CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Amanda F. Bryant-Dunmire

Project Number
S1201

Project Title
Felines vs. Canines

Abstract

Objectives/Goals
In this experiment, animals will use their paws for many things but, some scientist don't know what paw the animals favor. My hypothesis is that cats will be more left-pawed and dogs right.

Methods/Materials
Materials: 20 cats and dogs, toys(feathers and balls), data table and treats.

Results
My results came out to be that cats were left-pawed and dogs right-pawed. My hypothesis was incorrect

Conclusions/Discussion
In conclusion, I wanted to see if cats and dogs have a paw preference. Overall for cats I found out that they were mostly left pawed and dogs right. They switched. If I had more time I would spend more time on the project and on the animals.

Summary Statement
To tell if cats and dogs have a paw prefence

Help Received
none

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Gautam S. Bulusu

Project Number

S1202

Project Title

Biomarkers in Risk Prediction Model (RPM) Predicting Recurrence in Patients with Ductal Carcinoma in situ (DCIS)

Abstract

Objectives/Goals

DCIS is heterogeneous without clear prognostic indicators for recurrence defined in terms of DCIS or IC. While the Van Nuys Prognostic Index (VNPI) has been used clinically for predicting recurrence, there has been no good biomarker(s) that predict outcome in DCIS patients. Cancer Genome Atlas Network (Perou et al, Nature 2012) have identified specific novel gene mutations in GATA 3 and FOX A1 which exhibited strong association with Luminal A subtype. The purpose of study is to build a model that is based on a set of highly relevant biomarkers that could be used in predicting recurrence in DCIS patients.

Methods/Materials

Tumor blocks of 291 patients with DCIS were retrieved from tumor registry database. Out of these only 219 cases that had complete (clinical, radiological, treatment) follow up information were chosen for the study. The equipment used for study included microtome, Leica Bond Max Autostainer and Antibody kits. Formalin fixed, paraffin-embedded tumor blocks of tissue samples were cut by microtome to obtain blank sections. Immunohistochemistry (IHC) staining method was performed on these slides. IHC is the process of detecting antigen (protein) binding to antibody.

Netica and Graph Pad Prism were used for statistical analysis

Results

We are reporting the results of biological marker expression in terms of recurrence and ER status. We have stratified patients into ER (+) and ER (-) groups since patients with ER (+) invasive cancers have exhibited longer disease free interval and overall survival than ER (-) patients. ER (-) patients have expressed lower GATA-3 expression ($p<0.05$), higher HER2 expression ($p<0.05$), and higher proliferation rate for Ki-67 ($p<0.05$) along with higher recurrence rate either as DCIS or IC.

Conclusions/Discussion

Our study was the first to analyze novel transcription factors FOX A1 and GATA 3 biomarkers in a large cohort of cases with 15+ years of follow up to predict recurrence in DCIS patients. The predictive model can be used (1) by physicians and patients in monitoring and aggressively pursuing treatment options without waiting for the onset of recurrence. (2) In developing targeted therapies for FOX A1 and GATA 3 biomarkers in patients.

Summary Statement

The goal of my project is to build a model to predict recurrence based on a set of highly relevant biomarkers and subsequently develop potential therapeutic targets in precancerous progression of breast cancer.

Help Received

Used lab equipment at Hospital under the supervision of Dr Chivukula

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Laura A. Contreras

Project Number
S1203

Project Title
Is Nutri-Grain Berry Healthy?

Abstract

Objectives/Goals
This experiment was performed to compare the effects of eating Nutri-Grain bars and fresh strawberries on blood pressure.

Methods/Materials
I took the volunteer's blood pressure with a Vernier blood pressure sensor. I had the volunteer either eat a Nutri-Grain bar or a fresh strawberry. I weighed the fresh strawberries to 37(g), the same mass as the Nutri-Grain bar. I took the volunteer's blood pressure before they ate the strawberry or the Nutri-Grain bar. Next, I had them eat sitting in the chair. As soon as they finished eating, I took their blood pressure a second time. All my data was collected on a LabQuest2.

Results
My data shows the Nutri-Grain bar does raise blood pressure more than the fresh strawberry. The raise in blood pressure by the bar is not by chance. My data also shows the decrease in strawberry was by chance.

Summary Statement
I tested the affect of Nutri-Grain bars on blood pressure

Help Received
Participant in SSI Summer Science Institute

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Tara P. Iyer

Project Number

S1204

Project Title

Gender Differences in the Prevalence of Co-Morbid Disorders Affecting the ASD Population

Abstract

Objectives/Goals

Roughly 20 percent of the autism spectrum disorder population suffers from co-morbid diseases (co-occurring conditions that affect the individual in addition to ASD). While it is known that co-morbidities affect males and females differently the normally functioning population, little research has been done to assess such gender differences in the ASD population. This investigation aims to fill that gap by using clinical data from the Stanford Translational Research Integrated Database Environment (STRIDE) to compare gender and age differences in the prevalences of co-morbid disorders across the ASD and non-ASD populations.

Methods/Materials

A series of online queries was carried out to probe the STRIDE database for ten co-morbid conditions. Queries were constrained by population (ASD versus non-ASD), gender, and age (0 - 18 years, 18 - 35 years, and >= 35 years). A total of approximately 1, 847, 365 subjects were analyzed, 4790 of whom were diagnosed with ASD. The prevalence of each co-morbid disorder across genders, age groups, and populations was statistically analyzed.

Results

Statistical analysis showed significant gender differences ($p < 0.05$) in the prevalences of co-morbid epilepsy, schizophrenia, autoimmune disorders, diabetes mellitus, inflammatory bowel disorder, and ADHD in the ASD population when unconstrained by age. The unconstrained non-ASD population showed significant gender differences ($p=0$) for all ten co-morbid conditions. Gender differences changed with age in both populations, and were significantly disparate between the populations for bowel disorders, diabetes mellitus, sleep disorders, IBD, CNS/cranial anomalies, and ADHD.

Conclusions/Discussion

This investigation highlights crucial gender differences in the prevalences of co-morbid disorders ASD population, confirming that gender does indeed influence co-morbid susceptibility in ASD individuals. Co-morbid percent prevalences and gender differences were found to vary differently over age groups in the ASD population than they did in the non-ASD population, suggesting that ASD individuals do not respond to traditional treatment methods in the same way that non-ASD individuals do. These findings elucidate the need to gain a better understanding of how ASD affects co-morbid pathology in males and females, a factor that has important implications in the development of gender specific treatments for ASD individuals.

Summary Statement

This study highlights crucial gender differences in the prevalences of ten co-morbid disorders over age groups in the ASD and non-ASD populations, elucidating a need for further ASD and gender specific research in co-morbid pathology.

Help Received

Research conducted at Stanford Cognitive and Systems Neuroscience Laboratory under the supervision of Dr. Kaustubh Supekar.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Neda Izadyar

Project Number
S1205

Project Title
Differentiation of Human Adipose Stem Cells to Osteocytes and Chondrocytes

Abstract

Objectives/Goals
This study was conducted to test the efficiency of human adipose stem cell (hASCs) differentiation into chondrocytes and osteocytes. HASCs were used to differentiate into chondrocytes and osteocytes.

Methods/Materials
Some of the materials used in this experiment were: Human Adipose Stem Cells (hASC), hASC Expansion Media, Chondrogenic Differentiation Media, Osteogenic Differentiation Media, Alcian Blue (chondrogenic marker), Alizarin Red (osteogenic marker), Microscope (Olympus Inverted Microscope Ix71). The factor that was altered in this experiment was the chondrogenic and osteogenic media. The control was the human adipose stem cells. There were six plates in which the adipose stem cells were induced to either chondrocytes or osteocytes. The number and size of the osteocyte and chondrocyte patches were measured and the intensity of the Alizarin Red and Alcian Blue stain in the patches were determined.

Results
The Week 2 plate for the chondrogenic differentiation had the most number of patches out of the three weeks. The shapes of the patches in the chondrocyte plate tended to vary in the control versus the induced wells. The cells in the control were elongated and thin while the induced wells had rounder and larger cells resembling chondrocytes. The chondrocyte staining was observed as early as week one and increased by week two and its intensity was reduced at the end of the culture. However, the osteocytes had a steady growth with an increasing rate as it got toward the third week. By Week 3, 90% of every well in the induced section of the plate was stained with the osteogenic marker. Similarly, the intensity of the osteocyte patches at the microscopic level was significantly increased during culture. In the third week, the osteocyte staining reached its highest intensity. There was a spectacular bone-like structure with its calcium deposit held within it in small pouches. Even though the osteogenic media was supposed to cause the ASCs to differentiate into osteocytes, several adipocytes were found in the induced wells of the osteogenic plates.

Conclusions/Discussion
This study clearly shows that hASCs have the ability to differentiate to both chondrocytes and osteocytes; however the efficiency of hASC differentiation to osteocytes was much higher than the hASC differentiation to chondrocytes.

Summary Statement
In this experiment, the efficiency of differentiation of human adipose stem cells into chondrocytes or osteocytes has been investigated.

Help Received
Used lab equipment at Prime Gen Biotech under supervision of Tracy Wang

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Everett N. Kim

Project Number

S1206

Project Title

Artificial Sweeteners: The Effects of Sucralose and Saccharin on the Dietary and Metabolic Habits of Mus musculus

Abstract

Objectives/Goals

To record and observe the dietary and metabolic affects of artificial sweeteners such as Saccharin and Sucralose on the common mouse (Mus Musculus).

Methods/Materials

Materials: For this experiment you need to have laboratory mice, polycarbonate mouse tubs, hanging water bottles, artificial sweeteners (Acesulfame potassium, aspartame, sucralose, or saccharin), paper pulp bedding, rodent pellets, a digital postal or food scale, a graduated cylinder, recording equipment, gloves, and safety goggles.

Methods: Prepare each enclosure for the mice with the correct temperature, mark each one with a specific pattern of stripes on its tail or number on the container of each mouse, Weigh each mouse daily and record all data starting the day the project begins, Measure the amount of water that each individual mouse consumes for a period between on or one-half week(s), After recording the daily amount of water that each mouse consumes for about a week, add the variant of artificial sweeteners to each of the mouse's water each mouse should receive the average amount of water that they consumed the prior week, record the amount of food that they are consuming daily.

Results

Mice given artificial sweeteners are inclined to have diets that vary from day to day and maintain relatively consistent weight and Mice given no artificial sweeteners show regular diet over a longer period of time as well as high fluctuations in weight gain that are not relatively consistent.

Conclusions/Discussion

According to the data, the artificial sweeteners caused the mice to become unaware of their environment and uncontrollably consume food unlike in the control group where they ate to maintain their weights. Although the data seems insignificant, the simultaneous changes in weight and food consumption means that artificial sweeteners do effect the metabolism. This can be further researched upon to prevent national rates of obesity while at the same time be used to improve the status on world hunger by manipulating the body's ability to process and store energy.

Summary Statement

The effects of sucralose and saccharin on the metabolic and dietary habits of mice was tested

Help Received

professor Kimberly Hammond from UCR helped plan enclosures and gave advice on original plans for expirament

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Kevin K. Lee

Project Number

S1207

Project Title

Strongly Coupling the Electrical and Mechanical Dynamics of the Heartbeat in a Diffuse Interface Model

Abstract

Objectives/Goals

Mathematical models of the heart have proven essential to the study of cardiac arrhythmias, which are poorly understood yet the leading cause of death in the industrialized world. Existing models provide an unobstructed view of the heart's electrical behavior on both the surface and interior, but they have not been able to efficiently incorporate the physical beating of the heart due to the resulting difficulties in handling the moving boundaries of the domain of the governing partial differential equations system. Thus, I develop a novel method for strongly coupling the mechanical muscle contraction with electrical wave propagation in a diffuse interface model.

Methods/Materials

I represented the geometry of the heart with a diffuse domain approximation and modeled the soft-tissue mechanics through fluid mechanics principles. I coupled local contraction of the domain with the Calcium power stroke of the action potential and evolved the shape through a Cahn-Hilliard equation. I solved the equations on an adaptive multigrid using a second-order Crank-Nicolson scheme and employed a convex-splitting approach to ensure further stability of the algorithm.

Results

I validated my algorithm by demonstrating its convergence and showed that the model captures the differences in electrical wave propagation due to shape, evidence of successful strong coupling. The algorithm, is also shown to be several hundred times faster than those of existing strongly coupled models.

Conclusions/Discussion

By avoiding the need to explicitly track the boundary of the evolving and potentially complex domain, my work makes comprehensive simulations of total heart function tractable. The theory developed here efficiently facilitates more realistic simulations of the heart, providing a valuable tool to guide drug development for the treatment of arrhythmias and empowering dramatic improvements in their treatment and prevention.

Summary Statement

I created a much more efficient mathematical model of the heartbeat that successfully incorporates the two-way interaction between the muscle contraction and electrical signaling in the heart, a crucial component to fatal heart conditions.

Help Received

Professor John Lowengrub and Dr. Esteban Meca supervised the progression of this project and provided useful discussions.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Vick C. Liu

Project Number

S1208

Project Title

A Microfluidic Device for Blood Separation and Cell Morphology Analysis Using Acoustic Microstreaming

Abstract

Objectives/Goals

The objective of this project is to develop a fully integrated microfluidic device that can be used to automatically separate human blood cells and perform cell morphology studies on a chip.

Methods/Materials

The device was designed based on acoustic microstreaming and hydrodynamic separation principles to separate Red Blood Cells from White Blood Cells. The device was fabricated using soft lithography technology and consists of PDMS microchannels with widths of 10~30 μm. It also consists of pockets that are used to store air bubbles to generate acoustic microstreaming under an acoustic field created by a PZT disk. This device was tested with human blood samples.

Results

It was discovered that acoustic microstreaming not only served as a micropump to move fluids, but also as a method to achieve highly efficient blood cell separation (89% rate) similar to that of conventional centrifugation techniques. At higher frequencies (12kHz), acoustic microstreaming served as a micropump to move the blood solution at a flow velocity of 0.25 mm/sec. However, at lower frequencies (11kHz), the swirling fluidic vortices generated by acoustic microstreaming created a spinning effect, similar to conventional centrifugation. By utilizing different physical properties of blood cells in addition to the effects of acoustic microstreaming and hydrodynamic channels, I was able to successfully separate RBCs from WBCs based on their size difference, mass, and inertia and perform a blood cell morphology analysis to identify various blood cells including RBCs (e.g., sickle cells), and WBCs (lymphocytes, neutrophils, eosinophil).

Conclusions/Discussion

An integrated microfluidic device has been successfully developed to separate blood cells and to perform blood morphology analysis. Three onchip cell separation techniques (hydrodynamic, particle retention filter, and acoustic microstreaming) were investigated. While all achieved good cell separation, the former two suffered from a cell clogging issue. However, acoustic microstreaming showed superior advantages over the other techniques: 1) no cell clogging issues; 2) no moving parts; 3) simplicity; 4) easy to integrate and fabricate; 5) low cost; 6) high WBC separation efficiency. It is the first time this concept of MicroCentrifugation based on acoustic microstreaming has been demonstrated for blood separation and analysis.

Summary Statement

A fully integrated microfluidic device, which can be used to automatically separate human blood cells and perform cell morphology studies on a chip, was successfully developed.

Help Received

Used lab equipment at University of California, Irvine under the supervision of Prof. Lee.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kevin G. Makens

Project Number
S1209

Project Title
Can the Human Eye See above 60 FPS?

Abstract

Objectives/Goals
My objective in this experiment is to see if the high frame rate monitors of today are really worth it to gamers and if people can tell the difference. The main point of this experiment was to end the debate occurring on the internet, that you can not see above 60 Frames Per Second (FPS).

Methods/Materials
To run this experiment I used an ASUS VG248QE monitor that is capable of 144 hz (1 hz = 1 FPS) output. There were two experiments for this project, the first was testing if they could see a single frame, and the second was testing if they could tell using motion. I used two different pieces of software for the different experiments.
For the 1st, I finally used high speed video rendering software to flash the image on the screen after attempting to get Java, C++, or game engines to work with 100% reliability, which they did not. The idea behind this experiment is that you flash an image for one refresh of the monitor at the various speeds and ask the participant if they could see the image and what it was. I then used a set criteria to identify if they were right or wrong.
The second experiment I had each participant play 15 second of Battlefield 4 and ask which speed they thought it was running at after letting them see a control to give them an idea of a low speed.

Results
The results of the experiments showed that there was a slight difference in subjects ability to perceive, and in fact people could tell the difference between the higher and lower framerates. The two ANOVA tests that were run against the data in these experiments also support that there was a slight difference in the subjects ability to perceive. The implication is that the monitors may be worth it based on speed alone, but only with a very small increase in noticeable smoothness. The data also showed that it is in fact possible to see above 60 FPS.

Conclusions/Discussion
Overall this experiment supported the theory that there is a difference. The experiment provided evidence toward the objectives. The experiment showed that the image can be smoother with higher FPS, as well as providing evidence that the faster monitors are smoother.
This experiment provided me insight about framerates, game technology, and that things like garbage collection can impact the reliability of an experiment. This experiment also required me to be creative in problem solving with my programming, even though the initial code did not work out in the end.

Summary Statement
This project is done to see if people can perceive the difference between high speed 120+ hz and normal 60 hz monitors.

Help Received
Father gave feedback on abstract wording; Teacher graded original lab report and poster and provided feedback;

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Andrea Mora; Jade Purifoy

Project Number
S1210

Project Title
Is a Dog Really Man's Best Friend?

Abstract

Objectives/Goals
In our experiment we are going to determine if female dogs like a male or female human better and if male dogs like a male or female human as well. We are going to be doing this because many people think that all dogs love male humans better hence the fact "Man's Best Friend." We will be asking friends and family to test their dogs and we will get the results from there.

Methods/Materials
Dogs (Male and Female)
Humans (Male and Female)
note paper, a pencil, and a camera

Results
The results that we got only one of four charts (which is 25 each trial) shows that male dogs prefer male humans. On three out of four charts went to the female human but for the male one out of four of the charts chose the male human. So all in all the all chose female because they show more affection.

Conclusions/Discussion
While we where testing the dogs we noticed that the dog would just run off somewhere else and not pick a human gender so we had to put in another box to put into the chart. We did not expect the dog to just not pick someone so it got us thinking about that. We realized that it was a possibility that other dogs might not chose a gender as well so we added another box to the list and went along with it. It did end up happening that other dogs didn't choose a human gender so it was a very good idea that we added that in there.
We could also go on further with our experiment by seeing which breed of dog prefers male or female humans. For example we could only get German Shepard males and females and see which gender they prefer. We could also go into more research and see why mos chose the female human because maybe they like a person who shows more affection to them than men do. We could go farther in so many ways in our experiment.

Summary Statement
dog preference between human gender

Help Received
none

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alyssa L. Pompan

Project Number
S1211

Project Title
My Joints Crack: Should I Be Worried?

Abstract

Objectives/Goals
The goal of this study is to better understand joint cracking. This experiment analyzes differences between the sexes, which joints are involved, what percent of people are "crackers," and whether or not there are associated symptoms. The hypothesis of this experiment was that most people crack their joints due to stiffness. This experiment will hopefully allow us to better understand the phenomenon of joint cracking.

Methods/Materials
250 detailed surveys were distributed to males and females of ages 13 and over. The survey incorporated many questions about cracking joints as mentioned in the section above.

Results
66% of people surveyed crack their joints: 75% of individuals under age 30, 60% of those between 31 and 50, and 41% of individuals older than 50. The most common reasons for all males to crack their joints was habit as it was for females ages 13 to 30. For females 31 and older stiffness was the main reason. The majority of people have not experienced pain or swelling, or received treatment. The study suggests that older people crack their joints less.

Conclusions/Discussion
The study showed that approximately 2 out of 3 people crack their joints. Both males and females share the same pattern in terms of body parts, with the knuckles being the most common followed by the neck and back. Habit was the most common reason in the males followed by stiffness, whereas the results were reversed for females. When age is considered, 75% of people younger than 30 crack their joints. In patients between 30 and 50, 60% crack their joints. In the older than 50 category, only 41% of people crack their joints. This suggests that as people get older they are less likely to crack their joints. There were very few cases of pain and swelling. Overall, there was not a significant difference between the sexes.

The hypothesis was that the main reason for cracking would be "stiffness." However, the most common reason was "habit," with stiffness a close second. The vast majority of all people were not cracking their joints for pain relief. Given that there are so few individuals that have pain and swelling, it appears that there is no medical issue. More subjects would be needed to draw definite conclusions.

In summary, cracking of joints seems to be a very common phenomenon and a habit that people may eventually outgrow. Cracking of joints appears to be safe without any significant, harmful effects.

Summary Statement
The purpose of this experiment was to investigate different aspects of the phenomenon of cracking joints.

Help Received
My Science Teacher, for her help and guidance, the 250 participants who completed the surveys, my dad, mom, and brother for helping me distribute the surveys and getting my supplies.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Amanda Richno; Isabella Spangle

Project Number
S1212

Project Title
Male Dominance? Battle of the Sexes

Abstract

Objectives/Goals
We are trying to prove that gender has influence over the intelligence level in mice. We believe that male mice will be smarter based on the fact that they may have evolved to be more intelligent on the account that they must be more competitive for resources than female mice.

Methods/Materials
In order to ascertain data on gender intelligence, we devised a maze to test their ability to learn and retain information. We came to our conclusion based on the average trial time for each gender. We used four mice, two males and two females. We placed peanut butter at the end of the maze and then inserted the mouse at the beginning of the maze. We timed how long it took the mouse to find the peanut butter. We repeated the process for each mouse.

Results
We found that the male mice were in fact quicker at the maze than the females.

Conclusions/Discussion
We observed that the male mice seemed more competitive and eager to complete the maze, which further supports our theory that the males are more intelligent in order to reproduce successfully. In the time leading up to the experiment, we fed the mice the same amounts of food, ruling out the possibility that the male mice were hungrier than the female mice. This, however, does not account for possible metabolism differences between the male and female mice.

Summary Statement
This project investigates the differences in intelligence between male and female mice.

Help Received
Mother bought the mice.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alap A. Sahoo

Project Number
S1213

Project Title
Compositional Differences in Protein Content in Milk from rBST-Treated and non-rBST-Treated Dairy Cows

Abstract

Objectives/Goals
The goal of this study was to determine differences in chemical composition in milk from cows treated with rBST and cows not treated with rBST after the pasteurization process. rBST is a synthetic growth hormone used to increase yields in dairy cows, and has been banned in many brands and supermarkets due to consumer backlash. However, the FDA and various other consumer groups have found milk treated with rBST to be safe for human consumption, and have specifically found no difference in the protein content of rBST-treated milk and regular milk. This study aimed to test the last part of the FDA's claim, regarding protein content.

Methods/Materials
Samples of milk, consisting of equal number of rBST-treated and non-rBST-treated milk, were collected. Samples were separated into constituent whey and casein proteins using a centrifuge. The concentration of casein, whey, and total proteins in each sample was analyzed using the Bradford Assay method of protein determination.

Results
A 95 percent confidence t-test of means found no significant difference in protein content in milk from cows treated with rBST and those not treated. Specifically, there was no significant difference in either total, casein, and whey protein content.

Conclusions/Discussion
The results agreed with the FDA findings, as there was no significant difference in protein concentration between the two treatments. A key limitation of this experiment was the lack of analysis of specific protein types in the milk, which may be rectified by further research either next year or before the State Science Fair.

Summary Statement
My project seeks to determine the effect of rBST-treatment in dairy cows on the protein composition of the milk they produce.

Help Received
Used lab equipment at my high school and at CSU Bakersfield under supervision of Dr. LaFever.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Bijan A. Samimi

Project Number

S1214

Project Title

The Study of the Inheritance of Syndactyly

Abstract

Objectives/Goals

My project was to determine whether the gene for Syndactyly Type 1(cutaneous webbing of second and third digits of hands) to chromosome 2q34-2q36 can skip a generation of phenotypic inheritance by epigenetics.

Methods/Materials

Determination of who phenotypically had inherited Syndactyly Type 1 in my paternal family was conducted. I needed to find a primer for the 2q34-35 chromosome in which Syndactyly Type 1 is localized. Failing to do so, I focused on composing a pedigree chart of the last four generations of my paternal side by distinguishing who phenotypically inherited Syndactyly Type 1 or not. Research was then conducted to analyze the gene of Syndactyly Type 1 in regards to the autosomal dominate trait turning on or off allowing for two generations to be skipped on my paternal side of the family.

Results

Looking back four generations on my paternal pedigree, two generations were skipped showing no phenotypic signs of Syndactyly Type 1. My paternal great grandparents showed no phenotypic signs of any form of Syndactyly (first generation skipped). My paternal grandfather inherited Syndactyly Type 1, showing webbing phenotypically between his third and fourth finger of his left hand as well as my grandmother showing webbing phenotypically between her third and fourth toes of her left foot. My paternal grandfather had five male offspring through intermarriage (first cousin). All five sons showed no forms of Syndactyly phenotypically. My father being one of the sons got married in a non-inter marriage passing Syndactyly Type 1 to me and my sister on both of our hands.

Conclusions/Discussion

Syndactyly is an autosomal dominant limb malformation, characterized phenotypically by the webbing being either simple or complex and complete or incomplete. My research indicates that through epigenetics this autosomal dominate gene turned off for the generations in which it was skipped and subsequently turned on for the generations that showed Syndactyly phenotypically.

Summary Statement

My project is about my paternal family pedigree and how the inheritance of Syndactyly skipped two full generations due to epigentics and the gene linked to Syndactyly being an autosomal dominate trait.

Help Received

My older sister Sofhia Samimi mentored me throughout my entire project and my AP Biology teacher Mrs.Acquistapace

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Japmeet Sandhu; Ashima Thusu

Project Number

S1215

Project Title

Supertasting Ability, Satiety, and Childhood Obesity in the Hispanic Population

Abstract

Objectives/Goals

There are no data till date that link tasting ability, satiety, and childhood obesity in general and in the Hispanic population in particular. However, studies have also shown that an individual#s ability to taste (supertaster versus non-taster) can also be correlated with body mass index (BMI)/obesity.
Our primary goal was to determine if any correlation exist between sensitivity to taste, satiety and obesity in Hispanic children. We measured leptin and leptin receptors as indicators of satiety index and correlated the tasting responses to Phenylthiourea (PTC) in children with varied degrees of obesity.

Methods/Materials

A group of 100 children aged 6-18 years volunteered to participate in the study. The intensity of taste perception was measured directly by Phenylthiourea- Phenylthiocarbamide (PTC strips- Precision Laboratories FL). Cognitive eating behaviors were evaluated using study designed questionnaires; Body mass index was used as an indicator of obesity and Satiety was determined by measuring serum Leptin and Leptin receptor levels by an ELISA assay. 

Results

Of the volunteers that participated, 23% were normal tasters, 29% were non-tasters and 48% were dominant supertasters. The Body Mass Index of the subjects ranged from 17.5-42.9.The Leptin levels ranged from 700 pg/mL to 66,500 pg/mL. Leptin receptors levels ranged from 18.5 ng/mL to 73 ng/mL. There was a significant positive correlation between the Body Mass Index and the Leptin levels of our population $p<0.05$. There was a significant negative correlation between the Body Mass Index and the Leptin receptor levels of our population $p<0.05$. One way ANOVA comparisons of tasters, non-tasters, and dominant supertasters did not yield any significant difference between the Body Mass Index, Leptin levels, and Leptin Receptors.

Conclusions/Discussion

We need to continue enrolling more subjects to improve the power of our testing; although, some trends of correlation between satiety and tasting ability can be observed, but they are not statistically significant Also, exploring the possibility of conducting a genetic evaluations of these subjects related to the obesity and satiety genes will provide more information.

Summary Statement

We explored the link between tasting ability and satiety in childhood obesity in the Hispanic Population

Help Received

Did lab analysis at Universal Biopharma Institute of Health under the supervision of Dr. Kushoo; enrolled subjects at Alta Family Health Clinic

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Onkar S. Sandhu

Project Number

S1216

Project Title

Optical Coherence Tomography in Acute Coronary Syndrome

Abstract

Objectives/Goals

To study the prevalence of plaque rupture, plaque erosion, and fibrocalcific nodule in culprit lesions defined by optical coherence tomography in male and female patients presenting with acute coronary syndrome.

Methods/Materials

Twenty-six patients presenting with acute coronary syndrome to Community Regional Medical Center at Fresno and an identifiable culprit lesion on angiography were studied with the novel imaging technique of optical coherence tomography (OCT). The OCT procedure was performed successively after the initial coronary angiogram and before the placement of a coronary stent, if vessel(s) were not totally occluded. Using the frequency-domain C7XR OCT system, a 2.7-F OCT imaging catheter was carefully advanced distal to the culprit lesion. The automated pullback was performed at 20 mm/s, while blood was displaced by a short injection of Iodine contrast media through the guiding catheter. Risk factors and patient information associated with coronary heart disease were collected, including age, sex, smoking history, family history of heart disease, history of hypertension, and history of diabetes. Standard deviation for each variable was calculated. Student t-test, Pearson's chi-squared test, and Fisher's exact test were performed to compare the means of the sampled data.

Results

Plaque rupture was associated with acute coronary syndrome in 61% of patients, while plaque erosion was seen in 39 % of patients, which is statistically significant ($p < 0.05$). Plaque erosion was more prevalent in women (60%) as compared to men, who have higher occurrence of plaque rupture (69%) with statistical significance ($p < 0.05$). Smokers have higher incidence of plaque erosion (80%) as compared to plaque rupture (44%), which is statistically significant ($p < 0.05$).

Conclusions/Discussion

This study determined plaque rupture is more commonly associated with acute coronary syndrome as compared to plaque erosion. Women tend to have more plaque erosion as compared to men, who have higher incidence of plaque rupture. Smokers have higher prevalence of plaque erosion as compared to plaque rupture. Identifying the pathways in the etiopathogenesis of acute coronary syndrome may provide crucial understanding about coronary heart disease process; thus, the targeted therapy can be established. This understanding may further help to prevent the occurrence of coronary heart disease in the first place.

Summary Statement

Optical coherence tomography, a novel imaging technique, can be performed to determine the plaque morphology of coronary plaque in acute coronary syndrome.

Help Received

Research performed under the guidance of Dr. John Ambrose, Dr. Bipin Joshi, and Dr. Manjunath Harlapur at University of California, San Francisco at Fresno.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Christina Schaefer; Betsie Wilson

Project Number

S1217

Project Title

Domestic Felines' vs. Domestic Canines' Intellectual Capability to Comprehend Learning Specific Movements on Command

Abstract

Objectives/Goals

In our experiment, we will test numerous canines and felines using different tests, research information on their brain waves, and research companionship with humans to see which can learn the tricks we will attempt to teach them. The objective of the experiment is to efficiently teach domestic canines and felines to learn simple tasks on command.

Methods/Materials

The subjects we will be training will be our own, our neighbors', and friends' animals. We will have a total of thirty subjects, composing of fifteen cats and fifteen dogs. To conduct the experiment, we have created a rubric on a scale of 1-5 in judgement on how well the subject exerted the task after training.

Results

Based upon our results, our hypothesis, predicting that cats and dogs would learn at the same pace, was incorrect because the dogs proved to progress faster than cats through the testing trials. Through our trials with both cats and dogs, we observed that training dogs was easier than training cats because the dogs were more willing to put in the effort.

Conclusions/Discussion

Our Studies on training animals is useful to us because our cats and dogs learn to be obedient which helps them receive positive attention which in turn leads to happy relationships between pets and their owners. Training animals are useful to society becuase the knowledge of training cats and dogs can be used to prepare them for becoming service animals to help humans with disabilities. Trained canines and felines are safer to have around small children, babies, and the elderly.

Summary Statement

Our experiment is to train cats and dogs to complete specific tasks on command.

Help Received

teacher helped with guidelines of research report

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Melissa P. Thurston

Project Number
S1218

Project Title
The Comparative Effectiveness of CPAs DMSO, OCT, and Glycerol on Viability of Cells Extracted from Frozen Intact Teeth

Abstract

Objectives/Goals
The purpose of this experiment was to search for a cryopreservation solution that would allow for maintenance of dental pulp tissue vitality without the necessity of first removing the pulp tissues from the intact teeth prior to freezing.

Methods/Materials
8 human wisdom teeth were collected at the time of their extraction and placed in Hanks Balanced Salt Solution. Within 24 hours, 3 of the teeth were cut open and their pulp tissues were removed. These pulp tissues and the remaining 5 teeth were then placed into the following cryopreservation solutions: DMSO (control solution), DMSO/OCT, and DMSO/Glycerol (experimental solutions). The samples were then frozen in a -80 degree freezer. After 5 1/2 weeks, the samples were removed from the freezer and thawed. The cells were digested in collagenase type 1, suspended in PBS, and stained with Trypan Blue. Once stained, the cell suspensions were placed on a hemocytometer where the total number of cells and the total number of viable cells were counted in order to determine percent cell viability of the cells in each solution.

Results
The results showed that for all solutions, the samples of cells taken from pulp tissue frozen within intact teeth had lower percent viability than the samples of pulp removed from teeth prior to freezing. The results also showed that between the two experimental cryopreservation solutions that were used to freeze intact teeth, (DMSO/OCT and DMSO/Glycerol) the cells placed into the DMSO/OCT solution had a higher percent viability than the cells frozen in the DMSO/Glycerol solution.

Conclusions/Discussion
The results supported the hypothesis that, when intact teeth are cryopreserved, the pulp tissue with the highest cell viability will be from the tooth that was preserved in DMSO/OCT. By discovering the optimal solution for maintaining cell viability when freezing intact teeth the dental pulp stem cells located within the dental pulp tissue of the teeth can more easily be stored for future use in cell therapies.

Summary Statement
The search for a cryopreservation solution that can maintain the highest number of viable cells of the dental pulp tissue located within intact teeth.

Help Received
Oral surgeons extracted teeth and tested safety of blood from patients; used lab equipment at school lab under the supervision of Ariel Haas (teacher); mother (pediatric dentist) helped by opening the teeth, unsung dental hand piece

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Aileen F. Wang

Project Number

S1219

Project Title

A Novel Breast Cancer Detection Algorithm Using Point Region Growing Segmentation and Pseudo-Zernike Moments

Abstract

Objectives/Goals

Mammography has been one of the most reliable methods for early detection and diagnosis of breast cancer. However, mammography misses about 17% and up to 30% of breast cancers due to the subtle and unstable appearances of breast cancer in their early stages. The objective of this project is to design and develop a computer aided diagnosis (CADx) algorithm to automatically analyze and detect breast cancer from a mammographic image with the lowest False Negative Rate (FNR).

Methods/Materials

First, I developed an automatic and efficient image segmentation algorithm, Point Region Growing, to extract the single breast mass. Then, I developed a robust image reconstruction algorithm using the Pseudo-Zernike polynomial to analyze the segmented breast mass. Finally, I invented a new classifier, Root Mean Square (RMS), of Pseudo-Zernike moments to classify both benign and malignant breast masses. This novel CADx algorithm was implemented using MATLAB and validated on a set of randomly selected mammographic images from the Mammographic Image Analysis Society (MIAS) database.

Results

A comparative study among the various algorithms for the segmentation and reconstruction of breast masses was performed on randomly selected mammographic images. The results demonstrated that the newly developed algorithm is the best in terms of accuracy and cost effectiveness. More importantly, the new classifier RMS has the lowest FNR # 6%.

Conclusions/Discussion

This study has developed a novel CADx algorithm to automatically analyze and detect breast cancer from a mammographic image and reduced the best benchmark of FNR from 17.6% to 6%. This CADx algorithm can be easily integrated into the current breast cancer screening system and generalized to diagnose other type of cancers.

Summary Statement

This study has not only developed a novel CADx algorithm to automatically analyze and detect breast cancer from a mammographic image with the lowest FNR but also laid a foundation for diagnosing other type of cancers.

Help Received

Dr. James Li helped on the selection of the mammographic image database and provided feedback for my project.