CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Shangida Ahsan

Project Number
S1801

Project Title
Discovery of Novel HIV-1 Integrase Inhibitors

Abstract

Objectives/Goals
Human immunodeficiency virus (HIV) is the fourth leading cause of death worldwide and the first leading cause in Sub-Saharan Africa as noted in a report by UNAID. Infection with HIV eventually leads to Acquired Immune Deficient Syndrome (AIDS), where the body's immune system fails to defend against opportunistic infections. HIV-1 Integrase is one of three important viral enzymes essential for viral replication. Integrase has two catalytic functions: 3' processing using a metal co-factor and integration of viral DNA into cell chromosomes. We aim to identify compounds that inhibit integrase catalytic function. More specifically, the purpose of the project is to find lead molecules for further inhibitory action against wild type integrase in the presence of manganese in vitro.

Methods/Materials
Our methods include an enzymatic assay and PAGE gel electrophoresis.

Results
A random pre-screening of 167 diverse classes of compounds yielded several moderately active compounds and two highly active compounds at 20µg/ml. The data revealed compound p13 D10 and p13 E2 had over 70% inhibition at 20µg/ml.

Conclusions/Discussion
In conclusion, two small molecules show enough activity to investigate their inhibitory profile and binding action. The future goals would be to explore identified lead molecules functional groups effect on inhibitory action.

Summary Statement
To find lead molecules that will have distinct chemical functional groups necessary for inhibitory action against wild type integrase in the presence of manganese in vitro

Help Received
Used lab equipment at USC Health Science campus under the supervision of Dr. Nouri Neamati

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Sunil C. Bodapati

Project Number
S1802

Project Title
Novel Nanotubes: New Agent for Photothermal Therapy for Cancer

Abstract

Objectives/Goals
The use of functionalized nanoparticles as a method for treating cancer has become increasingly popular. Nanoparticles circumvent problems traditional cancer therapies succumb to, such as nonspecific destruction of cells or drug resistance. As more and more agents are found to have the potential for photothermal ablation of cancer, it is clear that several key tradeoffs remain. For a molecular agent to effectively absorb energy to heat up and kill the cancer, it must have a large cross-sectional area. On the other side of the coin, a larger area means that the agent suffers from a decreased circulation time in the system. Single walled carbon nanotubes were thought to have solved this problem, being extremely long (200nm), but extraordinarily thin (2nm). Unfortunately, immense laser power is needed to kill the cells, making them unfeasible in a clinical setting. This project aims to validate the use of a novel molecule (carbon nanotubes conjugated to ICG) as a potential agent for photothermal therapy for cancer.

Methods/Materials
Thorough in-vitro experiments were conducted to fully investigate this molecule and its potential for photothermal therapy. In-vivo experiments were performed to further vet the potential applications for this agent.

Results
Results indicate that extensive cell death (~90%) occurs after a mere 15 minutes of irradiation at a low power density.

Conclusions/Discussion
The agent has the potential to be a viable photothermal agent.

Summary Statement
This project aims to test a novel photothermal agent for its potential use as a therapeutic drug.

Help Received
Used Lab Equipment at Stanford University under the supervision of Adam de la Zerda (graduate student).

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Raven S. Burrell

Project Number
S1803

Project Title
In Search of New HIV-1 Integrase Lead Molecules

Abstract

Objectives/Goals
I hypothesize that the prescreened small molecules will have distinct functional groups that will show inhibitory activity.

Methods/Materials
Conducting Enzymatic Assays
Step 1:Make IN cocktail which contains Mn2+ cofactors.
Step 2: Make DNA cocktail, which contains pH buffers.
Step 3: Put IN cocktail into all labeled tubes (except DNA control).
Step 4: Add DMSO and compound dilution into specific tubes according to experimental template.
Step 5: Incubate at 30°C for 30min.
Step 6: Add DNA cocktail to all tubes and incubate for 1hr.
Step 7: Quench experiment using denaturing dye.

Gel Electrophoresis (PAGE)
Step 1: Make polyacrylamide gels.
Step 2: Pour TBE buffer into apparatus compartments and pre-run.
Step 3: Load an aliquot of each reaction tube into the wells of the gel.
Step 4: Set up positive and negative electrodes on the apparatus.
Step 5: After sufficient time (~3hrs),place the gel into a gel dryer for an hour.
Step 6: Place gel in a cassette with a P32 storage screen, expose overnight, and scan.

Results
The data that I collected demonstrated that: VL 104 IC50 value for cleavage and strand transfer was less than 33µM, VL 109 IC50 value for cleavage was 58µM and 26µM for strand transfer, VL 142 IC50 value for cleavage was 44µM and 17µM for strand transfer, VL 94 showed 50% inhibition, and RUS II Box 11 E10 showed 50% inhibition. Since, majority of my experiments had no inhibitory activity, I will conduct more experiments to discover various lead molecules. Also, some of the strands are smudged, which causes the small molecule to appear as inactive, but may be active.

Conclusions/Discussion
I conclude that I will have to continue to conduct more experiments since majority of my data and results showed no inhibitory activity. Once I receive accurate data, then I will conduct dose responses to test small molecules at different concentrations to further research if integrase was inhibited.

Summary Statement
To search for lead molecules that will result in inhibition of HIV-1 integrase.

Help Received
Used lab equipment at University of Southern California School of Pharmacology under the supervision of Dr. Neamati and mentor Tino Sanchez; Mother helped paste items on board.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Antranik M. Byas

Project Number
S1804

Project Title
Investigating the Effectiveness of Urina in Preventing Wrinkles and Acne

Abstract

Objectives/Goals
The purpose of the study is to test whether urine (Latin name:Urina) could be used as a cheap alternative to preventing wrinkles and acne especially in middle-aged women.

Methods/Materials
Everything pertaining to urine was researched # how it is produced and excreted in the human body; its composition; and how it is artificially made. The experimentation process was supervised by a dermatologist included finding women who were willing to use their own urine as a facial solution for a month while their progress was constantly monitored by taking before and after pictures. They submitted a sample of their urine for analysis. Data collected included pH, temperature, specific gravity, presence of protein and glucose, appearance/clarity, color, odor, and analysis using a microscope to check for bacteria.

Results
Out of the total ten volunteers, seven showed significant improvement of their facial skin. There was tightening of the skin and smoothness. Three were already users prior to the study so their eagerness to participate. Three did not show a major difference on their facial skin. This might be due to their skin type since they all had oily skin.

Conclusions/Discussion
Based on the research conducted, urine is an aqueous solution consisting of 95% water; and 5% urea, dissolved salts, and organic compounds. Urea, also known as carbamide is used in a lot of dermatological products such as Umecta PD which is used as a tissue softener for nails and skin. Urotherapy has been practiced throughout history and has been in existence over decades in various countries. People around the world have drunk their urine to cure all sorts of symptoms like the common flu, toothaches, burns and epidermal conditions such as psoriasis. I am not sure that it will cure all of that; however it is a strong possibility.

Summary Statement
This project involves using urine therapy as a cheap alternative to reduce wrinkles and acne in middle-aged women.

Help Received
Dr. Sampson, the dermatologist who supervised the project; Ms. Adriatico, my teacher/advisor who guided me in the process of conducting my research.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
David D. Calica

Project Number
S1805

Project Title
The Effects of Varying Concentrations of Used and New Motor Oil on the Germination and Growth of Lima Beans

Abstract

Objectives/Goals
Find the effects of varying concentration of new and used motor oil on the growth and germination of lima bean plants.

Methods/Materials
7 - Packets of Lima Bean Seeds
2 - 12 Quart Organic Soil Bags
1 - Bottle New Mobil 1 Engine Oil
1 - Bottle Mobil 1 Engine Oil (after 5 months of use)

A. Mix 8 containers of soil, water, and motor oil.
a. 2 control groups, 3 groups of new motor oil, 3 groups of used motor oil
b. In each group of 3 - 25% pollution, 50% pollution, 75% pollution
c. Plant 18 seeds in each group. Give each seed equal amounts of water per day.
B. Take average of total heights and every day for 3 weeks. Note total number of visible sprouts each day.

Results
Both the used and new motor oil had a significant effect on the plants. Both were lethal at 50% and 75% concentrations. The used motor oil hindered growth slightly more than the new.

Conclusions/Discussion
At a certain concentration, motor oil is lethally toxic to lima bean plants, regardless of additional effects of the chemicals in used motor oil.

Summary Statement
Compare the different qualities of new and used motor oil and determine whether or not varying concentrations of both oils are damaging to lima beans.

Help Received
Parents helped to obtain materials. Teacher helped to edit and reorganize notebook.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Autri Chattopadhyay

Project Number
S1806

Project Title
The Role of the Hippocampus in the Onset of Nicotine Addiction in Adolescents

Abstract

Objectives/Goals
I wanted to determine the differences in neuronal activation in the hippocampus in adults and adolescents when exposed to nicotine and what role the hippocampus plays in the onset of nicotine addiction in adolescents.

Methods/Materials
Computer, MCID Autoradiography Software, Special Lens for Radioactive Detection, Pre-prepared Brain tissue slides, Rat Brain Atlas

I used a Sprague Dawley Rat model for my experiment. Adolescent and Adult rats were treated with nicotine and saline (control) in acute and chronic levels. A total of about 40 rats were used. Then, in-situ hybridization using a radioactive probe was administered to prepare the slides for analysis. Subsequently, Autoradiography Analysis was done with MCID Software. I took readings of neuronal activation (c-fos expression) in dpm/mg in the CA1, CA3 and DG regions of the dorsal hippocampus.

Results
C-fos expression is a marker of neuronal activation in the brain. Dpm/mg is a measure of optical density meaning the disintegrations per minute per milligram of tissue. The higher the dpm/mg reading, the more activation in the brain tissue there is. In the P31 Chronic Nicotine Rats, the optical density was measured to be an average of 1925 dpm/mg in the CA1, 2015 dpm/mg in the CA3, and 2178 dpm/mg in the DG. Comparatively, the readings in the adults exposed to chronic nicotine were measured to be 1720 dpm/mg in the CA1, 1695 dpm/mg in the CA3, and 1640 dpm/mg in the DG. The higher amount of c-fos expression in the adolescents shows a greater neural response from an adolescent brain to nicotine than the adult brain. Similar results were observed when studying rats treated with acute levels of nicotine.

Conclusions/Discussion
Higher levels of c-fos expression were seen in adolescents after both acute and chronic treatments of nicotine. The higher levels of neuronal activity in response to nicotine in the hippocampus of adolescents indicate the possibility that hippocampus dependent learning in adolescents does in fact have a significant impact on nicotine addiction. The higher amount of activation also shows that there might be a stronger association being established between smoking and contextual stimuli in adolescents than in adults.

Summary Statement
I looked at the differences in levels of neuronal activation in the hippocampus in response to nicotine and analyzed the role of the hippocampus during the onset of nicotine addiction in adolescents.

Help Received
Used facilities at the Tobacco Transdisciplinary Use Research Center at UC Irvine under Dr. Frances Leslie. UCI Grad Student Jasmin Dao mentored me about autoradiography and lab research.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Natalie A. Chen

Project Number
S1807

Project Title
Leukemia Chemotherapy

Abstract

Objectives/Goals
My objective was to determine which drug combination [Clofarabine and Busulfan vs. Clofarabine and Melphalan] is more synergistic in DNA damage on Acute Lymphoblastic Leukemia [ALL] cells. I hypothesize that Clofarabine in combinations with Busulfan will have better synergistic results.

Methods/Materials
Methods: Western Blotting, MTS assay, Calcusyn program and cell culturing.
Materials: Reh [human leukemia cell line], general pre-clinical laboratory equipment.

Results
The Calcusyn program showed Clofarabine in combination with Busulfan to have better synergistic results. The Western Blotting tracing the yH2AX protein expression also showed Clofarabine in combination with Busulfan to have better synergistic results.

Conclusions/Discussion
The hypothesis was correct, Clofarabine in combination with Busulfan does have better synergistic effect than Clofarabine in combination with Melphalan.

Summary Statement
Pre-Clinical study comparing Clofarabine in combination with Busulfan versus Melphalan on Reh.

Help Received
City of Hope Eugene and Ruth Roberts Summer Academy Program. Mentors: Dr. Shika and Dr. Gaur.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Evaline Cheng

Project Number
S1808

Project Title
Nasal Responses of Exposure to Ultrafine Iron Soot Particles in Mice

Abstract

Objectives/Goals
Respiratory and cardiovascular diseases are associated with ultrafine particles in air pollution from fuel combustion. Since iron is a transition metal that is predominant in air pollution, my research study examined mucin production, epithelium growth, and iron particle deposition in iron soot exposed mice. My research objective is to better understand the negative health effects caused by ultrafine particles.

Methods/Materials
Mice were exposed to ultrafine iron soot particles produced from a laminar diffusion flame system for 8 days, 6 hours each day, and mice nasal tissue was sectioned to 5 μm slices by Center for Health and the Environment staff. I stained these fixed mice nasal tissue and carbon nanotube exposed rat tissue with Alcian Blue Periodic Acid Schiff's for mucin and Perl's Prussian Blue for ferric iron. I then used light microscopy to capture images of nasal tissue based on grids identified within the nasal cavity. ImageJ software was used to measure mucin volume, epithelium volume, basal lamina area, and iron soot particle volume by thresholding the stained areas.

Results
My research found that in exposed mice, there was a statistically significant increase in mucin within grid 5 or the septal region of the nasal cavity (p-value=0.0348). In addition to a significant increase in total epithelium volume for the exposed mice (p-value=0.0393), there was also a significant increase in epithelium volume for grid 5 specifically (p-value=0.0336). No quantifiable amount of iron soot particles were found within the iron soot mice epithelium, but positive iron labeling was present in the olfactory nerve fascicles of the carbon nanotube exposed rats.

Conclusions/Discussion
My results indicate negative biological responses from short-term iron soot particle exposure. The significant increase in mucin and epithelium volume in grid 5 of the exposed group suggests a localized immune response due to a high impact region of the septum as well as inflammation within the nasal cavity. My findings also suggest selective uptake of iron by the nerve fascicles in the olfactory nerve layer, which could render our brain vulnerable to damage. From these findings, it can be better understood how the iron soot particles in particulate matter evoke negative health effects. Being one of the few studies on mice noses, my findings could potentially provide information useful to reducing the impact of pollution on our health.

Summary Statement
Short-term exposure to ultrafine iron soot particles causes negative health responses such as mucosal defense, inflammation, and the possible transport of particles to the brain.

Help Received
Research was conducted at the Center for Health and the Environment at UC Davis under the guidance of Dr. Kent Pinkerton and Laurie Hopkins. Carbon nanotube exposed rat nasal tissue was donated by Dr. Gunter Oberdörster at University of Rochester. Ms. Alonzo helped with science fair supervision.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Alyssa N. Cook

Project Number
S1809

Project Title
Implications in Osteoporosis: Caffeine Impairs, Dexamethasone Increases Osteogenesis in MC3T3 Osteoblast Cells

Abstract

Objectives/Goals
To study the effect of caffeine and dexamethasone on osteoblast cell line MC3T3-E1, and determine the toxicity level of caffeine in these cells in vitro, so as to better understand the pathogenesis of osteoporosis.
Hypotheses: 1)Caffeine will interfere with MC3T3-E1 osteogenesis in a dose-responsive manner as evidenced by decreased amounts of mineralized nodules on Von Kossa staining. 2)Osteoblasts grown in culture media supplemented with dexamethasone will show greater mineralization as compared to cultures grown without dexamethasone, but this will also be negatively influenced by caffeine.
3)Caffeine will affect osteoblast growth in a dose-responsive manner as seen by the toxicity study.

Methods/Materials
Cell line MC3T3-E1 was maintained in DMEM with 10%FBS and gentamicin at 37 deg C., humidified and 5%CO2. For Investigations #1 and #2, culture solutions with or without the inducers glycerol phosphate and ascorbic acid were compared to cultures treated with various concentrations of caffeine, and a subset of cells enhanced with dexamethasone. At 19 days, these cells were stained by Von Kossa technique to determine formation of nodules. For investigation # 3, caffeine (0 mM control; 0.1mM; 0.3mM; 1mM; 3mM; and 10mM) was added to nonconfluent cells. Cells were fixed at days 3, 4, and 5. Cell counts were done to determine caffeine toxicity and effect on growth.

Results
Investigations #1 and #2 show osteoblasts grown with caffeine form fewer nodules, regardless of induction (10mM Caffeinated=238, vs. Non-caffeinated Control=937). Cells grown with dexamethasone show much greater matrix nodule formation, but this, too, is diminished by caffeine(10mM Caffeinated=726, vs. Non-caffeinated Control=10,436). A novel finding was that dexamethasone was seen to act as an independent inducer of osteogenesis. Investigation #3 shows that caffeine is toxic to osteoblasts and negatively affects growth,primarily occurring at levels of 1.0 mM and above.

Conclusions/Discussion
The results support my original hypotheses. Caffeine interferes with osteogenesis in a dose-responsive manner shown by decreased amounts of mineralized nodules. Cells grown in culture media supplemented with dexamethasone show greater mineralization as compared to cultures grown without dexamethasone, but were also negatively influenced by caffeine. Caffeine did affect osteoblast growth in a dose-responsive manner as seen by the toxicity study.

Summary Statement
This study investigates the effect of caffeine and dexamethasone on osteoblast cell line MC3T3-E1, and determines the toxicity level of caffeine in these cells in vitro, so as to better understand the pathogenesis of osteoporosis.

Help Received
Used lab equipment at UC Irvine under supervision of Dr. Gardiner; however, the design and work was all my own and not part of any university research program. My parents drove me and helped in typing and proof reading.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Logan L. Davis-Wallace

Project Number
S1810

Project Title
Is Fructose Absorption in Humans Improved by the Addition of Glucose?

Abstract

Objectives/Goals
In past experiments, I found that 70 % of human subjects malabsorbed 50.0 g of fructose dissolved in 8 oz of water and that none of the same subjects malabsorbed 29 oz of 7up soda, which contains 50.0 g of fructose and 40.6 g of glucose. I want to prove that it is the glucose in the soda and not the other components in soda (sodium, citric acid, sodium bicarbonate and potassium citrate), that improves the absorption of the fructose in humans.

Methods/Materials
Healthy subjects (without gastrointestinal problems or diabetes) 10 years or older were used for this experiment. A solution containing 50 grams of fructose, 40.6 g glucose and dissolve in 240 ml (8 oz) of water (20% fructose solution) was made. Breath samples were collected from subjects before test begins then were given the test solution and sampled at 30, 60, 120, and 180 minutes. Breath samples were analyzed for hydrogen concentration using a gas chromatograph. A person is considered to malabsorb fructose if the rise in hydrogen exceeds 20 ppm 60 minutes or more after ingesting the given solution, compared to the lowest level of hydrogen in the first 59 minutes.

The materials used included breath collection apparatus, glucose, fructose, and a gas chromatograph

Results
Previous experiments showed that 70% of human subjects malabsorbed 50.0 g of fructose in 8 oz of water. In this study, 0% of the same subjects showed fructose malabsorption when given 8 oz of a solution containing 50 g fructose and 40.6 g glucose. This is consistent with last years experiment where 0 % of subjects showed fructose malabsorption when given 29 oz of 7 UP soda, which contains 50.0 g of fructose and 40.6 g of glucose.

Conclusions/Discussion
This experiment confirms the hypothesis that it is the glucose and not other components in the soda (sodium, citric acid, potassium citrate, sodium bicarbonate) that improves the absorption of fructose in humans. The addition of glucose could be used to improve the absorption of fructose in humans in high fructose containing foods and reduce symptoms of malabsorption (abdominal pain, gas, diarrhea, and bloating) from these foods.

Summary Statement
Fructose absorption in humans is improved by adding glucose.

Help Received
Used equipment at California Digestive Disease Center under the supervision of Dr. Judy Davis.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Sally Z. Gu

Project Number
S1811

Project Title
Rescuing a Failed Acute Myeloid Leukemia Drug (Troxatyl) using Biomarkers

Abstract

Objectives/Goals
This project presents a method of using deoxycytidine kinase (DCK) biomarkers to improve the efficacy of a failed cancer drug, Troxatyl (TRO), in acute myeloid leukemia (AML) treatments through patient selection with genetic biomarkers.

Methods/Materials
Clinical data of TRO in AML patients were obtained from RSQ Pharmaceuticals under proprietary agreements. This study extracted all known 133 SNPs on the DCK gene region from three publicly accessible databases (NCBI, ENSEMBL, and GENECARDS). Correlations between patient clinical responses and genetic biomarkers were obtained by using SPSS software and modules developed by RSQ. Based on these correlations, two haplotypes were generated from two identified SNPs. Finally, a link between two haplotypes with gene expression was established, and the results were verified by clinical data (not included in this study).

Results
TRO treatment has a genetic predisposition factor related to different patients' responsiveness to the drug. A single SNP on DCK is not sufficient to predict the drug responsiveness in AML patients; however, two SNPs, namely TROAML1 (C/G) and TROAML2 (C/T), on DCK's 5'-UTR region form two unique haplotypes that are directly correlated to TRO efficacy.

Conclusions/Discussion
50% of the heterozygous allele (C/G-C/T) patients (31.1% of total patients) and 100% of the minor homozygous allele (G/G-T/T) patients (2.5%) responded to TRO treatment. Thus, patients who have at least one allele of G-T will most likely respond to TRO treatment, because these patients produce higher amounts of dCK protein. This predicted G-T haplotype will cover 1/3 of all AML patients, and will increase the efficacy rate from 18% (the original efficacy rate) to 60%. A new clinical trial that selects patients using the aforementioned SNP biomarkers is needed for TRO to obtain FDA approval.

Summary Statement
This project applied a method of using biomarkers to improve the efficacy of Troxatyl, a failed leukemia drug, in order to gain FDA approval.

Help Received
Used software provided by RSQ Pharmaceuticals

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Heidi S. Hirvonen

Project Number
S1812

Project Title
Effects of Estrogen Pollution in the Environment

Abstract

Objectives/Goals
The objective of this project is to test possible negative effects of estrogen pollution in water on wildlife and to prove that this particular drug pollution, which is a result of excess estrogen from birth control pills flushed through human waste, may be a concern in ecosystems.

Methods/Materials
Five ten-gallon fish tanks, each filled with de-chlorinated room temperature water, were set up and fifteen feeder goldfish were placed in each tank, where they were allowed to acclimate. Over a period of approximately two months, four of the tanks were routinely given a specific dosage of either an estrogen-progestin (or combination form) birth control pill or a pure estrogen pill. The fifth tank remained as the control group and so received no dosage of any kind throughout the experiment. The fish were periodically weighed by water displacement to test for mass increase or decrease. Changes in behavioral patterns were monitored.

Results
While not all goldfish were expected to survive throughout the experiment (an inference based upon prior knowledge that not all fish would survive the acclimation process), death rates of goldfish were charted as higher in the four dosed tanks than in the fifth control tank. Mass increase occurred in all four dosed tanks while the control tank experienced no fluctuation in mass. The tank with the greatest change of mass recorded was a tank receiving a dosage of one estrogen-progestin pill every other day. Behavioral changes included a decrease in reaction time to food and observed slower movements.

Conclusions/Discussion
Increases in mass as well as decreases in organism populations may disrupt functions of water organisms as well as hinder survival abilities. While estrogen pollution is the main concern (as estrogen is the active drug in birth control pills) progestin may be a concern to water organisms as well, seeing as data suggests that fish dosed with estrogen-progestin pills experience a greater increase in mass than those dosed with estrogen pills. This suggests that combination pills may be more harmful to wildlife than pure estrogen pills. Seeing as combination pills are the most common form of birth control pill, it may be considered wise for medical drug professionals to rethink the drugs used in pills for the sake of preserving the environmnent.

Summary Statement
This experiment tests the possible long and short-term effects of estrogen on goldfish, based off of a concern of possible negative effects of excess estrogen flushed into the environment through human waste.

Help Received
Professor Nick Anast provided fish tanks and mentorship.

Name(s)
Connie Ho; Steven Hu; Spencer Moh

Project Number
S1813

Project Title
The Effect of Environmental Contaminants on Freshwater Species of Daphnia

Abstract

Objectives/Goals
Daphnia magna are small crustaceans often found in freshwater environments. Their sensitivity to changes in the water and their transparent exoskeleton (which allows viewing of the beating heart) make daphnia an ideal indicator species. Many households dump medication and detergents down drains or into toilets as a method of disposal - a practice which allows many of these substances to enter aquatic habitats. This experiment aims to test the effect of such substances on aquatic organisms by using daphnia as an indicator species. We hypothesized that if daphnia magna are brought into contact with water containing Advil (ibuprofen), Sudafed (pseudoephedrine hydrochloride), Tide (dodecyl benzene) and Cascade (phosphoric acid), then their heart rates will increase.

Methods/Materials
We first measured the resting heart rate of each individual daphnia using a light microscope, then placed the daphnia into varying concentrations of each substance and measured the resulting heart rate. To control variation, each daphnia was compared against its resting heart rate and used as its own control; the percent change in heart rate was calculated and graphed. The amount of each substance dissolved for each concentration was also controlled along with the accuracy of the heart rate counted (by using multiple trials and different counters).

Results
The results of our experiment do not support our hypothesis. In general, our data showed that the heart rate actually decreased when substances were added. The optimum percent change in heart rate occurred at the concentration of 50 mg / 250 mL H2O for Tide and remained consistent between both batches. Both batches placed in Cascade showed an overall decrease in heart rate with optimum percent change at the lower amount of 50 mg / 250 mL H2O; the overall shape of the graphs of percent change in heart rate is also consistent between both batches. Data obtained by both Advil and Sudafed produced contradictory results.

Conclusions/Discussion
Despite inconsistencies in our results, addition of these substances into the daphnia's environment does hold an effect and causes changes in their heart rate. While the impact of these substances remains uncertain, it is still important to recognize the harmful effect they have on aquatic organisms. Consumers should avoid pouring them down drains and properly dispose of substances by sealing them in plastic bags and placing them in the trash.

Summary Statement
By bringing Daphnia magna into contact with substances that humans can easily pollute freshwater environments with, this experiment aims to observe how common products can affect an aquatic environment and its organisms.

Help Received
No outside help received.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Seth McFarland

Project Number
S1814

Project Title
Effectiveness of Varying Homeopathic Dilutions

Abstract

Objectives/Goals
To find if homeopathic solutions are too dilute to potentially be effective remedies.

Methods/Materials
Q-tips were used to streak petri dishes with Staphylococcus aureus and Escherichia coli. Paper disks were placed in the autoclave, then soaked in varying dilutions of penicillin and ampicillin and placed on the petri dishes. Graduated cylinders were used to measure the dilutions of antibiotics to be tested.

Results
The penicillin effectively inhibited the staphylococcus aureus culture at the six most concentrated dilutions (stock, 1/2, 1/4, 1/8 and 1/16 dilutions of the stock solution and the 1C dilution). The higher concentrations of the antibiotics inhibited the bacteria more than the more dilute concentrations, while the 1/32 dilution of the stock solution and the 3C and 6C dilutions were too dilute to have any affect on the bacterial cultures. This pattern was also true with the ampicillin on Escherichia coli. The main difference between the two antibiotics and the two bacteria, was that the ampicillin inhibited the growth of Staphylococcus aureus almost four times more than the penicillin inhibited the growth of Escherichia coli. The ampicillin was so effective on E. coli the 6C dilution (the most dilute concentration tested) inhibited bacterial growth in one replicate of the experiment.

Conclusions/Discussion
Some more concentrated homeopathic remedies have the potential to be effective. The 1C dilution inhibited bacterial growth in both bacteria types, proving itOs potential effectiveness. The 3C dilution was effective only in one of the tests, this showed it could be effective depending on the pathogen. It was found that the effectiveness greatly varies depending on the antibiotic or remedy used and disease that is being treated.

Summary Statement
To explore the feasibility of homeopathic remedies.

Help Received
Used lab equipment at Arcata High under Mrs. Condit's supervision.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Nahim Mizan

Project Number
S1815

Project Title
Sites of Ethanol Action in P2X4 Receptors

Abstract

Objectives/Goals
The site(s) of ethanol action in P2XRs are unknown. Through site-directed mutagenesis we have been able to identify an important amino acid within the transmembrane (TM1) domain that alters ethanol sensitivity of P2X4Rs. The residue at position 46 within the TM1 domain of P2X4Rs was mutated to amino acids with different physical-chemical properties. The wildtype (WT) and mutant receptors were then expressed in Xenopus laevis oocytes and tested for changes in ethanol sensitivity (200 mM) using two-electrode voltage clamp electrophysiology. Mutating tryptophan at position 46 to alanine (W46A) in P2X4Rs reversed the action of ethanol (inhibition to potentiation). Exchanging W46 residue with other aromatic residues did not significantly alter ethanol sensitivity whereas replacing W46 with aliphatic residues significantly reduced the action of ethanol. Taken together, these findings suggest that physical-chemical properties of the residue at position 46 in the TM1 domain may play an important role in ethanol action of P2X4Rs.

Methods/Materials
To conduct the ethanol sensitivity experiments, currents were generated by applying the P2X4R agonist (ATP at EC10 concentration) for 20 seconds. Upon observing a stable response with the EC10 and allowing a 5 minute washout time, a concentration of ethanol was co-applied with ATP for 20 seconds.

Results
Since the substitution at position 46 (W46A) completely eliminated the effects of ethanol, we extended our study by investigating the role of physical-chemical properties of the residue at this position on ethanol sensitivities.
The results suggest that physical-chemical properties of the residue at position 46 in the TM1 domain may play an important role in ethanol sensitivity of P2X4Rs.

Conclusions/Discussion
The ability to eliminate the effect of ethanol by mutating W46 to alanine indicates that position 46 plays an important role as a target for ethanol action in P2X4Rs.
Identification of specific residues (e.g., W46A) in which the mutation abolishes the action of ethanol without significantly altering receptor function can be used in future studies to investigate the role of P2X4Rs in ethanol-induced behaviors. A better understanding of the sites of ethanol action may help us to unravel the complexity of ethanol sensitivity of native P2XRs in the CNS.

Summary Statement
I am attempting to identify the positions in the TM1 domain of the P2X4 receptor where the effects of ethanol are present.

Help Received
Mentor, Letisha Wyatt, guided me and taught me the proper techniques required for the Two-Electrode Voltage Clamp. Lab equipment and supervision was provided by the University of Southern California's School of Pharmacy. Student of the Bravo STAR II program.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Jorie A. Moore

Project Number
S1816

Project Title
Testing the Toxicity Level of Different Residues Produced by Various Aquatic Environments

Abstract

Objectives/Goals
The objective of my project is to determine the toxicity level of different residues produced by various aquatic environments. My hypotheses were the residue from the heat pesticide environment would be the most harmful to the African Dwarf frog eggs hatch rate, the residue from the aeration fertilizer would be the least harmful to the frog eggs hatch rate, and each different environment will decrease the toxicity level of the toxins. The goal of the project was to determine if these residues produced would hinder the hatch rate of the frogs. The objective is to determine which of the four marine environments would be the most effective in diluting the toxins.

Methods/Materials
I used oil, Malathion, Ammonia Sulfate, and materials to create twelve different residues with the four marine environments heat, wave, cold, and aeration, 640 African Dwarf frog eggs. I put the toxins through the four environments for two days then I took the residue from the environments and placed 1 ml in to the twenty ml. container with the eggs. I had one control which had the eggs in their natural environment and three direct controls where I put the toxins directly into the frog eggs# environment for five days along with the other tests.

Results
I used oil, Malathion, Ammonia Sulfate, and materials to create twelve different residues with the four marine environments heat, wave, cold, and aeration, 640 African Dwarf frog eggs. I put the toxins through the four environments for two days then I took the residue from the environments and placed 1 ml in to the twenty ml. container with the eggs. I had one control which had the eggs in their natural environment and three direct controls where I put the toxins directly into the frog eggs# environment for five days along with the other tests.

Conclusions/Discussion
I concluded that the different environments had a positive effect on the toxicity of the pollutions when compared to the direct pollution but the residue still harmed the frog eggs# hatch rate when compared to the natural hatch rate of the eggs. The marine environments differed in results because of the unique aspects of each environment. The aeration environment or the heat environment would be the best methods to utilize in creating systems in bodies of waters to help pollution.

Summary Statement
To determine the effects of toxic residues produced by marine environments on African Dwarf frog eggs

Help Received
Frog eggs provided by Mr. Stewart Wiley. Mother helped revise project. Father supervised experiment involving toxic chemicals

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Adam D. Nitido

Project Number
S1817

Project Title
Mechanisms of Survival Against a Fatty Acid Synthase Inhibitor in Multidrug Resistant Ovarian Cancer

Abstract

Objectives/Goals
The main objective of this project is to define the biological mechanism(s) by which multidrug resistance (MDR) to a fatty acid synthase inhibitor occurs. Hopefully this investigation will improve the understanding of the MDR phenomenon to better refine the treatment regimen for women diagnosed with ovarian cancer.
Hypothesis
Multidrug resistant ovarian cancer cells treated with orlistat will undergo less cell death compared to drug sensitive ovarian cancer cells.
If GRP78 shows greater expression in drug sensitive ovarian cancer cells compared to multidrug resistant ovarian cancer cells during drug treatment then drug resistance to orlistat must be related to preventing endoplasmic reticulum stress.

Methods/Materials
A Trypan blue exclusion and a Sulforhodamine B assay (SRB) were performed to test cell viability. A SDS-PAGE gel electrophoresis separated out the proteins of interest and a western blot was used to probe for the protein GRP78. RT-PCR with GRP78 primers were used to measure GRP78 expression.

Results
After treatment with either orlistat or doxorubicin, the drug sensitive cell lines will die during the duration of the treatment with either drug, while the drug resistant cell lines continue to proliferate. Following 72 hours of treatment with orlistat, the multidrug resistant ovarian cancer cells, NCIADR, began to grow, showing a resistance to the orlistat, while the sensitive cells, OVCAR 8, continued to die.

Conclusions/Discussion
The first hypothesis, that multidrug resistant ovarian cancer cells treated with orlistat will undergo less cell death compared to drug sensitive ovarian cancer cells, was supported by several experiments including the Trypan blue exclusion and the SRB cell assays. The Coomassie stain showed changes in protein concentration and it is possible that these proteins may be related to drug resistance against the drug orlistat. The western blots and the RT-PCR show that there are similar levels of GRP78 expression in both the drug resistant and drug sensitive cell lines after treatment with orlistat. This does not support the hypothesis that drug resistance is related to the prevention of ER stress. It also appears that there is no increase in GRP78 expression after treatment with the drug orlistat compared to the untreated in both the drug resistant and drug sensitive cell lines.

Summary Statement
The main objective of this project is to define the biological mechanism(s) by which multidrug resistance to a fatty acid synthase inhibitor occurs.

Help Received
Jason Bush PhD, California State University Fresno

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Alexander P. Padilla

Project Number
S1818

Project Title
Effects of Supplemental Nutrients on Mus musculus

Abstract

Objectives/Goals
Determine the effects of vitamins on a mouse's ability to complete a maze.

Methods/Materials
250 Ball Point Pins, 1 304.8cmx609.6cm bag of pine shavings, 2 boxes of mouse pellets, 8 Mus Musculus(4male, 4 female), 4 foam boards 508.cmx76.2cm, Clear White Trash Bags(one per mouse per trial), 1 532.3mL water feeder, 1 stopwatch, 1 bottle Centrum Silver Multivitamins, 1 bottle Centrum Silver Energy Mutlivitamins, 1 bottle Centrum for Men Multivitamins

Results
The mice were affected positively and resembled the shape of a reverse sigmoid growth curce when graphed.

Conclusions/Discussion
Vitamins positively affect the ability of a mouse to complete a maze but it cannot be said exactly why because of the many parts of the body affected by vitamins.

Summary Statement
Investigation into possible positive side effects of supplemental vitamins on living organisms.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)

Darline Seu; Sheilalyn Solis

Project Number

S1819

Project Title

The Effects of Nerium oleander on Mutant and Wild-type Drosophila melanogaster

Abstract

Objectives/Goals

To test which part of Nerium Oleander (flowers, leaves, or bark) can most effectively be used to create an organic biodegradable insect pesticide safe for our environment. We predict the bark will be the most affective because it contains the highest concentration of toxic sap. If the toxins (neriine and oleandrin) are lethal enough to exterminate the flies then it has potential to be a pesticide.

Methods/Materials

We extracted toxins from the leaves, bark, and flowers of the plant using ethanol and spun it down in a centrifuge. After creating a 10% dilution using distilled water; extracts were used to hydrate the fruit fly medium and 10 fruit flies were placed into each tube. Mutant and wild fruit flies were both tested in this experiment to observe if genetics will affect the results. A positive control (distilled water with fruit fly growth food) and negative control (10% ethanol with fruit fly growth food) were used in each trial. Observations were recorded daily.

Results

Within two hours a reaction had occurred; flies were twitching on their backs while others had unnatural rapid movements in all tubes except the positive and negative controls. The following day, only two wild-type flies (red flower), one wild type (bark), nine wild-type (leaves), and seven mutant type flies (leaves) survived. In days, there was only one mutant fly (leaf) and one wild-type fly in each bark and red flowers alive. Within one week, all positive flies lived while five mutant and one wild flies were dead in the negative control. We believe the deaths were natural. During the second week the flies in both the positive and negative controls was reproducing. Out of the sixty flies used for this test with the pesticide, only one wild-type fly survived in the red flower extract.

Conclusions/Discussion

We've come to the conclusion that not only the bark, but all parts of Nerium Oleander can work as an effective and natural insect pesticide. With just one fruit fly surviving out of the hundred exposed to the Nerium Oleander pesticide, there is no doubt that the toxins from Nerium Oleander are effective enough to be used as an organic pesticide for agriculturists and gardeners in the future. Today, our society is becoming more "green" and eco-friendly, producing a biodegradable pesticide from Nerium Oleander will be highly marketable in the future due to its widespread availability and low production cost.

Summary Statement

We tested the toxicity of different parts of the Nerium Oleander on mutant and wild-type Drosphila Melanogaster resulting in an organic pesticide.

Help Received

Used lab equipment at Silver Creek High School under the supervision of Ms. Tran.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)

Barbara Shinaver

Project Number

S1820

Project Title

The Multigenerational Epigenetic Effects in Drosophila melanogaster Exposed to Green Tea

Abstract

Objectives/Goals

The purpose of my current project is to determine if multiple, successive generations of Drosophila Melanogaster bred on Green Tea possess an extended epigenetic effect of the supposed benefits of Green Tea, by studying the phenotypic aspects of the Drosophila.

Methods/Materials

From my three previous projects I have established that Green Tea is beneficial to Drosophila Melanogaster in protecting against environmental stresses and extending their lifespan. I have bred through the 2nd generation of Drosophila on the Green Tea medium and subjected these flies to a longevity study, which measures the flies entire lifespan on the tea as compared to the control medium (distilled water). The next set of flies tested for my project was the fourth generation of flies in my culture, and the first generation of flies to not be exposed to the Green Tea medium, as to measure the possible epigenetic effect from a phenotypic standpoint. These 1st generation non-exposed flies were subjected to environmental stress tests to determine their ability to withstand extreme heat and cold temperatures.

Results

Early results of stress testing do indicate that Green Tea exposure within the flies ancestry provides protection for the Drosophila when exposed to environmental stress. Drosophilae bred on Green Tea in multiple generations are not necessarily able to live longer than the control group when exposed to Green Tea throughout their entire lifespan. Further test results for environmental stress tests and longevity observations are pending.

Conclusions/Discussion

According to the current results from the statistical analyses ran on all data, Green Tea can affect a fruit flys ability to withstand environmental stress when exposed to the tea medium within their ancestry, but not during their physical lifetime. Green Tea cannot significantly increase the lifespan of multiple generations of fruit flies when exposed to the tea in both their ancestry and physical lifetimes, but past experiments did show an increased lifespan of flies raised on Green Tea when compared to flies raised on the control medium.

Summary Statement

Based on data from previous experiments, I bred multiple successive generations of Drosophila on Green Tea to determine if a possible extended, phenotypic, epigenetic effect exists when subjected to longevity and environmental stress tests.

Help Received

Nathan Whittington (teacher) provided equipment, Dr. Bert Tribbey helped run statistical analyses.

CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Chloe D. Su

Project Number
S1821

Project Title
Resveratrol and Aging

Abstract

Objectives/Goals
The objective of my project was to determine the effects (if any) of resveratrol, an antioxidant found in the skin of red grapes, on the longevity of fruit flies (Drosophila melanogaster), and to see if these effects could be applied to humans.

Methods/Materials
1. Fruit flies (Drosophila melanogaster) # at least 200
2. Vials (at least 20)
3. Drosophila food medium
4. Resveratrol supplemental tablets (65 mg per tablet)
5. Labels (2 different colors to distinguish groups)
6. Distilled water
7. Graduated cylinder
8. Teaspoon
9. 10 mL Syringe (for transferring solution to vials)

First I created different dilute solutions of resveratrol solution by dissolving resveratrol in water (30 mg/L, 15 mg/L, 7.5 mg/L and 3.75 mg/L). (My control was water only.) I mixed these solutions with the Drosophila food medium and put equal amounts of food (2 teaspoons of medium per 10 mL of resveratrol solution) in 5 different vials. I transferred 20 flies to each vial. Each day I recorded the number of living flies in each vial. Every three days I transferred the flies to new vials in order to ensure freshness and prevent the laying of eggs. There were two trial groups running at the same time, meaning that I surveyed 200 flies in total.

Results
The flies in the vials with higher concentrations (15 and 30 mg/L) of resveratrol lived longer than the flies with lower concentrations of resveratrol (3.75 and 7.5 mg/L) in comparison to the control group (water only). The lower concentrations (3.75 and 7.5 mg/L) did not seem to have any significant effect on the longevity of the fruit flies. There was an approximate maximum lifespan extension of 20% in the flies fed with the higher concentrations of resveratrol as compared to the control group.

Conclusions/Discussion
Resveratrol appears to extend the lifespan of the fruit flies, but only at higher concentrations. This seems to indicate that including resveratrol in the human diet would be beneficial, although the effective dose would still need to be determined.

Summary Statement
My project investigated resveratrol, an antioxidant found in the skin of grapes, and its possible anti-aging effects, using fruit flies.

Help Received
Dad helped in transferring flies; Brother helped make graphs on the computer