CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Mythri Ambatipudi

Project Number

S1201

Project Title

Using Circadian Rhythm Gene SNPs, Sleep-Wake Phenotypes, and MRI Morphometrics to Diagnose Cognitive Impairment Diseases

Abstract

Objectives/Goals

Early detection of Cognitive Impairment Diseases (CID) is challenging. Overlapping symptoms cause misdiagnosis & catastrophic effects. For e.g., Robin Williams's DLB (Dementia with Lewy Bodies) was misdiagnosed as Parkinson's(PD). Mistreating DLB aggravates hallucinations & depression. CID subjects suffer from nocturnal wakefulness & sundowning, symptoms similar to Circadian Rhythm Disorder (CRD). The objective is 1)Investigate if CRD influences CID 2)Use CR gene SNPs, sleep-wake phenotypes(SWP) & MRI morphometrics to differentiate DLB, PD & Alzheimer's(AD) 3)Identify machine learning algorithms (MLA) to predict rare DLB cases.

Methods/Materials

The project was conducted in 5 stages using PPMI/ADNI public databases: 1)Significance thresholds for DLB differentiation were calculated & potential DLB subjects identified 2)Pearson's chi-square test established association ($p<0.05$) between SWP & CID pathology 3)GWAS was conducted in PLINK. Manhattan plots identified SNPs with SWP association. Quality control on SNP data accounted for deviation from Hardy-Weinberg Equilibrium ($p<1e-6$), failed missingness (GENO>0.05) & frequency (MAF<0.01) & low genotyping (MIND>0.1). MDS analysis in R corrected population stratification 4)1.5T T1 MRI images were analyzed in Freesurfer. Chi-square test established SWP association with morphometric changes 5)Features were created with above results & MLA accuracies compared in Matlab/Weka with 34% holdout & 10-fold cross validation.

Results

32 potential DLB cases were identified. SWP association was noted for DLB ($p=8.9e-10$) & PD ($p=1.6e-3$), but not for AD ($p=0.33$). SWP association was noted for SNPs of DLB genes PODN, DDR2, & ATG10; CID gene APOE4 & REM-sleep gene ATG4C. Interestingly, migraine genes, CACNA1 & VARS were associated. Cortical thickness of visuospatial domains & caudate-binding ratios decreased more in DLB than PD/AD. Decision tree MLA was most effective.

Conclusions/Discussion

CRD influences DLB & PD disease pathologies & differentiates CID. Association with migraine genes is noteworthy, as white-matter lesions are found in migraine & CID subjects. Association with changes in visuospatial regions, areas controlling hallucination/orientation, is vital to DLB diagnosis. Decision tree MLA were most effective, as they group by similarity & split to make a conclusion before classifying. This multi-level screening process can be extended to accurately screen other diseases.

Summary Statement

This project identified Circadian Rhythm Disorder as a potential biomarker for diagnosing and differentiating cognitive impairment diseases.

Help Received

My science teacher and research club mentor, Mrs. Segal provided valuable guidance. My parents provided encouragement.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Rehet K. Chugh

Project Number
S1202

Project Title
Autologus Canine Plasma

Abstract

Objectives/Goals
The concept of Platelet Rich Plasma (PRP) therapy from human medicine is now finding it#s way into veterinary medicine. Not much is known about the effectiveness or exactly how it works, and studies are being conducted at various levels to figure out the effectiveness of the procedure in regards to animals. Questions like the following are all still unanswered:
What is Autologus Canine Plasma? How does it work? Is it an effective procedure? What canine conditions can be treated with ACP?
The study would be my attempt to find answers to such questions.

Methods/Materials
First, I created two questionnaires so that I could collect information about this newer procedure from the veterinarian and the clients.I also shadowed the veterinarian and the staff to a limited extent within permissible limits to learn the procedure and the details involved, the specialized equipment involved. The client questionnaires were filled on their follow up post treatment visits. The questionnaires were filled over the period of 8 months and then analysis was done and was used to arrive at different conclusions.

Results
After the procedure takes place, the follow up visit happens in 2 to 4 weeks depending on the site treated or the extent of injury.During our study, there was a 100% success rate on all of the cases; whether it was used superficially on the cutaneous wounds or acute tendonopathy because probably it induces cell proliferation, improves neovascularization and promotes early recovery.

Conclusions/Discussion
All of this success could be attributed to the fact that platelets release proliferative and morphogenic proteins. These growth factors are the healers in variety of tissue types. They work synergistically to induce proliferation and differentiation of various cell types (stem cells, osteoblasts, epidermal cells). They also stimulate angiogenesis and chemotaxis and enhance or modulate production of collagen and tissue inhibitor of metalloproteinases. Due to these reasons, ACP procedure has shown significant promise with respect to multiple clinical and surgical therapies in our companion animals.

Summary Statement
ACP can be prepared from the patient#s own blood by centrifugation and then injecting it back into the injured site, which either will heal it or will do nothing.

Help Received
Family Pet Hospital helped me conduct the study by giving out the questionnaires to clients and taught me about the procedure. The clients took the time to discuss the results of their pets with me during the follow-up visits.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Alexandria Cordero; Genessis Garcia; Melanie Le

Project Number

S1203

Project Title

The Effect of Different Environmental Conditions on Wildlife Activity

Abstract

Objectives/Goals

Our objective for this study was investigating any possible correlations between physiological differences, biological differences, and various environmental conditions from a large group of animals and possible increased activity from wildlife.

Methods/Materials

Data from camera traps from Tejon Ranch Conservancy, Google Spreadsheets, Microsoft Excel.

Results

Animal activity increased during a variety of environmental conditions and we tested the most active periods with their corresponding variables. A chi-square test showed that there was a strong correlation between certain conditions and different animals.

Conclusions/Discussion

Statistical analysis of data showed that there is a significant correlation between certain conditions and different wildlife species. The strongest correlations were present within species within predator and prey groupings, showing that certain environmental conditions do have an effect on the activity of animals to an extent.

Summary Statement

We found a strong correlation between a variety of environmental conditions and increased activity from different species.

Help Received

We obtained the camera trap data from Tejon Ranch Conservancy and members of the California State University of Bakersfield (CSUB) Geology department assisted in our understanding of the statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Bailey M. Gallagher

Project Number

S1204

Project Title

Effect of Height of a Jump on a Horse's Hip Angle

Abstract

Objectives/Goals

The objective of my experiment is to observe how the height of a fence affects a horse's hip angle at takeoff, mid-jump, and landing.

Methods/Materials

Video camera, protractor, jumping standards, 5 horses, 1 rider. Measured three different angles (takeoff, mid-jump, landing) of the horse#s hip over five different heights of fences (2#, 2#3#, 2#6#, 2#9#, 3#).

Results

Several horses were put over the five different height fences two times each and then the angles were measured and recorded. The angle at landing was the largest angle of the three so the horse would be able to clear the jump as the front hooves make contact with the ground. The next largest angle was at takeoff because the horse has to open its hip so it doesn#t run through the jump. The smallest angle was at mid-jump because the horse has to be able to clear the fence, so they adduct their rear legs to their midline. I also found out that most of time that the higher the jump was, the more open all the measurements of angles were.

Conclusions/Discussion

At the lower fences, the angles of the hip were relatively close and in uniform. After 2#6#, however, the angle measurements had more variation and started to scatter.

Summary Statement

I showed that the angle of a horse#s hip over a fence is dependent on the height of the fence and its takeoff point, not the height of the horse itself.

Help Received

Jamie Cullers, a professional horse rider, rode the horses in the jump trial. Mary Nicita, a professional horse rider and trainer, helped me assess the horses limitation and create the five heights that all the horses would be jumping in the trials. My biology teacher reviewed the results.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Paytra A. Klein

Project Number
S1205

Project Title
Onions to Treat Dry Eyes Syndrome

Abstract

Objectives/Goals
Keratoconjuntivitis Sicca, the medical name for dry eyes is a common problem occurring in 10-20% of people.Patients experience itchy or a gritty or tired sensation and can have vision loss. All of the available ophthalmologic topical solutions are chemicals and have preservatives. This experiment used onions as a natural treatment for dry eye syndrome.

Methods/Materials
Materials: yellow and purple onions, mini hand held veggie chopper
Sample size: 20 people Age range 16-83 , 16 Females and 4 Males, 12/20 had history of dry eyes

20 people were exposed to onions to make their eyes tear,
1) the patients were surveyed on their immediate reaction
2) and patients were asked if their eyes were moister over the next 12 hours

Results
The Results of this experiment are interesting in that 19/20 patients noted that onions made their eyes water(at least a little) and most patients noted that their eyes were less dry immediately and during the following 12 hours. One patient who did not notice any tear production was a patient with olfactory dysfunction (lack of smell). This made us think that the olfactory sense is a necessary part of the mechanism of our tear production caused by onion enzymes. The patient who wore contact lenses was tested twice and she noted slight watering of her eyes. She reported a benefit for the rest of the work day. We know that contact lens wearers struggle with dry eyes and we propose that this group of patients may benefit from our experiment. Fortunately, none of our patients experienced any detrimental side effects.

Conclusions/Discussion
The results of this experiment are promising, 19 out of 20 patients had some benefit using onions to treat their dry eyes. Onions are a natural and safe alternative to the pharmacuetical solutions (chemicals and preservatives) currently available. Future experiments need to include better techniques for onion delivery, larger same size, and longer treatment periods for our patients. I proved my hypothesis : Onions make eyes water and can benefit patients with Dry Eye Syndrome.

Summary Statement
Onions are a safe and natural way to help patients with dry eyes.

Help Received
Thank you to my STEM advisor Mr. Alan Krause

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Camryn L. More

Project Number

S1206

Project Title

Cold vs. Allergy: The Use of Nasal Cytology to Determine if High School Students Can Predict Their Own Diagnosis

Abstract

Objectives/Goals

To determine if high school students can predict if their nasal symptoms represent a cold or nasal allergies, by using nasal cytology to confirm their diagnosis.

Methods/Materials

High school student volunteers were recruited with active nasal symptoms (nasal mucus production). Informed consent was obtained from subject or subject's parent (if under 18). Participants were assigned through alphanumeric code. Subjects were asked to blow their nose into a tissue-sized piece of plastic wrap. All subjects filled out a questionnaire based on their symptoms, which included nasal and non-nasal symptoms, were asked qualifying and disqualifying questions, and asked if they thought they had a cold or allergy. Nasal mucus samples obtained from subjects were smeared onto a glass microscope slide using a cotton swab and allowed to air dry. The slide was stained with Hansel stain and rinsed with distilled water. Excess stain was removed with 75% ethyl alcohol. The slide was then read to determine most predominant cell type. A predominance of eosinophils suggests a diagnosis of allergy, while a predominance of neutrophils suggests a cold/infection. The prevalence of allergies were calculated by dividing the number of people who have predominant amount of eosinophils by the total amount of subjects tested (times 100). This same prevalence calculation also done for colds with a neutrophil predominance. People who predicted correctly that they had a cold or allergy divided by the total number of subjects gave the percentage of correctly predicted. Subjects who predicted incorrectly that they had a cold or allergy divided by the total number of subjects gave the percentage of who predicted incorrectly.

Results

A total of 74 subjects completed the study. Predominance of eosinophils was found in 50%, 36%, 60% of subjects for fall, winter, spring, respectively (p=NS). Predominance of neutrophils were found in 41%, 55%, 40% of subjects for fall, winter, spring, respectively (p=NS). Fifty-three percent of subjects correctly predicted their diagnosis over all time periods (p=NS).

Conclusions/Discussion

Eosinophils were the predominant cell type during fall and spring, likely due to mold and tree pollen allergy seasons. Neutrophils were the predominant cell type during winter, corresponding to the peak of cold season. Subjects were unable to accurately predict if they had a cold or allergy.

Summary Statement

Through the microscopic examination of nasal cytology, I was able to determine how accurately students could predict if they had a cold or nasal allergy, as well as the prevalence of colds verses nasal allergies during different seasons.

Help Received

Daniel More, MD, Asst. Clinical Professor, UCSF School of Medicine, Kacee Fujinami, BS, Biology Teacher Salinas High School, Jennifer Kato, MS, Lecturer, CSUMB

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Madison Risk

Project Number
S1207

Project Title
The Effect of Chronic Sleep Deprivation and Blue Light Using a Nocturnal House Mouse (Year 7)

Abstract

Objectives/Goals
This experiment was performed to see if changes in sleep cadence affected the retention of knowledge by mice. This project builds on the previous six years projects; each year I studied the effects of artificial lighting on animals working up the food chain. I looked at sleep deprivation through two different mice learning techniques: the Morris Water Maze and a traditional running maze.

Methods/Materials
Morris Water Maze (2 sizes), fixed land running maze, 5 mice, 24 light source, iPad to provide blue light. Timed various mice in all mazes over a several week period.

Results
Morris Water Maze:
I recorded 180 maze runs (thirty-six for each mouse) at normal light conditions. When the timed test was similar to their natural light exposure of 12 hours per day, mice on average learned the course and ran it faster. For maze 1, the shortest time ran was 0:03 seconds. The length of time reduction ranged from 1:26 to 0:03. For maze 2, the shortest time was 0:07. The time reduction ranged from 1:08 to 0:07. When the lighting conditions were changed, the length of time that it took each mouse to navigate the maze increased. There was an increase from the last run in normal conditions to the first run in excessive lighting conditions. The average length of time for maze 1 increased from 0:05 seconds to 0:33 seconds. The average length of time for maze 1 increased from 0:09 to 1:17.
Fixed Land Maze:
I recorded 45 maze runs (nine for each mouse) at normal light. The average time it took for the mice to run the maze went from 3:28 to 0:20. After the blue light period, the mice on average took longer to run the maze; each mouse ran the maze twice in the sleep deprivation/blue light section. From the last (35th) run of the resting stage to the first run of the sleep deprivation/blue light stage, the average time increased from 0:20 to 1:46. Even in sleep deprivation, there were improvements in the length of time it took to run the maze.

Conclusions/Discussion
Mice are nocturnal. However, they are very adaptable and can learn. When the light changed, the learning patterns of the mice changed as well. At 12 hours of light, the mice learned the water maze; while they learned the maze under excessive light conditions as well, it took them longer. The sleep deprivation and the addition of blue light to the environment of the mice was a dramatic factor in their ability to retain knowledge.

Summary Statement
The learning ability of mice was negatively affected by the sleep cadence alterations from artificial lighting sources.

Help Received
I designed and built the running maze and the platforms in the Morris Water Maze by myself. My mother reviewed my results.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Onkar S. Sandhu

Project Number

S1208

Project Title

A Novel Risk Score for Predicting Readmission in Patients with Chest Pain

Abstract

Objectives/Goals

To establish predictors of readmission in patients admitted with primary complaint of chest pain.

Methods/Materials

The study was performed at Community Regional Medical Center. 950 patients were admitted to the hospital with primary complaint of chest pain over a period of six months. A sample of 660 patients were included in analysis, excluding patients with more than one primary complaint and inadequate data. Patients were identified from emergency department admit nurse registry on daily basis. Demographic and clinical data were collected from medical records and chart review. Three quality assessment tools were used to determine variation in management of chest pain: 1. Rate of Readmission: Defined as admission to hospital for chest pain within 30 days of index admission; 2. Rate of Intervention: Defined as non-invasive (stress test) and invasive (angiogram) procedures; 3. Co-Morbid Disease Score: Defined as presence of co-morbid condition(s) in patients with chest pain. The disease score is a quantitative in nature and based off of the following risk factors: Hypertension, Chronic Kidney disease, Diabetes Mellitus, Hyperlipemia, Low-Ejection Fraction < 45%, HbA1C > 7, Current Smoking, Previous Cardiac History including CAD, PVD,& CVA, and Anemia <10 g/dl.

Results

Overall about two-third (70%) of admitted patients had non-cardiac causes of chest pain. Higher rate of consult in: acute coronary syndrome patients (p=0.001, OR=7.84), males (p=0.004, OR=1.63), and patients with cardiac history (p=0.001, OR=2.21). Rate of Intervention was higher in patients with typical chest pain (p=0.032, OR=1.81). Higher rate of intervention was associated with decrease readmission rates (p=0.01, OR=0.60).

Conclusions/Discussion

Co-morbid disease score was the single most important readmission predictor in chest pain patients. Non-cardiac causes remains the main underlying etiology in more than two-thirds of admitted chest pain patients, and undergoing intervention was associated with decreased readmission rates. Better assessment of chest pain will lead to better quality of care as well as lessen the burden of healthcare cost. I will present my findings at the 21st World Congress on Heart Disease.

Summary Statement

I discovered a novel risk score to be utilized as an significant assessment tool in the identification of patients at high risk for readmission for chest pain.

Help Received

Used computers in Dr. Bipin Joshi's lab at Community Regional Medical Center. Shadowed Dr.Bipin Joshi on a weekly basis over the course of four years.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Kayla L. Williams

Project Number

S1209

Project Title

Mouse Runner: An Investigation on the Effects of Energy Drinks on Mouse Capability

Abstract

Objectives/Goals

Commercial energy drink companies advertise that products will provide consumers with energy, increased performance, alertness, etc. This project was designed to determine whether or not energy drinks live up to what#s promised and whether there are aftereffects. To test this, mice ran through a maze on and off energy drink. If mice are fed energy drink and run a maze, mice will complete the maze faster, but become slower when the effects wear off.

Methods/Materials

8 mice were purchased. A maze in which the testing would take place was built. Each mouse ran through the maze 1x for a baseline. 3 mice were then randomly selected to be the test group and receive energy drink. Mice were then placed back in cage for 12 hrs without food in order to give mice incentive to complete maze. At 5:00pm the next day, control mice ate 4 plain cheerios, and test mice 4 cheerios soaked in 2 mL of energy drink. Upon eating the soaked cheerios, a timer was set for 45 mins. to give the drink time to peak in the bloodstream and take effect. Each control mouse was tested in the maze and returned to the cage with food. When the 45 mins. were up, test mice ran the maze and returned to the cage. At 10:00, all mice were tested again to determine whether or not there was a change in maze run times. This process was repeated every day for 8 days.

Results

The test group consistently out-performed the control group during the 5:00 test,and consistently under-performed the control group during the10:00 test. The test group had the fastest, but also the slowest times, as the spread between peak and slump times in avg. seconds ranged between 5.1 and 11.8x slower. The spread between the control group times was only between 1.2 and 2.6x slower.

Conclusions/Discussion

The data supports the hypothesis by showing that energy drinks did cause the test mice to run the maze in faster times than the control mice. The data also showed that after the effects of energy drinks wore off, the consumer was slower and had less energy than before. This experiment has given evidence that the energy from energy drinks is short lived. With so many people in today#s world drinking energy drinks of all brands and quantities, experiments such as this one could help raise awareness to the truth of energy drinks.

Summary Statement

Mice were timed when running through a maze before, shortly after, and hours after consuming caffeinated energy drink and times were compared, finding that mice ran fastest shortly after consumption, and ran slowest hours after consumption.

Help Received

I designed the maze, and was aided in building it by my father. Throughout the course of the experiment, I fed, cared for, and tested the mice myself.