CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Mahuya Barua

Project Number

S1701

Project Title

The Effects of Curcumin on the Memory Curves of Planaria: A Model of the Treatment of Alzheimer's Disease

Abstract

Objectives/Goals

The purpose of my study is to determine whether the Indian herb, curcumin, delays the degradation of neurons demonstrated by the decline in the conditioned response of the flatworm, planaria. This can be used as a model for the pathology of neurodegenerative diseases, such as Alzheimer#s disease which affects millions of patients in the United States today. My hypothesis states that there will be a direct, dose-related improvement in the retention of memory of the planaria as the grams of curcumin increments in each experimental group.

Methods/Materials

This experiment had six experimental groups and one control group. Each group contained 10 planaria in a petri dish. Each group was given 0g-0.030 grams of curcumin mixed in with its pond water for an hour. After being exposed to curcumin for an hour, each group of 10 planaria will be entered into a Y-shaped maze together under the same setting for 10 repeated trials. An operant conditioning method was used to train the group to turn right in the maze where the liver was placed to be used as a reward.

Results

The results show a steady dose-related response in doses of curcumin from 0.010 g to 0.030g as expected. As the amount of curcumin intake increased, more planaria retained the memory to turn right toward the liver and the average time to complete the maze decreased for each group. As the trials increased, each group lowered the number of turns to the left and increased the number of turns to the right while the number of unfinished maze decreased for each group. The linear regression of minutes taken to complete maze shows a very high correlation between grams of curcumin and memory retained to turn right in the maze toward the reward.

Conclusions/Discussion

In conclusion, curcumin acts as a scavenger of free radicals and oxidants that lead to the deterioration of neurons, pathology postulated to occur in Alzheimer#s. Curcumin#s activity and structure#function relation as a radical scavenger, metal chelator, and antioxidant is the reason why it should be used more often on Alzheimer#s patients. As the curcumin was consumed, it decreased the oxidation and the free radicals that cause the worsening of neurons. This helps the planaria retain their memory of associating turning right with getting a reward. For further research, I want to gain a broader understanding of how curcumin reduces oxidative damage using a more complex maze and model.

Summary Statement

My project is about finding the relationship of curcumin, a herbal spice, and memory retention.

Help Received

Teacher let me conduct the entire experiment in the storage room. Mother helped me buy the planaria and curcumin.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Colton Bracken; Logan Hicks

Project Number

S1702

Project Title

Acne: An Herbal Alternative to Modern Treatments

Abstract

Objectives/Goals

The objective is to determine the effectiveness of various essential oils on Propionibacterium acnes, in comparison to the antibiotic Erythromycin.

Methods/Materials

First, an isolate of P. acnes was obtained from my pores. P. acnes was then grown in the presence of previously prepared essential oil treatments and placed in home made anaerobic chamber and incubated at 37 degrees C. The zone of inhibition was measured and compared to that of an Erythromycin zone of inhibition. Kirby-baur disc diffusion method was followed in this experiment.

Results

The zones of inhibition for several oils such as neem, echinacea, and grapefruit showed small zones of inhibition in repeated experiments, less than 10 mm in diameter, proving a relatively low effectiveness of these treatments. The more successful disks contained thyme, cinnamon, and tea tree oils. The high dosage (15 uL) Thyme in particular exhibited a zone of inhibition 67 mm across, approximately 50% larger than the 15 ug erythromycin disk. Treatments of turmeric and eucalyptis served as a moderately effective treatments but were not so successful as to stand out against the other disks.

Conclusions/Discussion

Through our experiment we were able to show that various essential oils exhibit quantifiable levels of cytotoxicity against P. acnes. In particular, we have found that Thyme - yielding a zone of inhibition of 68 mm - poses a very plausible alternative treatment for people afflicted with acne.

Summary Statement

We tested the cytotoxicity of essential oils on Propionibacterium Acnes, a primary factor in the pathogenesis of acne, and compared those results to those of the antibiotic erythromycin.

Help Received

Our teacher answered our inquiries and allowed us to work in her classroom. Also Los Robles Hospital allowed to us to use their facilities to perform a gram stain of our bacterial culture.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Jessica L. Cao

Project Number

S1703

Project Title

Household Cleaning Hazards: Investigating Effects of Chemicals in Windex and Formula 409 on A549 Lung Epithelium

Abstract

Objectives/Goals

The purpose of this experiment was to test (a) how household cleaning products, such as Windex, and Formula 409, and the carcinogenic chemicals that the aforementioned cleaners consist of, such as perchloroethylene, sodium hydroxide, and 2-butoxyethanol, affect the proliferation of A549 lung epithelium subsequent to in vitro exposure, as well as (b) which chemical can be identified as the #culprit# for such effects. The goal is to test the hypothesis sodium hydroxide will warrant cell death while the rest will instigate proliferation.

Methods/Materials

Each of the five agents, and a Phosphate Buffered Saline control were applied to the cell media at a serial dilution going from the concentration in misted Windex/Formula409, to a 1:10 and 1:100 dilution. The well plates were then incubated over night in a water-jacketed incubator at 37 C 5% CO2. Subsequently, the data was collected in terms of cells/mL (using a hemocytometer), and in terms of ATP Levels (using an ATP Assay in which luciferase induced production of ATP and photons measured by a luminometer).

Results

Sodium hydroxide treated media caused the most cell death, followed by media treated with Formula 409, Windex, perchloroethylene, and finally 2-butoxyethanol which yielded the highest number of cells next to the PBS control media. Generally, cells/mL decreased linearly with an increase in dosage of the agent, thus indicating that each agent caused some form of cell death.

Conclusions/Discussion

When based solely on results collected in this time frame, the hypothesis was refuted in that all of the agents engendered cell death in lieu of proliferation. However, cells exposed to Windex and carcinogenic chemicals listed by the EPA and OSHA were damaged but exhibited high ATP levels and quick repair, which eludes to potential effects of long term exposure based on the initial observations. The experiment can be extended through a prolonged study at a molecular level, observing mutagenic effects of such chemicals on DNA of adenocarcinoma lung cancer cells.

Summary Statement

This project investigates the effects of insidious chemicals found in seemingly innocuous household products on A549 lung epithelium, and in doing so, one can develop increased cognizance of harmful chemicals in today's innovative society.

Help Received

Used lab equipment at University of California, Riverside, under the superivion of Dr. Kathryn DeFea, PhD; Parents helped assemble wooden board and drill in hinges.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Shu-Hao Chang; Chih-Chun Hu

Project Number
S1704

Project Title
To Determine Which Smoke Is the Most Harmful to Living Plants

Abstract

Objectives/Goals
Considering to the global warming issue, as the toxic smokes increase,it causes the population of living plants decreases.The air becomes worse and worse recently because humans keep producing toxic smokes. And these smokes start to damage and even destroy living plants. Living plant is the main principle to maintain and neutralize the air condition.Basically, the goal of our lab is to know which smoke is the most pernicious to living plants by using the smokes of candle, incense, cigarette, and gasoline gas.We find out that both the smokes of incense and gasoline gas are the most harmful to our experimental plants- peas.Therefore, in order to improve the situation of global warming, to protect living plants, and to guarantee humans' safety, people should start to decrease the using of these two materials.

Methods/Materials
5 Peas, 5 empty bottles, Timer, Matches, 3incenses, 1Cigarette, Plastic bag, Gasoline gas, Tape, 1 Candle, Soil.

Results
Eventually,after the students' analysis, they definitely can determine that the smokes of incenses and gasoline gas are the most harmful and detrimental to the peas. Now, to pretend peas to living plants, such as grasses and trees, by this, the students can warn people to avoid using incenses, and to alleviate the production of gasoline gas. Eventually, people can safe their environment, and safe their lives.

Conclusions/Discussion
In conclusion, the student can surely say that their assumption is right- the smokes of incenses and gasoline gas are the most harmful to the peas. On the other hand, the students can use pea to represent living plants, includes trees and grasses, so if people use either incenses or to produce gasoline gas frequently, the living plants that surround people are going to die pretty soon. In LA, or other places, people should avoid producing these two toxic smokes of the materials, in order to safe people's environment, and to safe people's lives.

Summary Statement
To determine which smoke is the most harmful to living plants

Help Received

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Justin J. Choe

Project Number

S1705

Project Title

Characterizing the Toxicity of Copper Nanoparticles on Environmental Microorganisms

Abstract

Objectives/Goals

To accurately assess the impacts of ever-increasing inputs of copper nanoparticles on the environment, it is important to explore their interactions with microbes, which are at the foundation of all ecosystems, serving as primary producers and drivers of global nutrient cycles. Chlamydomonas reinhardtii is a photosynthetic unicellular freshwater microalgae. It serves as the primary producer of many freshwater ecosystems. The objective of this project is to evaluate the interaction of metallic copper nanoparticles with Chlamydomonas reinhardtii in order to understand fate and toxicity of nanoparticles in the environment.

Methods/Materials

Chlamydomonas reinhardtii cultures were grown in Tris Acetate Phosphate medium at 25 degress Celsius under 16h:8h light:dark cycle. Culture samples were transferred twice each, then taken from the mid-logarithmic growth phase and exposed to copper nanoparticle concentrations ranging from 0.098 to 100 mg/L or equivalent concentrations of copper ions derived from CuCl(2). CellTiter-Glo was added to the cell solution after incubation, and the cells were placed in a 384 well plate. Bio-luminescence was taken through high-throughput screening, and the logarithmic graph of ATP concentration was plotted. Chlorophyll concentration measurements were derived from optical density readings of cultures exposed to 20mg/L copper nanoparticles and copper ions.

Results

Chlorophyll, ATP concentration, and photosynthetic yields of algal viability declined with increasing dose, confirming that copper nanoparticles were toxic to algae. The average IC50 value for copper nanoparticles were 20mg/L, while those for copper ions were 15 mg/L, which are comparable. Thus, the results indicate that copper nanoparticles are primarily toxic due to the release of copper ions.

Conclusions/Discussion

Copper is critical for photosynthesis because deficiency causes chlorosis of chloroplasts, while excess copper is toxic to photosystem II. This project proposes a rapid and efficient method for assaying growth and viability counts of algae by utilizing novel high-throughput screening process. In summary, this research provided a foundation for understanding copper nanoparticles impact on environmental microbial communities as well as management of the global aquatic carbon cycle.

Summary Statement

This project investigated the toxic effects of copper nanoparticles on the carbon cycling microorganism Chlamydomonas reinhardtii

Help Received

Mentored by Dr. Shaily Mahendra of UCLA, Environmental Engineering; Used lab at UCLA under supervision of Melissa Spitzmiller; Advised by Mr. Peter Starodub

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Jack E. Davis

Project Number
S1706

Project Title
Aluminum Water Pollution: The Effects of Aluminum on Daphnia magna in Fresh Water

Abstract

Objectives/Goals
This science fair project first investigates the current state of aluminum water pollution in fresh water sources such as rivers and lakes. According to the World Health Organization (WHO), #fresh waters with near-neutral pH values usually have aluminum concentrations ranging from 0.001 to 0.05 mg/L but rise to 0.5#1 mg/L in more acidic waters or water rich in organic matter". Using these concentrations as a guide, the following experiments determined the acute toxicity of aluminum (in the form of aluminum nitrate) on Daphnia magna, a known biological indicator species.

Methods/Materials
The first method involved in this project is an aluminum serial dilution, from 10,000 mg/L to 0.001 mg/L. This was replicated multiple times, to accommodate for multiple trials. The second main method involved is the acute toxicity test. Roughly 15 Daphnia magna were placed into each concentration, and were observed over a 48 hour period. At the end of this period, I recorded how many Daphnia had lived, and how many had died. This method was replicated multiple times.

Results
By graphing the results of the experiment, and by finding the corresponding exponential trendline, the LC50 is calculated to be 1.07 mg/L. This means that in fresh water that has an aluminum concentration of 1.07 mg/L, 50% of Daphnia magna will not be able to survive.

Conclusions/Discussion
The data from these experiments show that the LC50 for Daphnia magna is 1.07 mg/L. If the data from the WHO is accurate, then a toxic level of aluminum in waters that are slightly acidic or waters rich in organic matter is likely going to be reached very shortly.

Even more troublesome is that few organizations monitor the level of aluminum in fresh water.

Over the course of these experiments, I spoke with the lead water quality monitors from the City of San Diego as well as the San Diego Coastkeepers. Both organizations explained that they do not currently monitor aluminum levels in water, citing both difficulty and budget restrictions. Given the results of this experiment, we may only be 0.07 mg/L away from reaching a toxic level of aluminum, and I would propose that aluminum levels be monitored, and efforts be made to reduce the level emitted into water sources.

Summary Statement
This project investigates the currents state of aluminum pollution in fresh waters, and determines the LC50 of aluminum for Daphnia magna, a known biological indicator species.

Help Received
Used my high school's lab equipment.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Stacey S. Dojiri

Project Number

S1707

Project Title

The Effects of Ocean Acidification on the Larval Shell Development and Calcification of the Red Abalone

Abstract

Objectives/Goals

This project focuses on the effects of increasing atmospheric CO2 and decreasing pH on the development and calcification of larval red abalone shells.

Methods/Materials

Female and male abalone were induced to spawn. Fertilized eggs were then siphoned into a beaker and a homogenous mixture of embryos was pipetted into each experimental bowl. There were 6 bowls per gas chamber. Four gas chambers were used: a control injected with 200 mL of air, one injected with 200 mL of 10% CO2, another injected with 400 mL of 10% CO2, and the fourth injected with 600 mL of 10% CO2. After 48 hours, final water quality measurements were taken. The larvae were transferred into culture flasks and examined under an inverted microscope.

Results

In the control chamber, 99.67% of the abalone developed normally. In the chamber injected with 200 mL CO2, 91.17% developed normally. 29.83% of the abalone in the 400 mL CO2 chamber developed normally, and only 1.33% developed normally in the 600 mL CO2 chamber.

Conclusions/Discussion

My hypothesis that increasing levels of CO2 and decreasing levels of pH would cause the abalone shells to develop abnormally was supported strongly by my results. These results clearly show that ocean acidification is impairing abalone growth and survival. This study is significant because red abalone are endangered, and the decrease in their populations has both environmental and economic effects.

Summary Statement

This project focuses on the effects of increasing atmospheric CO2 and decreasing pH on the development and calcification of larval red abalone shells.

Help Received

Rodeline Estiva helped with spawning abalone; Dawn Petschauer taught me how to calibrate pH meters and use the CETIS data analysis program; Masahiro Dojiri oversaw and supervised the project.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Eli Erlick

Project Number
S1708

Project Title
The Effects of 17 B-Estradiol on Embryonic Danio rerio Hatching Rates under Elevated Temperatures

Abstract

Objectives/Goals
The objective of this experiment was to determine if rising temperatures in waterways due to climate change could impact fish egg viability when exposed to estrogen, a contaminant of many waterways around the world.

Methods/Materials
20 zebrafish were obtained and bred. 200 eggs were collected and 50 eggs were put into 2 liters of water at 26.7 C, 50 eggs were put into 2 liters of water at 29.4 C, 50 eggs were put into 2 liters of water at 26.7 C and 10 Aμg/liter of estradiol, and 50 eggs were put into 2 liters of water at 29.4 C at 10 Aμg/liter of estradiol. The eggs were incubated for 4 days and hatching rates were determined. This was repeated two times for a total of three trials.

Results
The eggs that were exposed to estrogen at 29.4 C had a decreased hatching rate as compared to eggs that were exposed to estrogen at 26.6 C. This difference was greater than the decrease of hatching rate of eggs unexposed to estrogen to 29.4 C compared to eggs that were unexposed to estrogen at 26.6 C. This indicates that estrogen may increase the sensitivity of the eggs to the effects of heat. In both trials, the eggs that were exposed to both the higher temperature and estradiol had a lower hatching rate. This rate was statistically significant.

Conclusions/Discussion
The potential for synergism between environmental stressors is an important area of study if we are to save the earth's ecosystems. This experiment supports a concern regarding fish egg viability in estrogen exposed eggs when incubated at elevated temperatures. This study examines the potential for estrogen, a known pollutant, and warming waterways to affect fish egg viability.

Summary Statement
The effects of climate change and environmental pollutants were evaluated by incubating zebrafish eggs at two different temperatures with and without exposure to estradiol to determine hatching rates.

Help Received
Dr. Carla Longchamp helped obtain estradiol powder.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Mike D. Feehan

Project Number
S1709

Project Title
The Effect of High-Fructose Corn Syrup in Comparison to Sucrose and Water on the Weight Gain of Mice

Abstract

Objectives/Goals
My goal of this experiment to address the obesity dilemma in America and its relation to the artificial sugar HFCS-55. I wanted to test if 30 mice (15 male and 15 female) would gain more weight when presented a 20% HFCS-55 solution, 20% sucrose solution, or merely water. (along with their normal food for a period of 30 days)

Methods/Materials
I bought 30 mice (15 of each sex) put 5 mice of each sex in their separate container which has bedding and their designated solution (HFCS-20%, Sucrose-20% and water). I change the food and solutions regularly and weight them every 2 days for a period of 1 month on a gram scale. 15 male and 15 female mice; 6 big containers & lids; 6 8oz water bottles with hooks; mice food and 6 bowls; wood shavings for bedding; 6 boxes for their "houses"; 1 gram scale; cup to hold mice as they are being weighed; 2 pairs of yellow latex gloves; duct tape; scissors; electric drill and bit; 5 colors of nail polish; black hair-dye; permanent sharpies; pen/ pencil and composition book; 1 gallon of high fructose corn syrup; table sugar; plastic table cloth; paper towels; water, ml dropper, and funnel; measuring utensils; calculator; mixing spoon; wire mesh for top of containers; computer and printer.

Results
The results were that the total percent weight gained by all of the mice was 40% gained by the HFCS mice, 28% gained by the water mice, and 31% gained by the sucrose mice. The total average weight gain for the mice was 20.2 g gained by the HFCS mice, 22.4 g gained by the water mice, and 28.2 g gained by the HFCS mice. The only substance, out of the three, to reach 20 g gained for each individual mouse was HFCS with 3 mice gaining above that amount. Finally, the total weight gained for each solution group was 101 g gained by all the water mice, 112 g gained by all the sucrose mice, and 144 g gained by the HFCS mice.

Conclusions/Discussion
The difference in total weight gain between sucrose and water was only 11g whereas the difference between sucrose and HFCS is 32g which almost triples that of water and sucrose. This shows that drinking sucrose is extremely similar to drinking water, whereas drinking HFCS in relation to water which was a 43g difference is very opposite and will lead to obesity. I have achieved the results that I set out to prove that high-fructose corn syrup leads to obesity in mice significantly more than sucrose and water. United States has a big problem with obesity and one of the culprits is high fructose corn syrup. It found in an insanely large amount of food products due to the fact that it is cheap to manufacture and has a long

Summary Statement
I tested if High Fructose Corn Syrup does, indeed, cause more weight gain on mice than sucrose and water.

Help Received
My Mother helped me weigh the mice and decorate the backboard.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Zacariah Flores; Paula Mahzabeen; Jennifer Ocin

Project Number

S1710

Project Title

HIV-1 Integrase and LEDGF/p75 Protein Binding

Abstract

Objectives/Goals

Using a selective alpha screen assay process, we can identify if certain small molecules can inhibit or disrupt the interaction between the viral enzyme, HIV-1 integrase, and the human protein, LEDGF/p75 (lens epithelium derived growth factor).

Methods/Materials

There are thousands of structurally diverse compounds in our lab and we perform random screening of these compounds. Through an alpha-screen assay process, we test for protein-protein interaction. One microliter of each compound is added to tube of 99 microliters of alpha screen wash buffer for dilutions. Once the compounds are diluted, a template is made on an excel sheet, assigning where each drug will be placed on the assay plate. The template is used as a guide when pipetting 5 microliters of each compound into their corresponding wells. Also included are 2 sets of 3 normal controls (of only beads, buffer, and the two proteins), a beads control, and a buffer control. After the compounds are placed into the wells, 5 microliters of each protein are added to each well and the plate is incubated for an hour at 4 degrees Celsius. After this incubation period, the donor and acceptor beads are added to each well. The plate is placed again into an incubator, set at 37 degrees Celsius. In our assays, each light-sensitive alpha-screen bead, donor and acceptor, binds to its respective protein: HIV-1 integrase and LEDGF. After another hour-long incubation period, the assay plate is taken to the Envision machine where the tray is read and the results of the interactions are quantified.

Results

Out of a total of 1500 drugs tested so far, more than 1400 were found to be inactive, and 17 were found active.

Conclusions/Discussion

In the future, our goals include continuing random screening of drugs, conducting dose responses for drugs that are active from initial assays, and testing actives for toxicity through MTT assays. If active drugs are non-toxic to humans through MTT assays, we begin the rest of the trials, including animal testing and clinical trials. A new important concept being currently researched is finding new cofactors or binding partners for integrase.

Summary Statement

We are attempting to find small molecule compounds that can disrupt the interaction between the proteins, HIV-1 integrase and LEDGF/p75, through random screening of drugs and a selective alpha screen assay process.

Help Received

Used lab equipment at USC School of Pharmacy under the supervision of P.I. Dr. Nouri Neamati, mentor Erik Serrao, Junjie Qian, Dr. Tino Sanchez; Participants in Bravo-USC Science Technology and Research Program (STAR).

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Kevin Y. Huang

Project Number

S1711

Project Title

The Combined Effect of Heat Stress and the Oxidative Stressors Juglone and Paraquat on Caenorhabditis elegans Survival

Abstract

Objectives/Goals

In the environment, multiple environmental stressors interact and challenge an organism#s ability to maintain homeostasis. Little is understood about how an organism maintains homeostasis when exposed to multiple abiotic stressors. In general, interactions of multiple stressors can be categorized by three models: addition, synergism and antagonism. To figure out which model holds true and how consistent is this relationship, the model organism Caenorhabdits elegans was exposed to two environmental stressors: heat stress and oxidative stress. The project is a simulation of how multiple environmental stressors will affect an organism in extreme climate cases such as a heat wave, where the temperature is suddenly raised.

Methods/Materials

To induce oxidative stress, the organisms were exposed to juglone and paraquat, and their interactions with heat stress (four temperatures versus 6 different concentrations of chemicals) were compared. The exposure time is 4 hours, followed by a 24 hour recovery time.

Results

In the juglone experiment, as the temperature and concentration of the juglone experiment increased, the survival rate decreased. Int the paraquat experiment, as the temperature and concentration increased, the survival decreased as well. In both trails, the differences between the control trial (low temperature, highest juglone concentration + highest temp., lowest concentration) and the experimental trial (combination of highest temp. and concentration) were significant (juglone, $p<.001$; paraquat: $p<.25$).

Conclusions/Discussion

A synergistic interaction between both oxidative stressors with heat in affecting the survival of Caenorhabits elegans was observed. However, the synergistic interaction between paraquat and heat is less obvious and it takes higher amount of paraquat (a 1000 times more) to induce the same mortality level as julgone would induce with heat.

Summary Statement

Synergistic interaction between multiple environmental stressors (heat and oxidative stressors juglone and paraquat) was tested and confirmed on the nematodes C. elegans.

Help Received

Participant of the Student Science Training Program at the University of Florida. Thanks to Timothy Crombie, Dr. David Julian, and the rest of the Julian Lab for mentorship and laboratory equipment usage instruction.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Kamran Jamil

Project Number
S1712

Project Title
Developing New Drugs to Treat Autism

Abstract

Objectives/Goals
1)Are autism symptoms caused by excess purinergic signaling?
2)Would drugs that block P2X/P2Y signaling of extracellular ATP (such as Suramin) reduce the root cause and will treat ASD symptoms and behaviors in a mouse model?

Methods/Materials
C57BL/6J mice , RNA POLY (I:C) OR Polyinosinicpolycytidylic acid, SURAMIN (P2X/P2Y ANTAGONIST), 0.9% NS, 3CHAMBER CRAWLEY DEVICE, OPEN FIELD TEST SET UP, DIGITAL RECTAL THERMOMETER
1) Total of 80 C57BL/6J mice were used.
2) Mice were exposed in utero to saline (Controls = 40), or a simulated viral infection by injection of RNA (Poly I:C) into pregnant dams (Maternal Immune Activation) to mimic ASD (ASD = 40).
3) 8 weeks after ASD-like behaviors developed, half of control groups (N=20) and half of Poly I: C exposed mice (N=20) were treated with weekly injections of Saline or Suramin.
4) 4 experimental groups of mice (N=20) with equal number of Males & Females were evaluated at 12 weeks of age.
5) Social Approach Experiments: were carried out with classical 3-chamber Crawley social interaction paradigm with automated & hand scoring of the number & duration of social encounters of an experimental mouse with a control mouse placed under an inverted wire cup.
6) Hyperactivity Experiments: Hyperactivity was measured by The Standard Open Field test.
7) Core Body Temperature: was measured using a digital rectal thermometer in mice exposed to saline and Poly (I:C) in utero; & was repeated with anti-purinergic therapy.

Results
Social Behavior was improved by Suramin, Hyperactivity in Male ASD Mice was normalized with Suramin. The MIA Model of autism produced relative hypothermia compared to saline exposed mice, & Suramin restored body temperature in Poly(IC) exposed animals.

Conclusions/Discussion
We hypothesized that drugs that block P2X/P2Y signaling of extracellular ATP will reduce purinergic/neuroinflammatory signaling and thus will treat ASD behaviors in a mouse model, our results support this hypothesis. We believe this research is highly innovative as there are yet no publications that link mitochondrial metabolism to purinergic signaling or purinergic signaling to autism.

Summary Statement
At present there is lack of novel targeted therapy for Autism, the research goal is to develop new treatments.

Help Received
Started Project as a Summer Intern at Dr Naviaux's lab at UCSD

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Michaela A. Katz

Project Number
S1713

Project Title
The Effect of Non-Native Allelopathic Plant Waters on the Growth of Native California Poppies

Abstract

Objectives/Goals
The objective is to determine whether non-native allelopathic plants affect the growth of native California poppy seeds and whether different non-native allelopathic plants would have differing affects.

Methods/Materials
The leaves from four non-native plant species (eucalyptus, scotch broom, fennel and lavender) were crushed and soaked in tap water. The California poppy was used as the representative native plant. The poppy seeds were placed on paper towels in petri dishes and watered with the infused water and, a tap water control. There were eight petri dishes for each of the non-native plant waters and the tap water control (40 petri dishes in total). Observations were made regarding germination, sprouting of leaves and, the relative dampness and color of the towels the California poppy seeds were grown on.

Results
The results of this experiment indicate that non-native allelopathic plants have a negative effect on the growth of native plants. Overall, poppy seeds watered with tap water were the healthiest by a significant percentage in all categories and against all non-native plants. Oils from eucalyptus had the most detrimental effect in all categories followed closely by scotch broom and then fennel and lavender.

Conclusions/Discussion
The known toxins in allelopathic plants explain why the poppy seeds grown with the allelopathic plant waters did worse than the poppy seeds grown with water. Eucalyptus and scotch broom are more allelopathic and release oils more readily than lavender and fennel. A further study would be to test the long term effects of non-native allelopathic plant water on native plants by using the offspring of the plants that germinated after being watered with non-native plant water and growing those with non-native plant water.

Summary Statement
This experiment measured how non-native allelopathic plants affect the growth of native California poppy seeds.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Shu Hee Kim

Project Number

S1714

Project Title

Mathematical Modeling of Cancer Cell Proliferation after Radiotherapy

Abstract

Objectives/Goals

The main purpose of this research is to obtain a better understanding of optimal radiotherapy that can be used to treat cancer patients. Dedifferentiation is a relatively recent discovery which shows that cancer cells may revert back to their previous cell stages, instead of, as always presumed, progressing forward in cancer lineage. The influence of dedifferentiation is a pivotal aspect of cancer proliferation which my research studies.

Methods/Materials

By using the parameter values of renewal (p), differentiation (v), and dedifferentiation (q), the data collected from breast cancer strains exposed to radiation was fit to the computer software model. By comparing the changes in the steady state values from the model as a result of changes in the dedifferentiation rates, the impact of differing dedifferentiation rates on steady state populations was quantified.

Results

Thus, when dedifferentiation rate increased, the steady state populations of stem cells increased. The equilibrium population with a higher dedifferentiation rate was greater than the equilibrium population with a smaller dedifferentiation rate.

Conclusions/Discussion

This successful model quantifies the behavior of the stem cell and differentiated cell populations as a result of radiotherapy; furthermore, this computer model allows doctors to understand the best treatment for different types of cancers and for different cancer patients. Ultimately, this model can allow doctors to improve the efficacy of individualized cancer treatment methods for many different types of cancer.

Summary Statement

The main point of my project is to find the optimal radiotherapy treatment method for patients of all cancer types and cancer stages.

Help Received

Dr. John Lowengrub (UCI Professor) oversaw accuracy of mathematical equations and derivations

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Alexis Krauss; Fiona Valley

Project Number

S1715

Project Title

The Grass That Isn't Greener

Abstract

Objectives/Goals

The objective of this experiment was to determine whether 100mg/L of BPA would inhibit the germination and initial growth of annual ryegrass seeds over a period of twelve days.

Methods/Materials

Four trials were conducted in which 100 controlled ryegrass seeds and 100 seeds in contact with BPA were allowed to germinated for twelve days in an area with a constant temperature of 60-70 degrees Celsius. After twelve days, the lengths of the stems and roots of each seed were measured and recorded.

Results

On average, 44.7% of the seeds in contact with BPA had no growth, whereas only 26.2% of the undisturbed seeds did not grow. The average differences between the stem and root lengths of the BPA and undisturbed seeds were, respectively, 1.72cm and 1.56cm, the undisturbed seeds having the most growth.

Conclusions/Discussion

BPA is a chemical that can very easily be absorbed by organisms and give off weak, hormone-like properties. 100mg/L of BPA was found to inhibited the initial growth of 44.7% of annual ryegrass seeds, a crop used as fodder that could be affected by runoff and easily integrated into the agricultural world. The BPA also caused the seeds to grow 1.72cm shorter stems and 1.56cm shorter roots than those of controlled seeds. This data suggests that BPA may be a harmful substance and may be directly entering the agricultural system.

Summary Statement

This project tested if 100mg/L of BPA affects the germination and initial growth of annual ryegrass seeds, a crop which can easily be affected by runoff and direct chemicals into the agricultural system through biomagnification.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Eugene Laksana

Project Number
S1716

Project Title
Repelling Bemisia tabaci through the Infiltration of Natural Extracts into Verbena x hybrida "Babylon White"

Abstract

Objectives/Goals
This project aims to determine if anti-pest environments created by commercial pesticides can also be developed by infiltrating the liquid extracts of companion plants known to repel whiteflies and the implications of such methods. It also serves to provide discussion regarding the potential of substituting commercial pesticides with organic components in order to reduce environmental side effects.

Methods/Materials
Verbena plants were stripped down to 2 leaves, each of which was infiltrated with a designated liquid volatile plant extract (calendula, marigold, mint, and pepper/garlic.) Water infiltrated verbena and untreated verbena served as the negative controls. 25 whiteflies from a raised colony were collected then gently applied to each of the testing chambers before they were sealed. Surveillance was conducted via remotely operated webcams for 10 hours, and images were taken at 30 minute intervals. Constant overhead illumination was employed in order to eliminate the effects of day/night cycles. Five replications of the experiment were conducted.

Results
Since results from the untreated control were very similar to those produced by the water infiltrated control indicating that the act of infiltration had no effect on whitefly occupation, the data from this set were omitted from further. Throughout the 5 replications, the water infiltrated verbenas had an average of 26.9% whitefly occupation, and this value was used as the baseline to compare repellency of the other extracts. The average reductions in whitefly occupancy were 86% with Calendula, 53% with Marigold, 49% with Mint, and 31% with the garlic and pepper infiltrated verbenas.

Conclusions/Discussion
My results not only demonstrated that Calendula is an effective natural insect repellent but that it is possible to repel pests by infiltrating organic extracts into the mid-vein of verbena plants. This experiment illustrated a possible large scale application of natural liquid plant extracts as agricultural pest repellants. The objectives of further project developments include mass-reduction of commercial pesticide side effects present in our environment. Further phases of this project include the development of a more efficient method for repellent application in large-scale agriculture and the investigation of other possible plant extracts to be used for varying crops or ornamental plants as repellents.

Summary Statement
This experiment tested the potential of extracted calendula, marigold, mint, and pepper/garlic as whitefly repellents when infiltrated into

Help Received
Dr. Deborah Mathews from UCR supplied the white flies and verbenas that I used to experiment with. She also helped construct the white-fly capturing device and served as an adviser throughout the experiment. Mother provided transportation.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Samuel Z. Lang

Project Number
S1717

Project Title
The Toxic Effects of Teas as Pesticides or Repellents on Lumbricus rubellus, Genus Helix, and Genus Deroceras

Abstract

Objectives/Goals
The purpose of this project is to evaluate the pH and toxic effects of various teas on earthworms, snails, and slugs, with the possibility of application as a natural pesticide or repellent.

Methods/Materials
Subjects: Earthworms, Snails, Slugs.
Tea: Green, Red, Chrysanthemum.
Teas were steeped in boiled water for a quick dip, 3 minutes and 10 minutes, producing test media: liquid, waste, and liquid mixed with peat moss (simulation of liquid contamination in soil). pH was recorded for all media. Tested subjects were kept in containers holding test medium. Subjects were observed for health, motility, mortality, and weight change, status recorded and photographed. Two test formats were introduced: Direct Contact and Island. Direct Contact involved prolonged exposure to test media, showing immediate effects on behavior, motility, and health. Island format tests the medium's effects as repellent: the subjects are placed in safe areas allowed to remain or be exposed to medium.

Results
Both green and red tea liquids in all concentrations tested are lethal to all tested subjects, killing slugs within 10 minutes, snails within half hour, and worms within a few hours. Green and red tea waste in all concentration tested are deadly to slugs and worms in prolonged contact. Snails make epiphragms, emerging only when danger has passed. Both Green tea and Red tea liquid in high concentration mixed with peat moss is lethal to earthworms. However, they only showed little effects on slugs and snails. Island tests showed that slugs and snails do occasionally cross the lethal media. Although island may provide safe area, tested subjects eventually enter test media, expiring

Conclusions/Discussion
Liquid form of high concentration green or red tea proved most lethal for snail and slugs, and can be used as natural pest control or repellent. However, peat moss (mock soil) contaminated with green tea or red tea liquid is lethal to earthworm (which is an undesired complication, earthworms being a beneficial species). Therefore, it may be better for the garden if green or red tea liquid is applied to point sources to protect select plants from snails and slugs, minimizing harm to earthworms. Although green tea waste and red tea waste can kill slugs and earthworms and harm snails upon prolonged direct exposure, some of the tested gastropods passed through the "hot zones" with little difficulty to the container walls, utilizing massive amounts of slime to protect themselves from the testing media. There is no direct correlation between pH and toxic effect of various tea media.

Summary Statement
Green or red tea served as effective natural toxins and repellents to snails, slugs, and earthworms, especially in concentrated liquid form, but point sources are recommended for application, so to minimize harm to worms.

Help Received
Parents provided materials, brewed tea and helped build board

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Karley J. Lassley

Project Number
S1718

Project Title
Which Local Plant Extracts Will Be an Effective Pesticide on Mosquito Larvae and Still Be Safe for Other Aquatic Life? 2

Abstract

Objectives/Goals
The purpose of my project is to determine if local plant extracts will kill mosquito larvae and still be safe for other aquatic life. My goal in duing this second year study is to find a natrual pesticide that will not harm other living creatures in our enviroment.

Methods/Materials
Using pond water as a control in 10 trials for both frog eggs and mosquito larvae tests.
Cut plants to blend with water to obtain a plant extract.
added extract solution to 10 trials of frog eggs and 10 trials of mosquito larvae.
Repeated with all three variables(hyacinth, azalea, and chrysanthemum).
Checked test containers every 8 hours to determine effectiveness.

Results
The results show that of the variables used, Hyacinth was the only plant extract that allowed some of the frogg eggs to hatch. Both Azalea and chrysanthemum extracts dammaged all of the frog eggs. All three plant extracts were effective in killing the mosquito larve. However, the hyacith was the least effective.

Conclusions/Discussion
After completing my investigation I found my hypothesis for Azalea was incorrect. While all of the variables were effective in killing the mosquito larvae, only the hyacinth plant extract allowed the frog eggs to hatch.I feel that further testing needs to be done to find a more enviromentally friendly pesticide that will kill mosquito larvae and not harm the aquatic life in our ponds.

Summary Statement
In my project I found that certain indigenous plant solutions are an effective method in controlling mosquito larvae yet are also compromising to the health of aquatic life.

Help Received
Parents helped pay for supplies and with photos.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Jimmy Lin

Project Number
S1719

Project Title
Investigating the Inhibitory Effect of Resveratrol on Ovarian Cancer Cells

Abstract

Objectives/Goals
The experimental approach was formulated in order to investigate resveratrol#s pharmacologic influence on ovarian ascites cancer and to determine whether resveratrol can be used as a therapeutic drug for treating ovarian cancer.
i. Determine if Resveratrol inhibits Ovarian Cancer Cells
ii. Determine if Resvertrol's inhibitory effect acts dose-dependently
iii. Determine if SIRT1 expression is vital to Resveratrol's inhibitory effect
Hypothesis: SIRT1 is vital to the inhibitory effect of resveratrol on the growth of human ovarian ascites cancer cells

Methods/Materials
Drug Administration: 25um, 50um, and 100um doses of Resveratrol, Sirtinol, an SIRT1 inhibitor, and combined treatment were used to treat normal ovarian ascites cells, and ovarian ascites cancer cells
Cell Culture: Cells were incubated after treatment for 72 hours in order for the drugs to take an effect. Three tests were conducted on the samples after; Trypan Blue hemocytometr cell count test, MTT assay, and flow cytometry test. The experiment design integrates the use of these tests, and the results are cross referenced, which is original in this field.
Trypan Blue hemoctyometer: Plated cells are extracted and diluted with pbs and trypan blue then counted with a hemacytometer under a microscope.
MTT Assay: Samples are treated with MTT and undergo a spectrophotometer which indicates optical density that correlates with cell viability
Flow Cytometry: Samples undergo a flow cytometer and are examined for CD34 markers, which are exhibited by Cancer stem cells.

Results
Resveratrol resulted in inhibition of ovarian ascites cancer cells as suggested by the Cell Count data, optical density, and flow cytometry scatters. In addition, this inhibitory effect increases with increasing dosages. Combined treatment of Resveratrol and Sirtinol indicated less inhibition for all three tests

Conclusions/Discussion
These findings are consistent with the hypothesis that resveratrol inhibits the growth of ovarian cancer cells and SIRT1 expression influences the inhibiton process of Resveratrol. In conclusion, resveratrol may help to activate apoptosis in cancer cells, and its inhibitory effect on cancer cell growth can be applied in the development of anticancer therapies.

Summary Statement
Determine if Resveratrol inhibits ovarian cancer and see if SIRT1 is important in its process

Help Received
Used lab equipment at Taipei Medical University under the supervision of Dr. Daniel Tzu-Bi Shih

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Kevin Liu

Project Number

S1720

Project Title

Smart Bomb to the Tumors: Clostridial-Directed Enzyme Prodrug Therapy (CDEPT) Enhanced with Vascular Targeting Agents

Abstract

Objectives/Goals

It has been known that tumor hypoxia is a major setback in standard cancer treatment of radiation therapy and chemotherapy. This project is focused on turning this setback into an advantage by employing clostridia, a nonpathogenic obligate anaerobe, as a tumor-specific prodrug-activating enzyme delivery system. The goal is to develop a system with high delivery efficiency, high specificity and highly selective cytotoxicity with the combination of transformed clostridia and prodrug targeting at the hypoxic/necrotic regions of the tumors.

Methods/Materials

Gene of prodrug activating enzyme was PCR amplified from genomic DNA of E. coli and incorporated into an E. coli-clostridia shuttle vector, the resulting vector was then transformed into a clostridial host. In vitro growth inhibition assay was used for assessing growth inhibition caused by the enzyme-mediated prodrug activation with cell cultures mixed with prodrugs and cell extracts from transformed clostridia. Finally, the animal model with transplanted tumor was used for evaluating the anticancer efficacy of the proposed treatment with clostridia-targeted enzyme-mediated prodrug therapy in combination with or without the use of a vascular-targeting agent.

Results

In the most optimal conditions, a 96% decrease in tumor volume at 7 days after the start of treatment was observed in our animal model with transplanted tumor, with a single administration of the combination of transformed clostridial spores, prodrug and a vascular targeting agent. Furthermore, there was no tumor regrowth during our entire experimental duration, hence the tumor was considered cured.

Conclusions/Discussion

This research has established a gene delivery system targeting tumor hypoxia with nonpathogenic anaerobic bacteria. The Clostridia Directed Enzyme Prodrug Therapy (CDEPT) provides specific targeting of anticancer drugs to solid tumors. The therapy yields antitumor activity in nude mice with CD (+ 5-FC) and NTR (+ CB1954) with no tumor lysis toxicity. Vascular targeting agents enhance CDEPT anticancer efficacy in tumors with CD or NTR- producing clostridia.

Summary Statement

This project has developed an enzyme/prodrug therapy using transformed Clostridia that will yield tumor-specific anticancer effects, which are enhanced by the inclusion of vascular targeting agents.

Help Received

Lab equipment was kindly provided by Stanford University under the supervision of Dr. Fred Lartey. Most animal model procedures, especially those involving surgical techniques, were performed by the supervising scientist, including tumor implantation, tissue extraction, clostridial spores and drug injection,

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Guadalupe Melgarejo

Project Number
S1722

Project Title
Effect of Exhaust Fumes on Plants

Abstract

Objectives/Goals
Exhaust fumes come from automoblies and factories; they are not only harmful to the atmosphere, but also plants and ecosystems. In fact, exhaust fumes are one of the reasons global warming exists. To find the ways exhaust fumes affect plants, I decided to expose five different types of plants to exhaust gas. The plants I observed were: corn, zinnias, sunflowers, lettuce, and collard greens. With these plants I would not only be able to observe in what ways they are affected, but also which plants are more capable of living in a highly polluted area.

Methods/Materials
For 21 days I exposed my experimental group of plants to exhaust fumes. I exposed them to the gas by putting them in a large plastic bag and attaching it to the exhaust pipe of my dad's car. After the bag was filled with the gas, I removed it and tied it tightly with a rubber band. I let the plants sit in the bag for 30 minutes every day at around 4 o'clock in the evening. Every morning I recorded the heights of my all my control and experiemental groups of plants.

Results
Within a week I noticed that my control groups had much bigger and stronger plants, while the experimental groups had small and weak plants. At day 17 my experimental group of lettuce and zinnias died. At day 20 my experimental group of corn died, and the next day my experimental group of collard greens followed in the same direction. The only group of plants that survived were the sunflowers. However, they were much smaller than the control group of sunflowers and their leaves did not have much texture.

Conclusions/Discussion
From my results I am able to conclude that most plants are affected by exhaust gas. However, some plants can resist exaust gas longer than others and are more capable of growing in polluted cities. Sunflowers for example will most likely be able to grow in cities like New York, Beijing, China, and Instanbul, Turkey because they were not affected as severly as the corn, zinnias, sunflowers, lettuce, and collard greens.

Summary Statement
What plants are more capable of living in highly polluted areas and how are they affected by exhaust fumes.

Help Received
My biology teacher Mr. Callaway gave me some materials for my project.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Jorie A. Moore

Project Number
S1723

Project Title
Investigating the Effectiveness of Indigenous Plants in Inhibiting Mosquito Larvae Development

Abstract

Objectives/Goals
The goal of this project is to determine the effectiveness of indigenous plants as natural pesticides in inhibiting mosquito larvae development.

Methods/Materials
600 mosquito larvae were obtained from a local mosquito abatement facility. Three indigenous plants were used: Jimson Weed, Stinging Nettle, and Milk Thistle. There was a control for every test consisting of developing the mosquito larvae in water. There were three different concentrations prepared, a 10%, 5%, and 2% concentration made from a ratio of water to plant when blended. There was a direct kill test using the 10% solutions as a spray pesticide over a one-day period. There were developmental tests conducted using the 2% and 5% solutions where the larvae were placed into containers filled with the different concentrations of the plants. The number developed was recorded after the corresponding control group underwent a full cycle. Afterwards a field test using only the Jimson Weed plant was conducted to test its effectiveness in natural conditions. The results were observed after the control underwent the full developmental cycle.

Results
After the testing period the field control had survival of 95%. After the testing period the spray control had development of one hundred percent. The solutions control had 98% survival and development. The direct spray results are: Milk Thistle- 78% alive, Jimson Weed- 54% alive, Stinging Nettle- 100% alive. The 2% developmental results are: Milk Thistle- 84% developed, Stinging Nettle- 88% developed, Jimson Weed- 6% developed. The 5% developmental results are: Milk Thistle- 82% developed, Stinging Nettle- 90% developed, Jimson Weed- 4% developed. The field test results were 0% developed in the Jimson Weed test.

Conclusions/Discussion
As a natural pesticide, indigenous plants are effective in various degrees. Jimson Weed shows the most potential as a pesticide. Stinging Nettle was the least effective plant. The various methods of application in this experiment could mean producing different versions of a Jimson Weed pesticide. Using indigenous plants located within a common ecological system could be effective against various pests. It would maintain the ecosystem#s diversity and not cause immediate or insidious damage that a synthetic pesticide would produce.

Summary Statement
The effectiveness of indigenous plants from the surrounding environment where mosquito larvae develop was investigated as natural pesticides against mosquito larvae in a direct kill test, developmental inhibition test, then a field test.

Help Received
mother helped tape up papers on board.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Hari D. Patel

Project Number
S1724

Project Title
Anti-Alcohol Effects of Ivermectin Analogs on P2X4 Receptors

Abstract

Objectives/Goals
In the US alone, alcohol disorders affect over 18 million people and cause 100,000 deaths annually. Despite this significant social and economic impact, there are only a few treatment options for alcohol abuse and dependence that have yielded only minimal positive outcomes.

Methods/Materials
ATP-gated purinergic P2X4 receptors (P2X4Rs) are a member of the P2XR superfamily and are widely expressed in the brain. P2X4Rs are the most ethanol-sensitive subtype identified to date, when tested in vitro. Recent investigations suggest that P2X4Rs play a role in modulating alcohol consumption in rodents. Ivermectin (IVM - member of the avermectin family) is widely used as an antiparasitic medication in humans and is recognized as a valuable pharmalogical tool for identifying the contribution of P2X4Rs in ATP-mediated processes. Recent in vitro studies in our laboratory found that IVM competitively antagonized the inhibitory effects of ethanol in P2X4Rs.
Our current study starts to investigate the anti-alcohol potential of IVM-like compounds NAP-(1801-1803) using the in vitro screen of P2X4Rs. For this end, P2X4Rs were expressed in Xenopus oocytes and the effects of these compounds on ethanol inhibition was investigated using two- electrode voltage clamp electrophysiology.

Results
Among the few compounds we have tested, NAP-1801 has shown comparable modulating ability and anti-alcohol potential. However, 1802 and 1803 have not.

Conclusions/Discussion
Our studies have led to the conclusion that the ability of IVM/IVM-like compounds to antagonize ethanol inhibition depends on their potential to modulate P2X4R function. Differences in the potential to modulate and/or antagonize ethanol effects in P2X4Rs may be useful in the search for a lead therapeutic agent against alcohol-use disorders.
In the future, we will screen new NAP-compounds for their anti-alcohol potential.

Summary Statement
The anti-alcohol potential of IVM-like compounds (NAP compounds) may be useful in the search for a lead therapeutic agent against alcohol-use disorders.

Help Received
Support was provided by USC School of Pharmacy - Dr. Daryl Davies

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Amanda K. Penicks

Project Number
S1725

Project Title
The Comparison of Common Household Products and Labeled Chemical Pesticides on Mosquito Control

Abstract

Objectives/Goals
The objective of my project is to compare easily accessible household products and registered pesticides to compare their efficacy as a pesticide for mosquitoes in a backyard situation.

Methods/Materials
Using four- 1/2 barrels; each one filled with 30 gallons of water remained undisturbed in order to allow mosquitoes to lay egg rafts. After all four larva instar stages and pupa were developed, household chemicals/products were added to three of four barrels but none was added to the control barrel. During this time the mosquito larvae, pupae, and adults were counted to see if the various household chemicals affected the breeding and development.

A second experiment was conducted using four- 1/2 barrels and the same procedures with different chemicals. This time registered pesticides were added to three of the barrels, and none to the control.

Results
Only two of the three household products were effective in eradicating the instar larva stages and pupa, the second household product required two treatments with the second day being doubled. The third household product was used for 6 days. Days 2-6 the product was dosage was double and larva and pupa remained alive.
The registered mosquito pesticides killed the instar stages and pupa within 24-96 hours with one application.

Conclusions/Discussion
The use of household products/chemicals may be convenient but there is no certainty about the dosage and length of time required to eradicate the mosquito. One of the three household products was ineffective in killing the larva and pupa even after six consecutive treatments. The registered product only had to be used once and eradication occurred after 24-96 hours.

Summary Statement
The effectiveness of household chemicals and registered mosquito pesticides.

Help Received
Cynthia Ross- employee of Orange County Vector Control who administered the registered mosquito pesticides. Shannon Penicks- purchased supplies and equipment to conduct the experiment.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Samantha F. Perry

Project Number
S1726

Project Title
An Energized Mind

Abstract

Objectives/Goals
Are the effects that sports drinks have on one's body a placebo effect, or do they actually work to boost one's physical performance level?

Methods/Materials
To test this idea, I had people drink either water (control), sugarless lemonade (placebo) or Cytomax (sports drink) throughout three testing days, while they performed in four tests: The 800 meter run, a meter stick reaction time test, the long jump and an obstacle course. I used timing and measuring tools for the first three, and a variety of sports equipment for the last. Afterward, I asked the test subjects about their overall feeling throughout the testing day on a scale from one to ten.

Results
My results proved that the Cytomax sports drink works better than water and the placebo drink in the 800m, the obstacle course, the reaction time test, and the subjects' overall feeling. Even though the difference between all of the averages is miniscule, I can conclude that Cytomax actually works, and it is not just a placebo effect.

Conclusions/Discussion
Based on my data, my hypothesis was incorrect because I thought that Cytomax would be a placebo effect. It appears that Cytomax works, though. However, the limited data I gathered from the small sample size and trial numbers and other uncontrollable variables, such as the unreliability of people and weather, could have impeded the accuracy of my conclusion.

Summary Statement
To determine whether Cytomax, a sports drink, has a placebo effect on one's performance, I put test subjects through four physical tests, while having them drink water, placebo drink or Cytomax, and they subjectively rated their feelings.

Help Received
My parents, Elysa and Michael, helped me time the 800 meter run, work obstacle course stations and take pictures.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Vaishnavi L. Rao

Project Number

S1727

Project Title

Activity-Dependent Regulation of Nitric Oxide Expression: Novel Form of Neurotransmitter Plasticity

Abstract

Objectives/Goals

As a gaseous neurotransmitter, Nitric Oxide (NO) plays a key role in several physiological functions including sleep, feeding, sensory and motor functions. Imbalances in the levels of NO lead to neurotoxicity, implicated in multiple neurological disorders such as stroke, Alzheimer#s disease and Parkinson#s. Activating NO plasticity as a means of regulating NO levels has never been explored. Therefore, my novel study focused on unraveling the plastic properties of NO in the regions of the hindbrain via alterations in electrical activity. This could aid in the development of effective clinical therapies.

Methods/Materials

Fixed tissues of the embryonic tadpole X. laevis, previously injected with mRNA encoding for decreased and increased electrical activity through overexpression of potassium (Kir) and sodium (Nav) ion channels respectively, and cascade blue dye (control) were obtained. By means of cryostat sectioning followed by immunohistochemistry and observations under the confocal microcope, I obtained layer-by-layer count of neurons in each of the three hindbrain regions. Similarly, I examined the plasticity of classical neurotransmitters serotonin and GABA in relation to NO expression. This required significant enhancements to previously established protocols.

Results

Electrical activity does allow for NO regulation at a localized level. Under Nav, statistically significant increase in NO expression was observed in the reticulospinal region, whereas under Kir, there was a statistically significant decrease across all three regions. Furthermore, coexpression of NO with Serotonin and GABA was observed under decreased electrical activity.

Conclusions/Discussion

This research is the first to establish a successful model for regulation of gaseous neurotransmitter NO at a localized level using electrical activity. The results suggest the activation of reserve pools of neurons, which gain the ability to respecify neurotransmitter phenotypes. This holds promise for the restoration of broken neuronal circuitry that occurs as a result of neurotoxic conditions. The protocol developed here can be implemented for future studies on localized plasticity of NO. As opposed to pharmacological means, electrical activity offers a more immediate, efficient, localized and rapid response to be elicited by the nervous system.

Summary Statement

Electrical activity offers a novel and promising means of Nitric Oxide neurotransmitter plasticity in the form of localized regulation and recruitment of reserve pools of neurons, with enormous applications to neurodegenerative disorders.

Help Received

Staff at Spitzer Lab (UCSD) for providing supervision during independent experimentation.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Christina Ren

Project Number
S1728

Project Title
The Effect of Deer Antler on the Proliferation of Endothelial Cells in vitro

Abstract

Objectives/Goals

Deer antler, an intriguing natural substance, is the only mammalian organ capable of regenerating, and has been extensively used in Traditional Chinese Medicine for over 2000 years. My last year experiment examined its effect on the segment regeneration rate of Lumbriculus variegates. It was shown that regeneration rate is substantially enhanced by deer antler, which suggests that it may contain substances that can enhance cell regeneration.

The basic thrust of the current research is to explore in-depth the bioactive properties of deer antler and its therapeutic potential. Among many possible directions, I chose to focus on wound healing, due to its clinical significance and relationship with cell regeneration. Since wound healing is a complex biomedical process, the research focus is further narrowed down to cell proliferation and angiogenesis, which is one of the four key steps in wound healing.

Methods/Materials

Deer antler powder was first homogenized to obtain a water-soluble extract. A Bradford assay was used to determine the protein concentration, and SDS-PAGE was used to determine the molecular weight range of the extract. Two assays were designed and carried out to assess the cell proliferation and angiogenesis, respectively, on Human Umbilical Vein Endothelial Cells (HUVEC).

For cell proliferation assay, HUVEC were seeded in 96-well plates and exposed to various concentrations of deer antler extract. After incubation, cell viability and proliferation was determined by means of the MTT assay.

Results

It was found that the deer antler supplementation yields over 40% more cell proliferation. For angiogenesis,it was observed that deer antler supplementation yielded more complex tube formation, compared with controls.

Conclusions/Discussion

It can be concluded that deer antler extract promotes the cell growth and angiogenesis (with the formation of capillary-like structures). This result is an encouraging first step towards understanding deer antler#s therapeutic potential and towards the possibility of developing deer antler into a novel wound healing agent.

Summary Statement

This research shows that deer antler, an intriguing natural substance, enhances both cell proliferation and angiogenesis of Human Umbilical Vein Endothelial Cells, and thus has the potential to provide a novel wound healing agent.

Help Received

Used lab facility & equipment at Skyline College and Genetech. At Genetech, Mr. McKay provided instruction with equipment, and at Skyline College, Dr. Kapp provided guidance with equipment and cell handling tips

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Julia M. Riedelsheimer

Project Number
S1729

Project Title
Investigating Various Herbs in Stimulating or Suppressing Appetite Level

Abstract

Objectives/Goals
The purpose of my project is to determine if organic herbs can help diets of individuals. The reason I am doing this investigation is to determine if organic herbs will stimulate and suppress diets. I will use twenty laboratory mice as an objective organism to see if certain organic herbs affect the diet of mice.

Methods/Materials
I purchased 5 containers with 5 food and water dishes. I purchased 2 stimulate organic herbs; parsley and ginger. I then purchased 2 suppressant organic herbs; green tea and fennel. I purchased 20 mice and put 4 mice in each container and let them get used to their environment for 2 weeks. In each container I marked each individual mouse's with a different color sharpie. I labeled each container; Ginger, Parsley, Fennel, Green Tea and control. I then boiled water for 10 minutes and prepared organic herbs by placing each herb (individually) in pot and let sit for 10 minutes. I then placed regular control mouse pellets in a pan and for each herb I poured the herb over mouse pellets and let herb soak into pellets. In each container I feed the mice laced herbs three times a day. I continued this procedure for three weeks. I did an initial weight on all mice before beginning this experiment and mice were weighed each week.

Results
I found that my hypothesis of the herb ginger was a stimulate was correct. The average weekly gain with the herb Ginger was 5.32% compared to the control. At the end of three experimental periods the average percentage gained when the mice are consuming mice pellets with Ginger supplement is 10.23% of body weight compared to the control mice that were eating mice pellets with no herb supplement. The herb green tea was the best appetite suppressant with an overall loss percentage of 10.43% of body weight compared to the control.

Conclusions/Discussion
It seems weekly average weight changes had unreliable fluctuation. What is important in my investigation was the starting and ending weights of the test mice. Further test need to be taken in order to verify my results. I found that using herbs can be a healthy and natural way to aide in gaining or losing weight. Using organic herbs may not be as quick to see results but overall could help reach a goal of desired weight. In conclusion organic herbs could be effective in determining an organism appetite level, however, further test trials would be necessary.

Summary Statement
My project is to determine if organic herbs will stimulate or suppress diets of laboratory mice as an objective organism.

Help Received
Mom, teacher(Audry Bonomi), district science advisor (Carl Gong)

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Phoebe Stewart; Alana Vieira; John Waggoner

Project Number
S1730

Project Title
Acid Tide

Abstract

Objectives/Goals
The objective of this study was to determine the effect of an acidified ocean environment on the tensile strength of two intertidal photosynthetic organisms, a seagrass and a coralline algae.

Methods/Materials
The seagrass and the coralline algae were legally collected from Point Fermin, San Pedro. They were kept in tanks with artificial seawater made from Instant Ocean sea salt, as well as a bubbler to keep the water oxygenated. We used a spring scale and weights to measure the tensile strength of the seagrass and coralline algae grown in the artificial seawater (control). We then increased the acidity of the seawater using hydrochloric acid. We then measured the tensile strength of the seagrass and the algae again(experimental).

Results
We found that the coralline algae control broke under a strain of 1.6 Newtons and after acidification the coralline alagae broke at an average of 1.0 Newtons. The seagrass under controlled conditions held 3.4 Newtons before breaking whereas the seagrass in acidified seawater broke under strain of 3.35 Newtons.

Conclusions/Discussion
The coralline algae was more susceptible to the detrimental effects of the acidification of seawater than the seagrass. This is possibly because of the calcareous structure of the coralline algae. The seagrass, which has cellulose cell walls, was less susceptible to the effects of the acidification of seawater. The seagrass also has internal strengthening cells. However, on further reasearch, it was found that the seagrass requires the coralline algae, without it, the seagrass seeds cannot establish. The coralline algae also uses the seagrass as a sheild from the heavy wave action of the intertidal. It can be concluded that if either population suffered, both species would decline, causing an unravelling of the interdependent organisms that rely on seagrass and coralline algae as a food source and for shelter.

Summary Statement
The effect of an acidified environment on the tensile strength of two intertidal photosynthetic organisms which are subjected to wave action.

Help Received
Used lab equipment at Loyola Marymount University under the supervision of Dr. Drennan

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Madison R. Uetrecht

Project Number

S1731

Project Title

Melanin-Based Dietary Supplements Promote Pigmentation in Chrysaora colorata

Abstract

Objectives/Goals

Chrysaora colorata is a local southern California jellyfish with dark purple stripes on its bell. However, cultured specimens develop coloration that is only faintly reminiscent of that seen in their wild counterparts. The purpose of this project was to test whether certain dietary enrichments promote the development of proper bell pigmentation in cultured Chrysaora colorata. This experiment is important because the absence of the characteristic purple stripes may be an indicator of poor nutrition; cultured C. colorata may not be receiving optimal nutrients.

Methods/Materials

In this project, nine juvenile Chrysaora colorata medusae were divided into three tanks. One group was fed Artemia nauplii enriched with Haematococcus microalgae, a source of carotenoid pigment. The second group was fed nauplii enriched with squid ink, a source of melanin pigment. The control group was fed unenriched nauplii. Feeding occurred twice daily for 14 weeks. Photos were taken of all specimens once a week and were analyzed to measure each animal's bell pigmentation.

Results

After 14 weeks of experimentation, one specimen from the squid ink treatment developed distinct pigmentation, which was not seen in any other specimens; a ring of pigments formed above its stomachs along with stripes radiating outwards from the ring. Six weeks after the conclusion of the experiment, this individual's stripes continued to develop and darken.

Conclusions/Discussion

These promising results suggest that melanin-based dietary supplements may promote increased pigmentation on C. colorata. The results have the potential to revolutionize the way aquariums care for this species.

Summary Statement

Adding melanin-rich squid ink to the diet of cultured purple-striped jellyfish may increase bell pigmentation, resulting in a more natural appearance and potentially revolutionizing the way aquariums care for this species.

Help Received

My teacher, Mr. Peter Starodub, guided me through this entire process. Dr. Kiersten Darrow and the Cabrillo Marine Aquarium staff provided the materials, animals, and workspace, and reviewed my work. My parents drove me to the aquarium.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Mahesh S. Vashishtha

Project Number

S1732

Project Title

Effect of Histone Deacetylase Inhibitors on H3K4 Trimethylation in Mouse in vitro Models of Huntington's Disease

Abstract

Objectives/Goals

The project tested whether treatment of two different Huntington's Disease models with the HDAC inhibitors Trichostatin A and sodium butyrate would increase not only Histone 3 lysine 9 acetylation (H3K9Ac) but also H3K4 trimethylation (H3K4Me3) by causing transcriptional repression of the demethylase Jarid1C.

Methods/Materials

Cells from a mouse striatal cell line and primary cortical neurons were treated with TSA (25 or 100 nm) or NaB (.5 or 2 mM) for 24h or 48h. mRNA was extracted with the Quiagen kit and converted to cDNA. PCR was run using the SYBR Green method, with primers for Jarid1C, Jarid1B, or BDNF. For the western blot, cells were lysed and protein quantitated by the Lowry method. Protein was loaded onto the gel, and proteins were transferred to a nitrocellulose membrane. Primary antibodies were added first to H3K4Me3, and then to H3K9Ac. Secondary antibody conjugated to horse radish peroxidase was added, followed by color development.

Results

Treatment of striatal cells and primary cortical neurons resulted in an increase in both H3K9 acetylation and H3K4 trimethylation. In the primary cortical neurons, downregulation of brain-derived neurotrophic factor (BDNF) in HD-phenotype cells was rescued by 48h treatment with NaB. The demethylase Jarid1C did not show a decrease upon treatment in either model.

Conclusions/Discussion

As hypothesized, treatment with the HDAC inhibitors increased both H3K9 acetylation and H3K4 trimethylation. However, the increase in methylation was not caused by downregulation of the demethylase Jarid1C. Overall, this study supports the idea that HDAC inhibitors restore aberrant transcription in HD by increasing both acetylation and methylation, although more work must be done to fully understand the cross-talk between these two chromatin marks.

Summary Statement

This project is meant to study the effect of two histone deacetylase inhibitors on H3K4 trimethylation in Huntington's Disease.

Help Received

Used lab equipment at Dr. Leslie Thompson's lab at the University of California, Irvine under the supervision of Mrs. Alice Lau

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Emily S. Wang

Project Number

S1733

Project Title

Can It Bee? Investigating Cytotoxicity and Gene Regulation of Potential Anti-Cancer Agent Propolis

Abstract

Objectives/Goals

Propolis, a resinous substance produced by bees, has long been utilized as a popular folk remedy to its wide spectrum of purported pharmaceutical properties, including anti-cancer. To investigate propolis# anti-cancer effect, colon cancer cells and noncancerous fibroblasts were treated with two major constituents of propolis, quercetin and chrysin, to observe their effect on cell viability and gene expression.

Methods/Materials

HB-8059 mouse colon cancer cells were cultured with seven dosages of quercetin and chrysin for 24, 48, and 72 hours. A lactate dehydrogenase assay was conducted after the given time periods in order to count cell death. CLC-96 mouse fibroblasts were treated with the most effective dose from the results of the LDH assay to determine whether or not the drug was selective. After verifying the effect of the dosage, HB-8059 cells were serum-starved for 20 hours and treated with the effective dosage (120 microM) for 5 hours. RNA was isolated with TRIZOL, cDNA was generated using MMLV-RT, and RT-PCR was conducted with a qPCR machine to examine the effect of quercetin on several genes.

Results

The dose that significantly induced the most cell death was 120 µM quercetin, which resulted in a nearly two-fold increase in LDH activity relative to the untreated cancer cells. Quercetin-treated HB-8059 showed 1.8 times the cell death of the untreated cancer cells, while apoptosis among quercetin-treated fibroblasts was not significantly greater than that of untreated fibroblasts. Beyond 24 hours, the LDH levels did not significantly rise. FLT1 was downregulated with a 3.14 fold change ($p = 0.0019$). NOS2 was downregulated with a 2.35-fold change ($p = 0.0030$). JUN was downregulated with a 2.26-fold change ($p = 0.0004$). GADD45A was upregulated with a 2.72-fold change ($p = 0.0003$).

Conclusions/Discussion

Quercetin and chrysin can both play roles in the anticancer activities of propolis. Fewer fibroblasts were killed compared to cancer cells, suggesting that quercetin selectively kills cancer cells. Some oncogenes (FLT1 and JUN) were downregulated by quercetin, whereas a DNA repair and apoptotic gene (GADD45A) was upregulated. The downregulation of NOS2 may indicate the inhibition of pathways responsible for therapy resistance, which may allow quercetin to synergize with chemotherapy. All of these results indicate that quercetin may be a potential chemopreventive agent against cancer.

Summary Statement

To observe propolis' effect on cell viability and gene expression, colon cancer cells and non-cancerous fibroblasts were treated with propolis constituents quercetin and chrysin.

Help Received

Used lab equipment at Schmahl Science Workshop under supervision of Dr. Ali Haghighi, Dr. Joseph Bay taught me how to conduct RT-PCR

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Haley F. Washburn

Project Number
S1734

Project Title
Investigating the Effects of Various Environmental Conditions on the Degradation of Antibiotics

Abstract

Objectives/Goals
The purpose of my project is to determine how well penicillin, amoxicillin, and septra work after being exposed to different environments. This is important because these antibiotics are widely presrcibed and if changes in environment affect their ability to kill bacteria consumers could unknowingly be contributing to the breeding of antibiotic resistant bacteria.

Methods/Materials
To create a measurable area of bacterial inhibition I've diluted the 3 test antibiotics with distilled water (6ml antibiotic to 60ml dis water)and seperated them into 4 bottles for each antibiotic for a control, incubator, freezer, and direct sun test. The control was stored as suggested by the pharmacy, the others were exposed to their environments for 8 hours and then tested. I swabbed a sterile petri dish with bacillus subtilus bacteria then placed a test dot that had been dipped in the test antibiotic on the petri dish. I repeated this 9 times for a total of 10 tests (2 tests dots per dish).
The petri dishes were then placed in the incubator. After 48 hours I measured the areas of bacterial inhibition.

Results
Control tests for all 3 antibiotics had maximum areas of bacterial inhibition. Amoxicillin exposed to the freezer had an average inhibition area of 13.3mm, the direct sun tests averaged 7.3mm and the incubator tests had no bacterial inhibition area ar all. Penicillin exposed to the freezer had an average inhibition area of 11.6mm, the direct sun and the incubater tests had no bacterial inhibition area at all. Septra exposed to the freezer had an average area of inhibition of 10.6mm, the direct sun tests averaged 9.3mm, and the incubator tests averaged 12.8mm.

Conclusions/Discussion
The exposures used were picked to replicate someone leaving their antibiotic in a car on a winter or summer day or laving it in a sunny location for the day. Clearly, the ability for all 3 test antibiotics to create an area of inhibition around the test dot is affected by the different environmental exposures. Septra appears to be the hardiest of the antibiotics but the exposures have still weakened its ability to inhibit bacteria growth. This is potentially dangerous because exposing bacteria to antibiotics that are incapable of inhibiting growth could contribute to the development of antibiotic resistant bacteria.

Summary Statement
Determining if even 8 hours of improper storage of antibiotics will affect their ability to inhibit bacterial growth.

Help Received
Mr. Whittington provided the incubator, petri dishes and bacteria. Mother photographed project

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Cooper L. Wedge

Project Number
S1735

Project Title
The Effect of Chemicals on Glial Cell Counts

Abstract

Objectives/Goals
My objective is to determine whether rat glial cell colony formation is decreased when caffeine or kava is added to the growth medium.

Methods/Materials
I incubated 60 wells of glial cells in control, kava, and caffeine medium, using two levels of chemicals, 50mg/L and 20mg/L. I initially thawed the cells and incubated them overnight before washing them and detaching them with trypsin. I created a cell sample with a dilution factor of 2 by adding 50uL of trypan blue to 50uL of my sample. This stained the dead cells blue and allowed me to count the cells in a hemocytometer. The viable cells/mL sample was then diluted with medium to 200 cells/mL for healthy cell growth. I then incubated 60 cell samples for seven days, and fixed, stained, and counted the cell colonies.

Results
The cells cultured in 50mg/L of caffeine had a 34% lower cell colony count when compared to the control samples. The cells cultured in 50mg/L of kava had a 41% lower cell colony count when compared to the control samples. Therefore, 50mg/L of the caffeine and kava affected cell proliferation counts greatly and were statistically significant.

The cells cultured in 20mg/L of caffeine had a 1% lower cell colony count compared to the control samples. The cells cultured in 20mg/L of kava had a 3% lower cell colony count compared to the control samples. Therefore, 20mg/L of the chemicals had no statistically significant effect.

Conclusions/Discussion
My conclusion is that 50mg/L of caffeine and kava added to growth medium significantly affects brain cell proliferation, yet 20mg/L of the chemicals have an insignificant impact. While coffee consumption is a well established part of American culture, Kava cafes are new in California. This study suggests that healthy ingestion levels of both chemicals, but especially kava, given the 41% decreased cell count from the control, should be further researched with possible consumption levels labeled and monitored.

Summary Statement
My project investigates whether adding caffeine or kava to rat glial cell cultures, reduces the number of cell colonies formed.

Help Received
My teacher helped me get the brain cells and prepare fix and stain solutions and my parents helped me find supplies.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Derek J. Wong

Project Number
S1736

Project Title
Effects of a Selective Herbicide on Germination

Abstract

Objectives/Goals
A study was done to determine the germination rate and growth patterns of the non-target plant Vigna radiata when given the selective herbicide Spectracide at 3 different applications. A 0.1 ml dosage was applied either one time a day for ten days at 0.01 ml per day (group 4), one time only at the first contact to water (group 2), one time at the first sign of germination (group 3), and not at all (group 1).

Methods/Materials
144 mung bean seeds were tested, checked for deformities before beginning the experiment. 9 cups per group with sets of 4 seeds per cup were stored in plastic boxes covered by a translucent plastic wrap for heat and water retention. Groups were put in a mostly shady, balcony environment and given their specific amount of herbicide daily. Distilled water was added as needed in order to submerge approximately half the width of the seed. Length of the root was measured daily and placed into categories of length in increments of 5 millimeters.

Results
The herbicide immediately slowed any germination, seen when only seeds from groups that had not been treated germinated on the first day of measurement. No group but the control developed hypocotyls or true leaves. In herbicide treated groups, slight thickening of the radicle but little elongation occurred. It was apparent that the herbicide did significantly impede growths in all groups treated comparing to the control. Group 4 showed the most growth and was the only herbicide treated group to have a positive trend. Both groups 2 and 3 showed negative growth towards the end of the experiment, seeds from group 2 slightly less affected than those of group 3.

Conclusions/Discussion
It can be concluded that this herbicide is detrimental to Vigna radiata. The product will suppress growth of the root in all cases, but works best after seeds have sprouted with application beforehand as a close second. However, non-target seed roots should continue to grow with multiple, smaller applications. The generalization can be made that all legumes will show a similar response to the herbicide and that all non-target plants may be affected by these chemicals. Plants with stress tolerance capabilities that are the same as V. radiata will show a similar pattern of growth, and those with less tolerance may have an even slower growth or may be killed off entirely. Seeds with more stress tolerance may be able to recover faster and sustain a quicker growth.

Summary Statement
The commercially formulated selective herbicide blend Spectracide was tested on hydroponically grown seeds of the non-target plant Vigna radiata at three applications of varying time and rate.

Help Received
I would like to thank my mother for helping me with the display board and my father for his assistance during daily data collection.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Cynthia L. Yin

Project Number
S1737

Project Title
Structural Integrity of the Cytoskeleton in Response to Myosin Inhibitors

Abstract

Objectives/Goals
For cancer, diabetes, and other diseases, myosin inhibitors offer potential prevention and treatment by blocking cell migration and stopping diseased cells from spreading. The myosin inhibitors Blebbistatin, ML-7, and Y-27632 reduce signaling by non-muscle myosin II (NMII), myosin-light chain kinase (MLCK), and Rho-associated protein kinase (ROCK), respectively. These signaling pathways play significant roles in disease development and regulation of the cytoskeletal structure. Here, I studied a mechanism of controlling cell mobility by evaluating the effects of these myosin inhibitors on cytoskeletons. I hypothesized
(1) that Y-27632 would be the most effective in reducing cytoskeletal integrity, and
(2) that higher drug concentrations would weaken the cytoskeleton the most.

Methods/Materials
Cells were passaged and cultured in fresh media. After drug treatment, cells were fixed and permeabilized. Signal enhancer reduced nonspecific binding. Cells were immunostained with antibodies and imaged with fluorescence microscopy. Microtubule and stress fiber integrity with respect to drug concentration was analyzed.

Results
Y-27632 was the most effective drug in reducing actin and tubulin expression. ML-7 inhibited microtubule formation, while Blebbistatin weakened stress fibers. Y-27632 caused disassembly of central stress fibers. ML-7 caused disruption of peripheral stress fibers, as well as the cells' loss of spread morphology. No consistent correlation between cytoskeletal integrity and drug concentration was evident.

Conclusions/Discussion
As I hypothesized, Y-27632 is the most effective drug in weakening cytoskeletal integrity by affecting both stress fibers and microtubules. Blebbistatin inhibits the formation of stress fibers, while ML-7 weakens microtubules. ML-7 degrades peripheral stress fibers critical in maintaining the rounded cell shape, whereas Y-27632 reduces the number of central stress fibers. Therefore, cytoskeletal integrity depends mostly on ROCK expression, as well as the strength of peripheral stress fibers and microtubules. My other hypothesis that higher drug concentrations resulted in weaker cytoskeletal integrity was partially supported.

Summary Statement
Cytoskeletal integrity was observed in response to the myosin inhibitors Blebbistatin, ML-7, and Y-27632 which inhibit NMII, MLCK, and ROCK, respectively.

Help Received
Used lab equipment at University of California, Los Angeles under the supervision of Dr. Chih-Ming Ho.