CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Nikita Akkala

Project Number

S1701

Project Title

Drug Screening to Identify Novel Therapeutics against Glioblastoma Stem Cells: Year 2

Abstract

Objectives/Goals

Over the course of this two-year research project, I screened four different compounds (Vorinostat, Cisplatin, Cyclosporine, and Tacrolimus) to identify compounds that could form new therapeutics against human glioblastoma multiforme. Vorinostat and Cyclosporine are commonly used as chemotherapy drugs while Cyclosporine and Tacrolimus are immunosuppressant drugs. However, none of these compounds are specifically used to treat glioblastoma. I studied the effects of these compounds on the proliferation of two different lines of human glioblastoma multiforme stem cells, GBM-4 and GBM-8. Afterwards, I tested Tacrolimus and Cyclosporine against normal human neural stem cells, to determine if these drugs had the same impact they had on glioblastoma stem cells.

Methods/Materials

I plated GBM-4, GBM-8, and neural stem cells, all on separate well plates. After allowing them to grow, I added Cyclosporine, Vorinostat, Cisplatin, and Tacrolimus separately to the plates at 10 different dosages (ìM). The control wells didn't contain any dosage of drug. Then, I observed the differences in the cells¢ shapes between the different dosages and the control, under the microscope. Next, I added alamarBlue to all the cells and 24 hours later, analyzed the fluorescence intensity values to measure metabolic activity.

Results

As a result, in the cell plate with Cyclosporine, Vorinostat, and Cisplatin, the cells were completely healthy and appeared in spherical shape, in the absence of drug. The higher the dosage, the smaller the cells became and eventually the cells disintegrated and their metabolic activity dropped significantly. On the other hand, at all dosages of Tacrolimus, the cells remained spherical and healthy, and high metabolic activity was measured in all of the cells. In addition, neither Tacrolimus nor Cyclosporine exhibited harmful effects on the proliferation of normal neural stem cells.

Conclusions/Discussion

The results indicate that the immunosuppressant drug, Cyclosporine, has the potential to kill brain tumor cells without disturbing the growth of regular brain cells. This research has identified three drugs (Vorinostat, Cisplatin, Cyclosporine) that could form novel therapeutics against glioblastoma multiforme and has established a way to potentially attack and kill two stem cell lines of glioblastoma multiforme.

Summary Statement

The purpose of this project is to identify compounds that could form new therapeutics against human glioblastoma (brain tumor) stem cells without harming normal neural stem cells.

Help Received

Mentors Dr. Sandra Pastorino and Sandeep Pingle supervised this independent research project conducted at Kesari Lab at UCSD Moores Cancer Center; Parents and brother helped with setting up my board

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Easun P. Arunachalam

Project Number

S1702

Project Title

Examination of Quorum Sensing Mechanisms in Glioblastoma Multiforme

Abstract

Objectives/Goals

Glioblastoma multiforme (GBM) is a prevalent and deadly primary brain tumor in humans. It is reported that glycoprotein Prominin 1 (CD133/1) expression is associated with a distinct population of stem/progenitor GBM cells that have increased capacities for self-renewal, sphere formation, and tumor initiation. Quorum sensing (QS) is a cell-signaling mechanism utilized by bacteria to track cell density and coordinate gene expression and population behavior based on said cell density. I hypothesized that a QS mechanism may be used by GBM cells to regulate populations of CD133-expressing cells, and attempted in this study to probe populations of GBM cells for behaviors consistent with a QS mechanism.

Methods/Materials

Phase I: Patient-derived brain tumor cells (cell line PBT003) were cultured in vitro for several passages, following which fluorescence-activated cell sorting (FACS) was used to separate CD133/1^+ cells from CD133/1^- cells. Cells of the top 5% of each group (selected to ensure purity) were cultured separately for twelve days. Cells were then reanalyzed for CD133/1 expression using flow cytometry. Phase II: PBT003 cells were cultured in the presence or absence of exogenous tumor necrosis factor-alpha (TNF-alpha) for six days, following which their CD133/1 expression was assayed by flow cytometry.

Results

Phase I: CD133/1^+ and CD133/1^- PBT003 cell populations responded differently to culture: the CD133/1^- population originally isolated by FACS remained almost entirely CD133/1^-, whereas the CD133/1^+ population returned to a "steady state" in which the ratio of CD133/1^+ to CD133/1^- cells mirrored that of the original unsorted cultures. Phase II: Preliminary results indicate that TNF-alpha, a putative autoinducer, increases extracellular and intracellular expression of CD133/1 (as compared to cultures without TNF-alpha). Such a change in cell state would be an expected result of the addition of an autoinducer in a QS mechanism.

Conclusions/Discussion

The reversion of CD133/1^+ cells to a "steady state" is consistent with a QS mechanism. TNF-alpha has been shown to increase CD133/1 expression and could possibly be driving populations of GBM cells towards a more disseminatory phenotype. These results are consistent with the hypothesis that TNF-alpha secreted by tumor cells may be functioning as an autoinducer in a QS model of CD133 expression/glioma proliferation.

Summary Statement

Glioblastoma multiforme exhibits behaviors consistent with a quorum-sensing mechanism.

Help Received

Dr. Michael Barish and Dr. Susan Kane helped me fine-tune my idea; Ms. Nousha Khosh and Mr. Bradley Huss trained me in the use of lab equipment at the City of Hope Beckman Research Institute and supervised me while I conducted my project; parents helped me commute to City of Hope.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Masih A. Babagoli

Project Number

S1703

Project Title

Structure-Activity Relationship Exploration of Fatty Acid Amide Hydrolase Inhibitors

Abstract

Objectives/Goals

The goal was to find a fatty acid amide hydrolase inhibitor that is both effective and restricted from the central nervous system. Such a compound would enable raising endocannabinoid, substances associated with having analgesic and anti-inflammatory effects, levels just in the periphery.

Methods/Materials

Brain and liver samples were collected from mice previously administered the compounds in different doses. Each compound at each dose was tested in one trial with triplicates (n=3). Samples were placed into vials containing lysis buffer, homogenized, and centrifuged at 2100 rpm for 12 min at 4°C, and the supernatants were collected (S1 fraction).

In order to quantify the protein, BCA quantification assays were performed. They were analyzed with a plate spectrophotometer with optical density being an indicator for the protein concentration.

An ex vivo assay to determine FAAH activity was performed by incubating each sample containing 50 µg of FAAH for 30 minutes with H3-anandamide. Samples were analyzed with scintillation counter.

Results

Four compounds (ARN354, ARN715, ARN716, and ARN14038) were tested. Each was a derivative of a single compound but just with a different substituent in the para- position of the proximal phenyl ring. When administered orally at a dose of 1 mg/kg, ARN715 did not exhibit good oral bioavailability, while the other 3 compounds did. Only ARN354, ARN716, and ARN715 showed to be peripheral inhibitors. On the other hand, ARN 14038 was not restricted to the periphery. Lastly, ARN354 and ARN716 gained access to the brain when co-administered with Ko-143 (a selective inhibitor of the ABC-transporter abcg2).

Conclusions/Discussion

My hypothesis was correct. Manipulating the specified position did change the peripheral distribution of the compounds. Results showed that the hydroxyl group is necessary for the peripheral character of these compounds. Increasing the polarity also significantly limits the compounds' abilities to penetrate blood brain barrier. ARN 715 -- with a carboxyl group -- was unable to enter the central nervous system. Lastly, the loss of peripheral character comes with the elimination of an H-bond donating group, as ARN 14038 -- with the methoxy group -- was able to evade recognition by abcg2. Additionally, this compound had the lowest polarity, enhancing its ability to move across the barrier.

Summary Statement

This project was aimed at finding a fatty acid amide hydrolase inhibitor that is both effective and restricted from the central nervous system.

Help Received

Project was done under Dr. Moreno-Sanz at UCI. He did much of the experimental design. He also administered the drugs and collected the samples. After that, I did most of the work in analyzing the samples and was actively involved in all processes of the experiments, including data analysis.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Marc Bielas

Project Number
S1704

Project Title
Alcohol Dependence in C. elegans: A Behavioral Study

Abstract

Objectives/Goals
The National Institute on Drug Abuse reports that substance abuse and addiction cost American society $559 billion dollars a year in increased health care costs, crime, and lost productivity; however, little is known of the factors that induce addiction. Addiction, specifically alcohol dependence, can be observed in the nematode C. elegans. These studies seek to pair dependence on ethyl alcohol with stress (by way of starvation), and observe the effects of various combinations of these factors on C. elegans.

Methods/Materials
A chemotaxis assay was developed to assess the nematodes ability to choose between alcohol and E. coli (food). Alcohol was injected into agar at locations equidistant to the lawn of E. coli, whereupon a chunk of agar containing C. elegans was placed in the middle and C. elegans were allowed to choose between alcohol or food. The test groups were: 1) worms acutely pre-exposed to alcohol and stressed, 2) worms stressed but not acutely pre-exposed to alcohol, 3) worms acutely pre-exposed to alcohol but not stressed and the control, worms that were neither acutely pre-exposed to alcohol nor stressed. C. elegans were observed at different time periods up to 120 hours. Alcohol was re-injected into the agar at 72 hours to rechallenge the worms. Worms stressed were exposed to three consecutive days of treatment.

Results
Patterns of statistical significance were observed in the one and three day test groups, showing that stressed worms had a higher tendency to migrate to the alcohol. A subsequent analysis was done for a pool of the 120-hour data where the variable of alcohol pre-exposure was minimized, allowing stress to be examined individually. This analysis further illustrated the patterns seen in day one and day three showing a higher tendency to seek alcohol in stressed worms in three out of four comparisons.

Conclusions/Discussion
The unique behavioral assay developed for this study allowed stress to be identified as a major factor in the initiation and maintenance of alcohol seeking behaviors. The results of this study could be applied to a clinical setting whereby stress-inducing factors would be identified and eliminated from the environment of those susceptible to alcohol dependence.

Summary Statement
The central focus of this project is to evaluate the effect of stress and malnutrition on alcohol seeking tendencies in C. elegans, an animal model for human addiction.

Help Received
Used lab equipment (chemicals, glassware etc.) from school under the supervision of Dr. Willoughby as required by school policy.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Stephanie K. Bonilla-Sotelo

Project Number
S1705

Project Title
Lycopene in Watermelon: The Effects on the Daphnia's Heart Rate

Abstract

Objectives/Goals
To prove lycopene's claim effects are true and compare difference effects with different percentage concentrations by testing it on the Daphnia Magna's Heart.

Methods/Materials
Collect 5ml of watermelon tissue from the desired area,and blend into a slushy state.Then extract Lycopene using a organic chemistry distillation set.Afterwards dilute it into wanted percentage concentrations solutions with the distilled water.Have the daphnia magna ready on stand by and using a pipette place one on a microscope glass slide.Next use another pipette to add one drop of the selected solutions on the daphnia.Let it sit for 1-2 minute and then observe it under a microscope.Timing one minute count its heart beats and look for any body reactions.
Materials:Organic seedless Watermelon,spoons,containers,Organic chemistry distillation kit tape, marker,data sheet,camera (pictures),plastic wrap,dropper blender 100uL micropipettor 20-125 screw tap tubes distilled water bunsen burner ethanol (95%)daphnia magna small containers Microscope pipettes,glass slides

Results
After testing the different levels of lycopene the overall results matched up to the claims.The daphnia(bpm) decreased with a higher level of lycopene and if it was from the ring area of the watermelon.When compared the overall different concentration average with the lycopene extracted from the center was 101.55 bmp to 72.31bpm from the ring.Both groups display similar physical reactions and changes.Sometimes the level of lycopene was so intense that it would give the daphnia alike heart attack and then die suddenly.

Conclusions/Discussion
Lycopene being a powerful antioxidant and a natural carotenoid pigment is beneficial enough to alter the heart rate.This carotenoid may prevent the oxygenation of low-density lipoproteins, from damaging the cells of the heart and arteries.Which in turns, allow for the heart to have less stress, function properly, and have a lower heart rate.Daily intake levels of lycopene is good due to it being one of the most effective antioxidants and is suggested to prevent production of cancer cells and the buildup of fatty deposits in atheromas in arteries.The daphnia at rest was given watermelon extracted lycopene and an effected change was seen in its (bpm).

Summary Statement
To prove lycopene's claim effects are true and compare diffrence effects with different percentage concentrations by testing it to the Daphnia Magna's Heart Rate.

Help Received
Friends and Family support, Mrs.Del la Cruz guideance and suggestions.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Andre L. Cornman

Project Number

S1706

Project Title

Rapamycin Treatment Decreases the Secretion of Senescent Murine Cells with Wild-Type and Inactive p53

Abstract

Objectives/Goals

Cellular senescence is a tumor suppressor mechanism which functions by permanently arresting cell cycle, while keeping cells metabolically active. Senescence may be triggered by a number of factors, including dysfunctional telomeres, DNA damage, chromatin perturbation, and oncogenic stimuli. Recently, senescent cells have been found to secrete 40-80 factors which are mainly composed of growth factors, proteases, chemokines and cytokines. The purpose of this research is to test the effects of blocking the mTOR pathway by treating senescent murine fibroblasts with Rapamycin on the senescence-associated secretory phenotype (SASP). We tested Rapamycin both on wild-type murine cells, as well cells carrying an inactive form of p53.

Methods/Materials

Control (wild-type) and p53 mutated primary mouse embryonic fibroblasts (MEFs) were cultured in media. The cells were irradiated using X-ray (10 Gy) or not for controls. After irradiation, the cells were treated with either 12.5 uM Rapamycin (RAPA) or vehicle (dimethyl sulfoxide, DMSO). Induction of senescence was measured using Beta-galactosidase. qRT-PCR reactions for p16, IL-6 and MMP-3 were performed to measure their RNA expression. Western blot was performed to measure p16 protein expression. Supernatant was collected and analyzed for IL-6 secretion using an ELISA assay.

Results

We found that p16, IL-6, and MMP-3 expression increased dramatically with senescent cells. Rapamycin treatment effectively reduces the secretion of SASP factors, such as IL-6 and MMP-3, in murine senescent cells. Interestingly, we found that inactive p53 increases SASP factors and that Rapamycin restrains the induction.

Conclusions/Discussion

The results supported our hypothesis that Rapamycin can effectively reduce the SASP in senescent murine cells, both wild-type and with inactive p53. These results show that Rapamycin could be used to reduce pro-inflammatory and paracrine activities of the SASP, which may drive age-related phenotypes and pathologies, including cancer. Also, conventional anticancer therapies, including chemotherapy and radiation therapy, have been shown to induce senescence. By reducing the SASP, we can improve prognosis and long term outcome of the therapy.

To improve the experiment, we are planning to test other factors such as Cxcl1, or repeat the experiment with human cells.

Summary Statement

This project tests the effectiveness of Rapamycin treatment on reducing secretion of factors caused by cellular senescence, both in wild-type and p53 mutated cells.

Help Received

Used lab equipment at the Buck Institute for Research on Aging under the supervision of Dr. Demaria

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Shrey S. Desai

Project Number
S1707

Project Title
Antibiotic Alternative to Radiation in the Sterile Insect Technique

Abstract

Objectives/Goals
$200 million. That is the annual costs pests like the Screwworm fly gifts to the US agricultural industry, by infecting cattle, destroying crops, and proliferating, producing a generation ten times larger than the first. That is where the Sterile Insect Technique comes into play, a method of biological control, which uses radiation to sterilize male pests, so that when they#re released, they cannot compete with the wild-types and reproduce. However, radiation (its principle method) has a couple of problems including cost-effectiveness, managing, and aim. This project sets out to produce an alternative to radiation in the SIT, using the venue of antibiotics, by targeting guts inside pests # which can stop reproductive methods. I hypothesized if antibiotics can sterilize males better than status quo methods.

Methods/Materials
I used Canton S fruit flies and the antibiotic, erythromycin, to test my hypothesis. I used 15 vials in total for the experiment:
1. 5 control vials, 3 males, 3 females (per vial)
2. 5 erythromycin-1000 ug/mL, 3 males, 3 females (per vial)
3. 5 erythromycin-1500 ug/mL, 3 males, 3 females (per vial)

I made two divisions of the erythromycin antibiotic to see if the concentration of antibiotic would have any appreciable effect on the progeny count. I let the fruit flies mate for 3 days in all of the vials, then took them out. I inspected and counted the progeny and compared the E1000, E1500, and Control vials.

Results
My hypothesis was supported. The total amount of progeny: Control # 23, E1000 # 8, E1500 # 4. There were more than 5 times as less progeny in the Antibiotics vs. Control.

Conclusions/Discussion
All in all, my hypothesis was supported. Antibiotics did cause sterility in male fruit flies, as I observed in the decreased progeny count when I compared the Antibiotic vials to the Control group vials. Total progeny in the Control group was 23, E1000 group was 8, and the E1500 group was 4. Also, increasing the concentration of antibiotics inside the fly media decreased the progeny count further. When comparing the E1500 group to the E1000 group, the progeny count was cut in half (8 to 4). Thus, antibiotics could further be a better alternative to radiation in the SIT.

Summary Statement
This project determines if antibiotics are a better approach to sterilizing male pests, rather than the principle method of radiation, in the Sterile Insect Technique, a method of biological population control.

Help Received
All research, experimentation, analysis, writing, graphics, and board was done by myself; My mentor assisted me in making fly media and gave me tips on how to store antibiotics and how to take care of Canton S fruit flies; Parents helped screw the nut/bolts on to fit the two backboards together

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Ailis C. Dooner

Project Number

S1708

Project Title

Targeting Lung Mutagenesis: Mycosporine-like Amino Acids as ROS Scavengers for Reduction of p53 Mutation and Scission

Abstract

Objectives/Goals

This study assesses the capacity of mycosporine-like amino acids (MAAs) Shinorine (SH) and Porphyra-334 (P-334),secondary metabolites synthesized by macro- and microalgae, to scavenge PAH o-quinone derived reactive oxygen species and reduce mutation and strand scission of the p53 tumor suppressor gene, the most frequently mutated gene in human lung cancer. Polycyclic aromatic hydrocarbons (PAH) are atmospheric pollutants found in tobacco smoke and products of incomplete combustion. The aldo keto reductase-catalyzed metabolic activation and autooxidation of PAH generates redox-cycling o-quinones, BPQ, BAQ, and PNQ, and induces oxidative stress and mutation of the p53 tumor suppressor gene. MAAs derived from marine algae were applied as ROS scavengers to protect p53 from deleterious mutation and degradation.

Methods/Materials

The efficacy of SH and P-334 was evaluated with a p53 mutagenesis assay, a yeast transcriptional reporter system; and a gel-electrophoresis strand scission assay. In the p53 mutagenesis assay, a YIG397 yeast reporter strain was transfected with p53 plasmid treated with o-quinone, redox cycling conditions, and MAAs in vitro. Wild-type p53 binds to the p21 promoter, activates an adenine reporter, and turns colonies white (ADE+), while p53 mutated in the binding domain turns colonies red (ADE-), allowing for quantification of o-quinone mutagenicity. In the strand scission assay, DNA degradation was detected with agarose gel electrophoresis.

Results

SH and P-334 lowered mutational frequency by 59% with BPQ at 0.5 uM and 24% with BPQ at 0.25 uM, and significantly reduced shearing with o-quinones BPQ, PNQ, and BAQ in the strand scission assay, supporting initial hypotheses.

Conclusions/Discussion

This study demonstrates the capacity of algae derived mycosporine-like amino acids to scavenge PAH o-quinone derived ROS and reduce scission and mutation of the p53 tumor suppressor gene. This study develops a novel biomedical application of MAAs in lung cancer pharmacology, and based on my results, MAAs could be applied as a critical active ingredient in a pharmacological agent in the prevention or treatment of the world's most fatal cancer.

Summary Statement

This study assesses the capacity of mycosporine-like amino acids Shinorine and Porphyra-334, metabolites of aquatic algae, to scavenge PAH o-quinone derived ROS and reduce scission and mutation of the p53 tumor suppressor gene in lung cancer.

Help Received

I used laboratory equipment at University of Pennsylvania Perelman School of Medicine under the supervision of Dr. Jeffrey M. Field.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Mirna H. El-khalily

Project Number

S1709

Project Title

Using Different Types of Herbal Infusions to Protect against Loss of Bone Mass Due to Caffeine

Abstract

Objectives/Goals

The objective of this experiment is to determine which herbs would increase mineral bone density and which would protect against bone loss caused by the caffeine in Coke. My hypothesis was "If chicken bones are placed in a Red Clover, Alfalfa, Stinging Nettle, and Horsetail infusion then the bones in the Red Clover infusion will have the greatest increase in bone density and protection against caffeine."

Methods/Materials

Using an electronic balance to find mass and graduated cylinder to find the volume, the original densities of five chicken bones were measured. Each bone was placed in a different herbal infusion consisting of 500 mL of boiling water and 15 grams of each herb. The different herbs that were tested were Red Clover, Alfalfa, Stinging Nettle and Horsetail. After soaking for 5 hours, the the new densities of the bones were measured and the change in density from before to after soaking was calculated. Each bone was then placed in 500 mL of Coke for 2 hours. The new density and change in density of each bone was measured again.

Results

After soaking in the herbs, Alfalfa had the greatest positive average change in bone density of+0.017 g/mL and Stinging Nettle had the greatest negative change in density of -0.0153 g/mL. After soaking in the Coke, Stinging Nettle had the greatest positive overall difference in density of +0.0356 g/mL and the control had the greatest negative average change of -0.021 g/mL.

Conclusions/Discussion

In conclusion, Alfalfa had the greatest increase in the mineral bone density. In addition, Stinging Nettle had least decrease in density after soaking in the Coke, meaning it had the greatest protection against bone loss caused by the caffeine present in the Coke.

Summary Statement

The central focus of my project is to see which herb helps increase bone density and which herb helps protect against the harmful effects of the caffeine found in Coke.

Help Received

Mother helped buy supplies; Science teacher helped organized information on poster board

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Tanner M. Elder

Project Number
S1710

Project Title
Natural Pesticides

Abstract

Objectives/Goals
The problem of our experiment is to test and find out if there is an effective way to kill ordinary insects without harming the environment like DDT. Since DDT has been used, many animals, especially birds, have been devastated by the effects of it. DDT softens the shell of the birds, causing pre-mature hatchings and most likely, death. This chemical almost wiped out the bald eagle population. If we can find a substitute for these harmful chemicals, we can stop the harming of our environment and preserve our wildlife and prevent any man-made harm from destroying our ecosystem.

Methods/Materials
6 Petco plastic containers, 60 Large Crickets, 5 Plastic spray bottles, Tea, Diatomeous Earth, Citrus, Apple Cider, Vinegar, Corn Starch, Water. 1. Gather Tea, Citrus, Diatomeous Earth, Corn Starch, and Apple Cider Vinegar. We are also using a Control Cage to make sure data is precise
2. Grind ingredients and place 2 oz. of ingredient along with 2 oz. of water and soak overnight in a spray bottle.3. Next day, place 10 crickets in each of 6 containers. 4. Note time 5. After 1 hour, look at all 18 containers and record how many crickets have died.6. After 2 hours look and record hourly for the first 12 hours. 7. Then record after 24, 36, 48 and 60 hours.

Results
1. The first discovery was that the Tea was very powerful against the crickets. The Tea was the most powerful killer out of all of the materials used. Also, Tea, I think, is the easiest of all of the materials to use because it doesn#t have a strong odor and is easy to spray. As a result, Tea is the most useful of all the supposed natural pesticides.
2. The second discovery we came to was that citrus was the least effective of all of the pesticides. It had some effect on the crickets, but only a couple died. If citrus was effective, it would be the easiest and most convenient of the materials because of its pleasant smell and the ability for a garden owner to grow their own citrus. Also, we were able to notice that spraying our materials only working for materials that were in a liquid already, or if substances that were already solids were highly soluble. In Diatomeous earth, the dirt would settle at the bottom of the bottle, making it difficult to spray.

Conclusions/Discussion
In conclusion, we found that after our experiment, we can say that there are eco-friendly alternatives to ridding the insect pesticide raid, DDT, and other harmful chemicals.

Summary Statement
The reason for this experiment was to decide what Natural Pesticide is most effective in killing crickets.

Help Received
My mom purchased the materials and glued the information on the board.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Eli Erlick

Project Number
S1711

Project Title
The Effects of Citalopram on Danio rerio

Abstract

Objectives/Goals
The objective of this experiment was to determine if exposing Danio rerio (zebrafish) to citalopram, a contaminant of many waterways around the world, would decrease aggressive behavior in the fish.

Methods/Materials
20 zebrafish were obtained and kept in a 26.7 C aquarium. Two aquariums were set up, one with regular water and one with 10 micrograms per liter of ciatlopram. Five fish were placed in each and left for three hours. They were then placed into a different tank and their behavior was recorded. This was repeated five times per trial for three trials.

Results
Fish exposed to citalopram had 47% decreased rates of aggression. This is evidence that citalopram causes a significant reduction in aggression at concentrations found in our waterways.

Conclusions/Discussion
The potential for pharmaceutical medications that reach our waterways to harm our ecosystems is poorly studied and could have a large effect on our fish populations. The concern regarding the effects of pharmaceuticals on aquatic organisms is supported by this study, which indicates that citalopram may significantly decrease aggression in Danio rerio.

Summary Statement
This experiment was created to determine if exposing Danio rerio to citalopram (an antidepressant) would decrease aggressive behavior in the fish and found that the aggression significantly decreases in the presence of the drug.

Help Received
Dr. Carla Longchamp helped obtain citalopram pills; father assisted in blinding study

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Kathryn Feerst; Emily Kim; Jessica Vived

Project Number

S1712

Project Title

The Effects of Ocean Acidification on the Decalcification of Calcium Carbonate Shells

Abstract

Objectives/Goals

The objective of the project was to determine the effects of ocean acidification, caused by an increase in carbon dioxide, on the decalcification of calcium carbonate snail shells. We believe that if the amount of carbon dioxide is increased to an unnatural amount, the snails' shells will begin to decalcify.

Methods/Materials

10 Margarita Snails were obtained and placed into two separate and controlled fish tanks, 5 in each tank. The snails were given a couple of days to familiarize themselves with their surroundings. Then, using a carbon dioxide injector made from a two liter bottle filled with warm water, sugar, and baker's yeast, carbon dioxide was placed into one of the two fish tanks at an excessive amount. From there, the snails' environment -pH and salinity- and progress in both tanks were documented over the course of one week. After the one week time frame, the snails were removed from both environments and weighed. The average masses of snails from the two separate tanks were recorded. The snails were euthanized and removed from their shells to be able to measure the volume of the shells. Finally, both the separate and average volumes of the snails were recorded and considered for our concluding results.

Results

Our results revealed that densities of the snails' shells in the tank that had carbon dioxide added to it were less than those in the tank that remained constant. The average density of the shells in the carbon dioxide tank was 1.76g/mL while the average of the shells in the constant tank was 2.32g/mL. Also, the pH in the carbon dioxide dropped to a low 7.33pH while the pH in the constant tank remained close to 8.0pH (some minor fluctuations did occur).

Conclusions/Discussion

In conclusion, if the amount of carbon dioxide in salt water is increased, then the snails' shells will begin to decalcify. This is evident through our results. In the carbon dioxide tank, the average density of all the shells was 1.76g/mL while in the constant tank the average density was 2.32g/mL. This is a 0.56 difference in the average density which shows that the tank with carbon dioxide added, did have an effect on the calcium carbonate in the shells.

Summary Statement

This project documents the effects of carbon dioxide on the decalcification of Margarita Snail Shells over the course of one week.

Help Received

Mr. Bowns provided our project with certain pieces of equipment, including a graduated cylinder, scale, etc. Also, we emailed many college professors asking for any information pertaining to this project.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Jonathan F. Fung

Project Number

S1713

Project Title

Monosodium Glutamate: A Ligand for mGluRs One and Five Inducing Microtubule Depolymerization in Alzheimer's Disease?

Abstract

Objectives/Goals

Alzheimer's disease is a neurological degenerative disease projected to affect 13.2 million people by 2050. The many observed causes of Alzheimer's, varying from tau aggregations to aluminum, have a common link: microtubule depolymerization. Glutamate (GLU) has been experimentally verified to activate mGluRs (metabotropic G-protein coupled Glutamate Receptors) one and five, which then phosphorylates MAP2 protein, leading to EB3 protein accumulation and microtubule depolymerization. The primary objective of my investigation is to determine if Monosodium Glutamate (MSG) is a ligand to mGluRs one and five leading to microtubule depolymerization and Alzheimer's disease.

Methods/Materials

Due to limitations in school laboratory equipment, I adopted the flowering plant Arabidopsis Thaliana, a versatile model organism with homologous processes of the human neuronal microtubule cytoskeleton. Arabidopsis was grown in custom-poured agar plates with concentrations (10, 1, 0.1, and 0.01 mM) of the positive control GLU and experimental variable MSG. Trichomes (extensions of the plant proportional to microtubule length) were measured in microns.

Results

MSG elicited a decrease in microtubule length with increasing concentration. In 10mM MSG, 10mM GLU, and 1mM GLU, no trichome growth was observed. 0.01 and 0.1 mM GLU had average trichome lengths of 17.87 and 16.47 µm, respectively. 0.01, 0.1, and 1mM MSG had average trichome lengths of 19.83, 18.92, 14.03 µm respectively, as compared to control lengths of 51.78 µm. Exponential regression showed the correlation between MSG concentration (C) and microtubule length (L) to be L=log2_(852747e^-3.944C). P-values computed using Welch's T-test between MSG microtubule length and control microtubule length were all less than 0.05, thus proving the decrease in microtubule length MSG has elicited is statistically significant.

Conclusions/Discussion

This study provided statistically significant evidence to support my hypothesis: MSG acts as a ligand for mGluRs one and five, leading to microtubule depolymerization. If MSG passes the blood-brain-barrier, it will activate mGluRs 1 and 5, leading to microtubule depolymerization and Alzheimer's. Newborns and infants are especially susceptible, as their blood brain barriers are not fully developed. Further research would involve serotonin as a potential therapeutic for Alzheimer's, as it increases MAP2 levels leading to stable microtubules.

Summary Statement

I determined that MSG, one of the most commonly consumed food additives, is a ligand for mGluRs one and five, leading to microtubule depolymerization and Alzheimer's Disease when diffused through the blood brain barrier.

Help Received

I would like to thank my parents for paying for materials and providing support, and my advisor Ms. Fallon for providing extra materials from the STEM class and helping with statistics.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Durga Ganesh

Project Number
S1714

Project Title
Preserving the Lung for Transplant: Evaluation of Antioxidant Preservatives at Inhibiting Cell Damage from Free Radicals

Abstract

Objectives/Goals
The time limit for routine cadaveric lung transports in hypothermia is limited to 4 to 6 hours. This project identifies the effectiveness of antioxidant solutions in reducing free radical induced damage to lungs, for transplant.

Methods/Materials
Bovine lungs preserved in ice for 3 hrs since extraction. 3 samples per preservative were taken and immersed in antioxidant preservatives at 4 degree C for additional 3 & 5 hrs. Preservatives evaluated: Ice, Butylated hydroxytoluene (BHT), Vitamin E, Vitamin A, Vitamin C, Lutein, Safflower Oil, Melatonin, Biotin, and Distilled water. Tissue was fixated in 10% Neutral Buffered Formalin (NBF) for 48 hrs. Samples were embedded in paraffin wax, sliced by microtome, and stained with Haemotoxylin & Eosin (H&E). Slides were analyzed for cell damage under a 400x light microscope.
Cell damage assessed: cytoplasm color (lavender is healthy, pink is damaged) and coagulative necrosis (observed by faded chromotin with nuclei going through dissolution). Rating system: Nucleus and cytoplasm health were rated on a scale of 1 # 10 (1 = most cell damage, 10 = least cell damage). The final rating (out of 20) was a sum of these two scores per sample.

Results
The control (lung sample before preservatives)was rated at 18.5/20. Vitamin E was the most effective - 11.5/20 for both 3 hr and 5 hr samples, closely followed by BHT (11/20)and ice (9/20). Right from 3 hour check point onwards, Biotin (2/20) and Melatonin (3.5/20)were the least effective.

Conclusions/Discussion
The goal was to extend transport life of lung being transplanted using existing method of topical icy slush mixture. Significant cell damage (coagulated necrosis) develops due to free radicals during cold ischemia (ice storage).
Antioxidant preservatives improved lung cell health: Even at 3 hrs, oil by itself was a poor preservative (6/20). However, all the antioxidants that used oil as solvent were much better, even after 5 hrs of preservation (Vitamin E # 11.5/20, Vitamin A # 8/20, BHT # 11/20, Lutein # 7.5/20). All the oil soluble preservatives were more effective than water soluble antioxidants (Vitamin C # 5/20, Melatonin # 3.5/20, Biotin # 2/20).
Future research: Longer preservation with combinations of Vitamin E, BHT & Ice, and ViaSpan (default practice) can be evaluated on other organs. Methods to remove preservatives from organs prior to transplant must also be addressed.

Summary Statement
This research proved that readily available antioxidants Vitamin E and BHT are effective in neutralizing free radicals, thereby preventing excessive cell damage in the transport period of the lung transplantation process.

Help Received
I'm grateful to my teacher for guiding me and giving full access to our school lab, Dr. Collinson & Dr. Gardiner for H&E staining, San Jose Valley Veal for providing bovine calf lungs, and my dad for logistical help.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Ellen Kae Horowitz

Project Number
S1715

Project Title
Testing Essential Oil Pesticides against Common Greenhouse Pests

Abstract

Objectives/Goals
The purpose of this project is to test the use of #bee friendly# essential oil pesticides to treat two major pests, Green Peach Aphids and Sweetpotato Whitefly.

Methods/Materials
Green Peach Aphids and Sweetpotato whitefly were tested on roses and poinsettia as their hosts. The following essential oils were tested: bergamot, peppermint, and thyme. Water and polysorbate were negative controls, and Break-Thru and Proud 3 were positive controls. Plants were sprayed every 5-7 days and populations determined by counting 1-2 days before re-application.

Results
The most effective treatments were the essential oils, thyme and peppermint and Break-Thru where they significantly decreased the aphid populations in comparison to control treatments ($p < 0.05$). Thyme showed a higher efficacy than Break-Thru at day 21. Peppermint showed a higher efficacy than BreakThru at day 35. By day 47 the populations of aphids were similar for all of the treatments, indicating resistance had set in. For Sweetpotato Whitefly, none of the essential oils significantly decreased insect populations; only Break-Thru affected the adult Sweetpotato Whitefly.

Conclusions/Discussion
The essential oils solutions of peppermint and thyme could be used in a farming system called pesticide rotation. Since it is not uncommon for insects to become to resistant to any type of pesticides, the farmers would only use the oils for a period of 3-4 applications of the pesticide per month, then stop use after that month since the insect would later become resistant, and move onto a use of another pesticide. This study's results for Green Peach Aphids support the hypothesis, however the results do not support the hypothesis for the Sweetpotato Whitefly.

Summary Statement
Three essential oils (thyme, peppermint, and bergamot) were tested to see if they could be used as pesticides against the Green Peach Aphid and the Sweetpotato Whitefly.

Help Received
Dr. Villavicencio allowed use of space at the Center for Applied Horticultural Research and answered any questions.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Virginia F. Hsiao

Project Number
S1716

Project Title
Investigating the Effect of Antioxidants in Dark Chocolate

Abstract

Objectives/Goals
As individuals become more health conscious, they begin to feel afraid to indulge in sugary treats and desserts; however, when they succumb to these delectable temptations, they feel guilty and fear for their health. Recent studies, however, show that chocolate contains high antioxidant content. The goal is to examine how effective antioxidants in chocolate are, in helping the body "defeat" harmful free radicals by directly testing the effect on free radical damaged seeds. This reflects our life, as free radicals pose a major threat to health, and antioxidants that are produced and ingested into the body can reverse and prevent the damage.

Methods/Materials
To test the effects of chocolate's antioxidants, radish seeds were placed into hydrogen peroxide to simulate free radical damage. Then, the seeds were treated with different concentrations of cacao powder (45% concentration, 100% concentration, and a control). Afterwards, the seeds were placed in separate peat pots, watered, and recorded daily. Effectiveness was directly measured by seed germination rate and growth rate.

Results
The results indicated that there were different growth rates of each level (45%, 100%, and control) at different periods of time. T-tests were used to examine whether growth rates were statistically significant between 45% concentration and control group as well as between 100% concentration and control group. The results indicated that the third period of the 45% concentration plant's growth rate was statistically significant, compared to control group. Since the 45% concentration led the third period with a growth rate of 1.705 millimeters, it proved that the 45% concentration had the most effect on the seed's growth.

Conclusions/Discussion
This study demonstrated that it took some time for the antioxidant's effect to kick in. Additionally, the study showed that the presence of antioxidants is important; however, the benefit was not directly linked to the quantity. Rather, the 45% concentration was successful, because it had just enough to sustain a healthy plant.
Dark chocolate's ability to aid in neutralizing and preventing free radical damage could offer an economic, delicious method to stay healthy and perhaps combat diseases. By consuming dark chocolate in moderation, one can become healthier.

Summary Statement
I investigated the effectiveness of antioxidants in dark chocolate by directly testing the effects on plants; Dark chocolate's ability to aid in neutralizing free radical damage offers a delicious method to stay healthy.

Help Received
Special thanks to science teacher, Mrs. Ward for not only giving me a facility to conduct my experiment, but also for allowing me to use her growth lights in my experiment. In addition, she gave me advice and supported me throughout my experiment. My family also helped me purchase my materials.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Nicolle A. Iacobacci; Swetha Janardhana Rajavel

Project Number

S1717

Project Title

The Effect of Cardiac Glycosides on the Heart Rate of Daphnia

Abstract

Objectives/Goals

The objective of this project is to determine whether oleandrin and neriin, the two cardiac glycosides in nerium oleander, can be as effective as digitoxin, the cardiac glycoside in digitalis purpurea, in the treatment of CHF (Congestive Heart Failure) by comparing the effects of the two toxic plants on the heart rate of daphnia. If they are as effective then the heart rate of the daphnia should slow down steadily for when exposed to both plants.

Methods/Materials

The materials used are: Foxglove (Digitalis Purpurea), Oleander (Nerium Oleander), Daphnia (35), Microscopes, Petri dishes, Water, Beakers, Grinders, Pipettes, Nets, and Scissors. Each of the daphnia were observed for 3 minutes under the microscope under 7 conditions (Plain Water, Foxglove Leaf, Foxglove Stem, Foxglove Root, Oleander Leaf, Oleander Stem, Oleander Root). Data was collected at 1-minute increments, and consequently, analyzed.

Results

Arrhythmia was observed in the Oleander Stem group. One daphnia in the Oleander root group died immediately. Only the Oleander Stem group had a significant p-value of .03 when compared with the control group. The rest of the groups had non-significant p-values > 0.06. The Foxglove groups showed a steady decrease in heart rate. This trend does not mean much without significant p-values. With significant p-values, this would mean that Oleander causes irregular heartbeats, whereas Foxglove causes a steady decrease in heart rate.

Conclusions/Discussion

We do not have sufficient evidence to support our hypothesis that oleandrin, neriin, and digitoxin reduce heart rate steadily. It remains inconclusive without significant p-values whether or not any of these toxins are eligible to treat CHF. This data suggests that we repeat the experiment with improvements. These include: larger sample size, buffer period before observation, longer observation period, video evidence of daphnia's heartbeats for accurate counting, and isolated toxins for treatment instead of ground plants.

Summary Statement

This project is about whether cardiac glycosides other than digitoxin can be used to effectively treat CHF (Congestive Heart Failure).

Help Received

No help received.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Yousef Joseph; Nicholas Mah

Project Number

S1718

Project Title

The Varying Concentrations of Glyphosate on the Annelid tubifex

Abstract

Objectives/Goals

The objective of our project was to test the effects of roundup on tubifex worms and to see how it affected them at varying concentrations. We hoped to get results that would give us a good estimation about its effects on environment.

Methods/Materials

We subjected the worms to roundup by placing them in petri dishes filled with roundup in varying concentrations and observed them until they showed characteristics of death and recorded the time it took for all of the worms to die. We us Remuda glypphosate-based herbicide, 30 petri dishes, 2 gallons of spring water, 1 pipette, a 1 liter volumetric flask, 10-500ml. beakers, 1-50ml. beaker, 300+ tubifiex worms, 1 drawing brush, and 1 timer.

Results

At the end of our project all of the worms exposed to roundup were killed, except for the worms in a 25ppm dilution of it. the times for the worms to die decreased with the increase in concentration in an exponential manner.

Conclusions/Discussion

From our results, we were able to conclude that roundup has a very significant effect on the environment. However, we believe that the concentrations we used in the experiment was too high to be based off of real life runoff and environmental conditions.

Summary Statement

Our project is about the how roundup kills tubifex worms and in what ratios and speed.

Help Received

Mom helped with board, Teacher helped with materials

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Alexander Jow

Project Number

S1719

Project Title

Ethanol's Effect on Synaptic GABA-Mediated Paired-Pulse Inhibition: A Novel Mechanism behind Alcoholic Intoxication

Abstract

Objectives/Goals

To identify a novel molecular mechanism behind ethanol and its interactions with the central nervous system in order to better understand ethanol's actions at the neuronal level and to develop potential drug therapies and biomarkers for human alcoholism.

Methods/Materials

Experiments were run at different low concentrations of ethanol mixed with ACSF (0.10%, 0.25%, 0.50%, and 2.50%). Paired-pulse inhibition (PPI) amplitudes were measured before, during, and after the ethanol solutions were added, and the experimental PPI values with ethanol were compared against control PPI values to determine the percent increase in PPI amplitudes. A 105% increase or higher in PPI when ethanol was added was defined as a significant increase in PPI. The percentage of experiments carried out that illustrated a significant increase in PPI, defined as the percentage of responders, is also measured to examine the degree of effectiveness of each ethanol concentration. The number of spikes discharged per second was also measured when ethanol was added to control ACSF solutions, and the number of spikes was shown to increase in the ethanol solutions versus in regular ACSF solutions. Lastly, in each #wash-out# stage, in which ACSF solution was re-added to the hippocampal slices, the average PPI of each responder was shown to return to control levels.

Results

I mapped ethanol's actions at the low concentrations associated with human intoxication directly onto GABA-A-slow, and also developed a theoretical GABA pathway in the central nervous system that illustrates how GABA-A-slow may selectively inhibit GABA-A-fast. I also pinpointed the interactions of ethanol with GABA-A-slow to specifically within synapses, and proved how increases in the concentration of ethanol create much more dramatic effects on paired-pulse inhibition and on the percentage of responders.

Conclusions/Discussion

My experiment concluded that ethanol interacts directly with phasic, synaptic GABA-A-slow receptors at the low concentrations associated with alcoholic intoxication. By mapping ethanol#s effects onto these synaptic GABA-A receptors, a novel molecular mechanism of ethanol#s actions on the central nervous system was identified, and this mechanism is an area for future research and analysis on how to counter the effects of intoxication and genetic alcoholism.

Summary Statement

Electrophysiological experiments were conducted to identify a novel mechanism behind alcohol's interaction's with the central nervous system via GABA-mediated paired-pulse inhibition, which may lead to future therapies for alcoholism.

Help Received

I conducted this project at the Stanford University Medical Center under the invaluable mentorship of Dr. M. Bruce MacIver at the MacIver Lab. Mr. Tim Smay provided suggestions and feedback on the original draft of my research report.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Alyah Kanemoto

Project Number
S1720

Project Title
The Effect of a Neurotoxin on Planarian Eye Receptor Regeneration

Abstract

Objectives/Goals
The objective of my experiment was to see the effect of Monosodium Glutamate (MSG) on the rate of planarian eye receptor regeneration.

Methods/Materials
I used 75 planaria for 3 weeks of experimentation, and I used 25 planaria each week. I performed the serial dilution procedure in order to obtain my concentrations of MSG. The next procedure I performed was the cutting procedure; in this procedure I identified the planarian eye receptors and auricles and decapitated the head of each planarian. Lastly, in order to test the planaria eye receptors I performed a phototaxis procedure, in which I gave each planarian 90 seconds to cross to the dark side.

Results
The results of my experiment did not entirely correlate with my objective. Based on my daily phototaxis procedure, I was able to identify that MSG was having some effect on the planarian eye receptor regeneration. Most of my control planarian moved away from the light like they're supposed to, a negative phototaxis response. In contrast, the planarian concentrated with MSG had movement in both directions, a positive and negative phototaxis response. The control and concentrated planarian's observed movement that indicated that MSG is having some effect on the planarian's eye receptor regeneration. After each set of data, the number planarian that died showed the survival rate of each concentration. After analyzing my data, I was able to narrow down my concentrations with that information I hope I'll be able to have more accurate data.

Conclusions/Discussion
Based on my results, it is clear that MSG effected the planarian eye receptor regeneration. However, it did not completely support my objective; it did in the sense I was able to identify deformity in the highest concentration(s) but I was unable to understand how the planaria were being effected by MSG at a molecular level, my hypothesis. My objective was not completely achieved on the effect of MSG on the rate of planarian eye receptor regeneration due to the large amount of variables such as: my method of measurement, inconsistent incisions, temperature controller problems, and exposure to lighting at unnecessary times. Because my objective was not fully achieved, it was inconclusive. In the future, I plan on redoing my experiment. I will modify my procedures and narrow down the number of variables in the hopes of getting supportive and conclusive data.

Summary Statement
The effect of Monosodium glutamate on the rate of planarian eye receptor regeneration.

Help Received
My and dad for mom for support, my uncle for guidance, and Mr. Center for providing materials.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Akhil V. Kasibhatla

Project Number
S1721

Project Title
Effects of Tumor Microenvironment and Anticancer Agents on Colon Cancer

Abstract

Objectives/Goals
The purpose of this experiment was to determine what effects a tumor microenvironment can have on the growth of colon cancer cells.

Methods/Materials
HCT116 and HCT15 colon cancer cell lines were cultured in McCoy 5A media and soft agar. Two cell lines were used since cancers differ among each patient and we wanted to show the results as continuous through multiple cell lines. The culture medias differed in that in the soft agar medium, the cells would for a microenvironment. Anticancer agents targeting RAF, MEK, MET, EGFR, and IGF1R were applied to cells in both environments and IC50, or the concentration of a compound at 50% confluency, was recorded. Standard of care, or chemotherapeutic compounds, were also used as toxic agents. Confluency, or percentage of healthy cells covering well plate, was calculated from images taken with Celigo Cytometer.

Results
Cells with microenvironment had lower confluence levels that cells in plain media. Standard of care compounds killed cells with and without microenvironment equally. Combinations of different compounds had lower confluencies as concentration increased than independent compounds. HCT116 cells had an overall lower confluency than HCT15 cells when both had the same compounds applied to them.

Conclusions/Discussion
From the results, several conclusions could be made. First, the effect of compounds changed significantly in the presence of a microenvironment. Second, HCT116 cells are more sensitive to different anticancer agents than HCT15 cells. Third, combinations of compounds proved more effective in killing cells than compounds applied individually. Finally, standard of care compounds proved nonspecific as they killed cancerous cells in the tumor and healthy cells in the microenvironment.

Summary Statement
To study why compounds which are successful in a lab setting aren't as effective in the human body.

Help Received
Used lab equipment at GNF under supervision of Tim Smith.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Karley J.K. Lassley

Project Number
S1722

Project Title
Which Indigenous Plant Extract Will Inhibit Mosquito Larvae Development While Maintaining a Healthy Aquatic Ecosystem?

Abstract

Objectives/Goals
The purpose of my science project is to determine which indigenous plant extract will inhibit mosquito larvae development while maintaining a healthy ecosystem. In my last science project I proved that the chrysanthemum plant did in fact work as a pesticide for mosquito larvae, yet it also killed the frog eggs. My goal is to find a plant extract that is effective as a safe solution to killing mosquito larvae without harming the ponds ecosystem.

Methods/Materials
In the control test I will place 10 mosquito larvae and 10 frog eggs in 10 clear containers filled with pond water.
In the next set of containers I will place 10 mosquito larvae, 10 frog eggs to pond water, and a 5% solution of Oleander extract. I will observe and record how long it takes for the mosquito larvae to die and for the frog egg hatch rate. I will repeat test using chrysanthemum extract. 10 trials of each.
MOSQUITO LARVAE MEASURING CUP
AQUTIC HEATERS FROG EGGS
OLEANDER PLANT CAMERA
POND TEST STRIPS BLENDER
STORAGE CONTAINERS PLASIC CUPS
CHRYSANTHEMUM PLANT PLASTIC BOWL
CHEESE CLOTH SOLUTION DROPPER
WATER POND WATER

Results
Unfortunately both oleander and chrysanthemum would not be safe for the other aquatic life in ponds, nor would they allow for safe pH and nitrate levels. However, of the two chrysanthemum did prove to be the safest.

Conclusions/Discussion
After completing my project, I have found my hypothesis for chrysanthemum was partly correct. I believed that the chrysanthemum extract would kill the most larvae, be safer for aquatic life, and have less of an effect on the pH and nitrate levels of pond water than oleander. Although both were an effective pesticide on mosquito larvae, neither allowed the frog eggs to hatch. also both substances negatively affected the pH balance and nitrate levels.

Summary Statement
My goal is to find a plant extract that is an effective solution to killing mosquito larvae, without harming the ponds ecosystem.

Help Received
help with typing

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Elyssa S. Lawrence

Project Number
S1723

Project Title
The Effect of Agricultural Chemicals on Daphnia magna

Abstract

Objectives/Goals
If I put varying amounts of Tiger 90 Sulfur, diesel, motor oil, and regular gasoline in jars with live Daphnia magna, then the death rates will be higher in motor oil, lower in regular gasoline and diesel, and lowest in Tiger 90 Sulfur.

Methods/Materials
My procedure began with the placement of twenty jars in columns of five and rows of four. Four columns tested the harshness of a particular agricultural chemical on D. magna. The fifth column of this experiment was used as a control. Each row then consisted of a specified amount added to the jars, for each chemical. The jars were filled with equal amounts(100mL) of tap water that had been treated with water conditioner, and the jars were filled with the same amount(6mL) of green algae for the D. magna to sustain themselves on. The designated amounts of toxins were added in each jar for each different chemical. The twenty jars were given three hours of direct light from grow lights for algae growth. The number of live D. magna were counted in each jar every twenty-four hours.

Main Materials: Twenty jars, 120 Daphnia magna, 120 mL of algae, water purified with water conditioner, several pipettes, and two grow lights.

Results
The Daphnia magna(D. magna) died more quickly in the motor oil than in any of the other chemicals. Diesel and regular gasoline followed up the motor oil by both incurring a slower death than which the motor oil D. magna had. Tiger 90 Sulfur resulted in deaths, but they occurred less quickly than all three of the oily substances used to intoxicate the D. magna.

Conclusions/Discussion
The results support the hypothesis made that D. magna death rates would be highest with the added Motor Oil and least with the added Tiger 90 Sulfur. In conclusion, these results help promote awareness to create research opportunities and to develop new technologies to reduce agricultural run-off of Motor Oil and quite possibly diesel and regular gasoline.

Summary Statement
The purpose of this project is to see how the agricultural chemicals in my area effect the biodiversity of life in a pond ecosystem.

Help Received
Mother helped assemble board; Mentor helped guide me in the right direction

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Alexandra Maloof

Project Number

S1724

Project Title

Bifidobacteria as the Potential Biotherapeutics in Controlling Type 2 Diabetes

Abstract

Objectives/Goals

It is increasingly recognized that the gut microflora in Type 2 diabetic (T2D) patients is characterized by lesser numbers of Bifidobacterium. The objective of this study is to find if giving T2D humans bifidobacteria for five weeks could effectively decrease their mean blood glucose levels.

Methods/Materials

T2D patients were selected from an Internal Medicine Practice and were instructed not to alter their lifestyles during the five-week duration of the project. For the five weeks, patients took two bifidobacteria capsules per day and monitored their glucose levels on Mondays, Wednesdays, and Fridays in the mornings and evenings. The researcher obtained the patients past HbA1c exams for the two months prior to the treatment and compared this value to their mean glucose readings for the five weeks.

Results

The bifidobacteria helped decrease the mean blood glucose levels of all patients except patients #2 and #9, because patients #2 and #9 altered their lifestyle and eating habits during the five-week period of the project. All the other patients experienced a 10% or greater decrease in their mean blood glucose levels. Other advantages of bifidobacteria were discovered in this project, including eliminating acid reflux (patients 8 and 12) and helping with weight loss (patients 1, 4, and 10). Even when including patient #2 and #9 data in calculating the t-test statistic, the yielded p-value was statistically significant at the 0.01 alpha level.

Conclusions/Discussion

The potential clinical impacts of this study are 2-fold: first, bifidobacteria can be utilized to prevent and treat T2D. Second, this project revealed that bifidobacteria has several other advantages such as eliminating acid reflux and helping with weight loss that can be further investigated. In conclusion, this project showed that bifidobacteria was shown to significantly decrease the mean blood glucose levels of T2D patients.

Summary Statement

The oral consumption of bifidobacteria can decrease the mean blood glucose levels of Type 2 diabetic patients.

Help Received

Dr. George John M. Jr., MD supervised the project.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Eyobed T. Mesfun

Project Number

S1725

Project Title

The Study of the Effects of Electromagnetic Fields at Various Frequencies upon Cancerous and Noncancerous Cells

Abstract

Objectives/Goals

The objective of this experiment was to see what effects various frequencies of Electromagnetic fields had on the reproductive growth of cancerous and noncancerous cells.

Methods/Materials

1. Culture the cell lines CCL-107, CCL-219, and CRL-2535 according to ATCC procedures.
2. Construct nine electromagnetic field emitting boxes.
3. Take your petri dishes place 5 mL of the growth medium with the cells you want to test in each petri dish. Para film the edges to insure no leaks. Place 4 petri dishes in each of the electromagnetic field boxes and 4 controls in the incubator (do this separately for each cell line).
4. After 48 hours remove the petri dishes from the aluminum boxes in the incubator, take a 500 microliter sample from each petri dish, place those samples individually in different capsules with a 1:1 volume of Trypan blue staining dye.
5. Then pipette 10 microliters and place it in the groves of a hemocytometer and place a glass slide over it and count the number of cells in each of the four 1 square mm corners and divide to get the average.
6. Then multiple by 10 to the 5th power to get the approximate cells in the 5 mL petri dish.
7. Lastly Run a one way ANOVA test and analyze your data.

Results

The data I collected regarding electromagnetic field exposure upon Glioblastoma Multiforme (GBM) suggests:

1. The P-value, which is 1.06E-16, provides the evidence to reject the null hypothesis which states that EMFs do not affect the growth of GBM.

The data I collected regarding electromagnetic field exposure upon Leukemia suggests:

1. The P-value, which is .397, leads to the acceptance of the null hypothesis which states that EMFs do not affect the growth of Leukemia.

The data I collected regarding electromagnetic field exposure upon healthy glial cells suggests:

1. The P-value, which is .015, provides the evidence to reject the null hypothesis which states that EMFs affect healthy glial cells in a harmful manner.

Conclusions/Discussion

Through all the information obtained throughout the course of this experiment I have proven half of my first hypothesis to be correct. GBM when exposed to the various EMF frequencies decreased in cellular reproduction on average by 48.03% amongst all the trials, with P-values supporting these results.

Summary Statement

Low intensity high frequency electromagnetic fields have the ability to disrupt the cellular reproduction of cancer cells.

Help Received

Howell Ivy helped me construct my EMF emitting boxes. Valley Christian provided the lab equipment.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Sophia R.R. Moore

Project Number

S1726

Project Title

Runaway Runoff: Effect of Ammonium Acetate on Phytoplankton in the Oakland Estuary

Abstract

Objectives/Goals

The objective is to determine the effect of different amounts of ammonium acetate on the population on phytoplankton living in the Oakland Estuary.

Methods/Materials

Ammonium acetate was created by combining 50g of household ammonia and 50g of white vinegar. This mixture was at 5% dilution. Using three sets of five cups filled with 0.5 liters of estuary water, drops of ammonium acetate solution were put into each cup in counts of zero, one, five, ten and twenty-five. After leaving the cups for twenty-four hours, a sample from each cup was viewed underneath a microscope at 10 times magnification. A count was made of phytoplankton in each view and recorded.

Results

It was determined that ammonium acetate in small concentrations between 5 ppm and 25 ppm increased observable phytoplankton numbers in samples of estuary water by 161.7 % and 103 % respectively. When concentrations of ammonium acetate were 50 ppm or higher there was no observable change in population.

Conclusions/Discussion

The ammonium acetate appears to have acted as a fertilizer by providing the nutrient nitrogen to phytoplankton for photosynthesis at levels from 5ppm to 25 ppm. The population count of phytoplankton rose at lower concentrations but remained unchanged at 50 ppm and above because ammonium acetate was toxic to the phytoplankton at these levels. This experiment suggests that there is a great need for research to be done on the impact of chemicals that runoff into the estuary.

Summary Statement

One of the many chemicals that flow into the Oakland Estuary, ammonium acetate, was tested to see how it affected the estuary phytoplankton population at various concentrations.

Help Received

Father helped with assembling the board and supervised making ammonium acetate.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Leane S. Nasrallah

Project Number

S1727

Project Title

Effects of Induced Diabetes on Development and MIOX Expression in Fruit Flies

Abstract

Objectives/Goals

MIOX (myo-Inositol oxygenase) is an enzyme found in human kidneys that catalyzes the first committed step in the catabolism of myo-inositol. MIOX has been found to be upregulated in diabetic animal models. (Choi et al. 2012). myo-Inositol is an isomer of inositol that is related in insulin regulation. Alterations of the levels of inositol have been linked to Type 2 Diabetes.

Methods/Materials

The organism Drosophila melanogaster is used as a model because it has a short generation time, and is easy to maintain. Furthermore, the entire D. melanogaster genome has been sequenced and published (Celniker et al., 2002). D. melanogaster have been shown to have insulin-like proteins and a diabetic-like state (Type II) can be induced by high sugar diet (Pasco & Leopold 2012). In order to examine MIOX expression, In Situ Hybridizations were performed using developing embryos. Development of flies was also monitored by recording the number of eggs laid, then the number of those eggs that hatched after 24 hours in defined media with increased sugar concentration (5X). A control group of flies with normal sugar concentration (1X) was also monitored. Growth of flies in high sugar (and flies in regular sugar concentration) was observed by placing a specific number of flies in a controlled environment and recording the number of deaths each day for 10 consecutive days.

Results

After pooling data from 3 separate trials, there was no evidence that the flies grown under increased sugar had a different survivability than the flies grown under normal sugar conditions.

Conclusions/Discussion

Preliminary data show that flies grown under increased sucrose concentration showed substantial developmental delay. This developmental delay might be due to the disruption of insulin-like proteins (Dilps) that are involved in growth and metabolic homeostasis. Unexpectedly, preliminary data show that there is no difference in embryo hatching percentage in flies grown under different sucrose concentrations. The data shows that survivability of adult flies is not affected by the concentration of sucrose added to their medium.

Summary Statement

My objective was to analyze the effect of induced diabetes on fruit fly development and the expression of a protein (MIOX) that is related to Type 2 Diabetes.

Help Received

Used lab facilities/equipment at Cal State University, Long Beach, under the supervision of Dr. Lisa Klig and Eliseo Villarreal; Parents drove me to and from the lab

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Xueting Nie

Project Number

S1728

Project Title

Expression and Functional Analysis of Human Mutated Relaxin-2

Abstract

Objectives/Goals

In this project we attempt to design and obtain in Pichia pastoris a functional recombinant human Relaxin-2 with mutations reducing the binding specificity toward RXFP2, but preserving the binding to RXFP1, for pharmaceutical purposes.

Methods/Materials

Pichia pastoris was induced by 3% Methanol, with cell density at 30~35 OD600nm, and for 24 hours. Proteins in the supernatant were separated by SDS-PAGE was detected on the membrane using a specific anti-His antibody. The protein was purified through a TALON column. The purified protein was then cleaved by thrombin to produce the mature mutated human Relaxin-2 protein. The CHO cells were transfected with empty vector or the vectors carrying RXFP1 or RXFP2 gene by lipofectamine. Recombinant mutated human Relaxin-2 was added to the cells with a final concentration of 1nM. The cAMP was detected by ELISA.

Results

1. Recombinant mutated human Relaxin-2 can be expressed and secreted in the Pichia pastoris system.
2. The purity of recombinant mutated human Relaxin-2 is over 98% after affinity purification.
3. Under the physiological concentration, 1mM recombinant mutated human Relaxin-2 can significantly activate RXFP1 receptor resulting in an accumulation of cAMP. However, there is not obvious difference of the RXFP2 expressed cells and Control cells in cAMP level.

Conclusions/Discussion

In this study, we successfully expressed and purified a mutated human Relaxin-2 from Pichia pastoris. This mutated human Relaxin-2 can significantly activate the cells with expression of RXFP1 receptor, but not RXFP2, suggesting selective activation of RXFP1 by the mutated Relaxin-2. However, our study does not provide direct ligand-receptor binding evidence thus we cannot exclude the binding possibility between the mutated human Relaxin-2 and RXFP2. Addressing this question and examining the cardioprotective functions of the mutated human Relaxin-2 in animal models will be our next focus.

Summary Statement

It have designed and produced a mutated human Relaxin-2 that preferrally activates RXFP1

Help Received

Used lab at Newcca corporation under the supervision of Dr. Wenbin Tan

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Arantxa Ortiz

Project Number

S1729

Project Title

The Effects of Eugenol-based Natural Anesthetics on Nerve Conduction Velocity in Lumbricus terrestris

Abstract

Objectives/Goals

The goal of this project was to determine whether natural anesthetics composed of Eugenol affected conduction velocity in earthworms. Since reflexes become slower under anesthetics and analgesics , it is hypothesized that the nerve impulses will be slower.

Methods/Materials

The Lumbrius terrestris are anesthetized in solutions of ethanol, clove oil, and cinnamon oil. After anesthetizing the earthworms each worm is stimulated with a glass probe and the action potentials that result are recorded by the computer software Audacity. Then when the impulse passes through each electrode (all of them are one inch apart) the difference in time is analyzed in order to calculate the conduction velocity. When comparing conduction velocity, the unanesthetized worms serve as the negative control while worms anesthetized with ethanol serve as the positive control. After this, 2 sample t tests are used to determine whether or not there is a difference in conduction velocity when using these Eugenol-based solutions. The materials used are 2 beakers, 1 graduated cylinder, 2 medium sized glass containers, tap water, two-channel input cable, cinnamomum cassia oil, cinnamomum vera oil, clove oil, 40% ethanol, ruler, Spikerbox, glass probe, styrofoam, Faraday cage, laptop, and Lumbricus terrestris.

Results

After conducting 2 sample t tests, the results contradicted the hypothesis that Eugenol-based natural anesthetics result in slower nerve impulses. Contrary to this, the t tests showed that the solutions with higher naturally occurring percentages of Eugenol resulted in faster nerve conduction velocities. However, Cinnamomum cassia (10% Eugenol) resulted in the slowest nerve impulses.

Conclusions/Discussion

From this research it can only be concluded that a higher percentage of Eugenol results in faster nerve impulses. However, the fact that anesthetizing earthworms with Cinnamomum cassia resulted in the slowest conduction velocities leaves room for further research. With this experiment it is impossible to ascertain which properties of Eugenol are causing the impulses to become faster. The increase in conduction velocity can not be attributable to the anesthetic and analgesic properties. In the future, a solution of Eugenol extract would allow for more accurate measurements of the effects of Eugenol, as it would exclude the effects of the other components of these anesthetics/analgesics.

Summary Statement

The project tests the effects of natural anesthetics and analgesics on nerve conduction velocity in earthworms.

Help Received

Kyle Shannon, Graduate Neuroscience student from UCSD provided counsel

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Stephany M. Rubio

Project Number

S1730

Project Title

Does KaiO Make a K.O.?

Abstract

Objectives/Goals

To test the effectiveness of the multi purpose cleaner and bathroom cleaner used at Pioneer Valley High School on E.Coli bacteria.

Methods/Materials

Petri Dishes, Micro Pipettes, Speed Sticks, LB Broth, Bleach, Flask, Beaker, Funnel, Goggles/Apron/gloves, Incubator, KaiO/Kaiblooey, Epi tubes, Microwave, Culture tube of E.Coli, Tweezers, distilled water, Test Tubes, Assay Disks, Graduated Cylinder, Agar.

Results

I found that the KaiO multi purpose cleaner that is used frequently on our campus is not effective towards killing bacteria. It sure leaves a nice scent and is #green sealed# approved, but that does not justify the fact that it does not do its job. The bathroom cleaner, Kaiblooey is the same situation. It smells nice and leaves the toilets shiny, but the bacteria is still present. The cleaners do kill some bacteria, but very minimal to where it safe to say that the dilutions used are ineffective. From my results, the KaiO cleaner started killing bacteria when the percentage of the concentrated cleaner in the solution was at least 10%. The Kaiblooey bathroom cleaner started killing bacteria when the percentage concentration was at least 30%. The original percentage that the company suggests is 1.56% for the KaiO! The obvious solution is to increase the concentration of the concentrated cleaner and decrease the amount of water used.

Conclusions/Discussion

The effectiveness of the bathroom and counter top cleaner at Pioneer Valley High School on killing bacteria is very negligible. The ratio of the concentrated cleaner to water that is used, is too minimal to actually kill an effective amount of bacteria. My hypothesis was correct because it was based off of finding that the cleaners are extremely diluted. So I came to the conclusion that KaiO and Kaiblooey cleaners wouldn#t be effective enough on killing bacteria. The cleaners have the potential to kill bacteria at an effective rate, only if the concentration percentage is increased.

Summary Statement

To test the effectiveness of the multi purpose cleaner and bathroom cleaner used at Pioneer Valley High School on E.Coli bacteria.

Help Received

Used equipment in the Biology class at Pioneer Valley High School, under the supervision of Mr. Magni.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Rohan A. Savoor

Project Number

S1731

Project Title

Investigating the Role of Extracellular Cinacalcet on the Proliferation of MIN6 Pancreatic Beta Cells in vitro

Abstract

Objectives/Goals

Last year, the American Diabetes Association recognized 2.6 million people in the United States to be diagnosed with Insulin Dependent Diabetes Mellitus (IDDM), or more commonly, Type 1 Diabetes, a chronic disease characterized by the autoimmune destruction of pancreatic beta cells. Previous research has been conducted to understand the physiologies of surface receptors of beta cells as well as their respective agonists, and to connect them to a treatment for IDDM. Specifically, the prevalence of the Calcium Sensing Receptor, a Class C G-protein-coupled receptor, on the beta cell surface has been well-documented, and this receptor is linked to cellular proliferation in embryonic fibroblasts and osteoblasts in murine models, as shown in various past studies. The present study investigates the role of Cinacalcet, a calcimimetic drug, as an agonist to the Calcium-Sensing Receptor in order to stimulate proliferation in the MIN6 pancreatic beta cell.

Methods/Materials

The MIN6 beta cell culture was incubated in cell culture plates using media prepared primarily with Dulbecco's Modified Eagle Medium (DMEM). In preparation for treatment, the culture was divided into six sets, and each set was seeded into an eight-well plate. Aliquots of 1.0 uM dimethylsulfoxide (DMSO) control, Cinacalcet, and NPS 2143 negative control, were prepared and added to the seeded cells. Treatment was administered for 24 hours and 48 hours at 37 degrees Celsius. The cell proliferation assay was conducted using immunohistochemistry techniques and fluorescent microscopy.

Results

It was discovered that the Cinacalcet treatment yielded 24% more cell proliferation after 48 hours of treatment compared with the DMSO control. Using a one-tailed T-test, this data was shown to be statistically significant ($p < 0.05$).

Conclusions/Discussion

It can be concluded that Cinacalcet stimulates significant cellular proliferation in MIN6 pancreatic beta cells. These results can prove to be a valuable asset to beta cell regeneration as a potential treatment option for Type 1 Diabetes.

Summary Statement

This research shows that Cinacalcet, a calcimimetic drug, stimulates cellular proliferation in MIN6 pancreatic beta cells, thereby providing an opportunity to investigate a novel approach to treating Type 1 Diabetes.

Help Received

The German Lab at UCSF provided the lab facility and equipment for experiments. Dr. German and Dr. Macias supervised and provided instructions on proper use of equipment and handling of the cell line.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Nikash D. Shankar

Project Number

S1732

Project Title

Potential Cure for Alzheimer's: A Novel Therapy Using Polymeric Nanoparticle-Encapsulated Curcumin to Inhibit Caspase

Abstract

Objectives/Goals

Alzheimer's disease (AD) is characterized by accumulation of beta amyloid (Abeta) plaques in the brain and activation of caspase pathway leading to neuronal apoptosis. Curcumin, a principal curcuminoid of turmeric, has anti-amyloid, anti-apoptotic, and antioxidant activities, which are beneficial in AD. However, curcumin's water insolubility and poor bioavailability limit its efficacy as a therapeutic agent in AD. This project overcomes these limitations by using a novel polymeric nanoparticle (PEG-PLGA) encapsulated curcumin as an effective vehicle for curcumin delivery to an in vitro AD neuronal cell model thus improving curcumin's potential as a therapeutic option in AD.

Methods/Materials

PEG-PLGA nanoparticle-encapsulated curcumin (nanocurcumin) was analyzed for size, shape, and in vitro release kinetics. Neuro-2A cells were exposed to Abeta oligomers and then treated with curcumin, nanocurcumin, and PEG-PLGA nanoparticles for 24 hours. The protective role of nanocurcumin versus curcumin on Abeta levels, cell viability, caspase activity, and antioxidant activity were determined. Cellular uptake of nanocurcumin and curcumin was imaged using fluorescence microscope. Healthy cells were kept as negative control and cells exposed to Abeta were kept as positive control.

Results

In vitro release kinetics of nanocurcumin showed 70% of curcumin release from nanoparticles at 24 hours. Characterization of nanocurcumin by DLS confirmed a size of 200nm. Fluorescence microscopy images proved an increased cellular uptake of nanocurcumin compared to curcumin. Cells treated with 20µM nanocurcumin exhibited less Abeta levels ($p<0.05$) and less caspase activity than those treated with 20µM curcumin. Increased cell viability was seen with nanocurcumin (>20%) compared to curcumin, as early as 7 hours with sustained effect at 24 hours. Also, nanocurcumin exhibited comparable antioxidant activity (90%) to that of the curcumin. Further, PEG-PLGA nanoparticles were not toxic to the cells.

Conclusions/Discussion

While previous studies have identified the therapeutic use of curcumin, this study is the first to use a polymeric nanoparticle vehicle for curcumin delivery in AD. By effectively increasing the water solubility and cellular uptake of curcumin, nanocurcumin successfully reduced the buildup of Abeta and inhibited the caspase-mediated apoptosis much more than curcumin alone. Nanocurcumin may thus be a viable potential cure for AD.

Summary Statement

I used a novel drug delivery system of curcumin encapsulated with PEG-PLGA nanoparticles, which could potentially be a therapeutic option in AD.

Help Received

Dr. Ibtisam Khalif and Dr. Aru Hill for advice and supervision of lab use; Dr. Keith Vossel, Gladstone Institute for advice on initial research; Nanoscience Lab for use of SEM, DLS, Fluorescence microscopy; Ms. Belinda Schmahl and my parents for support.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Derek J. Wong

Project Number
S1734

Project Title
Phytotoxicity of Two Glyphosate Formulations to Vigna radiata: Non-target Pesticide Exposure, Year 2

Abstract

Objectives/Goals
Due to legally withheld ingredient information, formulation specific pesticide studies are often difficult to complete. Glyphosate, one of the most widely used herbicides in the US, is approved for both food and nonfood use and is registered for crop dessication and pre-harvest application on the mung bean. The objectives of this project were to determine if two commercially available glyphosate based formulations were capable of inhibiting the growth of Vigna radiata at non-target levels and to determine if active ingredient concentration was indicative of phytotoxicity.

Methods/Materials
720 Vigna radiata seeds were grown hydroponically and given one of three dilutions of Roundup (2% glyphosate) or Ortho Total Kill (1%): 10-1, 10-3, 10-5. A control was given distilled water and a separate group was given a 10-3 dilution of Roundup reduced to a 1% glyphosate concentration. From 3 trials, 720 germination counts were taken and 240 root lengths measured using the Grid Intersect Technique.

Results
Germination was generally reduced in both groups with increasing concentration. However, Roundup was more effective than Ortho in reducing germination at every concentration except 10-3. The greatest difference in count was at 10-1 (Roundup inhibited all germination, 9% more than Ortho). Root length was affected by Roundup and Ortho differently than germination. Even though it only contained half the amount of active ingredient (1% glyphosate), Ortho inhibited more growth at all concentrations except for 10-1. At equivalent amounts of glyphosate (1%), Ortho reduced germination by 13% and suppressed more root growth than Roundup.

Conclusions/Discussion
Active ingredient concentration does not necessarily reflect the phytotoxicity of a formulation. Residual levels of glyphosate can be harmful to mung been seeds, possibly reducing their quality after harvest. If this response is similar in other plants and organisms, non-target exposure may pose a risk to the environment.

Summary Statement
I tested dilutions of 2 glyphosate herbicides on the mung bean and found that very low levels inhibited growth and that the active ingredient concentration did not necessarily indicate the phytotoxicity of the products.

Help Received
Mr. Hunt, Ms. Corbett, and Dr. Gardiner gave me advice and supplies for the experiment. My mom helped me with excel and the display and my dad supervised me during experimentation.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Maria H. Yerena

Project Number
S1735

Project Title
Effect of a Commonly Used "Organic" Fungicide on a Freshwater Plankton Community

Abstract

Objectives/Goals
My objective was to understand how a fungicide that is commonly used in Santa Cruz County and is certified for use on organic farms can affect plankton abundance and diversity of pond ecosystems.

Methods/Materials
I collected plankton at Pinto Lake by towing a plankton net along the surface of the water from a dock and diluted it in 10 L of lake water. I mixed the bucket of water and plankton and filled each of 24 cups with 300 ml of water and plankton. 48 hours later, I applied treatments of 0, 1, 2, 3, 4, or 5 drops of the copper fungicide to 4 cups of each treatment using a pipette. 10 days later, I decanted each cup over a fine mesh filter and preserved the filtrate into test tubes in isopropyl alcohol. Using a Sedgwick rafter (slide for counting plankton) and compound microscope to count the amount of zooplankton per volume of sample, I counted each organism and assigned it to the lowest taxonomic level possible using a key we made.

Results
10 days following the fungicide treatment, experimental ponds (cups) with higher treatments of fungicide were visibly less green, suggesting the fungicide had an effect on phytoplankton. Overall, I found no clear relationship between the amount of fungicide applied and the average number of individuals per cup or the average level of biodiversity.

Conclusions/Discussion
The results do not strongly support my predictions that the number and biodiversity of zooplankton would decrease with increasing concentrations of fungicide. There were, however, visible (although not quantified) effects of fungicide on the color of the water, likely caused by effects on phytoplankton. Future studies should look further into impacts of fungicides on phytoplankton growth, since like zooplankton, phytoplankton is an important part of pond systems. I could also try realistic concentrations of fungicide from farm runoff and run the experiment for longer periods of time.

Summary Statement
I found that a copper fungicide had no clear effect on the abundance or biodiversity of zooplankton collected from a lake strongly impacted by agricultural runoff.

Help Received
UCSC grad student Dave Fryxell helped design experiment, analyze data, and put together board.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Amanda M. Shi

Project Number

S1796

Project Title

The Effect of Ammonium on Silver Nanoparticle and Silver Ion Induced Inhibition of Nitrosomonas europaea

Abstract

Objectives/Goals

Silver nanoparticles (Ag-NP) and silver ions (Ag+) have been shown to inhibit the nitrite production of ammonia oxidizing bacteria, a discovery that can affect the efficacy of wastewater treatment plants. The purpose of this study is to analyze the influence of an ion commonly found in wastewater, ammonium (NH4+), on silver nanoparticle and silver ion induced inhibition of the ammonia-oxidizing bacteria N. europaea, and subsequently determine whether Ag-NP or Ag+ more significantly impacts the bacteria's inhibition when in contact with NH4+.

Methods/Materials

Two separate experiments were run to compare the effect of NH4+ on the toxicity of Ag-NP and Ag+ to N. europaea. The first evaluated the change in nitrite production of N. europaea when exposed to a constant concentration of Ag-NP and varying concentrations of NH4+. The second evaluated the change in nitrite production of N. europaea when exposed to a constant concentration of Ag+ and varying concentrations of NH4+. Triplicates of eleven treatment conditions were tested per experiment, with NH4+ concentrations ranging from 0 to 50 mM. Samples of each triplicate were taken every 45 minutes over a 3 hour testing period. The nitrite production of each condition was measured through a colorimetric nitrite assay at an optical density of 540 nm via UV-Visible spectrophotometer.

Results

As the concentration of NH4+ increased in triplicates containing N. europaea and Ag-NP, nitrite production significantly decreased. Contrastingly, as the concentration of NH4+ increased in triplicates containing N. europaea and Ag+, nitrite production remained fairly constant.

Conclusions/Discussion

These trends suggest that NH4+ attaches to and pulls off the Ag+ that coat the surfaces of Ag-NP to form a silver amine complex, which is just as toxic to N. europaea. Ag+ then quickly regenerate on the surface of the nanoparticle. However, in the second experiment, because there is a limited amount of Ag+ free in solution, even though silver amines form, the overall toxicity remains constant despite varying concentrations of NH4+. This research suggests that Ag-NP would be more toxic in an environment with high concentrations of ammonium rather than in one with low concentrations; it provides a footing for understanding the effects of constituents in wastewater on the toxicity of Ag-NP and Ag+, as well as on the overall efficiency of wastewater treatment plants.

Summary Statement

To analyze the effect of ammonium on silver nanoparticle and silver ion induced inhibition of the ammonia-oxidizing bacteria N. europaea.

Help Received

Mentored by and used lab equipment under the supervision of Dr. Tyler Radniecki, SDSU.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Adam J. Protter

Project Number
S1797

Project Title
Effects of Triclosan on Sperm Motility, Fertilization, and Early Development of Strongylocentrotus purpuratus

Abstract

Objectives/Goals
The objective of this project was to determine if Triclosan, a widely used antimicrobial compound found in many household items, has an effect on the fertilization, embryological development, and sperm motility of the purple sea urchin (Strongylocentrotus purpuratus).

Methods/Materials
Gametes were first diluted to an optimal concentration for fertilization and then exposed to a range of Triclosan concentrations which have been detected in human urine and breast milk. Sperm motility was observed under a microscope, and fertilization was assessed by measuring the percent of successful fertilizations within each concentration as compared to the control (no Triclosan). Embryonic development was assessed visually under a microscope from cleavage to larvae.

Results
Above 1ppm Triclosan causes sperm immotility and blocks all fertilization. Above 100ppb, Triclosan inhibits the ability of fertilized eggs to develop into viable embryos.

Conclusions/Discussion
A model for the method of action of Triclosan#s ability to cause immotility in sperm is proposed: As sperm possess calcium channels and it is known that triclosan depolarizes L-type calcium channels in mice, this study proposes that Triclosan is disrupting the calcium channels on the sperm, which is in turn causing the flagella to stop. Furthermore, it is hypothesized that Triclosan can act as a molecular probe used to investigate the function and properties of calcium channels.

Summary Statement
This project investigates Triclosan and its effect on the fertilization, sperm motility and embryonic development of the purple sea urchin.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Natasha Kohli; Kosha Patel

Project Number

S1798

Project Title

How Will the Regeneration Process of Planarians Be Affected by Exposure to Microwave and Ultraviolet Radiation?

Abstract

Objectives/Goals

This experiment was conducted to discover the effects of different types of radiation on the regeneration process of planarian. The expectation was that the regeneration process would be slowed down because of previous experimentation. Based on the result of the tests conducted on mealworms, radiation released from microwave ovens has been proven to stunt the growth of the worms. So, it is a likely possibility that exposure to radiation released from a microwave oven and a UVC light will also slow down the regeneration process of planarian.

Methods/Materials

To conduct this experiment, ten planarians were exposed to microwave radiation, ten planarians were exposed to UVC radiation, and ten planarians were exposed to no radiation. The planarians were cut in half so that the head and tail ends were both five millimeters long. We observed different aspects of the regeneration process for ten days such as the length of the planarians, speed of regeneration, and any mutations.

Results

After testing the effects of radiation on planarian, we concluded that the microwave radiation caused for the regeneration of the planarians to slow down, however they grew longer than the control. The UVC light radiation caused the planarians to grow their heads and tails back at a faster rate, but grew to be shorter than the control. The overall effects of both types of radiation caused for the planarians to grow darker and fatter than expected.

Conclusions/Discussion

The exposure to radiation led to negative consequences for the planarian, which could eventually lead to negative consequences for humans. Planarians regenerate their bodies, while humans regenerate their liver and skin cells. Consequently, exposure to radiation can cause for the regeneration of the liver and skin cells to not be as speedy and efficient which has proven to be unhealthy for humans.

Summary Statement

It has been proven that exposure to microwave and UVC radiation drastically changes the regeneration process of planarians, which can be compared to the skin and liver cells of humans.

Help Received

None

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Eugene Laksana

Project Number

S1799

Project Title

Contrast. Eff. of Comp. Plant Ext.& Commercial Neonicotinoid in Regulating W.F Inhab. of Verbena& Tomato Plants Yr. 2

Abstract

Objectives/Goals

Colony Collapse Disorder has grown in prominence since 1919, now accrediting for losses as much as 40-50% of honey bees in some European countries during the winter of 2012. The primary culprit of the disease is the abuse of neonicotinoid, known to be acetylcholine receptor agonists. The objective is to develop a new system of pest control that substitutes the usage of neonicotinoid through the integration of the repelling properties of concentrated volatile plant extracts and an improved variation of trap cropping.

Methods/Materials

Five verbena and tomato plants were each stripped down to two leaves and contained in separate testing chambers, where they were treated with either 25% or 75% concentrated C. officinalis or garlic/pepper topical solutions. Water served as a neg. control. 25 separately bred whiteflies were then sealed into each chamber and placed under constant overhead lighting and surveillance for 10 hours. Still-shot images were taken at 30 minute intervals via web cameras, and data was collected by counting the number of whiteflies occupying both leaves at each interval. This experiment was replicated five times on consecutive days.

Results

Though the C. officinalis solution at 75% concentration appeared to produce optimal results, a 3% difference in efficacy with the C. officinalis solution at 25% concentration should not warrant a tripling in the cost of production. The garlic and pepper solutions at both concentrations produced significantly inferior results to the C. officinalis solutions at either concentration, but they still developed trends that suggested a common factor was responsible in repelling the whiteflies from both tomato and verbena plants.

Conclusions/Discussion

An unexpected 89.2% efficacy from 75% concentrated C. officinalis extract occurred. Because repellency, is more likely than mortality to affect subsequent generations of whiteflies, the solution, if properly employed, can potentially develop generations of whiteflies bred to avoid target crops while negating the side effects induced by neonicotinoid. However, further studies regarding the life spans of these volatile solutions and a possible presence of an olfactory system in whiteflies must be conducted. Ultimately, careful and possible integration of repellents into trap cropping techniques will ideally redevelop pests to target decoy plants, rather than primary vegetation.

Summary Statement

This project aims to form a fourth generation of pest control by integrating solutions based off of concentrated volatile plant extracts and redeveloped trap cropping to substitute the use of commercial neonicotinoid.

Help Received

Dr. Deborah M. Mathews from UCR helped supply reagents and provided mentorship throughout the duration of the project.