robert Carr and Tracy Drake for allowing me to work with Madrona Marsh; Mr. Deedar Samant, for letting me use the AnalySIS software at the Doheny Eye Institute; Mr. Peter Starodub for guiding me through the research process.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Kenna N. Falk

Project Number
S1505

Project Title
Effectiveness of Sunscreen against UVA and UVB Rays

Abstract

Objectives/Goals
The objective is to determine which brand of sunscreen will most effectively protect against both UVA and UVB rays and why.

Methods/Materials
Five brands of sunscreen with identical SPFs of 30 were used to make a 10% dilution. That dilution was then inserted into a cuvette and inserted to the Spectrophotometer which had a preset wavelength of first UVA waves, then UVB waves. The absorption and transmission readings were recorded. This process was repeated three times for each brand of sunscreen for both UVA and UVB waves.

Results
Aveeno, the sunscreen with the highest amounts of UVA and UVB protectors as active ingredients, was the most effective with the lowest average UVA transmittance at 89.333. Target brand and Banana Boat sunscreens were close behind with average UVA transmittances of 90 and 90.333 respectively. Aveeno had the average transmittance of 0 against UVB rays. Coppertone Sport was the least effective against UVB rays with an average transmittance of 22.666.

Conclusions/Discussion
My conclusion is that hypothesis that the sunscreen with the most UVA and UVB protectors as active ingredients in the highest amounts would be the most successful was supported. Although Aveeno had the highest UVA absorbance at 7%, this number is extremely low when considering what the sunscreen claims to be doing for our skin. This suggests that though some sunscreens claim to protect against both UVA and UVB rays, the protection offered is poor. SPF measures specifically UVB protection, and in my results UVB protection was far better than protection against UVA rays, however UVA rays are responsible for long term skin effects so you may be unaware of the damage you are causing your skin.

Summary Statement
My project tests the effectiveness of sunscreens against UVA and UVB rays and to determine why some are more successful than others.

Help Received
Used lab equipment at Woodbridge High School thanks to Mr. Nakaue

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Margo E.C. Georghiou

Project Number
S1506

Project Title
Pectin-Aid

Abstract

Objectives/Goals
I plan on developing a medical gel using pectin and gelatin as my substances. I will apply the gel topically on minor skin abrasions to act as a blood coagulant. To test this, I will prick finger-tips and apply the pectin mixture to the pricks. To make an easy-applicable gel, I will make three different mixtures with different ratios. Using a finger absent of pectin as my control, I will observe the three samples and compare them.

Methods/Materials
First, sprinkle two packets of Knox# Unflavored Gelatine over 60mL of cold water. After 5 minutes add 237mL of boiling water, stir to dissolve.
When the gel has formed, mix 2 tbs. of it with ¼ tbs. of pectin in a bag until even. Repeat with 1 tbs. and 3 tbs. of pectin.
Next, prep the subject by sterilizing his finger tips with rubbing alcohol. Use a Lancet to prick a finger. Wait 5 seconds, wipe the blood on a piece of paper and immediately apply the gel. Record the time it took for the blood to coagulate. Repeat three times with each mixture.
Knox Unflavored Gelatine; Sure Jell Premium Fruit Pectin; Lancets; Timer; Rubbing alcohol; Human subject; Water; 3 Ziploc sandwich bags; Rubber gloves

Results
Both the 2:3 and the 2:1 coagulated the blood in less than five seconds after the gel was applied. However, the 2:1 coagulated more efficiently. The 2:1/4 slowed the bleeding slightly. This mixture did not have enough pectin for it to perform the job.

Conclusions/Discussion
The amount of pectin in the gel does affect the blood coagulation time. Yet, my hypothesis was proven incorrect because the 2:1 ratio gel worked the best. Both the 2:3 and the 2:1 ratios coagulated in under five seconds of application yet the 2:1 did a more efficient job.
Errors in my project ranged from not being able to determine the exact coagulation time to not being able to make large cuts on the subject. Due to this my results are not exact.
Not only can the gel be used as a product to keep in the medicine cabinet at home, but it can be taken on camping trips, or kept in a first-aid kit in the car or office.
Furthering my experiment, I would try different ratios. My goal being cost efficiency along with the same great results. I would have tested more subjects in the safety of a lab, hoping to gain more accurate results.

Summary Statement
By creating a pectin-gel, I tested it's blood coagulanting abilities.

Help Received
With a nursing backgroud, my mother supervised the Universal Precautions method throughout the experimentation.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Kyra H. Grantz

Project Number
S1507

Project Title
The Effects of Ocean Acidification

Abstract

Objectives/Goals
The purpose of this project is to determine the effects of ocean acidification (a process in which waters have lowered pHs and higher CO(2) concentration) on purple sea urchins. The urchins# homeostasis will be measured by observing mortality rates and the amount of food consumed. The urchins were exposed to pHs of 8.2 (control), 7.5, 6.8 and 6.2. It was believed that all the urchins would die in the pH of 6.8.

Methods/Materials
The experiment began by placing the urchins in 8 - 2 gallon sea-water tanks. The pH was adjusted using dry ice, with two tanks allotted to each pH level being tested. A buffer of citric acid was added to each tank to keep the pH at a more constant level. Although the water flow was removed to keep the pH constant, the tanks had screened tops so oxygen was still entering the water. The urchins were fed 50 grams of fresh kelp every day, and the food remaining from the previous day was measured. Every day, the tanks were siphoned to be cleansed of the debris accumulated over night. Water would be removed from the tanks in this process, which was then replaced, and the pH was re-adjusted. Whenever an urchin died, it was removed from the tank.

Results
After nine days of testing, 15 of the 48 original sea urchins had died. One urchin each died in a control tank and one tank with a pH of 7.5. In the tanks with a pH of 6.8, three urchins died. Ten urchins died in the tanks with a pH of 6.2. The least food was eaten in pH 6.2 (an average of 255 grams per tank over nine days), while the most was eaten in the control tanks (average 395 grams per tank). An average of 372.5 grams of kelp was eaten in the tanks with a pH of 7.5, whereas 332.5 grams average was eaten in each of the tanks with a pH of 6.8.

Conclusions/Discussion
This information did not support the hypothesis, as only 25% of the sea urchins died in 6.8 pH. However, 83% of the sea urchins died in the tank with a pH of 6.2, supporting the idea that ocean acidification could still have devastating effects on the environment. Further research could be done with other animals the utilize calcium carbonate, or in an ecosystem with different species in varied levels of the food chain.

Summary Statement
The purpose of this project is to determine the effects of ocean acidification (a process in which waters have lowered pHs and higher CO(2) concentrations) on purple sea urchins.

Help Received
Inspiration, support, and help in planning the project from Dr. George Matsumoto of Monterey Bay Aquarium Research Institute, used lab equipment at Hopkins Marine Station (of Stanford University) courtesy of Freya Sommers

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Erin C. Gray

Project Number
S1508

Project Title
Prevention of Marine Biofouling Utilizing Natural Substances

Abstract

Objectives/Goals
The objective of this project was to determine whether the biofouling of boat materials (fiberglass) could be avoided by the use of natural substances such as lime juice and olive oil when mixed with latex paint.

Methods/Materials
A piece of fiberglass was cut into eight equal pieces using a saw and a hole was drilled into each one. 40 ml. of lime juice and 60 ml. of white latex paint were mixed as well as 40 ml. of extra virgin olive oil and 60 ml. of the paint. Two of the samples were painted with the lime mixture, two with the olive oil mixture, two with plain latex paint, and two with copper bottom paint. They were allowed to dry in-between the two coats. After all of the paint had dried thin rope was used to tie each piece of fiberglass to the PVC pipe and was submerged into the water.

Results
The final results show that the lime juice sample had the smallest amount of growth out of the samples painted with a natural, nontoxic substance.

Conclusions/Discussion
The results did not support my hypothesis; I believed that the fiberglass pieces painted with the olive oil mixture would help prevent biofouling the best as it creates a slick surface and deflects water. The lime samples proved to prevent a large amount of biofouling and hold up to the rough ocean environment without significant paint loss. This suggests that lime juice does inhibit the development of organisms on fiberglass and may be a good antifouling agent without the harmful effects of chemicals and toxins.

Summary Statement
This project investigates the utilization of natural substances, such as lime juice and olive oil, and if they can be proven effective in preventing marine biofouling without the excretion of toxins from chemicals.

Help Received
Father helped cut fiberglass.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Otana A. Jakpor

Project Number
S1509

Project Title
Indoor Air Pollution: The Pulmonary Effects of Ozone-generating Air Purifiers and Other Household Devices

Abstract

Objectives/Goals
Although air purifiers are advertised to improve breathing, some air purifiers emit harmful ozone. This study examines the hypothesis that ozone-generating air purifiers and other ozone-generating household devices may impair pulmonary function. Year 1 of this study focused on the pulmonary effects of ozone-generating air purifiers. In light of the alarming findings of Year 1, I expanded the study 4-fold in Year 2 in order to determine if other ozone-generating/ionizing household devices also pose a pulmonary hazard.

Methods/Materials
8 experiments were conducted over 2 years. In the 2 ozone emissions experiments, the amount of ozone generated from several types of air purifiers, food purifiers, and assorted ionizing household devices was measured with an ozone sensor. In 6 pulmonary experiments, a microspirometer and a pulse oximeter were used to measure the pulmonary function of human subjects before and after exposure to various types of air purifiers, hair blow dryers, and a food purifier.

Results
Some air purifiers and a food purifier produced ozone concentrations far higher than a Stage 3 smog alert. A two-hour exposure to an ozone-generating room air purifier caused a statistically significant drop in pulmonary function among asthmatic subjects, but not for the whole study sample ($p<0.05$). There was a mean decrease of 11% in the FEV1/FVC ratio among the asthmatics. A three-hour exposure to a personal air purifier caused a statistically significant reduction in pulmonary function among the whole study sample as well as the asthmatic subset by 9.6% and 22.8%, respectively ($p<0.05$). One asthmatic individual experienced a 29% drop accompanied by an acute asthma attack. A food purifier caused a reduction in the FEV1/FVC ratio of 4.2% and 9.6%, respectively, among the whole study sample and the asthmatic subset.

Conclusions/Discussion
An ozone-generating food purifier produced ozone levels rivaling those of ozone-generating air purifiers. The ozone-generating air purifiers and food purifier tested had a negative effect on pulmonary function, especially among those with asthma and allergies. The new research on ozone-generating food purifiers further corroborates the pattern seen in my earlier findings with regard to air purifiers. This original research in Year 2 suggests that the California Air Resources Board should consider expanding their new regulation to include ozone-generating food purifiers.

Summary Statement
This original research found that some ozone-generating air purifiers and a food purifier produced ozone in levels higher than a Stage 3 Smog Alert and reduced pulmonary function (FEV1/FVC ratio), especially among asthmatics.

Help Received
My mother, an asthmatic, lent me her pulse oximeter and her microspirometer. Eco Sensors, Inc. donated an ozone sensor. Mother helped with the cutting board and gave editorial assistance. Mr. Steve Kinney, Ms. Holly Hall, and Mrs. Karen Jakpor hosted parties and allowed me to test the guests.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Elizabeth S. Koo

Project Number
S1510

Project Title
Effect of Trans-Resveratrol, a Natural Polyphenolic Compound, on Body Weight, Size and Behavior of Baby Gallus gallus

Abstract

Objectives/Goals
Imagine a world in which chickens are not given massive doses of antibiotics and synthetic compounds that affect not only the chickens but also the people who consume the chickens. With my project, a safer alternative to these antibiotics and synthetic compounds might be found. This alternative is resveratrol, which comes from the skin of grapes and is found in red wine. The purpose for testing resveratrol on baby chickens was to see if it could make the chickens grow more. Resveratrol also has antiviral and antifungal effects.

Methods/Materials
Materials: Nine Two-week Old Chicken, Trans-Resveratrol, Chicken Feed, 3 Cages, Water, Scale, 3 Bowls filled with water, Three color sharpies, heat lamp, ruler.
Separate the chicken into three groups with three chickens in each group. There will be three groups: P group (high dosage of resveratrol), R group(low dosage of resveratrol), and B Group(control). I diluted 125 mg of resveratrol with 10 ml of water. 2 ml of the solution was poured into 500 ml of water. This is the drinking source for P Group chicken. R Group's dosage is 1/4 of that. I weighed all chickens, and measured their leg length and wing span daily. They were fed 6 oz of the Chicken Feed, and given 500 ml of water every 12 hours. The project lasted for 12 days. On the last day, I calculated an average percentage of change in weight, leg length, and wingspan from day 0.

Results
The average percentage of change in weight from Day 0:
P group chickens: 145%, R Group chickens: 136%, B Group chickens: 115%.
The average percentage of change in leg length from Day 0:
P Group chickens: 63%, R Group chickens: 56%, B Group chickens: 55%.
The average percentage of change in wing span from Day 0:
P Group chickens: 66%, R Group chickens: 66%, B Group chickens: 54%.

Conclusions/Discussion
My hypothesis was correct. P Group chickens' growth increased the most by 145%; 30% more than B Group chickens. This is because resveratrol has the same functions as estrogen, a female hormone. It can bind to proteins called estrogen receptor genes (ER), which causes the enzyme SIRT1 to be turned on. After SIRT1 is turned on, more mitochondrias are produced, therefore more ATP is made. This increases the metabolism, and the growth of the P group chickens. However, a long-term experiment is needed before resveratrol can replace antibiotics or synthetic compounds.

Summary Statement
My project ist the effect of trans-resveratrol on the growth, size and behavior of baby gallus gallus.

Help Received
Mother helped with weighing and measuring chicken and board.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Audrina LeBlanc

Project Number
S1511

Project Title
Toxicity of Methyl Iodide on Invertebrates

Abstract

Objectives/Goals
The objective is to determine if methyl iodide is toxic towards invertebrates. Methyl iodide is under consideration as a drop-in replacement for methyl bromide for use on plants requiring fumigation. Methyl iodide could, potentially, be used in our local strawberry fields. In contrast with methyl bromide, the liquid and water-soluble methyl iodide could end up in run-off from fields where it might interact with aquatic organisms.

Methods/Materials
I researched the effect that methyl iodide would have on two types of fresh water crustaceans, Daphnia and Amphipods. The crustaceans were exposed to a range of levels of methyl iodide from 0ppm to 3500ppm and the effect of the chemical on survival of the crustaceans was examined.

Results
I determined that methyl iodide killed all crustaceans over a 270 hour period, including the controls. As the concentration of methyl iodide decreased, the time that it took for the crustaceans to survive increased. These results indicate that at these concentration ranges methyl iodide is harmful to crustaceans. More testing is in process.

Conclusions/Discussion
If scientists and researchers decide to implement methyl iodide as a pesticide into the world of agriculture, they must be aware of its toxicity towards invertebrates. It potentially could affect other aquatic life because they feed on the lower organisms like crustaceans. As a result, if crustaceans are killed off through the use of methyl iodide, it eliminates the food source for other aquatic life forms. For that reason, it is important that if we do implement methyl iodide into agriculture, we must make sure that it#s at low concentrations

Summary Statement
The focus of my project is to determine if methyl iodide is toxic towards invertebrates.

Help Received
Used lab at the University of Channel Islands under the supervision of Dr. Hampton.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Wesley Leung; Ivy Nguyen

Project Number

S1512

Project Title

Pro-, Pre-, and Synbiotics: Analyzing the Effects of L. acidophilus with Lactulose as a Novel Approach to Weight Control

Abstract

Objectives/Goals

Human gastrointestinal flora includes probiotics, which are beneficial bacteria that participate in a wide variety of metabolic processes that confer good gastrointestinal health. Prebiotics, nondigestable food ingredients, are used to selectively stimulate the growth and activity of probiotics. The combination of the two is called synbiotics. To address the growing issue of weight control, this research focused on developing a probiotic treatment to induce weight loss in laboratory mice. It was hypothesized that the probiotics will consume glucose in the GI tract to induce weight loss and the efficiency with which it does so will be enhanced by increased dosage and the addition of prebiotics.

Methods/Materials

Four groups of mice were administered probiotic Lactobacillus acidophilus. Lactulose was used as a prebiotic in conjunction with l. acidophilus to aid probiotic survival in the GI tract. Weight was monitored daily. Additionally, l. acidophilus was cultured in glucose, lactulose, a combination of both, and simulated stomach acid (0.1 M HCl) to determine the viability of the strain in those mediums.

Results

L. acidophilus flourishes in glucose, lactulose, and a combination of both, covering an area over ten times that of the null treatment control group. Furthermore, the simulated stomach acid culture survived, covering a total area of about a third of that of control. A chi-2 test for significance indicates that these differences are statistically significant.

Mice weights show negative correlation for all treatment groups, indicating consistent weight loss. The average weights of mice administered synbiotics showed 60% and 370% greater loss than the control for single and double doses, respectively. Mice administered probiotics displayed similar results. In both treatments, increased dosage increased the rate of weight loss. There is, however, no statistically significant difference in weight lost between probiotic and synbiotic groups administered the same dose.

Conclusions/Discussion

L. acidophilus's effective metabolization of glucose and survival in simulated stomach acid lent support to the hypothesis that the species can promote weight loss. Though prebiotic lactulose did not lead to greater weight loss, an increased dose of either treatment did. Thus, while synbiotics have no added benefit, probiotics show promise as an effective approach to promoting weight control.

Summary Statement

This research tested the ability of probiotic bacteria to metabolize glucose in the GI tract to an extent that would induce weight loss and analyzed the effects of prebiotic lactulose in increasing the effectiveness of the probiotic dose.

Help Received

Veterinarian Greg Anderson gave advice on mouse care. Teacher Darra Cacao let us use biology room at school and lent us basic lab supplies.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Samantha Martinez; Alexandra Wall

Project Number
S1513

Project Title
The Ants Go Marching In

Abstract

Objectives/Goals
To determine whether a diluted and thus lower concentrated solution of the ant deterrent, Raid, is as effective as a fully concentrated solution of Raid.

Methods/Materials
Six different concentrations of Raid (in increments of 20%) were tested with each concentration tested twice. Ten ants were collected and placed in each sealed container with the appropriate level of Raid concentration. As an incentive, one tablespoon of maple syrup was placed on the opposite end of the container as the ants. Ten minutes were allotted and the number of ants living, weakened, terminated, and those which successfully crossed the Raid concentration were recorded.

Results
The number of ants which crossed the deterrent peaked at the 80% concentration and 0% concentration of Raid. Further, the 60% concentration proved as effective as the full concentration of Raid in preventing ants from crossing. The number of ants weakened by the deterrent displayed its high point in the 60% concentration and its low point in the full concentration.

Conclusions/Discussion
The hypothesis was proven partially correct: a lower concentration of Raid is as effective in deterring ants as the fully concentrated solution. However, a 60% concentrated solution is equally effective rather than the hypothesized 80% concentration. The data suggests that a lower concentrated and thus consumer and penny-friendly Raid solution would be just as effective in deterring ants as the full concentration.

Summary Statement
Whether a lower concentration of Raid is as effective in deterring ants as the full concentration of Raid.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Dana M. Meyenberg

Project Number
S1514

Project Title
Does Eating Poppy Seeds Affect Opiate Drug Tests?

Abstract

Objectives/Goals
The objective of my project was to determine if eating a single poppy seed muffin will cause an opiate drug test to appear positive.

Methods/Materials
With the consent of each subject, they were tested for opiate drugs. Once the tests were determined negative, they were fed a predetermined amount of poppy seeds or a poppy seed muffin. Their urine was then tested for traces of opiates using an opiate drug test kit.

Results
If five grams of poppy seeds, or the equivalent found in one poppy seed muffin, are consumed then the subject will show a positive result on an opiate drug test.

Conclusions/Discussion
These results prove that some opiate drug tests will appear positive, even if the subject hasn't consumed any opiate drugs.

Summary Statement
My project is to determine if poppy seed consumption causes a positive result on an opiate drug test.

Help Received
Mother purchased tests; brothers were tested.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Adam D. Nitido

Project Number
S1515

Project Title
The Effects of a Fatty Acid Synthase Inhibitor on Multi-drug Resistant Ovarian Cancer Cells

Abstract

Objectives/Goals
The objective is to determine the effect of a fatty acid synthase inhibitor on multi-drug resistant ovarian cancer cells compared to drug sensitive ovarian cancer cells.
Hypothesis: Multi-drug resistance reduces the endoplasmic reticulum stress response in ovarian cancer cells after treatment with Orlistat.

Methods/Materials
Cell viability was tested with the drug Orlistat to both the drug resistant and drug sensitive cancer cells with a trypan blue exclusion. The SRB assay was then conducted to compare cell viability after treatment with Orlistat. Finally a Coomassie stain was conducted to qualitatively assess the proteins in both ovarian cancer cell lines before and after Orlistat treatment.

Results
Treatment of ovarian cancer cells with Orlistat dramatically reduces cell proliferation as determined by the trypan blue exclusion assay. After a 72 hr orlistat treatment, the multi-drug resistant ovarian cancer cells, NCI/ADR, showed growth recovery, while the sensitive cells, OVCAR-8 continued to decline.

Conclusions/Discussion
As shown by the trypan blue exclusion and the SRB assay, there was resistance to Orlistat in the multi-drug resistant ovarian cancer cells. The Coomassie stained gel showed obvious differences in protein profiles between the two cell lines and between the treated and untreated cells. A Dual-Luciferase Reporter Assay will be performed with a DNA plasmid that responds to endoplasmic reticulum stress (GRP78-Luc). This will be compared to a control plasmid (pGL3) and a standard unit our internal control (Renilla plasmid) by measuring the amount of luminescence in a luminometer. The plasmids will be transfected into the both drug resistant and drug sensitive ovarian cancer cells. The luciferase reporter would be able to compare GRP78, which will show endoplasmic reticulum stress, activity between drug resistant and drug sensitive cells after Orlistat treatment.

Summary Statement
To determine the effect of a fatty acid synthase inhibitor (Orlistat) on multi-drug resistant ovarian cancer cells compared to drug sensitive ovarian cancer cells through several approaches.

Help Received
Jason Bush PhD, California State University Fresno

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Alexander P. Padilla

Project Number
S1516

Project Title
Effects of a Pyruvate Glucose Cocktail

Abstract

Objectives/Goals
This experiment explores the ability of "performance boosting" drinks and coffee to improve a mouse's ability to run through a maze. Also the behavior of the mice is studied to see the effects of the various drugs on their daily activities.

Methods/Materials
Eight white lab mice(Mus musculus)are run through a maze after being administered a drug which may or may not affect their ability to traverse the maze. The mice are administered a calculated amount of the drug and also put through a trial 30 minutes after being administered the drug and 60 minutes after being administered the drug.

Results
The mice which were administered a drug performed better during the first five trials but following that their times began to drop. After the tenth trial the mice administered a drug began to have times which were worse in comparison to the standard when they usually were better. Behavioraly the mice appeared more alert and active at first but also experienced more aggression as the test continued with the males becoming especially aggressive.

Conclusions/Discussion
The data of this experiment has shown that "performance boosting" energy drinks and coffee both increase the mouse's ability to run through the maze at first but once consecutive trials are run the mice begin to lose that boost of time and end up becoming worse in the amount of time it takes to run through the maze. These drinks do not have the ability to boost performance past a certain point and should not be taken on a regular basis and maybe even at all because of the possible side effects. Although it cannot be said which specific area is being affected by the drink, whether in the brain or the muscles themselves and more study is needed. The males also showed a more aggressive attitude the longer the test went on but the females did not until the final two trials so a study should be performed on gender specifically as well.

Summary Statement
Discovering the effects of "performance boosting" energy drinks and coffee on the ability of a mouse to transverse a maze.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Alex Q. Santillan

Project Number
S1517

Project Title
Effect of Caffeine on Fertilization Rate of Strongylocentrotus purpuratus

Abstract

Objectives/Goals
To test if caffeine effects the fertilization of the purple sea urchin

Methods/Materials
The gametes from the purple sea urchin were collected and were added to the concentrations of caffeine for a period of 5 minutes, and then slides were prepared and observed to determine the success rate of the fertilization process for each caffine concentration.

Results
The experimental results indicated a notable decrease in the success rate of each increasing concentraion of caffeine

Summary Statement
The focus was to see if caffeine effected the fertilizations success rate of the purple sea urchin

Help Received
used lab equipment at Mount Miguel High School

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Barbara Shinaver

Project Number

S1518

Project Title

Determining the Effectiveness of Green Tea in the Expression of the SIR2 Gene in Drosophila melanogaster

Abstract

Objectives/Goals

The purpose of my current project is to determine if the expression of the longevity-related SIR2 gene is a factor in the increased life-span of Drosophila Melanogaster bred on Green Tea.

Methods/Materials

From my two previous projects I have established that Green Tea is beneficial to Drosophila Melanogaster in protecting against environmental stresses and extending their lifespan. I have allowed two generations of flies to live on this Green Tea and Drosophila formula food solution, stopping the lives of 1st generation flies at 70 days and 2nd generation flies at 35 days and testing them at this point. With assistance and supervision by a Dr. and a lab technician at a UCLA laboratory, I studied the effects of Green Tea on both protein and the SIR2 gene through RNA by RT-PCR, PCR, electrophoresis, SDS Gel, and Western blot.

Results

After completing the study, I was able to determine with a high degree of certainty that the SIR2 gene was only present in the basal level, the expected amount of expressed gene. The proteins also showed this equal amount of minimal expression through visually equal amounts of protein bands seen in the Western blot test.

Conclusions/Discussion

According to the Agarose electrophoresis gel run with all samples, the SIR2 gene is as affected by Green Tea in the same manner it is affected by distilled water (control). The protein determination showed that the amounts of protein expressed were present and present in equal numbers, showing again (but not with complete certainty) that Green Tea did not abnormally affect the SIR2 gene.

Summary Statement

Based on data collected from previous experiments, I bred Drosophila on Green Tea to determine if it had an effect on the expression of the SIR2 gene.

Help Received

Used lab equiplent at UCLA under the supervision of Dr. Shalini Kumar

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Kanan K. Sindhu

Project Number

S1519

Project Title

The Role of Nitrosative Stress in Testosterone Depletion and Overload in Skeletal Muscle

Abstract

Objectives/Goals

The objective is to test the hypothesis that testosterone depletion will cause nitrosative stress as seen through increased nitrotyrosine levels. This will result in the nitration of tyrosine residues in proteins, which will lead to protein dysfunction. The nitration of the tyrosine residues will occur because inducible nitric oxide synthase (iNOS) will be producing nitric oxide (NO) in greater amounts in castrated samples and in those supplemented with supraphysiological levels of testosterone. Thus, iNOS levels should be greater in these samples. Additionally, supplementation with physiological levels of testosterone will reverse these effects.

Methods/Materials

Western blots were conducted to determine the relative abundances of inducible nitric oxide synthase (iNOS) and nitrotyrosine. Testosterone levels were altered. Four groups of samples came from a total of 16 mice: those that had been castrated, those supplemented with physiological testosterone levels, those supplemented with supraphysiological testosterone levels, and the controls. Each experiment was repeated three times.

Results

The expressions of both iNOS and nitrotyrosine were significantly upregulated in the castrated samples and the samples supplemented with supraphysiological doses of testosterone. Supplementation with physiological doses of testosterone ameliorated this upregulation.

Conclusions/Discussion

Testosterone depletion caused nitrosative stress, as did testosterone overload. The upregulation of iNOS led to the increased production of nitric oxide (NO), which then reacted with increased superoxide radical levels. This produced the peroxynitrite radical (ONOO-), which then nitrated tyrosine residues of proteins, causing protein dysfunction. This suggests that testosterone overload and depletion cause nitrosative stress, thereby resulting in protein modification. Supplementation with physiological testosterone levels prevented such protein modification.

Summary Statement

Testosterone depletion and overload cause protein modification.

Help Received

Used lab equipment at Charles Drew University under the supervision of Dr. Ram Sindhu

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sarah Waliany

Project Number
S1520

Project Title
Transformation of Herceptin-Sensitive Breast Tumor Cells into Resistant Cells by PI3K/Akt Pathway Activated by t-Darpp

Abstract

Objectives/Goals
This study aimed to confirm that t-Darpp protein can cause Herceptin-resistance in previously Herceptin-sensitive Her-2 positive breast cancer cells by activating the anti-apoptotic PI3K/Akt pathway.

Methods/Materials
SKBR3 breast tumor cells transfected (experimental clones) and not transfected (control clones) with t-Darpp were used. Sulforhodamine B (SRB) Assay determined the cells' total protein biomass to indicate cell growth in the presence of different Herceptin concentrations, including 0uM. A cell counting assay directly measured cell growth in the presence of 0.2uM Herceptin. Western analysis determined the cells' expression levels (also in the presence of 0.2uM Herceptin) of the anti-apoptotic proteins Akt and pAkt, as well as t-Darpp to confirm that transfection with t-Darpp in experimental clones was successful.

Results
Cell counting assays showed that experimental clone cells grew in Herceptin's presence whereas control clone cells died. On day 4, the Control Clone NVo cells treated with 0.2uM Herceptin had an average cell count of 6.00E+04 cells, which decreased to 2.00E+04 cells on day 10. On the other hand, on day 4, the average cell count of Experimental Clone A cells treated with 0.2uM Herceptin was 9.33E+04 cells, which increased to 2.20E+05 cells on day 10. SRB assay showed similar results. The control clone cells that were treated with 0.03uM Herceptin had an average protein biomass of 0.1964 after 7 days and 0.1401 after 10 days, indicating that the cells died in the drug's presence. On the other hand, the experimental clone cells that were treated with 0.03uM Herceptin had an average biomass of 0.4231 after 7 days and 0.7580 after 10 days, indicating that the cells continued to grow in Herceptin's presence. Western analysis showed that control and experimental clones expressed Akt before and after Herceptin treatment. On the other hand, control clones expressed pAkt only before drug treatment while experimental clones expressed both pAkt before and after treatment.

Conclusions/Discussion
This is the first study that shows that Herceptin-sensitive breast cancer cells become resistant through transfection with t-Darpp that possibly causes this resistance by activating the anti-apoptotic PI3K/Akt/pAkt pathway. Understanding t-Darpp's drug-resistant mechanisms in breast tumor cells will facilitate in blocking these pathways and promoting sensitivity to Herceptin in breast tumor patients.

Summary Statement
The protein t-Darpp can activate the anti-apoptotic PI3K/Akt/pAkt cellular pathway to make once Herceptin-sensitive SKBR3 breast tumor cells become resistant to Herceptin.

Help Received
Used lab equipment at Beckman Research Institute at City of Hope under the supervision of Dr. Susan Kane and Dr. Long Gu.