CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Mizna Akbar; Dayna Thai

Project Number

S1201

Project Title

Correlation between Helicobacter pylori and Irritable Bowel Syndrome

Abstract

Objectives/Goals

The hypothesis is that there is a distinct correlation between Helicobacter Pylori infection and a specific type of Irritable Bowel Syndrome (C-constipation, D-diarrhea, or M-alternating). Also, H.pylori may be associated with specific symptoms of Irritable Bowel Syndrome(IBS) or certain comorbid conditions.

Methods/Materials

62 patients with IBS from a private GI practice were mailed an informational letter asking for their participation along with a questionnaire regarding their IBS symptoms. 14 patients volunteered, and each performed a Urea Breath Test using Urea Breath Analyzer to see if they were H.pylori positive. Data was analyzed to look for correlations between H.pylori and multiple aspects of IBS (symptoms, duration etc.).

Results

21% (3/14) of the patients were found to be H.pylori positive. The positive patients had either IBS-C or IBS-D. However, none of the positive patients had IBS-M (alternating), while nearly half (5/11) of the negative patients did,which means that there is a possibility that H-Pylori may play a role in IBS-C or IBS-D. There were no clear correlations found between the presence of H.pylori and certain abdominal symptoms or comorbid conditions. The data suggests that symptoms of positive patients were more consistently severe than those of the negative patients. Other small connections were found between H.pylori infection and certain characteristics of IBS, but no distinct correlations could be found.

Conclusions/Discussion

The hypothesis was not supported by the results. Though the data did not show any distinct correlations between Helicobacter Pylori and Irritable Bowel Syndrome, there were still promising suggestions that there may be an association in certain aspects, such as age, severity, length since diagnosis etc. With this study, an attempt was made to find a correlation between the globally widespread H.pylori infection, one already known as a major cause of peptic ulcer disease, and Irritable Bowel Syndrome, a disorder with a prevalence of about 10% in the US. IBS can be a debilitating disorder, and if treating a bacterial infection can improve patients# symptoms, then it could significantly improve their quality of life.

Summary Statement

The project involved searching for correlations between Helicobacter Pylori infection and certain aspects of Irritable Bowel Syndrome (IBS), such as a specific type, certain symptoms, or comorbid conditions.

Help Received

Assisted by Ambreen Khurshid M.D. from California Gastroenterology Associates in recruiting patients for the study and in administering the Urea Breath Tests

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Emily J. Alexander

Project Number
S1202

Project Title
Think Before You Drink: A Closer Look at Vitamin Water

Abstract

Objectives/Goals
My purpose of this experiment was to find out if Vitamin Water is unhealthy for you, and how if it dehydrates the body in relation to Coke, and other drinks.

Methods/Materials
My basic set up included six rodent cages, newspaper, and a highly sensitive scale. I would periodically weigh the newspaper to measure urination rates of 40 mice.

Results
I measured mice urination levels over a seven day period and observed energy levels to find that the Orange-Orange Vitamin Water, high in Vitamin C, caused the most urination followed by Coke, Dragon Fruit Vitamin Water, Water, then Orange Juice.

Conclusions/Discussion
The numbers taken from the vitamin water cages and the coke cages were extremely similar, proving that vitamin water is just as bad for a body as coke, nutrient wise. These drinks can cause an unhealthy amount of urine, especially when drank one or multiple times a day, depleting the body of vitamins and urinating out the excess sugar, often dehydrating the body. Excess sugar consumption also causes a health issue that makes it hard for the kidneys to function properly. My data supported my hypothesis that the mice drinking coke and vitamin water will produce the most amount of urine.

Summary Statement
My project is about showing how Vitamin Water dehydrates the body because of the high sugar levels in the drink.

Help Received
advice from Dr. Edward Putnam, DVM

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Erika Badalyan

Project Number
S1203

Project Title
Stress Relief from Laughter? It's No Joke

Abstract

Objectives/Goals
The objective was to determine the effect laughter yoga has on perceived stress levels, blood pressure, oxygen saturation, and heart rate.

Methods/Materials
25 human subjects met for 3 sessions over the course of 3 weeks: 12 teenagers, and 13 senior citizens. Each age group was divided in half: 6 human subjects were the control group and the other 6 were experimental (7 for senior citizens). Each session involved breathing and stretching exercises, simulated laughter, chanting, clapping, and meditation. The 40-minute control intervention involved discussing health-related topics with human subjects. Before and after the 40-minute laughter yoga class, the human subjects would take a stress questionnaire, measure their blood pressure with a sphygmomanometer, and measure their oxygen saturation and heart rate with an oximeter.

Results
There was significant decrease in perceived stress scores, and increase in oxygen saturation, with an increase in oxygen saturation for senior citizens by 2% from an average of 95% for before to 97% for after, and for teenagers, the increase was also by 2%, with an average of 97% to 99%. For teenagers, stress levels were decreased by 72.31% ranging from 22/34 to 6/34 before and after the laughter yoga sessions.

Conclusions/Discussion
The hypothesis of the project was supported. Laughter yoga reduces perceived stress levels, improves blood circulation and oxygen saturation, and decreases blood pressure. The contributions of this project could be beneficial to schools and hospitals alike; laughter yoga classes could be a great stress-reducer for both teenagers and hospital patients.

Summary Statement
This project is about beneficial effects of laughter yoga on perceived stress levels, oxygen saturation, blood pressure and heart rate.

Help Received
Teacher advised on research guidelines; Mom assisted with purchasing equipment

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Megan R. Banwarth

Project Number
S1204

Project Title
Cow Colors

Abstract

Objectives/Goals
Can cattle discriminate between feed pans that are the same type, but two different colors? This research applies to showing cattle and the day to day care of them. This project relates to seeing if the cattle can tell between the many pans used. The hypothesis for this project is that the heifer will not be able to tell which pan is the one she has been using.

Methods/Materials
The materials used in this project are: grain (three 50 pound bags), feed scoop, one dark blue pan, one bright red pan, and a heifer. The method used for this project is to acquire a dark blue and bright red feed pan. Then feed the selected heifer the same amount and type of grain in the same pan for two weeks. After the two weeks are finished, place the two pans four feet from each other and let the heifer choose which one she eats out of. Repeat this step for the next three feedings while recording your results.

Results
The result of this experiment is that the heifer could not tell between the two pans, since she choose them randomly.

Conclusions/Discussion
Researchers can conclude that cattle are color blind, thus they cannot tell between the feed pans and their color. This result supported the previously mentioned hypothesis, which was that the heifer would not be able to tell the two feed pans apart. This could be an addition to the feed lot/slaughter house design created by Temple Grandin.

Summary Statement
This project tests the myth that cattle can differentiate feed pans by color.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Braeden C. Benedict

Project Number

S1205

Project Title

Pathology and Chemistry of the Brain in Sanfilippo Syndrome Type B

Abstract

Objectives/Goals

The effects of Sanfilippo syndrome type B, a rare genetic lysosomal storage disease, on the mouse brain were studied. It was hypothesized that affected mice would have decreased volume and/or neuron counts in the amygdala, a region of the brain previously observed to have been affected in humans. Also, it was hypothesized that the activities of choline acetyltransferase (ChAT) and acetylcholinesterase (AChE), enzymes involved with the acetylcholine neurotransmitter pathway, would be lower in diseased mice.

Methods/Materials

Using stereology software, volume and cell count measurements of the amygdala region were made using snap-frozen brain tissue samples of both carrier (healthy) and mutant (diseased) mice treated with both a Nissl stain and an AChE activity stain. The activities of both AChE and ChAT throughout the brain were quantified by performing enzyme activity assays using brain tissue homogenate from carrier and mutant mice. ChAT immunohistochemistry (IHC) staining was also performed to locate specific affected regions.

Results

While there was no significant difference in volume or cell counts, it was observed that the intensity of AChE staining was lower in the diseased brains. It was measured that the activity of AChE was lower by 25% in the region of the brain containing the amygdala and by 12% throughout the brain. Likewise, the ChAT activity was lower by 14% in the amygdala region. IHC staining for ChAT yielded a surprising result, with mutant animals having a higher number of cholinergic neurons stained in a region near the brainstem than the carriers. A corresponding increase in AChE activity was also observed in this region.

Conclusions/Discussion

Although the hypothesis regarding amygdala volume and cell density was disproved, observations made during that study led to discovering significant changes in the activities of AChE and ChAT. The enzyme activity changes can provide an indicator of disease progression and could provide an indicator of the success of an attempted therapy. This knowledge will aid in the development of treatments first in animal models, then in human patients.

Summary Statement

The effects of Sanfilippo syndrome on the mouse brain were studied, and it was discovered that the activities of AChE and ChAT enzymes are significantly reduced, especially in the amygdala region.

Help Received

Worked in the MPS Laboratory at the Los Angeles Biomedical Research Institute under the supervision of Dr. Patricia Dickson.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Yesica Cisneros

Project Number

S1206

Project Title

Comparison between Female and Male Exposure to Four Shades of a Hue

Abstract

Objectives/Goals

The basis of this research project is to determine whether the female eye can more efficiently distinguish the darker shade of a hue then a male.

Methods/Materials

The computer program Pantone will be set up to show two shades of 4 hues red,blue,yellow and black. 40 human subjects 20 female and 20 male all containing 20/20 vision around the ages of 16 and 17 will be shown 2 shades of hue and will be asked to choose the darker shade.

Results

The experiment was conducted to determine whether the female eye can more efficiently distinguish which shade of a hue is darker then the male eye.Comparing graphs 1 and 2 all 20 females and males correctly choose the darker shade between black and white.Comparing Graph's 1 and 2 both males and females did poorly on choosing the correct darker shade of yellow meanwhile females did better on red then males. Males did better on choosing the darker shade of blue then females. However overall the female subjects did distinguish the darker shade of a hue better then a male.

Conclusions/Discussion

The experiment proved that the female eye can more efficiently differentiate the darker shade of a hue then a male. To furthermore continue this experiment the number of test subjects and color should be increased to more efficiently back up the results. The light waves in the room should be measured to be able to know what color waves are being translated by the cones.Another way to better the experiment is to increase the range of the subjects age. Will a color blind person distinguish the two shade differently then a person who is not colorblind?

Summary Statement

A female and male are both exposed to observe two shades of a hue to determine whether the female eye can differentiate the correct darker shade of the hue than that of the male eye.

Help Received

Ms. Valero helped to form the idea on this project.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Jessica M. Cronin

Project Number
S1207

Project Title
Variations in Heart Rate Pre- and Post-Exercise: Human vs. Equine

Abstract

Objectives/Goals
My goal was to find out whether a horse or it's rider's heart rate would be most affected after jumping a course of jumps.

Methods/Materials
Stethoscope, Stopwatch, Course of Jumps, Horse/Rider Combos

Results
The horse's heart rate was most affected according to percentages.

Conclusions/Discussion
If you look at the amount of beats per minutes the heart rates changed, it looks like the rider's heart rates were most affected. However, since human hearts beat slower than horse hearts, you must find the percentage of the change to see that the horse's heart rates actually changed more.

Summary Statement
My goal was to find out whether a horse or it's rider's heart rate would be most affected after jumping a course of jumps.

Help Received
Since I had to get heart rates before they could lower, I had the riders take their own pulse while I took the heart rate of their horse.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

S. Annika Daug

Project Number

S1208

Project Title

The Association between Atypical Laterality and Attention Deficit Hyperactivity Disorder

Abstract

Objectives/Goals

The aim of this study was to determine if there is a higher occurrence of atypical laterality, as manifested by mixed handedness, mixed eyedness, and hand-eye cross dominance, in children with ADHD. This study has important implications for the possible early detection of ADHD risk in the general population.

Methods/Materials

Hand and eye preference of 48 ADHD and 48 age and gender matched non-ADHD children, were assessed using the Lateral Preference Inventory. Preference was noted by a Pediatrician via direct observation or verbal response for 4 items of handedness and 4 items of eyedness. Responses were noted as right, left, or either. Data was scored for each subscale as the number of #right# responses minus the number of #left# responses. Mixed-handedness and mixed-eyedness were defined as all those who were not consistently right or left sided, plus those who were undefined. Cross dominance for hand and eye was recorded if the dominant hand and the dominant eye were on opposite sides. Percentage of mixed-handedness, mixed-eyedness, and hand-eye cross dominance between the ADHD and non-ADHD groups were compared.

Results

In the ADHD group, 16 out of 48 (33.3%) were mixed handed compared to 7 out of 48 (14.6%) in the non-ADHD group. Chi square value was 4.631, which was more than the table value of 3.841 at .05 level of significance. The results showed that there was a significant association between mixed handedness and ADHD. For eye dominance, both groups had a 31.3% incidence of mixed eyedness. For hand-eye dominance, 12 out of 48 (25%) had cross dominance for the ADHD group, compared to 11 out of 48 (22.9%) for the non-ADHD group. The difference was not significant.

Conclusions/Discussion

Mixed eyedness and hand-eye cross dominance did not prove to be associated with ADHD. On the other hand, mixed handedness was found to be significantly higher in ADHD. The results suggest that mixed handedness can potentially be used as a clinical marker of increased ADHD risk, especially because hand preference can be easily ascertained at no cost. This is valuable because if children with increased ADHD risk can be identified at an early age, intervention can be instituted promptly.

Summary Statement

This project is about determining if there is a higher incidence of mixed handedness, mixed eyedness, and hand-eye cross dominance in children with ADHD.

Help Received

Dr. Lilith Idea, Pediatrician, administered the questionnaires and noted hand and eye preference of the participants.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Zoe R. Fairlie

Project Number
S1209

Project Title
Mountain Lions and Pumas and Cougars, Oh My: Are They Really as Dangerous as You Think?

Abstract

Objectives/Goals
Mountain lions are being spotted all over Santa Cruz, even downtown. Mountain lions are powerful and dangerous animals with the ability to harm people. The purpose of this project is to research all previous mountain lion attacks, fatal and non-fatal, to determine if there any correlations or relations between them. I focused on patterns in victim characteristics, mountain lion characteristics, and environmental characteristics. Whenever an attack occurs people speculate why it occurred, but they don't look at previous attacks. I looked at all mountain lion attacks together to see if there were any connections between them.

Methods/Materials
I did not conduct a traditional experiment or build something for this experiment because mountain lions are too dangerous. Instead, I collected data from several different sources. The most important source of data was from California Department of Fish and Wildlife, which provided information on every verified attack on a human occurring in California in the past 30 years. I gathered extensive information on each of these attacks from online searches through web pages and news articles. I categorized information by three factors: i) victim characteristics, ii) mountain lion characteristics, and iii) environmental characteristics. I also created several maps to help analyze data, along with tables.

Results
I found that most mountain lion attacks happened upon smaller sized people. But unlike most people would think, the victims were not always alone or in small groups. Some victims were with up to 10 other people. They also were mostly hikers but some were bikers. In months previous to the attacks, there was a lack of rainfall, and the areas were in drought conditions. There were no patterns in season the attack occurred in, or in geographical location.

Conclusions/Discussion
Some of my hypotheses from my experiment were correct and some were incorrect. The advice of being tall around a mountain lion appears to be correct. I learned that most victims were small. If drought conditions in California continue then there may be more frequent mountain lion attacks. When there is a lack of food mountain lions are stressed and they may attack humans. Drought conditions could make this worse. In most attacks surprisingly the victim wasn#t alone, but in the fatal attacks the victim was alone. It is important to have someone accompany you when in mountain lion areas.

Summary Statement
My experiment is about previous mountain lion attacks and how they relate to each other.

Help Received
My dad helped get data on distribution of person heights.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Alejandro G. Gonzalez

Project Number
S1210

Project Title
Finding a Correlation between Public School Lunch Meal Cost and Public School Physical Fitness Test in the State of CA

Abstract

Objectives/Goals
This experiment will determine if there is a correlation between public school lunch meal costs and the public school physical fitness test in the state of California.

Methods/Materials
After using a linear regression t-test to prove that there is a correlation I will then use the correlation formula to show a positive linear relationship between the two. If this relationship is seen, it will show schools with a lower lunch cost will have low percentage of students in the healthy fitness zone while schools with a higher lunch cost will have a higher percent rate of students in the healthy fitness zone. Data for county lunch costs and county fitness test results will be gathered from the California Department of Education website.

Results
The data supported my hypothesis. The linear-regression t-test showed that there is a positive linear relationship between the data. These results show that there is a correlation.

Conclusions/Discussion
Because my data comes from a census from all California counties and n is sufficiently large (satisfying the Central Limit Theorem), I was able to perform the t-test. I used my TI-84 calculator for the linear regression t-test. Based on the results from the linear regression t-test, I am able to reject the null hypothesis at the 5% level and even at the 1% level, therefore I accept the alternative hypothesis. This shows that there is a positive linear relationship between California county lunch prices and the percent of students in the Healthy Fitness Zone for that county. Based on the r2 value of 0.282, even with the alternative hypothesis accepted, the relationship is moderately weak with an r value of 0.53 and the linear regression line ($y = 66.031 + 3.779x$) only being 28.2% accurate. Because the data seems to be normally distributed along the residual plot, I can assume that the linear regression line is a good predictor for percent of students in the Healthy Fitness Zone based on a counties lunch price even with an r2 value of 0.282. With this statistical analysis I can conclude that there is a moderately weak linear relationship between county lunch cost and the percent of students in the healthy fitness zone. In addition the linear regression line can be used as a good predictor for the data.

Summary Statement
To find a correlation between public school lunch meal cost and public school physical fitness test in the state of California.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

JonMichael Harmon

Project Number

S1211

Project Title

Safe Free Diving: Tachypnea without Hypocapnia

Abstract

Objectives/Goals

Hyperventilation before free diving allows the diver to hold their breath longer, but also increases the risk of shallow water blackout and drowning. The urge to come to the surface for a breath does NOT come from a lack of oxygen, but instead from the build up of CO2 in the blood. Hyperventilation before diving causes a dramatic drop in blood CO2 levels, and this suppresses the bodies natural trigger to take a breath. Hyperventilation is dangerous when free diving because if your CO2 level is very low when you start the dive you may dive long enough to have your blood O2 level drop down to the blackout range before your CO2 has built up high enough to give you a strong desire to go to the surface to take a breath. My project was to determine if there is a safe number of deep breathes that can be taken before free diving that allows the diver to hold their breath longer but does not put the diver at risk of shallow water black out. My hypothesis is that there is a number of deep breaths that can be taken before breath holding, that is both safe and effective.

Methods/Materials

Methods: The experiment is done under the direct supervision of a physician. Attach a pulse oximeter to the test subject's finger. Tell the test subject to start the stopwatch when they start to hold their breath, and to stop the stopwatch when they experience the first sensation to take a breath and not the maximum breath holding time. Tell the test subject to hold their breath without any preceding deep breaths. Record the blood oxygen level in SpO2% at the beginning and the end of the breath holding. Record the breath holding time in seconds. Allow the test subject to rest for 5 minutes. Repeat the procedure with the test subject now taking 1, 2, 3, 4, and 5 deep breaths before breath holding. Record results. Measure Blood CO2 levels after taking up to 5 deep breaths.

Results

There was a very large increase in the breath holding time going from no deep breaths to 1 deep breath taken before breath holding. Each additional breath taken resulted in a progressively smaller benefit. The data showed that with up to 4 deep breaths the CO2 never dropped below the normal range.

Conclusions/Discussion

With two deep breaths taken before breath holding, the breath holding time increased by nearly 400%, and the blood CO2 remained in the normal range. Taking two deep breaths is both safe and effective. The data supports my hypothesis.

Summary Statement

My experiment is to see if there is a safe number of deep breaths that can be taken before free diving that allows the diver to hold their breath longer without an increased risk of shallow water blackout.

Help Received

Dr. Gerdes, Dr. Yandell, and Dr. Sageman approved my experiment and answered questions; Dr. Sageman also hooked me up to the capnography; Leslie Sweeny RN gave me the SpO2 meter for my experiment; Michael Harmon, MD supervised during the experiment and was one of my test subjects.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Austin Hartman; Ed van Bruggen

Project Number

S1212

Project Title

Pupillometry Made Easy: Measuring How Hard You Think

Abstract

Objectives/Goals

Everyone knows that your eye constricts and dilates when exposed to different light levels. However almost 100 years ago scientists observed that other things can cause your pupils to change size, such as non-visual stimulation, mental load, or increased attention (eg, thinking about a multiplication problem). This technique can be used to diagnose diseases of the brain. In the past, however, this is done with complex and expensive equipment. The purpose of our project is to engineer a cheap but effective way to measure the size of a person's pupil in response to attention effort.

Methods/Materials

To capture the eye#s response to a mental load we used a Logitech webcam disassembled and mounted to a plastic glasses frame and took a series of pictures of the eye while the subject was completing a multiplication problem (eg, 23 x 13). The dilation of the pupil is miniscule during a mental task compared to one based from light, so we had to write an image analysis algorithm to that allowed us to accurately quantify the size of pupillary response.

Results

To test our experimental setup and image analysis program we measured the size of a user's pupil while a bright light was shone in their eyes. We observed the pupil quickly and dramatically constricted, which could be quantified with our program. Having established that our system was working we repeated the experiment with a mental task instead of a light source. We were able to detect a small but significant pupillary dilation associated with our test subject performing mental effort. When presented with a memorized multiplication problem the test subject#s pupils did not dilate.

Conclusions/Discussion

We were successfully able to create a pair of glasses to measure the size of the users pupil when they are under a heavy mental load, such as a difficult multiplication problem. With this cheap and accessible system anyone can perform a cognitive test at home to could be used for monitoring diseases of the brain such as Alzheimer's or ADHD.

Summary Statement

We engineered an inexpensive device to measure pupil dilation that, when combined with our image analyzing algorithm, was able to show pupillary responses to complex cognitive tasks, such as advanced multiplication.

Help Received

Parents proof read abstract and poster

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Jessica H. Hui

Project Number

S1213

Project Title

Do Lifespan Extending Drugs Reduce Mitochondrial DNA Mutations and Slow Muscle Aging?

Abstract

Objectives/Goals

Aging is a concern of our society as is the loss of muscle function in late life. Mutations of mitochondrial DNA (mtDNA) have been implicated in age-related muscle weakness. We hypothesized that rapamycin, a drug which increases mouse lifespan, might do so by reducing mtDNA mutations in mouse skeletal muscle.

Methods/Materials

We are using two approaches to measure mtDNA mutations in 22-month-old mouse skeletal muscles: 1) histological analyses for a loss of cytochrome c oxidase (cytOX) activity and 2) digital PCR analyses of mtDNA. We stained ten 10-micron thick muscle sections from 32 individual mice for cytOX activity. The number, length and cross sectional area of the abnormal fibers was measured in each section. MtDNA mutation analyses by digital PCR of the muscle samples are ongoing.

Results

We found 66 cytOX negative (cytOX-) muscle fibers from a total of 96,000 fibers examined, with an average of 2.13 affected fibers/mouse. When normalized to the volume of tissue examined, we found 0.0925 ± 0.012 cytOX- fibers in the control female mice versus 0.013 ± 0.010 cytOX- fibers in the rapamycin treated females. In performing a two-sample t-test, we found that the treated female mice contained fewer cytOX- fibers/tissue than female control mice at a p-level < 0.0001. We also found that six out of the eight rapamycin-treated females contained zero cytOX- fibers, while all eight female controls contained some cytOX- fibers. Males, however, demonstrated no difference between treated and non-treated male mice and even perhaps indicated a trend of increasing cytOX- fibers in rapamycin-treated males. In addition, we found that neither males nor females showed a statistically significant difference in cytOX- fiber region length between the male control and rapamycin-treated mice. From these same tissue samples, we are isolating DNA to perform digital PCR mutation analysis to measure the mtDNA deletion mutation frequency.

Conclusions/Discussion

Rapamycin reduces cytOX- fibers, but only in female mice and may even increase cytOX- fibers in males. Despite reducing the number of cytOX- fibers in female mice, rapamycin did not slow the growth of cytOX- fibers, suggesting that mutant mitochondria may be able to escape recycling. Lastly, we concluded that drugs used to treat age-related diseases and extend lifespan likely have sex-specific effects. DNA isolation for the digital PCR analyses is underway.

Summary Statement

By examining the effects of a known lifespan-extending drug, we found that reducing mitochondrial DNA mutations may be a source of slowing down muscle aging in mice.

Help Received

I would like to thank Dr. Wanagat for his mentorship and supervision in working in his lab at UCLA.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Adithi R. Iyer

Project Number

S1214

Project Title

The Role Model Effect: Optimizing Blood Macrophage Signal Transduction in a Novel Treatment Method for Leukemia

Abstract

Objectives/Goals

Leukemia is notoriously difficult to detect and to treat. The current leading treatments, radiation and chemotherapy, are either indiscriminate in inducing general cell death or only effective over short periods of time. The Role Model Effect seeks to explore a venue for treatment that primes the macrophage-mediated immune response to act against leukemic cells while selecting for healthy cells by increasing macrophage density to facilitate apoptotic signal amplification.

Methods/Materials

Pro-B leukocytes of five different genetic markers, (WT, MIG IRES, P210, JAK2VF, JAK2VI) were cocultured with macrophage "role models" plated at high densities over 72 hours. Every 24 hours, the B cells were counted using flow cytometry. After the assay was completed, the macrophages were stained for Annexin V-PE to indicate apoptosis. In a secondary assay, the apoptotic rates of cocultured MIG cells were compared with those in MIG treated with UV-A radiation, chemotherapeutic drug thapsigargin, and untreated cells 24 hours following treatment.

Results

In all cell groups, growth slopes either reversed or plateaued after treatment by factors of 60X or higher while wild type cells thrived in treated environments. Treated VF cells had a 95.86% apoptosis upwards of 46.38% from the untreated strain; P210 increased 46.28% to 95.38%, and WT cells increased 9% to 89.89%. P210 and VF had the highest percent differences of around 46.28%.The MIG cells increased by 33.16% to 94.56% and VI increased by 27.49% to 95.47%. In the Case Study, thapsigargin showed 26.25% apoptosis and UV-A had 69.09%. The macrophage-treated MIG cells had 94.56% apoptosis.

Conclusions/Discussion

The results of this assay support the individual hypotheses of the Role Model Effect. The first hypothesis was that cellular #role models# would be able to have an impact in reversing proliferation characteristic of cancers. This was supported by the growth curves, in which the growth rates in untreated cells were considerably reversed in treated cells. The second was that these role models would push cancerous cells towards apoptosis through cell signaling. This was supported by increased apoptotic percentages across all groups which surpassed those of cells treated with simulated radiation and chemotherapy and was especially prominent in tyrosine-kinase stimulant mutations. This research paves the way for noninvasive macrophage transfusion in treating leukemia.

Summary Statement

The Role Model Effect presents a novel approach to leukemia treatment by amplifying cell signals in the macrophage-governed immune response to prime the immune system against leukemia and simultaneously select for healthy cells.

Help Received

Lab facilities and materials/procedures completed at UCI under supervision of Dr. Fleischman; Sarah Morse approved project parameters as they were drafted.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Neda Izadyar

Project Number
S1215

Project Title
Adipose Stem Cell Differentiation to Chondrocytes When Exposed to Various Conditions

Abstract

Objectives/Goals
The purpose of this experiment was to find out how adipose differentiation to chondrocytes is affected when the adipose stem cells (ASCs) are exposed to various conditions. It is hypothesized that the ASCs will prefer a three dimensional matrix (calcium alginate) and the scattered technique of plating for differentiation to chondrocytes.

Methods/Materials
The ASCs were plated on 96-well plates in four different conditions [scattered/gelatin (S-G), centered/gelatin (C-G), scattered/calcium alginate (S-CA), or centered/calcium alginate (C-CA)] for 16 days. At day 4, 8, 12 and 16, one plate was stained with Alcian Blue and Periodic Acid Schiff (PAS). Alcian blue was released to the media with Guanidine Hydrochloride and the absorbance was then measured at 620 nm using a colorimetric plate reader. PAS was released to the PBS media and was measured at a 550 nm wave length.

Results
The data revealed that the calcium alginate matrix absorbed approximately 20 times more Alcian Blue stain than the gelatin ($P<0.001$). Progression of chondrogenesis during the experiment showed that the two gelatin conditions absorbed very little Alcian blue as compared to the calcium alginate conditions. The absorbance values of both calcium alginate conditions increased progressively until day 12. Overall, the scattered/calcium alginate condition had the highest absorbance rate from day 8 to day 16. Similar to Alcian Blue, the cells cultured in calcium alginate absorbed approximately 4 times more PAS stain than the gelatin ($P<0.05$).

Conclusions/Discussion
Overall, the data showed that the scattered/calcium alginate condition was the most successful method for chondrocyte differentiation. The three dimensional structure of the calcium alginate beads may have provided a more natural environment for the adipose stem cells to develop and differentiate into chondrocytes. Also, more space in the scattered beads could provide the environment for the cells to be in the vicinity of each other but yet have enough room to expand. This finding could have implications for increasing the production rate of chondrocytes. Having more chondrocytes in a shorter period of time could potentially offer a higher chance of a successful cartilage transplant for patients suffering with cartilage damage.

Summary Statement
The purpose of this experiment was to find out how adipose differentiation to chondrocytes is affected when the adipose stem cells (ASCs) are exposed to various conditions.

Help Received
Used laboratory and lab equipment at PrimeGen Biotech under the supervision of Tracy Wang.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Holly M. Jackson

Project Number
S1216

Project Title
Computational Cardiology: An Automated Algorithm for Heart Murmur Detection

Abstract

Objectives/Goals
My eleven-year-old sister, Kate, was born with a heart condition which causes her to have a heart murmur. Kate's pediatrician first diagnosed her by carefully listening to her murmur several times. Even though Kate's pediatrician is a well-trained professional, diagnosing heart murmurs by ear is subject to human error. Most general practitioners aren't able to determine the specific murmur type. Even cardiologists determine the specific murmur type with only 25% accuracy by ear alone. I wondered if an algorithm could be created that could accurately detect the presence and type of a patient's heart murmur and improve the ease and reliability of murmur identification. My objective was to accurately detect and categorize common heart murmurs by employing signal processing methods, such as filtering, convolution, scaling, and thresh-holding.

Methods/Materials
I implemented and verified my algorithm in FreeMat, a free environment for engineering and scientific prototyping and data processing. I tested the algorithm against seventy-one, pre-recorded heart sounds from anonymous sources publically available on the web. These represented fourteen out of the twenty possible heart murmur types. After months of coding and debugging, I finally created a program that identified and categorized heart murmurs by their timing and shape, two aspects of heart murmurs.

Results
My algorithm differentiated between heart murmurs and normal heartbeats with zero false positives and only 5% false negatives. Identification rates for the timing and shape of systolic murmurs and the timing and shape of diastolic murmurs were both approximately 70%. Identification of timing for systolic murmurs was approximately 78% accurate, as was the identification of shape for systolic murmurs. In comparison, identification of timing for diastolic murmurs and shape for diastolic murmurs were both approximately 73%. The overall success rate of my algorithm at diagnosing the exact murmur from among the fourteen types in my sample data was 54%, double the accuracy of a trained cardiologist identifying heart murmurs by ear.

Conclusions/Discussion
My hypothesis was that I would be able to accurately detect and categorize common heart murmurs. I was able to accurately distinguish heart murmurs from normal heartbeats and categorize them with twice the accuracy of trained cardiologists. I believe my hypothesis was supported by my data.

Summary Statement
I created an algorithm that could accurately detect and categorize common heart murmurs from pre-recorded heart sounds by employing signal processing methods, such as filtering, convolution, scaling, and thresh-holding.

Help Received
My father, Deron Jackson, explained to me some of the more difficult concepts in FreeMat. My teacher, Victoria Evashenk, reviewed my technical paper and recommended that I find experimental studies on related devices.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Russell F. Lee

Project Number

S1217

Project Title

The Effects of Eyeglass Temple Width on Vertical and Lateral Peripheral Vision

Abstract

Objectives/Goals

The goal of this experiment was to determine the effects of eyeglass temple (joint part connecting eyeglass arm and supporting frame) width on vertical and lateral peripheral vision.

Methods/Materials

For this experiment, a 1.5 meter in diameter geodesic dome was constructed. In addition a transilluminator (light source) as well as 4 different pairs of glasses of varying temple widths were required. Eyeglass temple width values were 0.25cm, 0.5cm, 0.75cm, and 1.0cm. Subjects of varying ages and sexes were necessary.

Results

When tested with no glasses, subjects measured at approximately 93 degrees. Using glasses #2 (1.0cm thick), subjects measured at approximately 80 degrees (0.75cm thick). Using glasses #3 (0.50cm thick), subjects measured at approximately 85 degrees. Using glasses #4, subjects measured at approximately 81 degrees. Using glasses #5 (0.25cm thick), subjects measured at approximately 83 degrees.

Conclusions/Discussion

Results showed that when no glasses are used subjects maintain the greatest amount of peripheral vision (93 degrees). As temple width on the eyeglasses increased (0.25cm, 0.50cm, 0.75cm, 1.00cm), the overall amount of peripheral vision decreased. While it is true that eyeglass temple width affected subject#s peripheral vision, deviation from the original mean (no glasses) was not very large- meaning that eyeglass temple width does not severely hinder performance.

Summary Statement

This project was developed to determine the effects of eyeglass temple width on vertical and lateral peripheral vision.

Help Received

Mr. Antrim provided research help and project improvements; Parents supported construction of geodesic dome and project improvements; Judges of Intel ISEF provided useful insight on project improvements.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Vick C. Liu

Project Number

S1218

Project Title

A Handheld Hematology Analyzer Using Acoustic Enhanced Blood Smear Devices

Abstract

Objectives/Goals

The goal of this project is to develop an inexpensive handheld hematology analyzer that can concentrate and separate white blood cells (WBCs) from red blood cells (RBC), and capture cell images using a smartphone based microscope, followed by automatic cell morphology recognition and cell counting using cell image analysis software.

Methods/Materials

The microfluidic device, designed based on microvortex technology, was fabricated using soft lithography and consisted of pockets that were used to store air bubbles to generate microvortex force, which concentrated and separated WBCs from RBCs around the air bubbles in the microchannel. The iPhone based microscope was built using Legos, a set of lenses, and an LED light source. The image analysis program was developed using two image editing software: ImageJ and CellProfiler. Human blood samples were tested using this handheld analyzer.

Results

Experiments revealed that the acoustic enhanced microchannel devices successfully concentrated and separated WBCs from RBCs using microvortex technology. The rectangular lateral cavities is more effective for cell concentration and separation than the circular cavities. The device achieved highly efficient blood cell separation (89% rate) similar to that of conventional centrifugation. Two inexpensive iPhone based microscopes were built with different magnification: 30x and 100x. These handheld microscopes possessed a comparable image quality of a conventional microscope. For automatic cell image analysis, both CellProfiler and ImageJ were evaluated. CellProfiler proved to be more accurate in cell counts than ImageJ.

Conclusions/Discussion

An integrated handheld hematology analyzer has been successfully demonstrated. This analyzer consists of: 1) an acoustic enhance blood smear microfluidic device that was used to concentrate and separate WBCs from RBCs; 2) an iPhone based handheld microscope (both 30x and 100x). In addition, automatic cell image processing methods were developed for cell counting. This handheld analyzer is simple and low-cost and has a potential to change how blood tests are performed and save tens of thousands of lives in developing countries.

Summary Statement

I have successfully turned a smartphone into an inexpensive handheld hematology analyzer, which consists of an acoustic enhanced blood smear, an iPhone-based microscope, and software to perform automatic blood cell counting and recognition.

Help Received

Used lab Equipment at UC-Irvine under the supervision of Prof. Abe Lee.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Nitya Mehrotra-Venkat

Project Number

S1219

Project Title

The Effect of Herbal Remedies on Alleviating Hyperglycemia in Type 2 Diabetes

Abstract

Objectives/Goals

The foremost goal of this study was to help diabetics keep low glucose levels without any pharmaceutical products.

Methods/Materials

This approach explores the use Bitter melon (Momordica charantia), Fenugreek (Trigonella foenum graecum), Neem (Azadirachta indica), Okra (Abelmoschus Esculentus), and Turmeric (Curcuma Longa), which are commonly used alternative remedies. Different forms of these herbal remedies were explored (pills, gels, roots) to assess their efficacy. Solutions of the above elements were created, the enzyme invertase was used to accelerate the hydrolysis and the resultant glucose levels measured using glucose reagent strips and Benedict#s reagent for accuracy. For the assurance of the accuracy of results, the reagent strips and invertase were calibrated; multiple in vitro measurements were conducted in a laboratory setting. In vivo testing was also done with two willing subjects, one diabetic and one non-diabetic. The diabetic patient still took their medicines so that they would not be negatively impacted from the study. Interviews (in-person and crowd sourced) with diabetics were done to gauge the acceptance and magnitude of use of the herbal remedies.

Results

The natural remedies that worked best among those tested were T. Foenum Graecum gel, T. Foenum Graecum powder, C. Longa tablet and C. Longa root # human and animal testing conducted in other research indicates that the high levels of fiber in such remedies slows glucose absorption during metabolism, resulting in better blood sugar control. From the interviews and crowdsourcing surveys, it was discovered many took or were willing to try herbal remedies, especially if they experienced side effects with medicines. In reference to the in vivo study, it was found that the glucose levels of the diabetic patient reduced while the glucose levels of the non-diabetic stayed the same.

Conclusions/Discussion

The major finding of the study was that herbal remedies do indeed lower the glucose levels with T. Foenum Graecum powder, T. Foenum Graecum gel, C. Longa root and the C. Longa powder being the most effective. The experiments indicated a correlation between the effectiveness of the herbal remedy and the amount of fiber in the remedy. Non-diabetics were unaffected by the natural remedies, indicating that they do not lead to hypoglycemia and may be a good solution for pre-diabetics.

Summary Statement

My project evaluates the effectiveness of herbal remedies as a way to help Type 2 Diabetics lower their blood glucose.

Help Received

Received advice on methodology and information of the physiological aspects of diabetes from Dr. Ram K. Sindhu; Used lab equipment at UCI under the supervision of Dr. Andy Borovik and Mr. Sam Mann; Dr. Nalini Venkatasubramanian and Dr. Sharad Mehrotra taught me about different crowdsourcing

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Lillian R. Mitchell

Project Number
S1220

Project Title
Caffeine and Athletics

Abstract

Objectives/Goals
The goal of my project was to test how caffeine effected athletic performance in strength, speed or hand-eye coordination and if the placebo effect appeared to have any hand in this. (The placebo effect was not used in the original project due to constraints on time/subject availability, but it will be tested in the re-making of the project before the State Science Fair.)

Methods/Materials
Method:
Pre-Experiment:
1. Recruit test subjects.
2. Use measuring tape to mark off a length of 25 yards (75 feet), place a marker every 5 yards. This will be used in the 50 yard dash for the speed test and for the test of strength.

Experiment:
1. Have test subject run 50 yard dash, using a stopwatch and notebook to record their time.
2. Have test subject throw a small tennis ball three times, record the average distance thrown in notebook.
3. Have test subject throw a tennis ball against a wall or other similar flat, upright surface with one hand and catch it with the other. Record the number of times they were able to do this in 30 seconds. Record score in notebook.
4. Have the subject drink 100mg of caffeine. (The subject will not be told if this drink is caffeinated or not)
5. Wait 45 minutes and repeat steps 1 - 3.
6. Have test subject come back the next day and give them an equal serving of decaf coffee. (The subject will not be told if this drink is caffeinated or not)
7. Repeat steps 1 - 3.
8. Repeat this procedure with the remaining test subjects.

Results
The results of my original project indicated that caffeine had little to no effect on athletic performance, and in one case, had a negative effect.

Conclusions/Discussion
In my original project my results strongly supported my hypothesis, which was that caffeine would have almost no effect on the athletic performance of my subjects.

Summary Statement
My project tested the effects of caffeine (and the placebo effect) on athletic performance.

Help Received
Friends and acquaintances agreed to act as my test subjects.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Ken K. Noh

Project Number

S1221

Project Title

Evaluating Innate Immune Response in Allergic Patients Using Temperature Controlled Basophil Activation Testing

Abstract

Objectives/Goals

This study aimed to understand the effect of temperature on basophilic activation, as well as the effect of environmental factors during an allergic reaction.

Methods/Materials

In order to assess the severity of an allergic reaction, the developed Basophil Activation Test Assay (BAT Assay) was implemented. Whole blood taken from peanut-allergic patients was incubated with RPMI (negative control, growth hormone), anti-IgE (positive control), and peanut extract. After incubation, degranulation is stopped and cells are stained with fluorescent antibodies. On basophils, CD63 and CD203c are surface proteins which only become expressed during activation/degranulation. Thus by using CD203c-PE and CD63-APC, we tag the activated basophils which can later be recognized and isolated by flow cytometry. Using the flow cytometer, the cell poplulation from the whole blood sample is narrowed down to only basophils. In this isolated population, the percentage of activated basophils indicates the severity of the reaction. By completing multiple BAT Assays at room temperature, 37, 38.6, and 42 degrees Celsius, the trend of reactivity over temperature can be accurately assessed.

Results

Looking at the averages of the compiled data, the negative control as well as the positive control at higher temperatures resulted in less activation. Meanwhile, the peanut extract prompted a stronger allergic response at higher temperatures. The samples completed at room temperature and 42˚C varied too much to determine the trends.

Conclusions/Discussion

Because the peanut extract samples were more reactive at higher temperatures, unlike the anti-IgE samples, this suggests that peanut allergies may be non-IgE mediated at these higher temperatures. These results are imply that allergic pathways may be triggered differently due to blood temperature. Through this, more effective methods of treatment can target certain pathways at certain temperatures.

The hypothesis was partially supported; peanut extract was indeed more reactive at a higher temperature, whereas the anti-IgE and RPMI samples were not.

Summary Statement

Basophil Activation Tests were run at different temperatures to simulate changes in blood temperature during allergic reactions in order to assess the effect on the IgE mediated pathway.

Help Received

Used lab equipment at Stanford University under the supervision of Dr. Nadeau

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Jason S. Provol

Project Number

S1222

Project Title

Analysis of White Matter Hyperintensities on Brain Magnetic Resonance Imaging to Predict Walking / Gait Abnormalities

Abstract

Objectives/Goals

The purpose of this study is to examine measurements of White Matter Hyperintensities (WMH) and Cortical Atrophy derived from computer analysis of patient MRI#s, to be used for diagnosis in patients with Gait Abnormalities.

Methods/Materials

MRIs were collected for 29 patients; 15 of these patients exhibited an irregular gait and 14 were healthy volunteers (controls). These MRI scans were post-processed using software called FreeSurfer to provide quantitative measurements for regions of the brain. Gait Abnormal patients were tested using standardized testing protocols including MOCA, TUG, and Timed 25# Walking Tests. WMH were measured using MATLAB at the UCSD laboratory.

Results

To compare subjects, the W+G was divided by the intracranial volume to normalize the amount of atrophy for each subject. The results were then compared across subjects.

Pertinent results include:

1. As WMH increased, the volume of the left hemisphere of the brain tended to decrease. For each 1% change in WMH, an average of a 0.3% decrease in left hemisphere volume was observed.
2. Patients with Gait Abnormalities exhibited lower relative brain volumes. Patients with gait abnormalities exhibited about 14% greater cortical atrophy than healthy patients. The average cortical atrophy for healthy patient is about 0.35. vs. 0.4 for a gait abnormal patient.
3. The average Healthy Patient showed a much higher MOCA score than the average Gait Abnormal Patient. The average healthy patient MOCA score is 28.3 for a healthy patient and 25 for a gait abnormal patient.

Conclusions/Discussion

Pertinent conclusions include:

1. Using FreeSurfer and MATLAB, occurrences of White Matter Hyperintensities and Cortical Atrophy can be more accurately identified and measured
2. Measurements of White Matter Hyperintensity and Cortical Atrophy employed in this study show promise as a diagnostic tool for Gait Abnormality Disorders
3. Recommendations for further study

a. A larger sample group

b. Examine other cortical regions for further correlation

Summary Statement

This study provides initial confirmation of the viability of WMH and Cortical Atrophy measurements as tools to assist in the diagnosis of Gait Abnormalities.

Help Received

Dr. Fatta Nahab # Neuroscience Research Professor at the University of San Diego, California, for providing consultation and guidance throughout the entire project Dr. Shen Qian # Biomedical engineer at the University of San Diego, California, for providing consultation and guidance on data analysis, data

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Pravin Ravishanker

Project Number

S1223

Project Title

ALZCan: Predicting Future Onset of Alzheimer's Using Gender, Genetics, Cognitive Tests, CSF Biomarkers, and Neuroimaging

Abstract

Objectives/Goals

Since no preventive methods or precise diagnostic tests exist for Alzheimer's disease, I hypothesized that one can create an accurate diagnostic/ prognostic software tool for early detection of Alzheimer's using resting-state functional MRI brain imaging (multi-voxel pattern analyses), genetic single nucleotide polymorphism data, cerebrospinal fluid (CSF) concentrations, demographic information, and psychometric tests.

Methods/Materials

Using "open-source R project" and data from the Alzheimer's Disease Neuroimaging Initiative (ADNI), an ongoing, longitudinal, global effort tracking clinical/imaging AD biomarkers, I examined 678 4D NIfTI fMRI scans and 56847 observations of 1722 individuals across three cohorts (Healthy-Controls (HC), Mild-Cognitive-Impairment (MCI), Alzheimer's (AD)). Independent Component Analysis on fMRI scans yielded graph structures of connectivity between different brain networks.

For diagnosis: 4 Support Vector Machines and 6 Gradient Boosting Machines were trained 10 times each for fMRI, genetic, CSF biomarker, and cognitive data.

For prognosis: 3 linear regression models predicted cognitive scores 6 to 60 months into the future. Forecasted cognitive scores and demographic information were used for prognosis.

Results

ALZCan had an overall 81.82% diagnostic accuracy, with high specificity for diagnosing AD and HC groups (91.7% and 81.6%) and high precision for MCI (83.3%).

With 97.5% CI, prognostic accuracy 6, 12, and 18 months in future was 75.4%, 68.6%, and 55.6% respectively. MCI prognostic accuracy was above 97%, and specificity for AD and HC was above 99%. AD patients showed significantly lower transitivity and average path length between functional brain networks. Cognitive tests (ADAS-Cog) and biomarkers like beta amyloid exerted high influence on predictive accuracy. I confirmed my previous year's findings that gender has a higher relative influence than genetic risk factors on AD diagnosis.

Conclusions/Discussion

This study engineered a novel neuroimaging feature selection method by using machine learning and graph-theoretic functional network connectivity properties for diagnosis / prognosis of disease states. I examined relative influence and predictive power of multiple biomarkers in Alzheimer's. This analytical tool elucidates Alzheimer's underlying pathology and known etiology and is capable of predicting the future onset of the disease with significant accuracy.

Summary Statement

By analyzing cognitive scores, functional connectivity in resting state fMRI, cerebrospinal fluid biomarkers, genetic data, and demographic information, I built a novel analytical tool for accurate diagnosis/ prognosis of Alzheimer's.

Help Received

My family, my teachers, and Mr. Wong for encouragement, my mom Shanthi Pichai for mentoring, Dr. Ariana Anderson (UCLA School of Medicine) for guidance on functional network connectivity based classification, and ADNI and its investigators for valuable data.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Alberto Ruiz

Project Number
S1224

Project Title
Tracking Ancient Ancestry though DNA

Abstract

Objectives/Goals
The objective is to reveal through DNA that our human spices arose over 100,000 years ago in Africa from a single founding population and that every single human being can trace their ancestry back to this founding population showing that all humans are share a unique genetic relationship to each other.

Methods/Materials
Informed consent was received by 25 students and their parents to participate in having their Mitochondrial DNA extracted from their cheek cells using a saline solution. The DNA was amplified using Polymerase Chain Reaction. Gel electrophoresis was done to see how much amplified DNA I received and sent the samples off to the lab to be sequenced. The results were posted online. I looked for Single nucleotide polymorphisms (SNP). SNPs are identifiable with a haplogroup. When each haplogroup was found, the SNP, age of the group, area it arose, and from what haplogroup it descended form was documented.

Results
46% are members of haplogroup D, 24% were in haplogroup H, 8% were in haplogroup B, and the rest were unique and spread evenly by 4% among haplogroups A, B, C, L, M, N, T, U, and X. The results I obtained displayed that the haplogroups are descendants of one another and can be traced back to one founding population. Individuals in haplogroups D, X, U, L, and A are all descendants of haplogroup M. Haplogroup M is a descendent of haplogroup L, the founding population.

Conclusions/Discussion
Due to the fact that haplogroups are descendants from one another a pattern of decendence is created leading to the founding human population. Wall share a genetic relationship to each other. We are all members of the human species regardless of the physical differences. Race is simply a way of classifying all the diversity of our species. We are all one diverse, big family.

Summary Statement
My project is about how DNA contains the answers to our human ancestry and how we are all related to one another.

Help Received
Used lab equitment at Mount Diablo High School under the supervison of my biotechnology teacher Colin Jones. Professor John Riggs of UC Davis consulted with me about futher steps I could take to help advance my project. My dad helped me construc my boar. I used sciencebuddies.com to help me answer

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Nicholas A. Saavedra

Project Number

S1225

Project Title

Effect of Sports Stimulants on Reaction Time

Abstract

Objectives/Goals

The objective of my project was to measure and compare the effectiveness of four key components of energy drinks, advertised to increase performance, at improving reaction time in humans.

Methods/Materials

Supplements of 100mg caffeine, 1000mg taurine, 1000mg vitamin B12, and 500mg vitamin C were administered separately over a period of time to consenting participants aged 15-18. Their reaction time was then electronically measured 10 times per supplement and percent change calculated from their performance without the supplements.

Results

After performing the experiment there was a noticeable improvement in reaction time after taking both caffeine and taurine, with caffeine having the largest effect. Across all participants, caffeine improved the mean reaction time by 8%, while taurine improved it by around 7%. Vitamin B12 improved reaction time on average by almost 2%, while vitamin C had a detrimental effect on reaction time by close to 2%.

Conclusions/Discussion

Caffeine had the largest improvement on reaction time on individuals who had not developed a caffeine tolerance. Participants who identified as having a high caffeine intake did not experience a major improvement in reaction time compared to their peers, as the dosage of caffeine was equivalent to or less than what is commercially available in various products. In individuals with caffeine tolerance, taurine led to the largest improvement in reaction time. Future experimentation would compare the effectiveness of caffeine of those with tolerance to those who have not developed the tolerance.

Summary Statement

My project measured and compared the effectiveness of four key components of energy drinks at improving reaction time in humans.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Onkar S. Sandhu

Project Number
S1226

Project Title
Heart Attacks in Young Adults of Central California

Abstract

Objectives/Goals
To investigate the risk factors associated with acute coronary syndrome (heart attack) in young adults in Central California.

Methods/Materials
Patients admitted over a ten-year time period at a regional medical center were included in this case-controlled retrospective study. Using ICD 9 codes, patients admitted with diagnosis of acute coronary syndrome(ACS), STEMI and NSTEMI, were identified. Patients older than 18 years but less than 50 years of age were defined as young ACS patients. Patient 50 years of age or older were defined as old ACS patients. A random sample of 100 patients was selected from each of the four groups. Baseline characteristics including demographic data, comorbid disease diagnose, and laboratory values were collected for patients in each of the four comparison groups (young ACS, old ACS, young non-ACS, and old non-ACS).

Results
Lipid profiles were significantly different in the comparison groups. Young ACS patients had higher mean TG when compared to old ACS patients; (P=0.001). Young ACS patients experienced significantly more metabolic syndrome as defined by TG/HDL ratio greater than 3.5 (P = 0.02). Hypertension was more prevalent in the older ACS patients (71%) followed by older non ACS patients adults (64%) (P=0.001). History of cardiac disease (41%) was more common in older ACS patients as well (P=0.024). Body mass index, race, illicit drug use, and prevalence of diabetes mellitus did not differ significantly between young and old ACS adults or the non ACS groups. On multivariate logistic regression analysis, male sex (OR 2.73, 95% CI 1.38 to 5.39, P=0.001), smoking (OR 2.74, 95% CI 1.47 to 5.09, P=0.005), and metabolic syndrome (OR 2.91, 95% CI 1.52 to 5.5, P=0.006) were independently associated with young patients presenting with ACS.

Conclusions/Discussion
Young adults with ACS in Central California have a different clinical, biochemical, and angiographic profile. Young ACS adults are more likely to be males, smokers, and have propensity for single vessel disease, specifically the left anterior descending artery. Metabolic syndrome is associated with acute coronary syndrome in young adults, and it may be helpful to identify these patients as at risk of premature coronary artery disease. These young adults may require additional risk stratification and control beyond traditional risk factors.

Summary Statement
Risk factors for heart attacks in young adults are uniquely different from traditional risk factors seen in the older population.

Help Received
Research performed under the guidance of Dr.Bipin Joshi at University of California, San Francisco at Fresno.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Therese A. Santiago

Project Number

S1227

Project Title

Detection of Biomarker Ciz1 b variant for Early Detection of Lung Cancer

Abstract

Objectives/Goals

Lung cancer is one of the leading causes of death in the US and worldwide. Despite multimillion-dollar research, the mortality rate continues to remain high. Most patients have delayed diagnosis due to lack of symptoms, which results in poor prognosis of the disease. So far, early diagnosis has been the only factor that improves survival in lung cancer. CT images can detect abnormalities but do not distinguish benign lung nodules from cancer nodules. Therefore, additional research using biomarkers is needed to increase diagnostic accuracy. Ciz1 b variant is a biomarker that has only been detected in one study. The b variant Ciz1 was found to control the function of cancer cell DNA and factors that promote cell growth. Presence of the b variant form of Ciz 1 has been associated with malignant tissue. However, presence of the b-variant Ciz-1 in lung cancer tissue must be validated in order to assess its diagnostic utility. In this study, the goal is to identify the expression of the Ciz1 marker in lung cancer. Non-Small Cell Lung Cancer (NSCLC) is found in approximately 85% of all lung cancers, so this research is focused on NSCLC. It was hypothesized that detection of the Ciz1 biomarker in Lung Cancer may help in early diagnosis and monitoring of lung cancer.

Methods/Materials

Ciz1 b variant expression was examined in surgically removed Stage 1 NSCLC tissue. Tumor section slides were prepared using IRB approved protocol. Immunohistochemical (IHC) staining was used to study Ciz1 expression in tumor cells. Findings were validated using PCR and the Eliza assay.

Results

The data shows that Ciz1 is highly expressed in Stage I NSCLC compared to normal tissue. Identification of Ciz1 in cancer tissue of early stage lung cancer indicates that Ciz1 can be used as a marker for early stage lung cancer.

Conclusions/Discussion

Presence of the Ciz1 b variant has been correlated with malignant tissue. The finding of Ciz1 b in Stage I NSCLC compared to the control tissue suggests that Ciz1 expression in tumor cells can be used to identify cancer. This finding may open an important avenue for Ciz1 as a biomarker for the early detection of lung cancer, which could lead to better prognosis. The Ciz1 marker may have high potential for use as a tumor maker alongside CT screening for early detection of lung cancer. If validated, Ciz1 expression may be used to differentiate benign from malignant lung nodules.

Summary Statement

Our findings of detection of the Ciz1 marker in lung cancer tissue may open an important avenue of using Ciz1 as a biomarker in Stage 1 lung cancer. If validated, Ciz1 expression may be used to differentiate benign lung nodules from malign

Help Received

This study was conducted at the University of California San Francisco (UCSF) Fresno under the supervision of Dr. Upadhyay.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Elliott E. Stenzler

Project Number

S1228

Project Title

Determining the Effect of Video Gaming on Finger Dexterity in Teenagers

Abstract

Objectives/Goals

Finger Dexterity is the skill of performing tasks, especially with your hands. Higher level of finger dexterity can be beneficial in areas such as music performance, dentistry or surgery. The purpose of this study was to determine if teenagers who video game a certain amount of time each week have an improvement in finger dexterity. The study also evaluated if a difference existed between male and female video gamer's and finger dexterity.

Methods/Materials

20 female and 25 male teenage subjects were randomly selected for this study. Subjects were given a questionnaire on the amount of time and frequency of video gaming they engage in each week. The O'Connor Finger Dexterity Test was used to assess the level of each subject's finger dexterity. The object of the test is to see how fast a person can place 3 pins in a hole at one time, until all 100 holes are filled. Subjects were tested who video gamed 0 hours, 3 or less hours, 3-5 hours, 5-7 hours or 7 and more hours per week. The time was recorded for each subject. The O'Connor FDT formula was used to determine the overall time. The O'Connor FDT Norm Chart was used to record the finger dexterity percentile rank.

Results

The results demonstrated a significantly higher finger dexterity percentile rank in teenagers who video gamed 7 or more hours each week (98.82% percentile rank) as compared to teenagers whose weekly video game was 0 hours (26.87%), under 3 hours (45.67%), 3-5 hours (48.23%), and 5-7 hours (90.28%). A difference existed between the scores of female vs male subjects. Males average 22.69% higher than females overall in percentile rank in most video gaming time categories.

Conclusions/Discussion

This study supported my hypothesis that teenagers who video game 7 or more hours each week have better finger dexterity than teenagers who video less than 7 hours per week. Female teenagers scored lower than male teenagers and may have to do with the type of video gaming they are participating in. These results provide important knowledge and support that video gaming may provide a benefit to teenagers. Improved finger dexterity can lead to a higher success rate with certain jobs or activities

Summary Statement

Finger dexterity skills can be enhanced by engaging in video gaming on a weekly basis.

Help Received

Pine Street Physical Therapy for discussing the various finger dexterity tests available & for loaning me the O'Connor FDT. Ms. Tina Lanter-Skokan, for being my teacher adviser.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Aileen F. Wang

Project Number

S1229

Project Title

A Novel Cancer Diagnosis Framework Using Optimal Point Region Growing Segmentation and Pseudo-Zernike Moments

Abstract

Objectives/Goals

Cancer is the second most common cause of death in the US. Early diagnosis is the key to cure cancer and increase the patient's survival rate. The current computer aided diagnosis (CADx) system usually needs several iterations for segmenting the lesion and requires the extraction of many features for classification. It also lacks a common framework. The objective of this project is to design and develop a CADx common framework to simplify the diagnosis process and more efficiently and accurately diagnose cancers in their early stages.

Methods/Materials

The framework consists of automatic segmentation of a lesion using Optimal Point Region Growing Segmentation, reconstruction of the segmented lesion using Pseudo-Zernike moments, and Supported Vector Machine (SVM) classification of the lesion using the single feature, Root Mean Square (RMS) of Pseudo-Zernike moments. This novel CADx framework was implemented using MATLAB and validated on the mammographic images and the dermoscopic images from the Mammographic Image Analysis Society (MIAS) database and the published study examples, respectively.

Results

A comparative study among the various algorithms was performed on the selected mammographic images and dermoscopic images. The results demonstrated that the newly developed framework has over 86% average recognition rate, further improved the accuracy of Tahmasbi#s CADx algorithm by 7.56%, and reduced the False Negative Rate (FNR) and False Positive Rate (FPR) by 7.24% and 3.48%, respectively.

Conclusions/Discussion

This study has developed a novel CADx common framework to simplify the diagnosis process and more efficiently and accurately diagnose breast cancer and melanoma from a mammographic image and dermoscopic image, respectively. It has improved the best benchmark of recognition rate by 8%. The new framework is generic and can be used for diagnosing different types of cancers.

Summary Statement

This study has not only developed a novel CADx framework to more efficiently and accurately diagnose breast cancer and melanoma 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. He also recommended "Digital Image Processing using MATLAB " by Rafael Gonzalez, which helped me to master my MATLAB image processing skills.