GREENSPUN
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Spring Semester Research Experience

ABSTRACTS

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Kinesiology, Nutrition Sciences

Jessica Knurick, Ph.D., Kinesiology and Nutrition Sciences

Effects of Intermittent Fasting on Fat Oxidation During Submaximal Exercise

Fasting, limiting or removing the intake of food, has been practiced for health and religious purposes. Intermittent fasting (IF) consists of distinct protocols that include periods of voluntary abstinence from food and caloric liquid intake, often resulting in reduced energy intake (Patterson et al., 2015). Recently, intermittent fasting has become more popular in mainstream culture with proclamations of improved weight control and other health benefits (Patterson et al., 2015) while contemporary review has indicated significant gaps exist in the scientific literature (Harvie et al., 2017). Fat oxidation, as a higher percentage of total energy expenditure, is generally associated with low to moderate intensity physical activity and decreases significantly as exercise increases to max intensity (Venables et al., 2005). As maximal exercise intensity is achieved carbohydrate oxidation becomes primarily responsible for energy expenditure during exercise (Venables et al., 2005). Respiratory exchange ratio (RER) - the absolute volume of carbon dioxide expired to oxygen inspired and metabolized - estimates contributions of fat and carbohydrate oxidation to energy expenditure during exercise. While dietary patterns are often considered in relation to RER values, it appears that previous research has not identified a direct correlation between altered fat metabolism during exercise and intermittent fasting. Therefore, the purpose of this study is to identify if dietary patterns that include purposeful intermittent fasting may predictably alter RER at varying submaximal exercise intensities.

Methods

Participants were recruited from the student population of University of Nevada, Las Vegas that self-identified as non-smokers and physically active. Those that identified as practitioners of intermittent fasting were grouped together (Intermittent Fasting Group) while others were group in the Non-Intermittent-Fasting Group. Surveys were administered to acquire anthropometric data such as age, sex, height and weight with additional assessments of dietary patterns, health risks related to exercise, and habitual physical activity levels. Participants completed a maximal exhaustion treadmill protocol while heart rate and respiratory gas exchange values were recorded at rest and throughout the protocol. Survey results and metabolic data were compiled and analyzed to determine dietary, intermittent fasting and physical activity patterns, lifestyle, and aerobic fitness. Differences in VO2peak and observed trends in RER progression throughout treadmill protocol were compared between participant groups.

Results and Conclusion

Participants averaged a VO2peak of 45.1 ± 9.4 mL/kg/min, however there were distinct differences between the groups for VO2peak (IF Group 41.2 ± 7.1 and Non-IF Group 52.4 ± 9.1), BMI (IF: 23.5 ± 3.4 and Non-IF: 22.6 ± 1.7), and resting heart rate (IF: 75.7 ± 8.3 BPM and Non-IF: 71.7 ± 12.9 BPM). These findings indicate that the Non-Intermittent-Fasting Group population is more aerobically fit when compared to the Intermittent-Fasting Group as determined by VO2peak results. This also is consistent with measured BMI and resting heart rate. As a result, observed RER changes were incongruent with the hypothesis. Additionally, a number of limitations emerged in this study such as too broad participant qualifications, too narrow a sample size, and lack of diversity in participant groups regarding sex/gender. Future inquiries should consider these limitations and may benefit by study design that includes prequalification and selection, specific dietary intervention, and observation over a given period to limit external factors that affect RER, dietary patterns, and general aerobic fitness.

Camille Catelo

Nursing

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Histopathological Analysis of Lung Tissue Features in Rodents Exposed in Areas with Naturally Occurring Asbestos

Introduction

Asbestos has been used throughout the world in the past due to its usefulness in the construction industry and other commercial purposes. However, after it was proven that asbestos is a human carcinogen, many countries, such as the United States and the European Union implemented a ban or restriction on the use of asbestos. Asbestos is characterized by the fibrous habit of long (>5 um) and thin fibers (< 0.25 um), high tensile strength, flexibility, and resistance to acids and heat. The term asbestos refer to six naturally occurring silicate minerals which include chrysotile, crocidolite, amosite, tremolite, actinolite, and anthophyllite. There are other fibrous minerals displaying asbestiform habit which can also cause asbestos-related lung diseases, but since they were not commercially exploited, they are thought to be non-contributors to the toxic effects of inhaled fibers[1]. Naturally Occurring Asbestos (NOA) refers to either regulated or non-regulated asbestos minerals present in rocks and soils that can cause asbestos-related lung diseases such as pleural plaques, fibrosis, asbestosis and pleural thickening when it is disturbed and results in airborne fibers. NOA found in Nevada includes actinolite asbestos, erionite, winchite, magnesioriebeckite and richterite[2]. Because of the arid climate in Nevada, it seems reasonable to investigate the potential health risks of these NOA that have the possibility to become airborne through dust emissions from wind erosion, anthropogenic and recreational activities.

Hypothesis and Methods

We hypothesize that collected native wild mammals around Boulder City, an area with elevated levels of Naturally Occurring Asbestos (NOA) will show signs of negative health-effects compared to mammals collected around Red Rock Conservation area where there is no known source of NOA. Ten individuals from the five species of rodents were collected from Boulder City area last year and twenty rodents were collected from the same location three months ago using Sherman live traps. The five species of rodents include: *Dipodomys merriami*, *Neotoma lepida*, *Ammospermophilus leucurus*, *Thomomys bottae* and *Peromycus maniculatus*. In our research project, my role included comparing different methods of tissue processing to determine which method yields an optimal result, developing techniques in histological preparation of lung tissue, and analyzing the results of the experiment. Histological preparations include fixation using 4% buffered formaldehyde solution, dehydration, clearing, embedding in paraffin wax, sectioning at 3-5μm, and staining lung tissues with Masson's Trichrome, Toluidine Blue, and Perl's stain. Following established protocols from the asbestos literature[3,4], we expect to see asbestos bodies, elevated levels of mast cells, and pulmonary fibrosis in the lung tissue of the animal subjects. Light microscopy was used to view prepared slides with staining, which highlights microscopic changes induced in lung tissue by asbestos fibers and a Perl's stained section which will reveal any possible asbestos fibers. Masson's trichrome stain will be used to distinguish collagen fibers or fibrosis from lung tissue.

Results and Future Directions

We found that 1 out of 10 of our animal subjects showed evidence of pulmonary fibrosis, 5 out of 10 showed elevated levels of mast cells, and 5 out of 10 have asbestos bodies in the lung tissues of the first set of rodents that we collected last year. In February, we collected more samples to repeat our experiment in order to determine if our original results hold up when reaching a statistically significant number of test subjects. Twenty individuals were collected around Boulder City using Sherman live traps. We are currently working on staining the remaining lung tissues to determine other pathological factors caused by NOA exposure.

Rosalie Chaleunsouck

Biochemistry

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Extent of Mutation and Sex Influence at the Risk of Mortality in a Mouse Model of Developmental Epilepsy

Introduction

Sudden Unexpected Death in Epilepsy (SUDEP) is characterized by the abrupt mortality of seemingly healthy individuals and continues to be a leading cause of death in the epileptic population. In particular, children that suffer from severe uncontrolled seizures, such as those with Dravet and Dup15q syndromes, have been observed to have a higher susceptibility to SUDEP. This increased risk of mortality places many families in unbearable positions of emotional stress. However, despite the significant threat that SUDEP poses on epileptic patients, little is known of the molecular and genetic contributions to this condition. It is hypothesized that due to the nature of the GABA receptor, homozygous mice will have an increased risk of mortality. In epileptic patients, it has been observed that males are more susceptible to SUDEP and we believe that our model will mirror that observation.

Methods

The Hines Group recently developed the mutated mouse strain, Gabra2-1, which serves as our current model for developmental epilepsy. Many mice within the Gabra2-1 colony have been observed to exhibit behavioural seizures during development, with the peak of these seizures reaching approximately 20 days of age. In the present study we are examining the Gabra2-1 genotype (heterozygous or homozygous for the mutation) as well as the sex of the offspring that are found dead using polymerase chain reaction (PCR). PCR was ran using specialized primers to detect the genotype of the Gabra2-1 mutation, and the SRY gene to determine sex, the resulting PCR products were run through an agarose gel for analysis. The PCR findings are compiled into a comprehensive database that will be used to examine: 1) the potential relationship between the mutation genotype (heterozygous or homozygous) and mortality 2) the influence of the sex of offspring on mortality 3) comparisons between the pups that had died during development and those that survived to maturity.

Results

The pups found dead were chosen for this study based on age of death between ages 10 to 40 days of age postnatal, consistent with increased risk of mortality among children. There were a total of 152 dead pups that were evaluated and genotyped for the GABRA2-1 mutation in this study and were categorized between wild type, heterozygous and homozygous for the mutation. Upon evaluation of the PCR results, there were 11 wild type (7%), 72 heterozygous (47%) and 69 homozygous (45%). Of the 41 pups genotyped for sex, 27 males (66%) and 14 females (34%) were observed within the sample. The mortality rate among the mouse colony overall has been calculated to 5% in heterozygous and 10% in homozygous based on the evaluated mortalities of the pups found dead.

Conclusion

Contrary to our earlier hypothesis, similar rates of mortality were seen in both the heterozygous and the homozygous genotypes bearing the GABRA2-1 mutations. As seen in the PCR results for the SRY gene, male mice have a higher susceptibility to mortality during development than their female counterparts. This is consistent with observations seen in human populations. These findings warrant further investigation into the potential mechanisms in which the GABRA2-1 mutation affects mortality. The GABRA2-1 mouse strain is observed to be a viable model for SUDEP.

Lina Chan

Biological Sciences

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Clostridium Difficile Strain 630 Genes Expressed for Antibiotic Resistance

Introduction

Antibiotic exposure to *C. difficile* has evolved hyper virulent strains in clinical settings. This results in *Clostridium difficile* infection (CDI) being the number one hospital acquired infection after antibiotic treatment. Cephalosporins, a family of β-lactam antibiotics, promotes increased growth in *C. difficile*. Twenty-five putative genes have been identified, but understanding of the genes expression flux in the presence of cephalosporins is not well characterized.

Objectives

The primary objective of this study was to explain the patterns of gene expression in *C. difficile* when exposed to different cephalosporins.

Methods

This was an experimental design conducted on *Clostridium difficle* strain 630's gene expression towards different cephalosporins. Total RNA is extracted after late exponential growth phase and then using the relative standard curve method for quantitative data analysis. Gene expression is quantified in the non-exposed inoculate of 630, the ampicillin treated sample which is the positive control, and the cephalosporin treated samples which are the experimental groups. Comparison is made between the different groups to define which genes are unregulated under the exposure of cephalosporins.

Results

Qualitative analysis for gene expression was performed with polymerase chain reaction (PCR) and gel electrophoresis for several of *C. difficile* putative genes exposed to ampicillin. CD630_03440, CD630_04580, CD630_04640, CD630_27420, and CD630_36510 encode potential β-lactamases and were shown to be expressed. Qualitative analysis also showed that CD630_04700 and CD630_31960, which encode putative penicillin-binding-proteins, are not expressed under the exposure of ampicillin.

Conclusion

The expression of putative β-lactamases was tested in this study. Quantitative tests will be performed in future studies with quantitative PCR (qPCR) to identify which genes are upregulated in the presence of different cephalosporins.

Rodolph Dagher

Biological Sciences

Lloyd Stark, Ph.D., Associate Professor, School of Life Sciences

Can *Syntrichia Caninervis, a Low-Desert Soil Crust* Species, Recover During Standardized Post- Desiccation- Hydro Period?

Introduction and Objective

The main goal of this project is to assess the resiliency of an ecologically important desert moss species to rapid desiccation events experienced in the Mojave Desert during summer of 2017. This project monitors the species of moss—*Syntrichia caninervis*—systematically along three different aridity gradients. Aridity gradients encompass a range in the amount of dryness this species experiences because it is found on three different elevation sites. Along this gradient in the Desert National Wildlife Refuge (DNWR), we predict there is a specific location where these mosses perform best at their optimal conditions.

Methods

We are looking at three main aridity gradients (experimental factors) when examining the performance and resiliency of populations of this species in the DNWR. Performance of these mosses is measured as Fv/Fm which tests their photosynthetic ability/performance. We compare these results with those of cultured plants which are grown under a controlled, optimal condition that are fully hydrated in an environmental growth chamber. Studying resiliency to desiccation across natural aridity gradients on field-sourced mosses will help us predict their fate in a future climate. Two recovery assay sets were performed for two sampling designs, n= 96 and n=24 each with a different yet vital role in recovery. The n=96 took fluorescence readings of T0 & T24 and the second assay was a more intensive protocol that took fluorescence readings at T0, T4, T8, and T24. The intensive assay was done to test whether mosses can reach optimal photosynthetic performance in a shorter period of time. Samples were measured post-rehydration after being dark-adapted (significant for PSll activity) for ~25 minutes. A reading is then taken using a Hansatech Fluorometer that tests how stressed the tissue is. Initial T0 Fv/Fm is measured at 30min post-rehydration and measures how stressed these mosses were during Summer of 2017; Fv/Fm measures how much photosynthesis the species are capable of performing. Using a growth chamber, we simulated average recovery conditions following a winter rain event (diurnal cycle: X C for X hrs under X umol/m2/s photosynthetically active light (PAR), X C for X hrs in the dark, relative humidity >95%). In order to estimate climate/light conditions, we explored data from one winter of rain events at the three sites and averaged the daily PAR and temperature during cloudy days near winter solstice (during or immediately following rain if possible) with the premise that optimal recovery would occur under cloudy conditions. The samples were stored in the growth chamber between physiological measurements for 24 hours.

Results

We observed a large initial variation in the summer stress signal of 96 moss samples collected across three ecosystems, three topographical aspects, and three shade levels. This T0 observation was made 30m following rehydration, rather than at true time zero in order to allow the previously dry and dormant mosses sufficient time for metabolic activation prior to measurement of photosynthetic performance as estimated by the chlorophyll fluorescence ratio, Fv/Fm. The large variation suggests that some combination of environment and genetic variation are shaping this physiological response within this Mojave Desert population.

Discussion

Field plants in this study recovered fully to levels at or slightly exceeding those documented by Stark (2017, unpublished data) for healthy plants from one cultured genotype that have never experienced a desiccation event. Recovery varied by source ecosystem (site) after 24 hours, but was not influenced based on source topographical aspect or shade level, suggesting that despite large variations in desiccation stress during summer 2017, *S. caninervis* has great potential to fully recover during a 24hr average winter hydroperiod regardless of microhabitat exposure. However, it should be noted that simulated recovery conditions were an average across the elevation gradient and therefore may be more uncommon for mosses at Site 1, potentially limiting their ultimate recovery. In conclusion, the rapid recovery (within 24hr) of all 96 samples under a simulated winter hydroperiod for the Mojave Desert suggests that *S. caninervis* will be able to recover from extreme summer conditions in the future, similar to or perhaps exceeding those experienced by this population during June – September 2017.

Alia Hamdan

Physics

Daniel Proga, Ph.D., Professor, Department of Physics and Astronomy

A Statistical Distribution of Lines in Active Galactic Nuclei

Introduction

Astral winds play a fundamental part in outflows in various objects. There are two important types of winds, thermal driven and line driven winds. Line driven winds are reliant on the different opacities of the lines. The way the optical lines are distributed in these winds are therefore fundamental to the analytical solution of the winds. AGN's have a much broader spectrum than black bodies; which are used to model stars. Line distribution of the winds are assumed to follow a power law for both opacities and frequency. It is also assumed that the opacity and frequency are independent variables so we are able to calculate an analytical solution (Puls, 2000).

Purpose

This study intends to determine the distribution of line of different opacities and frequencies for AGNs. We intend to show whether or not the CAK (1975) formulation can be extended to AGNs since they have a much larger spectrum and thus cannot be modeled as black bodies.

Methods

In this experiment we use over two million lines generated by the Heasoft program XSTAR. We discarded lines with opacities less than 10-7 η as their effects are negligible. We created line lists with various log(ξ) values from a Black body spectrum and two AGN spectra. We ran regressions to find the slope of the curves and then plot the theoretical line distribution derived by CAK with the cutoff added by Owocki, Castor, Rybicki (1988) against the opacity and frequency distributions. This way we will assess the power law in the formula and whether or not it holds true for AGNs as well as black bodies.

Results

We found that as log(ξ) increases the AGN curves get further away from the black body curves. They are more curved where as for the black body the distribution is more linear. We also found that the cutoff value decreases so there are less optically thick lines at higher energies. We found that within the range of temperatures we used the maximum percentage difference of the experimental α to the known is 3.2%. The percentage differences for AGN one and are 40.6% and 58.8% respectively. The line distribution vs frequency is composed of two parts that follow power laws however lower frequencies should be neglected since the energies are too small to drive a wind. The frequency distribution for AGNs shifts to the right indicating more energetic photons.

Conclusion

We found that for lower temperatures the current CAK formulations does a good job at modeling line distribution however it begins to fail in two main ways. The cutoff value begins to shift in AGNs while it doesn't in black body and the value of alpha changes more drastically in AGNs than it does for black bodies. The number of thick lines is lower in AGNs as they are more energetic and so there will be more transitions available for the photons at lower opacities. The greater curvature shows that the value of α is decreasing. α is the ratio of the acceleration from the thick lines to total lines, thus as the number of optically thick lines decreases, the value of α is supposed to decrease as well, causing more curvature. Further research needs to be conducted in order to understand the frequency distribution better and how much of an effect these finding have on the current treatment of line driven winds in AGNs however in general power laws are still present and the assumptions still hold.

Li Huiling

Kinesiology

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The Impact of Transcranial Random Noise Stimulation of Motor Skill Acquisition in Golf Putting Task

Introduction

The use of transcranial direct current stimulation (tDCS) as an intervention to improve motor performance has been increasing over the past several years. Overall, most studies have indicated that tDCS and similar techniques can improve motor skill in humans, despite being non-invasive and relatively simple to implement (1, 2). Transcranial Random Noise Stimulation (tRNS) is a relatively new form of tDCS stimulation that may have several advantages and could be more effective in improving motor skills. A first step would be to determine if tRNS can improve motor skill in young adults. If successful, the technique could be further refined to impact patients with neurological diseases, such as Parkinson's disease. Therefore, more research is needed to learn about the effects of tRNS on motor skill acquisition.

Objectives

The purpose was to determine if tRNS application could increase motor skill acquisition and motor learning in a complex motor task (golf putting) in young adults to a greater degree than practice alone.

Methods

This study was a randomized, between-subjects, SHAM-controlled, double-blind experimental design. A total of 24 healthy male subjects were randomly placed in a tRNS or SHAM group. At the start of the experiment, subjects watched a didactical video of an expert golfer performing the golf putting task in order to understand the putting technique. Participants started the examination with a baseline testing block that consists of six trials. After that, four continuous blocks of fifteen trials were administered and done simultaneously with the application of tRNS. The tRNS electrode was placed over the hand area of the motor cortex, which was located with transcranial magnetic stimulation prior to the prior to performing the golf putting task. Following a five-minute rest, each participant performed a post-testing block consisting of six trials. Finally, a six trial retention testing block was completed without stimulation 24 hours later.

The dependent variables were the average endpoint error (distance of putts from the target) and the endpoint variance (putting variability).

Findings

The results indicated that there were no significant differences in either endpoint error or endpoint variance between the tRNS and SHAM groups for the practice blocks.

However, there was a significant effect for *block* (F[3, 66] = 3.519, $P = 0.02$) and post hoc analyses indicated that the endpoint error was greater for the first block of practice trials when compared with the second, third, and fourth practice blocks ($P = 0.022$, 0.022, and 0.047, respectively). Endpoint variance was also similar between the two groups, yet endpoint variance was greater for the first block of practice compared with the second, third, and fourth practice blocks. For the test blocks, endpoint error and endpoint variance were significantly reduced from the baseline block to the post test block (P = 0.000 and P = 0.001, respectively). Furthermore, endpoint error was greater for the baseline test block compared with the post-test and retention blocks ($P = 0.001$ and 0.03, respectively). Ultimately, there were no differences in performance in the test blocks between the two groups for either endpoint error or endpoint variance.

Discussion

The findings indicate that a single application of tRNS applied during practice of a complex golf putting task does not increase the rate of motor skill acquisition or the amount of motor learning experienced by young adults. When considered in the context of the existing tRNS and tDCS literature, the results of the present study suggest that tRNS may not be able to significantly improve motor skill or learning in complex bimanual tasks that involve the whole body or that it may take multiple stimulation sessions over several days for any positive effects to become evident. Future studies will attempt to discriminate between these possibilities.

Christina Jackson-Bagain

Electrical Engineering

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The Timed Up and Go Mobile App

Introduction

The purpose of the Timed Up and Go Score Mobile App is to conveniently deliver aggregated information to the physical therapist so that they may see how the patient compares in context. The Timed Up and Go (TUG) Test is a clinical assessment which evaluates elderly patient's mobility (2017 Centers for Disease Control and Prevention). The standard time for completion is >= 12 seconds (Centers for Disease Control and Prevention, 2017).

Objectives

The goal of this research is to create a mobile cell phone app to be used by physical therapists. This will aid in determining if their patient is at risk of falling.

Methods

The methods which are being implemented to create the app are using Android Studio for application development and SQLite for database management. Android Studio is an integrated development environment (IDE) (Mullis, 2017). Within Android Studio is SQLite: a database management engine, which is lightweight and ideal for mobile apps (SQLite, 2018). The database that will be used for delivering

scores to the users is provided by Dr. Szu-Ping Lee. Dr. Lee is an assistant professor at the University of Nevada Las Vegas (UNLV) in the School of Allied Health Sciences Department (UNLV, 2018).

Implementation

The app allows a user to input key characteristics of a patient they are assessing. This includes sex, age, weight, height, ethnicity and health conditions. The app calls the database and returns the expected time, based on the average calculated by pulling the scores of similar patients in the database.

Conclusion

Moving forward, there are a few steps that need to be taken in order to take the Timed Up and Go Mobile App. First, the database needs to include more diverse demographics in order to have more accurate results for physical therapists and their patients. It is difficult to come up with accurate averages with this sample size. There are two methods in achieving this: making a call to specific demographics that the database needs more of for a case study and allowing users to input new entries into the database.

Joel Jimenez Vargas

Biological Sciences

Kelly Ai-Sun Tseng, Ph.D., Associate Professor, School of Life Sciences

Eye Regeneration in Xenopus laevis

Introduction

Xenopus laevis tissue regeneration has been well studied throughout the years. Many researchers have studied the way in which different cells differentiate when the regenerate eye cells begin to proliferate and where those cells come from (Tseng AS, 2017). It has been shown that retinal regeneration after retinal damage occurs by the transdifferentiation of the Retinal Pigmented Epithelium (RPE) (Del Rio-Tsonis, & Tsonis, 2003). Histological techniques such as paraffin sectioning in addition to hematoxylin & eosin staining have been used before to show the different structures of the eye (Kha *et al*. 2018). Paraffin sectioning and H&E staining are great histological techniques to study the structures of the eye and observe from what structures new regenerate cells originate from.

Objective

The objective of this project is to perform Hematoxylin and Eosin (H&E) histological staining in eye tissues of Xenopus tadpoles to determine from what eye structures new regenerate cells are originating.

Methods

Paraffin sectioning in addition to hematoxylin and eosin staining will be the technique to obtain data in this experiment. Tadpoles will first be euthanized in three different groups: control, 6 hours post-surgery (hps), and 12 hps. The samples will then be dehydrated using a series of washes with methanol. After the dehydration protocol, the tadpoles will be embedded in paraffin to eventually obtain the sections. 10 μm thick paraffin sections of the eye will be obtained using an Accu-Cut Microtome. The sections will be obtained transversely going through the frontal area of the tadpole here the eye and brain tissue

are located. These sections will then be stained using Hematoxylin and Eosin to differentiate the different types of tissue surrounding the eye. Control sections should show the entire structures of the eye, including tissues such as brain, lens, RPE and CMZ. On the other hand, sections from tadpoles with a regenerate eye should show only partial eye structures and new cells originating from certain areas of the tissues surrounding. Analyzing and determining from what tissue the new cells are coming from will help determine the origin of the regenerate eye.

Preliminary Results

After perfecting of the paraffin embedding and H&E staining, control slides of stage 29 tadpoles were obtained. Images of the slides were obtained at x110 magnification. Some structures such as the eye and brain tissue are clearly visible in the slides, however more detailed tissues of the eye are not visible. More work perfecting the H&E staining is necessary to obtain better images and be able to distinguish more accurately different structures of the eye.

Future Directions

Although some advances have been made in the project, there is still a lot of work needed to perfect the H&E staining and obtain sections of tadpoles with regenerate eyes. The next step of this project is to perform surgery with a stage 29 tadpole and remove the eye. After eye removal, let the tadpole regenerate the eye for a specific number of hours, fix the tadpole, perform paraffin section and H&E staining to compare with the control. Improvement of the H&E staining will be essential to be able to distinguish the different layers of the eye and obtain more accurate and detailed results.

Ginger McNamara

Biological Sciences

Sean A. Neiswenter, Ph.D., Assistant Professor-in-Residence, School of Life Sciences

Comparison of *Limulus polyphemus* Nutritional Status

Introduction

An arthropod molt is the process of changing a juvenile exoskeleton to an adult exoskeleton. This process is governed through the concentration of hormones that are secreted into the bloodstream. For *Limulus polyphemus,* secretion of juvenile hormone into its hemolymph, inhibits the development of an adult carapace, therefore remaining in a juvenile form (Miyakawa et al, 2014). In contrast, allatostatin secretion prevents the synthesis of juvenile hormone, thereby promoting other hormones, such as ecdysone, to stimulate molting (Stay and Tobe, 2007). When *L. polyphemus* encounters stressful events, molting does not occur. This is because the development of a stress response affects the hormones that are responsible for molting. This is an "inducible defense" mechanism used to protect themselves from predators (Miyakawa et al, 2014). Additionally, nutritional status of *L.polyphemus* may also affect molting, by having either too little or high nutrient concentrations within the hemolymph.

Objective

The primary objective of this study was to compare nutritional status of wild caught and captive *L. polyphemus* for a potential cause in terminal molt inhibition, during a typical stress response. Analysis of previously extracted hemolymph data of *L. polyphemus* was conducted.

Methods

An analysis of previously collected data from the Shark Reef at Mandalay Bay was conducted to determine the nutritional status of wild caught and captive populations of *L. polyphemus*. A cardiac puncture was performed to obtain hemolymph samples from fourteen individuals. One to three milliliters of hemolymph were collected shortly after arrival to Mandalay Bay, and then again a month later. A comprehensive blood panel was used to measure calcium, potassium, glucose, blood urea nitrogen (BUN), triglycerides, sodium, alanine aminotransferase (ALT), total protein concentration and other nutrient concentrations. The mean and standard deviation of each nutrient was compared with data of wild caught *L. polyphemus* from the National Aquarium Clinical Pathology Laboratory and University of Miami Department of Pathology and Laboratory Medicine. A pooled t-test between the wild caught and captive populations was conducted to test for significance. The panel was used to determine the effects of habitat change on the nutritional status of *L. polyphemus.* Ultimately, the panel was used to determine the next research step for the cause of terminal molt inhibition during a typical stress response.

Results

The mean values for the total protein concentration between the captive male and female *L. polyphemus* were relatively similar (x = 11.625, s = 2.716 vs x = 9.433 g/dL, s = 2.102). However, the values differ when compared to the wild caught male and females (μ= 6.428, σ=1.056 vs μ= 3.863 g/dL, σ=1.897). The male and female mean values for the ALT concentrations of the wild caught population were higher (μ= 50.96, σ=8.609 vs μ= 31.56 U/L, σ=20.112) than the captive population (x= 16.75, s = 5.701 vs x=12.83 U/L, s = 5.706), pooled t-test results showed significant (*p<0.05). The results for BUN concentrations are inconclusive for the captive male and female populations, for each horseshoe crab had a mean value of 5 mg/dL and a standard deviation of 0. However, the wild caught population had much lower mean BUN values (μ= 0.648, σ=0.811 vs μ= 0.44 mg/dL, σ=0.632). The triglyceride mean values showed the greatest contrast between the male and female captive (x= 75.125, s = 81.828 vs x= 37 mg/dL, s = 12.791) and wild caught populations (μ= 2.64, σ=2.361 vs μ= 5.56 mg/dL, σ=6.671), pooled t-test results showed significance (*p<0.05). The pooled t-test for wild caught and captive populations for sodium, chloride, potassium, and calcium (*p<0.05) had significant changes compared to magnesium (p>0.05).

Conclusion

The results of the analysis demonstrate nutritional status as a possible factor towards terminal molt inhibition. The significant change in the mean macromolecule values suggest habitat change as a stressor for *L. polyphemus*. For instance, the difference in triglyceride and alanine aminotransferase concentrations may be because of the change in environment or diet. When in the wild, *L.polyphemus* is dependent on the food found within its current environment. In contrast, when in captivity, *L. polyphemus* is fed at consistent times and possibly with different foods than found in the wild. Also, they could be over fed by the veterinarians or technicians. Environmental change may also affect nutrient and protein levels because of the imminence of threat and adaptation to the new environment. In turn, we hypothesize that stress from the environment will cause a release in hormones and nutrients in *L. polyphemus* to protect itself from danger and inhibit terminal molting. Further study needs to be conducted to determine the primary cause of inhibition and the hormones present during a typical stress response. Also, further study in the typical stress response of *L. polyphemus* may aid in better conservation efforts for animals brought into captivity.

Samrawit Misiker

Biological Sciences

Tamara D. Madensen-Herold, Ph.D., Graduate Director, Department of Criminal Justice

Medical Response During Mass Casualty Incidents

Introduction

Currently, the level of emergency preparedness among Las Vegas resorts and venues is unknown. As Las Vegas is centered around the tourism industry, it is imperative that there are plans in place to respond to potential mass casualty incidents. We can improve our preparedness level by understanding our current emergency plans and processes. Because there has yet to be a systematic survey concerning current plans of action, it would be beneficial to assess current knowledge and response plans and share this information across resorts to improve response planning and effectiveness. The Las Vegas Security Chiefs Association is composed of over seven thousand hotel and casino security chiefs from Las Vegas, Henderson, Mesquite, Laughlin, and Reno. It originated as a way to maintain communication between resorts throughout Nevada while promoting security personnel professionalism. The LVSCA creates a network of security chiefs who are provided the opportunity to attend seminars and conferences in order to enhance their skill sets and learn about current issues in their profession.

Objective

The primary objective of this study is to determine the level of preparedness for mass casualty incidents in Las Vegas venues. This will be accomplished by creating a survey to distribute to security personnel through the Las Vegas Security Chiefs Association. The survey will be used to determine which types of security tactics and response plans are currently in place. The survey will also allow for data collection from those who are directly responsible for developing and implementing prevention and response plans in our Las Vegas venues.

Methods

This study will use survey methods to obtain responses from Las Vegas Security Chiefs Association regarding the preparedness of Las Vegas resorts for mass casualty incidents. To formulate the questionnaire, research about past surveys of resorts was gathered; even though some sources did not display their exact questions, the purpose of these surveys led to the development of questions for the current survey. In addition, questions were created from reading studies about medical response in mass casualty incidents. The questions focus on whether the subjects have implemented techniques that research suggests are effective. Many questions focus on communication and planning between agencies because most research studies emphasize the importance of these processes. An online survey will be constructed using Qualtrics, an electronic survey platform, and administered through email to the Las Vegas Security Chiefs Association members. These members include security chiefs from every casino property in the Las Vegas valley. Closed- and opened-ended questions will be used so that both quantitative and qualitative analyses can be conducted.

Discussion/Conclusion

As this survey evaluates the preparedness levels of Las Vegas resorts and casinos, the results are valuable to the Las Vegas community. Due to the October 1 tragedy, the community's awareness of mass casualty incidents is heightened; if another incident were to occur, it is critical that tourist venues, including casinos, are adequately prepared. Once the results are acquired, there will be three primary methods of information dissemination. First, the findings will be posted on the social media platforms of UNLV Tourism Security & Crowd Science as a way to inform UNLV students and the greater Las Vegas community. Second, the research findings will be presented at one of the Las Vegas Security Chiefs Association monthly meetings. This will inform resort security personnel so that they can assess and modify existing emergency plans. Third, a Research in Brief (RIB) will be distributed through UNLV's Center for Crime and Justice Policy to inform scholars and future research to improve tourism safety.

Irwin Munoz

Kinesiology

Brach Poston, Ph.D., Assistant Professor, Department of Kinesiology and Nutrition Sciences

Results of Balance Performance from Transcranial Direct Current Stimulation on Patients with Parkinson's disease: Preliminary study.

Introduction

Parkinson's disease (PD) is the second most common neurodegenerative disorder and practical, non-invasive, and effective therapeutic adjuncts to complement existing treatments are needed. Individuals diagnosed with PD endure changes in their gait performance over time and pose a risk to increase disability from adverse events such as falls. Biomedical and behavioral researchers are focused on treating symptoms of PD that increase patients to long-term disability such as gait and balance control (Alon, Yungher, Shulman, & Rogers, 2012). A non-invasive approach that has increased in popularity in the literature has been the use of non-invasive brain stimulation (NIBS) such as transcranial-direct current stimulation (tDCS). TDCS may represent an intervention with a realistic potential influence balance performance and be translated into clinical practice

Objective

The purpose is to determine the ability of tDCS to improve balance in PD patients while they are on their medications.

Methods

The study was a sham-controlled, double-blind, between-subject's experimental design. Sixteen patients diagnosed with PD were randomly assigned to either a treatment group (anodal tDCS) or control group (SHAM tDCS). The study comprised 2 weeks of gait training on a instrumented treadmill combined with either anodal or SHAM tDCS. Baseline and follow-up assessments on balance were performed before the first day of training (T1), one day after training (T2), 2 weeks (T3) and 4 weeks later (T4), respectively. TDCS was applied over the left tibialis anterior

representational area in the motor cortex with a 1mA current for 20 minutes. SHAM stimulation was applied based on established guidelines. Balance assessments were performed through the sensory organization test (SOT) using a computerized dynamic posturography (CDP) automated system termed the Bertec Balance Advantage™. The main outcomes analyzed for this abstract and preliminary study were composite scores, which represents overall balance performance along with systems scores from the SOT. The output scores here represent the integrity of the somatosensory, visual and vestibular systems on balance performance. For the statistical analysis, a two-factor repeated measures ANOVA: 2 *Group* (tDCS, SHAM) x 4 *Test* (T1, T2, T3, and T4) was performed on each outcome.

Results

For the composite score the *Group* x *Test* interaction was not significant (P = 0.648). Similarly, the main effects for both *Group* and *Test* were not significant (P = 0.853 and 0.652, respectively). For the vestibular, visual, and somatosensory scores the *Group* x *Test* interactions were not significant (P-values ranged from 0.317 to 0.779). In addition, the main effects for *Group* and *Test* for these three variables were also not significant (P-values ranged from 0.361 to 0.706).

Conclusion

TDCS over the tibialis anterior area representation of the motor cortex did not increase balance performance compared to SHAM stimulation in this preliminary analysis. However, at least 8 more subjects need to complete the protocol to reach our initial recruitment goals based on a power analysis.

Nhan Nguyen

Biological Sciences

Pradip K. Bhowmik, Ph.D, Professor, Department of Chemistry and Biochemistry

Design and Synthesis of Ionic Liquid Crystal Based on Viologen Containing Tetradecylbenzenesulfonate

Introduction

Ionic Liquid Crystals (ILC) have been exclusively studied for awhile by researchers because they exhibit many fascinating properties which would be useful for the industry in the future. Therefore, it is significant for scientists to explore further into ILCs.

Objective

The chief goal for this study is to capture the main development in both structure and property that 1,1'-di-n-propyl-4,4'-bipyridinium tetradecylbenzenesulfonate (TDBS) possesses.

Experimental Procedure

The desired ILC was synthesized through 3-step reaction. The first step was to produce the 1,1'-di-n-propyl-4,4'-bipyridinium bromide, which displayed as the yellow compound. The second step was to synthesize the tetradecylbenzenesulfonic acid. The final step involved in the product of the first two steps combine to create the ILC, known as 1,1'-di-n-propyl-4,4'-bipyridinium TDBS. The reaction was set on reflux for 72 hours and dissolved in a reasonable amount of methanol in a 100 mL round bottomed flask (RBF). In this reaction, since 1,1'-di-n-propyl-4,4'-bipyridinium bromide was sensitive to light, a large piece of aluminum foil was applied to cover and protect the RBF from the light. The solvent was then removed by the rotary evaporator. Then, the compound was washed and filtered with water twice. The collected product weighed 1.85 g which was approximately 93% yield.

Results

The product was subsequently characterized and analyzed with experimental techniques, including proton nuclear magnetic resonance (^{1}H NMR), carbon nuclear magnetic resonance (^{13}C NMR) spectroscopy, differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and polarizing optical microscopy (POM). The peaks assigned in the ^{1}H and ^{13}C NMR spectra accurately corresponded to the types and positions of hydrogen and carbon atoms present in the desirable viologen salt. The DSC thermograms illustrated the crystal-to-LC phase transition occurred at 107 ^{o}C and the LC-to-liquid phase transition occurred at 148 ^{o}C. The TGA thermogram displayed that the viologen salt was stable up to 283 ^{o}C, at which 5% weight loss occurred at a heating rate 10 ^{o}C/min in nitrogen. Photomicrographs were taken with the POM in between 108-130 ^{o}C on heating and cooling that indicate the synthesized viologen salt formed an LC phase.

Discussion

After a series of analysis, the synthesis was successfully achieved; and the structure of the viologen salt was identified. Consequently, this salt was indeed an ILC. Additionally, ILC can be utilized in a few applications, such as in batteries and even solar cells. In the future, X-ray diffraction studies will be conducted to confirm the type of liquid crystalline (LC) phase in ILC.

Timothy Ogburn

Biological Sciences

Jeffery Shen, Ph.D., Professor, School of Life Sciences

Single Nucleotide Pilymorphisms May Play a Role in 5–Azacytidine Resistance in Myelodysplastic Syndrome Patients

Introduction

Blood disorders are defined by the uncontrolled production of hematocytes. Whereas leukemias involve the over-proliferation of certain cell-types, myelodysplastic syndrome (MDS) involves the ineffective hematopoiesis, leading to cytopenia[1].Various genetic factors associated with the epidemiology of MDS are noted to be mutations in genes involved in chromatin remodeling, DNA methylation, and mRNA splicing[2]. With the advent of "personalized medicine", it has become increasingly acknowledged that in addition to MDS having genetic predispositions, the successful treatment of MDS may require genetic screening of the MDS-patients. In a follow-up retrospective cohort study[3], MDS-patients who have been treated with 5-azacytidine, a nucleoside analog commonly used in MDS treatment[4], have fallen into two groups. First, are patients who have been treated using 5-azacytidine and have been successfully treated with the drug; second, are patients who have been treated, but no benefits of using 5-azacytidine have been observed[5]. Using bioinformatics tools, this lab will assess patient DNA to determine if there are any genetic mutations that may be correlated or causative of the lack of successful treatment.

Objective

The objectives of the research project are as follows: grasp an understanding of leukemia and how it is treated, diagnosed, and characterized; develop an ability to perform computer programming skills necessary in the field of bioinformatics; analyze patient information and interpret any possible meaning behind the data; and present the results to both the lab and public in an attempt to contribute to the growing field of bioinformatics and genomics.

Methods

This project was performed as a retrospective cohort study using patients from the University of Chicago Medical Center. Patient DNA was taken, sequenced, and then annotated using RefGene. The annotated DNA was then subjected to the variant calling program, SAMtools. Variants used for analysis included single nucleotide polymorphisms (SNPs). As a positive control, SNP data from the 1000 genome project was used to compare against. To model how patient DNA will be analyzed, bacterial 16s rRNA from species *Klebsiella pneumoniae, Enterobacter aerogenes,* and *Bacillus anthracis* were subjected to SNP variant calling via SAMtools.

Results

Upon testing the sample 16s rRNA from closely related species *K. pneumoniae* and *E. aerogenes*, a 98% sequence similarity was observed as expected[6] (>95%) while the sample control analysis comparison of *K. pneumoniae* and *E. aerogenes* to *B. anthracis* yielded 94.4% and 94.8%, respectively, a lower sequence similarity that would be typical conserved sequences of distantly related species . From these expected results, it is implied that a successful variant calling can be performed using the 1000 Genomes dbSNPs as a positive control against the successfully treated and unsuccessfully treated patients' DNA.

Discussion

Bioinformatics is a powerful field of mathematics, computer science, and biology that enables researchers to mine large sets of data and extract useful, and clinically relevant results. Leukemia and MDS patients who are resistant to certain therapeutics can potentially be given different drug-treatments that are more effective toward targeting the disease simply by sequencing their genome and comparing it to a reference genome that is already established to be susceptible to different therapeutics – the ultimate goal of personalized medicine. The preliminary controls that were performed in this study lends to future experiments that will include actual patient data.

Tanya Ricasa

Biological Sciences

Barbara St. Pierre Schneider, Ph.D., Research Professor, Nursing

Macrophage Infiltration Patterns in Injured Skeletal Muscle

Introduction

Skeletal muscle accounts for nearly 50% of body tissue and skeletal muscle is critical for our mobility, the completion of our normal physical activities, and engagement in recreational physical activity. However, skeletal muscle is easily injured by a variety of insults, including trauma, and consequently, skeletal muscle injury can hinder our mobility and physical activity. When skeletal muscle is injured, the process of inflammation occurs. Different cell types are involved in the inflammatory process; however, a key cell type is the white blood cell or leukocyte. Therefore, soon after skeletal muscle is injured leukocytes travel from the blood to the site of skeletal muscle injury. Leukocytes express a variety of proteins. In addition, leukocytes that enter the injured skeletal muscle can exhibit different infiltration patterns.Within injured muscle fibers, leukocytes as evidenced by specific protein expression can exhibit different distribution patterns. That is, leukocytes may be distributed in (a) along the edge of an injured muscle fiber, (b) at the edge and inside the of the injury fiber, or (c) have a complete infiltrated fiber.

Objectives

The primary objective of this project is to describe leukocyte infiltration into a muscle fiber that could occur transversely or longitudinally. This research examines the emerging role of cellular infiltration within injured fibers at certain time points and seeks to address the following question is cellular infiltration progressive and not immediate.

Methods

Previously stained immunohistochemistry 10-micron thick serial cross sections of injured muscle were used to track leukocytes along the length of the injured muscle fibers. These serial cross-sections were immunolabeled with antibodies that recognize specific leukocyte protein CD68 and CD11b. Image analysis techniques were used to track the leukocyte protein expression within injured fibers across ten serial cross-sections from three different time points. Also, fibers were quantified by the percentage of infiltration using image analysis software.

Conclusion

At both 24 and 48 hours postinjury, the CD68 macrophage infiltration patterns appear to vary over a 100-micron range. At 24 hours postinjury, a similar percentage of fibers were partially infiltrated or negative. At 48 hours postinjury, while the majority of fibers were partially infiltrated, more fibers were completely infiltrated at this time point than at 24 hours postinjury. These findings suggest that the activities of CD68-positive macrophages may vary along the length of an injured fiber. Also, the CD68-positive macrophages may not commonly completely-infiltrate injured fibers or may take longer than 48 hours to completely-infiltrate injured fibers. Therefore, the CD68 protein may be involved in the removal of injured fibers over a period of 2-3 days, which could be a key point to address in developing interventions to expedite muscle recovery.

Beanca Jhanine Samiano

Biological Sciences

Chyna Miller, MS, Mathematics Learning Center

Self-Regulated Learning Interventions: An Exploration of the Role of Undergraduate Teaching Fellows in Preparatory Mathematics Courses

Introduction

Studies showed that many students enter community colleges and universities academically, emotionally, and culturally underprepared due to lack of self-regulation strategies and self-efficacy (Bol, Campbell, Perez, & Yen, 2015). In fact, Kersici and Erdogan (2009) emphasized the importance of self-regulation strategies and intrinsic motivation to reduce Mathematics anxiety, an emotion associated with students' stress and negative experiences with mathematical concepts and problem-solving methods. As a result, self-regulatory interventions should be provided by instructors or school-managed tutoring programs for skilled science learning (Miller, 2015). In Fall 2016, the Mathematics Learning Center of the University of Nevada, Las Vegas established the pilot program of "Undergraduate Teaching Fellows" (UTFs), which will cater to students in preparatory Mathematics courses such as Math95(A/B/C) or Math96. This program utilizes high-performing undergraduate students or UTFs as peer tutors in class, collaborative learning activities, and Math autobiographies exam and survey prompts to provide both the UTFs and instructor insight on how to communicate with students while being sensitive to their needs, self-efficacy, and Math learning.

Objectives

The purpose of this study is to test the reliability of the Undergraduate Teaching Fellow program as a self-regulated learning intervention to alleviate students' Mathematics anxiety. This study also aims to better formalize the autobiography process in preparatory Mathematics courses for future and more intensive research.

Methodology

The participants of the study were 15 students enrolled in Math95B in Fall 2016. Because the researcher was unable to obtain a random sample, the characteristics of the sample were not necessarily reflective of the population of students taking preparatory Math courses. The students' autobiographies were collected through three exam prompts and surveys, and their exam scores (assessments with a prompt) were compared with their final exam scores (assessment without a prompt). In addition, students' class performance was examined based on their overall course grade.

Results

Because this research is exploratory in nature, no formal hypothesis was established and simple statistical analysis was performed. The exam I average was 82.73% while the exam II average was 89.33%. The exam III average was 91.4%, which was the highest among the three assessments with a prompt. On the other hand, the final exam (assessment without a prompt) average was 63.73%. The students' overall performance was examined in which 47% of the class received a C or C+, 40% got a B- or B, and 13% had an A- or A.

Conclusion

Kersici and Erdogan (2009) emphasized that mathematics anxiety is significantly and negatively correlated to getting good grades. Based on the results, students' averages demonstrated an increasing trend on assessments with a prompt. This could be due to the fact that students were able to express their feelings and emotions and relieve their anxiety through journaling before starting the exam. In addition, students on average scored 24% lower on the final exam compare to exams where they were prompted to journal. The absence of an exam prompt could not be directly correlated to low average score since students took a cumulative final exam and perceived the material as more challenging.

Ronda Sawa

Biological Sciences

Dennis Bazylinski, Ph.D., Professor, School of Life Sciences

Diversity of Magnetotactic Bacteria in Different Environments of Great Salt Lake, Utah

Introduction

Magnetotactic bacteria (MTB) are a morphologic and phylogenetic diverse group of motile organisms that biomineralize intracellular, single magnetic domain crystals of iron oxide magnetite (Fe_3O_4) or greigite (Fe_3S_4) in lipid membranous vesicles called magnetosomes. Magnetosomes are generally organized in linear chains and orient the cell body along geomagnetic field lines while flagella actively propel the cells, resulting in so-called magnetotaxis. Even though Magnetotactic bacteria were discovered over 40 years ago, and considering their ubiquitous distribution and diverse physiology and biomineralization, there are relatively few strains in pure culture because of their fastidious growth requirements and strong metabolic diversity.

Objectives

The purpose of this study is to examine the diversity of magnetotactic bacteria in different environments of the Great Salt Lake and isolate in pure culture and characterize at least one strain of magnetotactic bacteria from this environment.

Methods

Bacterial communities of MTB, concentrated from different areas of Great Salt Lake (GSL), were observed under the microscope and surveyed by cloning and sequencing the gene codifying the 16S rRNA and inoculated in culture media, for that, MTB were concentrated using the south magnetic pole of a magnet. Cells were collected and observed under the microscope and concentrated again using racetrack. Cells from Racetrack were used for amplifying the 16S rRNA gene, and for inoculation in culture media. Basic semisolid autotrophic [O2]-gradient medium containing sodium bicarbonate as a carbon source was used to try to isolate the MTB communities observed in different environments of GSL. The pH and salinity were adjusted with base in the different environments. After 8 days of inoculation, the tubes with bacteria were observed under the microscope and tested for magnetotaxis. Tubes with magnetotactic bacteria were used for isolation and purification of MTB, using two strategies: 1) new racetracks using bands of cells from the contaminated tubes, and posterior inoculation in new semisolid autotrophic or heterotrophic [O2]-gradient medium, and 2) inoculation of bands from the mixed cultures in solid autotrophic [O2]-gradient medium, applying the dilution-to-extinction and shake-tube techniques (Seeley et al., 1991). The new strains isolated this technique were growing in different culture media.

Results/Discussion

The different environments sampled in Great Salt Lake presented salinities between 2 to 123 ppt and pH between 7.4 and 8.9. Samples with salinities less than 20 displayed MTB, however, only one sample with salinity of 103 ppt show some MTB. Under the microscope magentotactic cocci, spirilla, vibrio, and rods were observed, but rods were the dominant population in the different environments. Phylogenetically, all the strains were affiliated to the Alpha and Deltaproteobacteria class. In this study only one strain of *Magnetospirillum* was isolated in pure culture using the media tested. The magnetotactic bacteria isolated has a helical morphology, and was isolated from a freshwater environment in GSL (Salinity 2 ppt; pH 7.67). The phylogenetic analysis based on the gen codifying the 16S RNA showed that the magnetotactic spirilla isolated from GSL belong to the *Alphaproteobacteria* class, and has 99.724% of identity with Alpha proteobacterium CC-2, 99.723% of *Magnetospirillum* sp. CF18, 9.65% of *Magnetospirillum* sp. XM-1, and 99.021% *Magnetospirillum magneticum* strain AMB-1, forming a monophyletic clade in the *Magnetospirilla* genus. Future analysis of transmission electron microscopy, and the genes involved in biomineralization will be necessary to study the biomineralization process in these bacteria isolated from GSL. However, all those strains synthesize a single chain of magnetosomes, similar to the other species of *Magnetospirillum* (Dziuba *et al.*, 2016). *Magnetospirillum* GSL grows in the oxic – anoxic interface of autotrophic or heterotrophic medium. Heterotrophically, *Magnetospirillum* GSL use acetate, succinate or fumarate, as carbon sources but it was not able to grow using formate. The bacteria can grow autotrophically using bicarbonate and sulfite, however seems not be able to use thiosulfate as an electron donor. Pure cultures of MTB are important to have a better understanding of the biomineralization process, magnetotaxis, and the study of how the function of the MTB on the geochemical cycling of iron, carbon, and sulfur works in different environments.

Conclusion

GSL present a high diversity of MTB, however only one strain of MTB was isolated using the culture media tested in this study. The bacteria isolated belongs to the *Alphaproteobacteria* class along with *Magnetospirillum* genus. Future genomic and transmission electron microscopy analysis are necessary for a better characterization of the *Magnetospirillum* GSL.

Henry Taiwoong Park

Biological Sciences and Mathematics

David Lee, Ph.D., Associate Professor, School of Life Sciences

Biomechanical Interpretation of Osteoarthritis

Introduction

The underlying cause of osteoarthritis is still unknown. It is crucial to examine the physical interactions that occurs in the mammalian joint to investigate the cause of osteoarthritis. XMA Lab (X-ray imaging software) can used to carefully examine mammalian joint systems. This research project can possibly lead to the discovery of the underlying cause of osteoarthritis.

Objectives

The primary objective of this research is to take a close look at the mammalian joint interaction via XMA Lab to better understand the underlying cause of osteoarthritis.

Methods

I have been viewing and editing X-ray images of guinea pigs using software called XMA Lab, which is designed to track bones using anatomical landmarks or implanted markers. Digitally tracking markers in two views allows scientists to track the 3D movement of bones. I have also incorporated C^{++} code for frame-averaging to enhance contrast and used XMA Portal for management of our X-ray videos and metadata.

Results

After marking and editing the X-ray images of guinea pigs via XMA Lab, it has become more apparent that there is a clear indication of abnormal loading on the guinea pig joint. The markers located around the guinea pig knee joint come closer together in distance to indicate that there is a force loaded onto the knee joint of the guinea pig, which causes abnormal loading.

Conclusion

After a close inspection of guinea pig knee joint, the 3D X-ray Motion Analysis suggests that the tibia and the femur come closer together over the course of the guinea pig locomotion, creating an abnormal loading on the knee joint. This further suggests that the guinea pig osteoarthritis can be caused by the abnormal loading on the knee joint, which causes degradation of connective tissues and ligaments in the joint.

Shiela Mae Tolentino

Health Care Administration and Policy

Betty Burston, Ph.D., Assistant Professor-in-Residence, Health Care Administration & Policy

Diabetes Mellitus Practice Guidelines and Asian Americans: Some Notes for Primary Care Providers, A Systematic Literature Review & Content Analysis

Introduction

Clinical practice guidelines in the diagnosis and treatment of diabetes mellitus among patients have been established by multiple healthcare associations and organizations. These guidelines are routinely updated and used by physicians to support the most evidence-based practices. However, the degree to which these various practice guidelines embody research that is specific to the treatment of Asians Americans, and specific Asian subgroups, has not been well established.

Objective

The objective of this research was to identify ways to support primary care physicians in better serving the Asian-American population who are at risk of pre-diabetes or diabetes.

Methods

Two research questions were developed: 1) Does recent published literature on the prevalence and incidence, causes, and manifestation of diabetes mellitus among Asian Americans show significant findings that indicate the need for distinct treatment? and 2) If so, to what degree do current practice guidelines specifically address these findings and instruct physicians in modifying their practice when diagnosis and treating for this disease in Asian Americans? A systematic literature reviewed was completed to answer the first research question. Research on PubMed was conducted, using keywords, identifying approximately 158 relevant articles published within the past 20 years. Key findings from their abstracts were listed and used to identify common points. To answer the second research question, a content analysis was completed on 27 practice guidelines listed by the National Institute of Diabetes and Digestive and Kidney Disease and the National Guideline Clearinghouse. Keywords were used to determine whether these practice guidelines included recommendations specific to Asians Americans and their sub-groups. Findings were then used to identify gaps between the research and the practice guidelines and propose tools and products that can deliver practice notes to physicians in geographical areas with significant Asian American population.

Results

The literature review revealed that Asian Americans have a higher prevalence rates of diabetes compared to non-Hispanic Whites. Asian Indians were the subgroup with the highest rate. Asians were less likely to receive other types of screening tools for diabetes, including blood sugar tests, feet checks, eye examinations, and had a higher rate of under diagnosis. In addition, Asian Americans had a greater probability of diabetes self-management than their Caucasian counterparts. Asians are also at risk for diabetes at a lower BMI ($\geq 23 kg/m^2$). Although Asians have an overall lower BMI than for any other ethnic group, they have higher abdominal fat. The literature review also revealed that Asians have multiple diabetes-related comorbidities. The list included breast cancer, retinopathy, amputations, kidney disease, and macrosomia. Yet, based on the content analysis, only 10 of the 27 practice guidelines analyzed (37%) even mentioned the unique needs of Asian Americans. A mere 8 of the 27 practice guidelines (29.63%) recognized that Asians are a high-risk population group for diabetes and recommended they be screened at a lower BMI. Only 3 of the 27 (11.11%) practice guidelines provided an in-depth description of the need to differentiate treatment for certain Asian sub-groups. Finally, 0% of the 27 guidelines address the related comorbidities or the use of the other screening methods, aside from BMI.

Conclusion

The insignificant amount of practice guidelines addressing the needs of Asian Americans with diabetes mellitus suggest a need for the inclusion of recommendations for diagnosing and treating this population and its sub-groups. The absence of such differentiated recommendations can lead to more cases being undiagnosed. As a result, Asian Americans are placed at a higher risk of diabetes complications. This can lead to increased health care expenditures for the economy as a whole.

Kira Tran

Public Health

Amanda Morgan, DHS, MPH, Faculty-in-Residence, School of Community Health Science

An Investigation Into The State of Sexuality Education and Access to Reproductive Healthcare Services for Vietnamese Adolescents and the Implications

Introduction

Vietnam's rapid growth within the last decade has proved beneficial to economic development (Nguyen & Wilson, 2017). However, with this growth has come increased privatization of health care that has further marginalized disadvantaged populations, increasing health disparities in rural, urban, and mountainous populations across Vietnam, specifically amongst sexuality and gender minorities (Hoang, Nguyen, & Duong, 2017). To reduce such disparities, comprehensive, non-stigmatized, accurate, and accessible sexuality education and reproductive health services must be available to adolescents (Ngo & Hill, 2011). However, additional information must be assessed in order to ensure that effective policies and practices regarding sexuality education and reproductive health services are available and accessible in Vietnam.

Objectives

The purpose of this study is to determine whether or not current adolescent sexuality educational practices in Vietnamese rural, urban, and mountainous communities provide comprehensive information and services. Additionally, by reviewing the current state of clinical practices of existing facilities, this study aims to provide recommendations for improvements to Vietnam's policies and practices regarding adolescent sexuality education.

Methods

A meta-analysis was performed to assess the status of Vietnam's current sexuality education and reproductive health services. Using Academic Search Premier, the University of Nevada, Las Vegas Library Database Search, and Google Scholar, keywords and phrases such as "sex education Vietnam," "reproductive rights Vietnam," "education systems Vietnam," and "healthcare Vietnam"

were used to search for relevant articles and to find common themes. To account for Vietnam's recent economic and social growth and the researchers' language limitations, the search was filtered to only include literature written in English and published after 2000. Thirteen articles were reviewed due to these language and timeframe limitations and using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), an evidence-based methodology for reviewing evaluations of interventions (Moher, Liberati, Tetzlaff, & Altman, 2010). Using PRISMA, inclusion of articles was determined based on relevance to key audiences such as healthcare providers and policy makers. The resulting thirteen articles were further examined and reviewed to identify four key themes related to accessibility of reproductive healthcare.

Results

After reviewing the articles, four common factors were found as influential to the accessibility of reproductive healthcare: (1) of the three regions, urban, rural, and mountainous, populations in the geographical mountainous region were found to have the most health disparities and least access to care; (2) social stigma towards topics of sex and sexual health effect both preventative reproductive health and availability of aftercare; (3) high rates of emergency contraceptive use is linked to difficulties in receiving preventative contraceptives and ease access to abortion services; and (4) significant disparities in sex education practices exist in mountainous and rural populations compared to urban populations.

Conclusions

This study aimed to increase the body of knowledge that exists regarding the current state of sexuality education in Vietnam and the accessibility of reproductive healthcare services. Suggestions were made to improve the current state of the sexuality education young adults receive in Vietnam at national and local levels of policy.

Thien Truong

Computer Science

Evangelos Yfantis, Ph.D., Professor, Department of Computer Science

Neural Network Architectures: Evolution of Neural Networks for Image Classification

Introduction

Image Processing has been a huge field in technology for numerous years. In the past, edge detection algorithms were the leaders in image detection. However, within recent years machine learning has begun to dominate image processing. For instance, neural networks have revolutionized pattern recognition and image classification, and has helped artificial intelligence improve vastly (Jia, et al., 2014). This research will investigate which neural network architecture is the best for image recognition problems.

Objective

The primary objective of this research will be training and testing different neural network architectures to see which model yields the best results for the image classification problem of Mnist. We will be implementing a deep-fully connected neural network and convolutional neural network. Throughout this experiment, we will be testing various hyper-parameters on our model to determine the highest score achievable for each. Hyper-parameters are parameters that express "higher-level" properties of the model such as its complexity or how fast the model can learn.

Methods

The dataset that this research will use to train and test the different architectures is the Mnist-Dataset. This dataset comprises of two parts: a training set and a testing set. The training dataset has 60,000 handwritten digits along with 60,000 truth labels for those images. The testing dataset is comprised of 10,000 handwritten digits along with 10,000 truth labels as well. Both neural network models use stochastic gradient descent(SGD) as their optimizer to minimize the cost/loss function. See below.

$$W_{i+1} = W_i - \eta \Delta E(Z_i, W_i)$$

η is a hyper-parameter and also known as the learning rate in our models. Δ is the error gradient of W_i during the i-th iteration. $E(Z_i, W_i)$ is the differential equation that we take the partial derivatives of in order to get the appropriate costs.

When calculating the error and passing it back through our model, we will be using the backpropagation algorithms. As stated before, it takes the partial derivatives of our model's cost function to compute the total error, which is then passed back to its correct weights/offsets. (Yfantis, 2018) For a simple model, the partial derivations for a weight w could be represented as:

$$\Delta w_i = -\epsilon \frac{\partial E}{\partial z} \frac{\partial z}{\partial net_i} \frac{\partial net_i}{\partial w_i}$$

(Derivation of Backpropagation, 2018)
In this example, we take the partial derivative of the cost function with respect to the output of the system. Then we take the partial of the output, with respect to the partial of the system (which is condensed). Finally, we take the partial of the system, with respect to the partial of the weight that we are trying to propagate the error back to.

The first method is to implement a fully connected neural network designed for image recognition. Then we will optimize the hyper-parameters to achieve the best score on the training and testing sets. The second method is to implement a convolutional neural network and optimize the hyper-parameters as well.

Results will then be compared against one another.

Results

Implementation of the deep fully connected and convolutional neural networks were both successful. Various permutations of hyper-parameters were tested for achieving the highest scores possible for both models. The deep fully connected neural network scored a high of 97.7\% during training and 96.3\% on testing.

The convolutional neural network scored a high of 99.998\% during training and 98.92\% on testing.

These percentages are a measure of correctness for the models when fed 60,000 during each training iteration and 10,000 for the testing stage. Both networks slightly dipped in accuracy from their highs during training to testing, but this is justifiable since the cases used in the testing set were designed to be more difficult than the images provided for training.

Conclusion

The convolutional neural network produced a higher score for this image classification problem of recognizing handwritten digits. Thus, for most image classification problems, a convolutional neural network model should be use. \newline
Neural networks are one of the fastest growing field in machine learning. There are various real-life applications. Self-driving cars already use convolutional neural networks as their basis to learn and react, however perfecting the convolutional neural network model would allow for perfected self-driving cars. They also have a plethora of applications in the medical imaging field. Imagine using a convolutional neural network to classify if a patient has some disease by passing a CT scan of the potential malignant area, this is very achievable. In conclusion, neural networks are extremely important for the advancement of machine learning. Thus, perfecting the understanding of this field could lead to great things in the future!

Keala Watson

Biological Sciences

Laurel Raftery, Ph.D., Professor, School of Life Sciences

Prevention of Fat Cell Death in *Drosophila melanogaster*: Effects on the Ovary

Introduction

Drosophila melanogaster has been extensively studied over the years. During the life cycle of *Drosophila melanogaster*, there is a larval stage. At the end of the larval stage *Drosophila melanogaster*, cells go through apoptosis (Aguila, Hoshizaki & Gibbs, 2013). This study focuses on the larval fat body, which is the only larval tissue that does not undergo apoptosis at the larval stage (Aguila, Hoshizaki & Gibbs, 2013). The larval fat body stores many nutrients and energy to supply to the larva during the pupal stage in the life cycle because the pupa is physically unable to get any nutrients and nutrients are needed to allow the pupa to transform into an adult fly (Aguila, Hoshizaki & Gibbs, 2013). This larval fat body then becomes circulating fat cells in the adult stage of the life cycle (Aguila, Hoshizaki & Gibbs, 2013). After about 2 days as an adult *Drosophila melanogaster*, circulating fat cells undergo apoptosis (Aguila, Hoshizaki & Gibbs, 2013). The fat body provides important resources females' reproductive abilities (Spradling, 1993). This research strives to understand how egg production would be altered if we prevented apoptosis of adult fat cells.

Objective

The primary objective of this research project is to study the effects of inhibiting apoptosis in fat cells on the ovary size, and amount of eggs in *Drosophila melanogaster*.

Methods

UAS-DIAP1 strain of flies are mated with LSP2-GAL4 strain of flies which creates the experimental group of flies. The progeny of these two strains together have a genotype of {UAS-DIAP1/LSP2-GAL4}. This genotype changes the physiology of the flies. These two genotypes together activate a protein that prevents the normal process of larval fat cells dying (Duffy, 2002). The flies that are needed for this research are unable to maintain the normal operation of larval fat cells dying which affects the normal operations of the fly. We want to look at those effects that the alteration causes. LSP2 turns on GAL4 and GAL4 is needed because UAS cannot be expressed unless it binds to GAL4 (Duffy, 2002). Control flies are used so that we have an unperturbed group of flies with very similar genotypes, these will be our control samples for all comparisons. Control flies represent all parts of experimental genotype, but none have the alteration we are making in the experimental group. This group of flies consists of w[1118] flies mated with LSP2-GAL4 and yw flies mated with UAS-DIAP1. We use this control group to control for any unpredictable changes that may come from these components.

Materials

CO_2 was used to put the flies to sleep to be easier to manipulate. The flies are stored in incubators to maintain a controlled environment. Dissection of the flies were done using dissecting needles, wells, PBS (Phosphate Buffered Saline), stereomicroscopes, and CO_2 as well. Microscopic imaging used to capture images of ovaries that are dissected. The magnification factor for the microscope objection is 2X to ensure that images can be compared to each other to determine size difference.

Results

The ovaries in day one controlled flies were noticeably smaller than the day one experimental fly ovaries. This is surprising, based on what we know about egg maturation. To further study these results, we plan to measure ovary area from these images, for quantitative comparisons between the control and experimental group ovaries. Understanding how flies use resources to produce eggs is important because *Drosophila melanogaster* have very similar basic systems to humans. We can potentially use these discoveries to help better understand the more complex systems in mammals.

Crystal Wu

Earth and Environmental Science

David Kreamer, Ph.D., Professor, Department of Geoscience

Review of the Ecological Impacts of Selenium in the Grand Canyon

Introduction

The Grand Canyon supplies water to over six million visitors annually. The springs are a natural habitat and water source for aquatic and avian organisms in the southwestern United States (Walters et al. 2015). However, the Grand Canyon is contaminated by various chemicals. Selenium, a chemical element, and nutrient to all living organisms is toxic in high levels (Tan and Nancharaiah 2016). The contaminant has been traced throughout the food web (Walters et al. 2015). Although the water in the Grand Canyon has been studied and sampled for decades, no current, comprehensive database stores the information in one location. The lack of a database hinders the ability to analyze the water quality accurately. The development of a compiled database can provide a comprehensive source of water quality samples, verified data sources, and a uniformed format. The database is significant since it supplies information to study the impact of various chemicals to the ecosystem, mining contamination, and sustainability of native tribes.

Objective

The primary objective is to compile data on the water quality of the Grand Canyon into one comprehensive database.

Methods

We are composing collected data from different agencies such as the U.S. Geological Survey, EPA's Storage and Retrieval system, Natural Park Service, and Arizona Department of Environmental Quality into a comprehensive database. We also included data from published books, peer-reviewed scientific journal articles, and verified field notebooks. The database we are composing divides the different contaminants sampled from springs, creeks, and rivers. Various chemicals and water measurements have already been tested and documented in the field. Chemical elements such as Selenium, Uranium, and Arsenic are incorporated in the database. Also, turbidity, pH, and the temperature are included in the hydrologic measurements. After entering all of the data, we will be creating different graphs, data trends, and comparisons to analyze chemical concentrations, data gaps, and comparing maximum contaminant levels.

Preliminary Findings

Within the Grand Canyon, there are water quality regulations to preserve the environment. The maximum contaminant level (MCL) determines the allowed amount of contaminants in the water. Various chemicals have exceeded the maximum contaminant level in the Grand Canyon. Selenium with a maximum contaminant level of 50ug/L has been surpassed in approximately seven springs. The maximum contaminant level for freshwater organisms is 5ug/L. The high levels of Selenium have a potential to impact the ecosystem of different springs (Luoma and Presser 2009). Also, Selenium has only been analyzed 8.3% of the time. Each time the chemical has been tested, it exceeded the MCL standard.

Discussion and Implications

Since contaminants have surpassed the maximum contaminant level in various locations in the Grand Canyon, monitoring and remediation are necessary. There is a need for further fish and wildlife sampling to determine the negative implications to the food web. Ecosystems can be permanently altered with high levels of contaminants (Walters et al. 2015). With a comprehensive database, areas with high Selenium levels can be identified and adequately treated. The database will be a critical device to facilitate research.

Kurt Yumang

Kinesiology

Brach Poston, Ph.D., Assistant Professor, Department of Kinesiology and Nutrition Sciences

Cerebellar Transcranial Direct Current Stimulation for Motor Skill Acquisition During a Throwing Task

Introduction

Cerebellar transcranial direct current stimulation (c-tDCS) is a non-invasive brain stimulation technique that has been shown to acutely increase motor performance in young and old adults. c-tDCS may even be able to outperform tDCS applied to motor cortex depending on the task being practiced. However, current studies that have investigated the influence of c-tDCS on motor performance have used rather simple tasks or adaptation tasks.

Objectives

The purpose was to determine the influence of c-tDCS on the accuracy and variability of a complex, multi-joint throwing task in young adults.

Methods

The study was a sham-controlled, double-blind, between-subjects experimental design. Twenty-four healthy males (18-30 years of age) were randomly allocated into either a SHAM or c-tDCS group. Each subject participated in a practice session followed by an experimental session, which was completed 24 hours later. In the practice session, subjects performed 10 trials of a throwing task in a baseline test block, followed by 6 practice blocks of 10 trials, and a post-test block of 10 trials that was performed five minutes after the last practice block. In the retention session, subjects performed the throwing task for a single block of 10 trials. The throwing task involved accurately throwing tennis balls puts to a small target placed on a concrete wall 6 meters away from the subjects. Anodal c-tDCS or SHAM stimulation was applied during the practice blocks at a current strength of 2mA for 25 minutes. For c-tDCS, the anode was place 3cm lateral to the inion overlying the cerebellar hemisphere ipsilateral to the throwing arm, whereas the cathode was placed over the ipsilateral buccinator muscle. The dependent measures of interest for the throwing task were endpoint error and endpoint variance.

Results

For the test blocks, the endpoint error and endpoint variance were similar in the baseline test between groups. For endpoint error, there was a significant Test main effect (P = 0.003). Post-hoc tests indicated that endpoint error was greater in the baseline test block compared with the post-test block (P = 0.004) and there was a trend for lower endpoint error in the post-test block compared with the retention test block (P = 0.063). For endpoint variance, there was a significant Group x Test interaction (P = 0.034), but post-hoc tests just failed statistical significance (baseline test vs post-test, P = 0.107; post-test vs retention test, P = 0.067). For the practice blocks, the main effect for Group was not significant for endpoint error (P = 0.148) or endpoint variance (P = 0.152). Furthermore, the main effect for Block was not significant as the decline in endpoint error and endpoint variance was similar over the course of the practice blocks for the two groups (endpoint error, P = 0.534; endpoint variance, P = 0.326). The Group x Block interaction was not significant for either variable.

Conclusion

These findings indicate that a single application of c-tDCS applied during practice of a complex throwing task increases endpoint accuracy and reduces endpoint variability in young adults when measured in retention tests performed 5 minutes and 24 hours after cessation of practice.

Samantha Andrews

Biological Sciences

Dale Devitt, Ph.D., Professor, School of Life Sciences

Pharmaceutical Toxicity in Plants

Introduction

We like to believe that fruits and vegetables are the healthiest things for us to eat, but what happens to them when they are grown with contaminated pharmaceutical wastewater? We can't completely control what's in the water that's used to help these plants grow so identifying how these pharmaceuticals in the water affect the fruit and vegetables we eat is vital. Knowing where the pharmaceuticals will travel, and if it's in safe amounts is critical to our health. There have been many studies on how certain pharmaceuticals in the leaves or fruit effect individuals but there is many inconsistent studies out there. In our research we calculated the amount of each pharmaceutical that is recommended for humans each day. Knowing this information can lead to more precautions when growing plants or even laws to lessen the amounts of chemicals that can be drained into water. Other research has also asked the question if wastewater could be used to safely irrigate crops and that's what we will be determining (Shilpi, 272-281).

Objectives

The main objective of this experiment is to detect the amounts of pharmaceuticals found in the plants grown and compare it to the levels that is recommended on a daily basis to see if it's safe to consume.

Methods

This experiment was done to test the effects of pharmaceuticals on plants that were watered with 13 different pharmaceuticals in the water. An LD50 value was calculated which tested the amount of each pharmaceutical that would kill 50% of the subjects tested. Showing that the LD50 value is an amount we don't want to consume of that particular compound. A NOAEL value was tested which provides the highest value of that pharmaceutical the subject can have without showing any adverse effects. Last an RDI value was determined which shows the suggested daily amount one can ingest that is still considered healthy. The RDI value was compared to the amount found in each plant to see if those values would be considered a safe amount for humans to consume. The end result was to see if plants grown in the greenhouse that were watered with contaminated wastewater had healthy amounts of the pharmaceutical in it or not.

Anticipated Findings

Future findings will be determined on how well the plants fare once they are treated with the different pharmaceuticals water. Based on initial findings compounds like Sucralose, Benzotriazole, and TCEP had higher amounts in the plants than the recommended amount to ingest. While all the other compounds were found to have safe amounts of the pharmaceuticals in it.

Discussion

The significance of this experiment is that it affects us all no matter where we live. What's in our water could be affecting the fruits and vegetables we eat, some of the healthiest food might contain the contaminates from the pharmaceutical that helped them grow. More can be done to make sure that there are more precautions when growing crops and protecting them from contaminated water. Laws can be made that makes it mandatory to check crops after they are cultivated and have to have a safe amount of the pharmaceuticals in it.

Hannah Barbarita

Biological Sciences

Frank van Breukelen, Ph.D., Department of Life Sciences, University of Nevada, Las Vegas

Heat Shock Protein 90 in Devil's Hole Desert Pupfish

Introduction

During stress in the Devil's Hole Pupfish, there are phenotypic changes that take place such as the absence of pelvic fins and smaller body sizes. Previous data has suggested that 90% of fish reared at 28C have pelvic fins compared to 60% having fins being reared at 33C. We hypothesize this is due to the epigenome. When experimenting epigenetically with *Cyprinodon diabolis*, a species of Devil's Hole Pupfish, via temperature, we will see that the expression of Heat Shock Protein 90 determines whether pelvic fins appear or disappear.

Objectives

The main objective is to test this hypothesis by treating *Cyprinodon diabolis* larvae at day 22, important for HSP90 determination, then wait to see if we get an increase or decrease in pelvic fin development. HSP90 protein effects other client proteins, thus resulting in a different phenotype which some believe to be a different species. A better understanding of the HSP90 protein could have implications for how we understand evolution.

Methods

Collecting larvae: The larvae are reared at 28C for 22 days post-hatch. Hatched eggs are checked every day at 1pm and transferred into a beaker using a 5 mL pipette. They are then counted, and placed into an incubation tube in an incubator with the number of larvae, date, initials, and treatment date on the vial. All information is then transcribed on the "Hatched Eggs" sheet and the larvae are fed. Treatment: Treatment happens on the day 22in different groups-Control at 28C-17-DMAG at 28C-Heat Shock at 33C. Thermomixers are used during treatment for controlled temperature for 24 hours. After the 24 hour treatment, the larvae are frozen, weighed, and pooled for Westerns to be performed at a later date. Treatment Protocol: C= Control group at 28C E1= 17-DMAG at 28C E2= Heat Shock at 33C. Transfer 1 larvae from beaker to 5mL Eppendorf tube with 3mL of its reared water and add *XmL of 17-DMAG to E1 group. Incubate for 24 hours at appropriate temperatures. 2 different thermal mixers: one at 33C and one at 28C with control and 17-DMAG. Weigh and freeze: weigh the boat, put fish on weigh boat, document weight of fish. Freeze at -80C for 5 minutes. Place 1 fish per 0.5mL Eppendorf tube using tweezers (label with date and initials). Pool until 54 at least and 150 at most. *XmL signifies filling tube until full.

Expected Results

The expected results are that in comparison to the Control group reared at 28C, the larvae treated with 17-DMAG will display different fin expression shown by the results of a Western blot on the larvae's client proteins associated with HSP90. The same outcome should be true of the larvae who were reared at 28C, but heat shocked at 33C.

Conclusion

The results will be significant, because they will show what is happening mechanistically in these fish. Changes in Heat Shock Protein 90 should be the cause of fin development changes in the Devil's Hole Pupfish which can explain the concept of evolution.

Rianda Carodine

Biological Sciences

Dustin J. Hines, Ph.D., Assistant Professor, Department of Psychology

Rochelle M. Hines, Ph.D., Assistant Professor, Department of Psychology

Expression of the GABA Type a Receptor Alpha 4 Subunit Upon Mutation of the Alpha Subunit

Introduction

Anesthetics exert their behavioral effects through depressing neuronal activity within the central nervous system (CNS). Within the clinical setting, the sedative qualities of anesthetics allow for the creation of medically induced comas which makes them highly favorable. Despite their clinical advantages, anesthetics are still dangerous because of a narrow therapeutic index, and improving these agents has been difficult because mechanistic details of anesthetic actions are still unclear. Extensive research has revealed that multiple anesthetics act via modulation of gamma-Aminobutyric acid type A receptors, $GABA_ARs$), which are targets of the principal inhibitory neurotransmitter GABA. GABA has two modes of inhibition: phasic and tonic. Phasic inhibition is mediated by receptors clustered at synaptic sites. Tonic inhibition is mediated by extra synaptic receptors that have a high sensitivity for GABA and long open time. Phasic, synaptic receptors are composed of, specialized subunits including two of α1-3, while tonic extra synaptic receptors are composed of α4-6. Different subtypes of anesthetics have been suggested to mediate their effects predominantly via tonic inhibition. Further, numerous studies have implied that there is a reciprocal relationship between phasic and tonic inhibition; however, more research is needed to understand these relationships, and how they impact the actions of anesthetics.

Objectives

The primary objective of this study was to characterize the expression of tonic α4 containing receptors upon manipulation of phasic α2 containing receptors

Methods

These studies will employ a mouse model bearing a mutation in the α2 subunit of $GABA_ARs$ that impacts the expression and localization of synaptic receptors (Gabra2-1). We began by perfusion fixation and cryosectioning of both the wild type control and Gabra 2-1 mouse brain tissue. We performed immunohistochemistry with antibodies directed against the α2 and α4 subunits of the GABA type a receptor, followed by fluorescent labeled secondary antibodies. The next phase of our experiment involved laser scanning microscopy to detect the fluorescent tags. We analyzed the expression of α2 and α4 using Image, comparing wild type control and Gabra 2-1 mice in brain regions important for regulation of the response to anesthetics.

Discussion

Imaging results are consistent with the hypothesis that upon mutation of the α2 subunit α4 expression is altered. Quantitative assessment of the relationship between α2 and α4 subunit expression levels will help us to understand how these modes of inhibition are regulated. Future studies will examine the impact of Gabra2-1 mutation on the response to anesthetics. These experiments are expected to advance our understanding of anesthetic action, helping to improve this important class of drugs.

Felipe D. Diaz

Biological Sciences

Kristen M. Culbert, Ph.D., Assistant Professor, Department of Psychology

An Examination of Pubertal Timing Effects on Drive for Muscularity in Men

Introduction

Researchers have examined links between the timing of pubertal onset and risk for several disordered eating symptoms (e.g., body dissatisfaction, dieting; Ullsperger & Nikolas, 2017); however, very few studies have explored whether differences in pubertal timing predict differences in Drive for Muscularity (DM) – a form of body disturbance that is particularly evident in males (Leone, Wise, Mullin, Harmon, Moreno, & Drewniany, 2015; McCreary, 2000). In males, pubertal maturation results in decreases in body fat and an increase in muscle mass, which moves boys closer to the socially-prescribed muscular body-ideal (Leone, 2007; Leone et al., 2015). Boys who mature later than peers may be at heightened risk for DM, relative to their peers, given their delay in physical/masculine maturation. Exploring this association may help inform models of risk for drive for muscularity in men and could help in the prevention and treatment of disordered eating.

Objectives

The primary objective of this study was to examine whether pubertal timing has an effect on drive for muscularity in young adult men.

Methods

The Retrospective-Pubertal Development Scale (Zehr, Culbert, Sisk, & Klump, 2007) assessed perceived (i.e., perception of timing compared to peers) and objective (i.e., age at onset of secondary sex characteristics) reports of pubertal timing on voice changes, body hair, facial hair, and spontaneous erections. The Drive for Muscularity Scale (McCreary & Sasse, 2000) assessed behavioral and cognitive aspects of DM. The Eating Pathology Symptoms Inventory (Forbush et al., 2013) also assessed behavioral aspects of DM.

Results

Associations of small-to-medium effect size were detected between later pubertal timing and DM. Notably, only objective indicators of pubertal timing significantly predicted DM and stronger effects were detected with DM behaviors. These effects held even after adjusting for Body Mass Index (BMI). No effects were detected between perceived pubertal timing and cognitive or behavioral aspects of DM.

Discussion

Later pubertal timing showed stronger predictive effects on behavioral aspects of muscle-building than on cognitive aspects, independent of BMI. These findings highlight the importance of differentiating perceived versus objective measures of pubertal timing and provide evidence that later pubertal timing may exhibit differential effects on various types of DM symptoms. Future studies should empirically identify the explanatory factors (e.g., internalization of the muscular body-ideal) underlying later pubertal timing effects on risk for DM behaviors.

Deborah Duncan

Biological Sciences

Colleen Parks, Ph.D., Associate Professor, Department of Psychology

Forgetting Distractors in Working Memory: Inhibition or Decay?

Introduction

Complete this math problem is your head: $8 \times (3^2 \times 2) + 10$. In order to do so, you have to remember the answers to the parts you have already solved and forget the numbers you no longer need. This illustrates working memory. Working memory is the ability to hold information in mind and process information at the same time. But how do we forget the distracting information in order to focus on what is important? There are two main ideas: inhibition (the SOB-CS model; Oberauer & Lewandowsky, 2016) and temporal decay (the TBRS model; Dagry, Vergauwe & Barrouillet, 2017). According to the SOB-CS model, forgetting occurs because there is an active process of removing the information (i.e., inhibition). On the other hand, according to the TBRS model, forgetting occurs when attention is diverted from the information (i.e., decay).

Objectives

The present study aims to explore the mechanisms involved in forgetting by testing these models in search of evidence that either supports or refutes their hypotheses.

Methods

In this study, participants were asked to go through a series of trials. In each trial, participants viewed a series of words in different colors. Words to be remembered were presented in red (i.e., targets) and while other words, presented in black, served as distractors. There are two types of trials: long and short. In the long trials, participants had 1.5 seconds after the distractor word and before the next target word; in short trials they only had 0.2 seconds between the two words. After each trial, participants were then asked to pick the target words in the order they were presented. We measured the number of distractors accidentally chosen in order to see if it was a function of the time given between distractors and targets.

Results and Conclusions

There was a significant difference in the number of distractors chosen in the short and long trials ($t(20) = 4.73$, p = 0.0001). Our experiment shows that participants remembered fewer distractor words in long trials when they were given a greater amount of time after the distractor, as compared to the short trials when they had less time. This finding more strongly supports the SOB-CS model because it provides evidence of inhibition. Since there was a lower number of distractors chosen in the long trials this means that participants were able to get rid of more distractors in working memory. In terms of the targets, we found that more targets were remembered in the long trials than in the short. However, it is difficult to distinguish which model accounts for this result because both models predict this result. The SOB-CS model predicts participants have more space to keep the targets in working memory because they were able to get rid of more distractors during the long trials. The TBRS model, which also accounts for this result, would say that because there is a longer period available to rehearse the targets, they are able to better recall them than when they had a shorter period of time. Future research could seek to investigate whether high spans and low spans differ in their ability to inhibit information.

Brisa Escobedo

Biological Sciences

Frank van Breukelen, Ph.D., Associate Professor, School of Life Sciences

The Role of the Gut Microbiome in the use of Paradoxical Anaerobism

Introduction

Devils Hole pupfish, *Cyprinodon diabolis*, are native to Ash Meadows National Wildlife Refuge and live in Devils Hole. Water in Devils Hole is 33.2 to 33.9ºC year round and there is a very limited food supply. In an effort to study the metabolic demands of these fish, oxygen consumption was calculated in a refuge population of *C. diabolis* acclimated at 28ºC and 33ºC. Although there was oxygen readily available, fish reared at 33°C oftentimes displayed no oxygen consumption for extended periods of time. This phenomenon was named paradoxical anaerobism (Heuton et al., 2015). When undergoing paradoxical anaerobism, the fish produce ethanol. It was thought that the bacteria present in the fish's gut may breakdown ethanol in the fish. Little is known about the role of the gut microbiome in paradoxical anaerobism, therefore, more research is needed.

Objectives

The main objective of this study is to identify whether the microbiome present in the pupfish gut affects use of paradoxical anaerobism.

Methods

To determine the role of microbiome in paradoxical anaerobism, we are conducting a laboratory experiment fish acclimated to 28°C and 33°C. There will be 12 fish per group, two acclimation temperatures, a control and an experimental group for each temperature for a total of 48

fish. The experimental groups will be administered a dose of an antibiotic mixture consisting of gentamycin, kanamycin, colistin, metrodinazol, and vancomycin 48 hours before the assay to clear these fish of their microbiomes. We will measure oxygen consumption in fish using oxygen electrodes with a flow-through system. We know that exogenous ethanol induces paradoxical anaerobism even in 28°C acclimated fish. Following a 1 h period of stable oxygen consumption, paradoxical anaerobism in the fish will be induced with 1% ethanol (EtOH).

Anticipated Findings

We anticipate that one of three things will happen to the experimental group; all the fish will go into paradoxical anaerobism, the fish will not survive, or there will be not effect on the fish using paradoxical anaerobism.

Discussion

The gut microbiome may lead to breakdown of EtOH in which case, we expect more fish to enter paradoxical anaerobism. The gut microbiome may also be breaking down sufficient ethanol as to prevent toxicity in the fish. In which case, we expect the fish to die or lose their ability to maintain posture in the metabolic chamber. If the microbiome is not involved in ethanol metabolism, we might expect no effect on the use of paradoxical anaerobism. The way that pupfish deal with exposure to alcohol may inform how humans deal with chronic alcoholism.

Joseph Fersini

Biological Sciences

Philippos Tsourkas, Ph.D., Assistant Professor, School of Life Sciences

Bacteriophage Genome Annotation

Introduction

Phage viruses hold promise in ecological and medical applications. There is still much to be discovered about the variety of phage viruses, especially in terms of their genomes and gene functions. Therefore, it is necessary to extract the genomes for annotation and determine the function of the genes. This process could potentially bring light to new discoveries relating to phage viruses and would be a step forward in the right direction if done correctly.

Objectives

Using bioinformatic procedures, the objective of this study was to identify and annotate the discovered genes of two different phages and submit them to be published in scientific gene-identification banks/journals.

Methods

Prior to annotation, the genomes of selected phages were extracted in a wet lab for analysis in the dry bioinformatics lab. Using multiple computer programs such as *DNA Master* I was able to perform the procedures and data collection necessary for genome annotation. These tasks include gene calling (determining whether to keep or delete genes based on validity), start codon identification (determining the length of the genes), and protein function assignment (determining the function of the proteins encoded by each gene). Using *Microsoft Excel Spreadsheet* as well as the notes section within *DNA Master*, I was able to collect data in an organized and efficient manner.

Results & Conclusion

Selected genes from the genomes of two phages "Riparian," "Chewbacca," and one Paenibacillus larvae "Heath" were put through multiple steps of bioinformatic genome annotation. In the first step known as "gene calling," possible genes to fill the genome gaps were identified and manually inserted into the genome for further analysis. The next step was to run all genes through the *NCBI BLAST Database* to identify associated protein relations. The values given by the database were used to determine whether or not the manually inserted genes were viable for even further analysis. It was determined that a few from each genome were in fact viable. Possible start codons other than the ones already called were then taken into consideration, and it was determined that some were more valid than what was called; and these were manually inserted into the genome. As a result of these annotation steps, the genomes of various and different phages have become more clear, and have been submitted for the scientific community to do further research upon if desired. This is a step further in the direction of bringing about the positive aspects of phage viruses and what they can do for ecological and biomedical applications.

Eddy Hernandez

Biological Sciences

Donald Price, Ph.D., Professor, School of Life Sciences

Effects of Starvation Resistance on D. Melanogaster

Introduction

Experimental selection for starvation resistance in *D. melanogas*ter has shown to increase lipid content in adult *D. melanogas*ter in comparison to *D. melanogas*ter that have been regularly fed, with a difference between sexes in male and female body size.

Objectives

The primary objective of this experiment was to observe the effects of starvation resistance on female reproduction as well as male and female survivability.

Methods

The starved lines of *D.melanogaster* we used in this experiment were selected for resistance for 100+ generations. The starved and fed lines were donated and bred by Dr. Allen Gibbs: groups A and C respectively (referred to as FA and FC for the fed lines and SA, and SC for the starved lines in this experiment). 300 larvae from each line were collected to ensure a sufficient sample size. The 300 larvae of each line were split into bottles containing 100 larvae per bottle to ensure no larval crowding took place. All flies were fed a mixture of agar, cornmeal, sugar, and yeast. When adults emerged, the virgin flies were sexed using a microscope and placed in vials with a unique identifier. Females were housed alone while males were housed in pairs. Body measurements were taken on a photo microscope using both male and female flies that were 5 days old. Each fly was placed on a CO_2 pad, until they were sedated. While under CO_2, flies had the length and width of their heads, abdomen, and thorax measured. All photos were measured in pixels and later converted into micrometers. Once both male and females were 7 days old when they were mated. 1 female and 2 males of the same line were placed in a vial containing food and yeast paste and were allowed 48 hours to mate. After 48 hours, females were placed in a grape agar vial to lay eggs and each male was transferred into its own agar vial for starvation resistance. Females were given 24hrs to lay eggs, after which they were also placed into an agar vial. All starvation vials were given a unique identifier. Flies were checked every half day to observe mortality, if any had died, the day and time were recorded. The eggs in the grape agar vials were counted and the number was recorded on a spreadsheet containing the appropriate identifier. Data analysis was done using R.

Results

Starved females were observed to have laid less eggs than their fed counterparts. Additionally, we found that starved females did not have a larger abdomen width than fed females. While the starved lines lived significantly longer than the fed line, we noticed that starved males had a higher abdomen width than fed males. From the data we speculate that given their selection for starvation resistance they allocate more resources towards survival in anticipation of a stressful environment in both males and females. This decrease in reproductive resources in females is what directly relates to a lower net production of eggs.

Lorena Herrera

Biological Sciences

Frank van Breukelen, Ph.D., Associate Professor, School of Life Sciences

An Assessment of Heart Rate Variability in Tenrec Ecaudates

Introduction

Hibernation involves periods of decreased metabolism (all chemical reactions that occur in an organism's body) and decreased body temperature. Unlike most mammals, *Tenrec ecaudatus,* native to Madagascar, are unconcerned about holding their body temperatures constant during hibernation and while active. They display an extended hibernation season with no evidence of periodic interbout arousals (IBA), a feature that is in contrast to most other hibernating mammals and makes restoration of metabolic imbalances possible(Van Breukelen & Martin, 2015). This raised the question of how these phenotypic plasticity mammals, with metabolic flexibility, can help other species such as humans survive reversible metabolic depression.

Objectives

The primary objective of this study was to examine ECG, electrical activity of the heart, of *Tenrec ecaudatus* and monitor any variability in its heart rate. Because the common *Tenrec* displays fluctuating and highly variable physiologic properties, such as internal body temperature and oxygen consumption, monitoring heart rate variability may reveal correlatory evidence that links these two processes.

Methods

To record heart rates, animals were placed one day in advance of testing into a temperature-controlled chamber, which was set to 20°C. On the day of testing, both shoulders and left thigh of the animal was shaved for proper ECG electrode placement. Placement of animal in clean bin containing corncob and water was followed.

Electrodes were then attached to designated shaved areas. ECG wires were maintained above the animal to prevent tangling and non-attachment. Since the preparation process artificially raises the animal's heart rate, 10-15 minutes of rest time was allotted to each, in order to normalize heart rate after ECG placement. A 3-lead ECG machine and LabScribe software was used to record 30 minutes of ECG tracings per animal. A display window consisting of one minute was used to display the tracings, which was also instrumental during data extraction and analysis. After the conclusion of each test run, the heart rate was manually counted and logged for every one-minute interval using the R peak in the QRS complex as a marker for each heartbeat. A Poincare plot was used to analyze heart rate variability. The heart rate for each one-minute interval was plotted against the heart rate of the next one-minute interval. Clustering of data points in a linear fashion on the graph represents invariable heart rate, whereas scattered data points represents a variable heart rate. Only two animals were graphed per plot for clarity and prevention of overlapping data.

Discussion

Linear clustering of data points was observed on a Poincare plot for all tested animals. This suggests that *Tenrecs ecaudatus* have an invariable heart rate. This finding was surprising, as this species has been shown to display highly variable body temperature and oxygen consumption during various states of activity. This decoupling of heart rate from oxygen consumption levels may be unique to the *Tenrec* and future studies that focus on this process may help elucidate a different regulatory mechanism for controlling oxygen consumption and body temperature that is independent of heart rate.

Cilla Jose

Biological Sciences

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Spectrally-Selective Copper-Oxide Spinel Absorber Coatings for High-Temperature Concentrated Solar Power Systems

Introduction

Concentrated Solar Power (CSP), in comparison to photovoltaic solar panels, involves methods to concentrate the sun's energy on to receiver systems that generate steam, activate turbines, and consequently generate electrical power. To achieve cost-effective power generation, CSP implementation in solar-favorable geographic areas provides a competitive avenue in the market for energy production. The selection of energy-efficient materials on both highly reflective heliostats that concentrate the sun's energy, as well as absorptive receiver systems, have a large influence on the CSP energy conversion process. One significant technology for reliable high-temperature operation has been the application of durable spectrally-selective solar absorber coatings on CSP receiver systems, using materials that favor ultraviolet, visible, and near-infrared solar irradiation responsivity while limiting spontaneous thermal radiation from emittance at higher wavelengths, correlating to a reduction of undesirable energy loss through waste heat.

Objective

The overall objective of this project will seek to improve energy-efficient technologies by innovating and utilizing high-temperature materials, limiting water and energy usage, and reducing environmental impacts for power generation at solar sites. This will be done by investigating variant metal-oxide materials that can be utilized to efficiently absorb solar thermal energy leading to enhanced CSP system efficiency. In addition, thermoelectric devices have been developed aiming to harvest low-grade thermal energy generated from solar facilities.

Methods

In this work, black metal-oxide nanoparticles comprising copper cobalt oxides ($Cu_xCo_{3-x}O_4$) and copper manganese oxides ($Cu_xMn_{3-x}O_4$) are synthesized for solar absorber coating potential by hydrothermal syntheses, selected for low-cost, energy-efficient fabrication capable for bulk manufacturability in contrast to sol-gel and dip-coating methods. The material is deposited onto high-temperature, durable Inconel substrates by a flexible spray-coating method, and characterization is performed by SEM, EDS, and XRD analyses, as well as measurements to gauge thermal performance. To extend spectrally-selective absorbance capability, the coating surfaces are geometrically-textured using sacrificial polymer beads that are jointly implemented in the spray-coating process. In addition to extending metrological and materials analyses, computational routines for optical simulations are discussed, regarding the feasibility for the energy-efficient solar absorber coaters presented in this work.

Abigale Ly

Biochemistry

David Copeland, Ph.D., Associate Professor, Department of Psychology

The Effects of Pronoun Usage on Reading Comprehension

Introduction

Narratives are popular because they can transport readers into a story – that is, readers can find themselves emotionally engaged in the text and attentive to what happens. It has yet to be strongly established, though, whether the perspective of narratives (I vs. You vs. He or She or They) affects transportability and reading comprehension.

Objectives

The overall objective of the study is to determine whether the point of view of a narrative has an effect on memory, reading comprehension, and transportation into the story. The purpose of the first experiment is to determine whether the relatability of the narrative and the point of view interact. The purpose of the second experiment is to determine whether gender specific perspectives paired with point of view affect transportation.

Methods

The preliminary stages of this study have focused on library research, planning the experiment, designing materials, and pre-testing the materials. The experiments will manipulate the relatability of the story themes and manipulation of the third person (He / She) and second person (You) pronouns. Preliminary ratings of the relatability of the topics was done through an anonymous survey that asked participants to rate how well they could imagine themselves in the story situation, using a scale from 1 to 5. We used these ratings to select story themes to be used in the experiments, and we also developed a generic formula for story length, number of characters, and number of story activities. We are currently writing the narratives so that we can write a proposal for IRB approval (i.e., permission to use human subjects).

Discussion

The preliminary survey ratings helped us to narrow down our narrative topics to a total of ten short stories. Of these stories, three focus on mundane / everyday activities (e.g., running errands), three on extreme activities (e.g., hunting, stealing), two on activities connected to females (e.g., wearing a dress), and two on activities connected to males (e.g., going to a barber shop).

Krysthal Morales

Biological Sciences

Allen Gibbs, Ph.D., Professor, Biological Sciences

Effects of Starvation Resistance on Female Fecundity of Drosophila Melanogaster

Introduction

Experimental selection for starvation resistance in *Drosophila melanogaster* has shown to increase lipid content in adult *Drosophila* in comparison to *Drosophila* that have not been selected for starvation resistance. There is also a difference between sexes. Starvation selected females have been shown to have seven times more lipid reserves than starvation selected males (Reynolds, 29). How does experimental selection for starvation resistance influence life history traits? Specifically, what is the effect on female fecundity?

Objectives

The primary objective of this experiment was to observe the effects of starvation resistance on female fecundity. We observed if there was a tradeoff between reproducing and surviving. Would the females allocate their resources (lipid reserves) to reproducing or would they allocate them to resisting starvation?

Methods

The starved lines of *Drosophila melanogaster* used in this experiment are offspring of flies bred for starvation resistance over 100+ generations by Allen Gibbs. The fed lines were also bred by Allen Gibbs as a control population. The fed and starved lines both have 2 sublineages, A and C. They are referred to as FA, FC, SA, and SC for fed line A, fed line C, starved line A, and starved line C, respectively. 300 larvae of each line were collected to ensure a large enough population would reach adulthood. Larvae of both lines were collected up to the 2nd instar. The 300 larvae of each line were split into bottles containing 100 larvae per bottle to standardize their environment. The bottles contained a food mixture made of agar, cornmeal, sugar, and yeast. When adults emerged, the virgin flies were sexed using a microscope and placed in vials with a unique identifier. Females were housed alone and males were housed in pairs.

Body measurements were taken using a photo microscope between days 2-5 of adulthood to check for any correlation between body size (lipid reserve), starvation resistance, and in females, fecundity. Each fly was taken out of their vial, placed on a CO_2 pad, and had their picture taken and saved under their identifier. Extra measures were taken to ensure each male in each vial was body sized. The photos were measured in pixels and later converted into micrometers.

On day 7 of adulthood, lines were mated. 1 female and 2 males of the same line were placed in a vial containing food and yeast paste and allowed 48 hours to mate. Lines were not crossed. After 48hrs, (9 days of adulthood) females were placed in a grape agar vial to lay eggs and males were transferred into a 1.5% agar vial for starvation resistance. Females were given 24hrs to lay eggs, after which they were also placed into a 1.5% agar vial for starvation resistance. Flies were checked every half day for death and time of death was recorded for each individual fly. The eggs in the grape agar vials were counted and the number was recorded on a spreadsheet containing each of the female flies' unique identifier. Analysis were done using R and other tests for significance.

Abigail Patalinghug

Biochemistry

Dale Devitt, Ph.D., Professor, School of Life Sciences

Analyzing the Spread of Antibiotic Resistant Genes in Microbes Through Practicing Agriculture with Reclaimed Water

Introduction

As global population grows, reclaiming or recycling water becomes more important with the decline in freshwater supply. At the same time antibiotic use has also risen along with the growing amount of antibiotic resistant viruses and microorganisms. Aside from antibiotic prescriptions for humans, antibiotics have been widely used in the agricultural industry with both plants and animals. (1) the most recently discovered antibiotic class followed one that was discovered nearly 30 years ago. (2) This poses a harm to humans receiving or would potentially receive antibiotic treatment. Antibiotics and antibiotic resistant bacteria have been found in reclaimed water. Since some countries already use untreated/partially treated recycled water for agricultural purposes, it is important to fill the gap in knowledge on the impact of antibiotics and antibiotic resistant bacteria on agricultural plants. (1,3)

Objectives

The objective of this study is to observe or detect the spread of ARGs in samples of spinach and tomato plants grown with the use of reclaimed water from Las Vegas.

Methods

Spinach and Tomato plants are grown in pots with water that have gone through three differing stages of water treatment in the Las Vegas Water District. One group of pots were watered with reclaimed water that went through the Ultrafiltration (UF) stage, water from another set of pots went through an additional step of disinfection and oxidation through ozone treatment, and the third set of 10 pots served as a control and watered with tap water until they were harvested. Once spinach and tomatoes were harvested, samples of fruit, leaves, root and soil corresponding to each group of water treatment were gathered and DNA was extracted and analyzed for the presence of antibiotic resistance to the following compounds: lidocaine, benzotriazole, Sucralose, Trimethoprim, Triclosan, sulfamethoxazole, carbamazepine, DEET, Meprobamate, ranitidine, atenolol, TCEP and Vancomycin. Samples of water that went through the stages of Ultrafiltration were also extracted for DNA and tested for ARGs. The presence of genes were analyzed by PCR and quantified by qPCR and visualized with gel electrophoresis.

Results

The antibiotic resistance to ampicillin was found in soil treated with UF water, while no detection of the antibiotic resistance gene for ampicillin was found in the UF water itself. No significant amounts of ARGs were found during the analysis for all other antibiotics so far, this includes: vancomycin, trimethoprim and sulfamethoxazole (sul2).

Conclusion

From analysis from the gel electrophoresis so far for the four ARGs, the ARG for ampicillin has shown from no detection in the water to a stronger band found in the soil. This suggests that the contamination of ampicillin in reclaimed water has influenced the spread of the ampicillin ARG. This can pose as a harm to human health since the drug is used for a broad array of bacterial infections including bacterial pharyngitis, pneumonia, urinary tract infections, etc. (4)

Joshua Thomas

Information Management

Andrew Hardin, Ph.D., Professor, Lee Business School

Data Mining in Historical Management

Introduction

As the age of the internet moves along, historians face more and more with the task of taming an ever-growing amount of information. Tens of millions of historical documents are being digitized and uploaded into internet archives every year. The Library of Congress alone has digitized over 8 million documents as part of its American Memory project and Google has promised to digitize over 15 million books. Analyzing this amount of data is unmanageable using traditional historical research techniques. One potential solution is the introduction of data mining (the process of extracting new information from data) techniques to historical research to gain new insights and uncover historical trends.

Objectives

The objective of this paper is to determine if data mining is an effective tool in conducting historical research.

Methods

To explore the usefulness of data mining in historical research methodology this paper will apply data mining techniques to a set of 40,419 New York Times headlines during the American Civil War. Python's Natural Language Toolkit (NLTK) and VADER (Valence Aware Dictionary and sentiment Reasoner) modules will be used to conduct this analysis. NLTK is a suite of libraries developed for natural language processing (NLP) that will be used to break down sentences by word. VADER is a model for sentiment (whether the headline displays positive or negative emotions) analysis that will be used to calculate the sentiment of the headlines. VADER compares each word in a sentence to its built-in lexical library and assigns it a score from -1 to 1(-1 representing extremely negative and 1 representing extremely positive), while also taking into consideration punctuation, degree modifiers (sort of, kinda, by far etc.), capitalization, and changes in sentiment within a sentence due to the word "but" (For example: He's a nice man, but a terrible teacher. While the first clause is positive, the overall sentiment of this sentence is negative).

Results

The overall sentiment of the New York Times to start the war was relatively neutral with an average polarity score of -.042, but dropped significantly in 1862 to -.25 indicating an influx of negative headlines. In the following year the sentiment of the New York Times raised to -.09 and remained relatively stable going into 1864(polarity = -.12) before finally returning to neutral again after the war with a polarity score of 0 in 1865. Despite the overall negative sentiment during the war, headlines featuring General Grant remained positive throughout the duration of the war, with the highest sentiment in 1861 and 1865 with polarity scores of .26 and .22 respectively and the lowest scores being .09 in 1862 and 1863 and a score of .03 in 1864. This analysis also showed that early in the war, by far the two most prominent Union Generals were General McClellan and General Burnside, with 87 mentions of General Burnside and 90 mentions of General McClellan in 1862(compared to 29 mentions of general Grant for example). However, as the war progressed their prominence in the New York Times faded and General Grant and General Sherman came to dominate the news having more mentions than almost every other prominent Union general combined in the final two years of the war (217 mentions of Grant in 1864/1865 and 230 mentions of Sherman). On the other side of the war, General Lee dominated the news coverage with 425 mentions throughout the course of the war. For reference, the second most referenced General was Jackson with 135 (his presence declined significantly after his death in 1863).

Conclusions

This study has shown that data mining can be a powerful technique in a historian's toolbox. This simple analysis was able to uncover trends from data available to everyone that would have been impossible otherwise. Using something as simple as news headlines can uncover interesting trends in media sentiment as well as other interesting insights such as the prominence of certain people and concepts in the media. As the amount of digitized history continues to grow, historians should be trained in data mining techniques to fully take advantage of the resources available to them.

Zykeya Webb

Biochemistry

Scott Abella, Ph.D., Assistant Professor, School of Life Sciences

Application of Dendroecological Techniques to Determine Environmental Variation in White and Black Oak Species of the Toledo, Ohio Area

Introduction

We like to believe that fruits and vegetables are the healthiest things for us to eat, but what happens to them when they are grown with contaminated pharmaceutical wastewater? We can't completely control what's in the water that's used to help these plants grow so identifying how these pharmaceuticals in the water affect the fruit and vegetables we eat is vital. Knowing where the pharmaceuticals will travel, and if it's in safe amounts is critical to our health. There have been many studies on how certain pharmaceuticals in the leaves or fruit effect individuals but there is many inconsistent studies out there. In our research we calculated the amount of each pharmaceutical that is recommended for humans each day. Knowing this information can lead to more precautions when growing plants or even laws to lessen the amounts of chemicals that can be drained into water. Other research has also asked the question if wastewater could be used to safely irrigate crops and that's what we will be determining (Shilpi, 272-281).

Objectives

The main objective of this experiment is to detect the amounts of pharmaceuticals found in the plants grown and compare it to the levels that is recommended on a daily basis to see if it's safe to consume.

Methods

This experiment was done to test the effects of pharmaceuticals on plants that were watered with 13 different pharmaceuticals in the water. An LD50 value was calculated which tested the amount of each pharmaceutical that would kill 50% of the subjects tested. Showing that the LD50 value is an amount we don't want to consume of that particular compound. A NOAEL value was tested which provides the highest value of that pharmaceutical the subject can have without showing any adverse effects. Last an RDI value was determined which shows the suggested daily amount one can ingest that is still considered healthy. The RDI value was compared to the amount found in each plant to see if those values would be considered a safe amount for humans to consume. The end result was to see if plants grown in the greenhouse that were watered with contaminated wastewater had healthy amounts of the pharmaceutical in it or not.

Anticipated Findings

Future findings will be determined on how well the plants fare once they are treated with the different pharmaceuticals water. Based on initial findings compounds like Sucralose, Benzotriazole, and TCEP had higher amounts in the plants than the recommended amount to ingest. While all the other compounds were found to have safe amounts of the pharmaceuticals in it.

Discussion

The significance of this experiment is that it affects us all no matter where we live. What's in our water could be affecting the fruits and vegetables we eat, some of the healthiest food might contain the contaminates from the pharmaceutical that helped them grow. More can be done to make sure that there are more precautions when growing crops and protecting them from contaminated water. Laws can be made that makes it mandatory to check crops after they are cultivated and have to have a safe amount of the pharmaceuticals in it.

David Zagaceta

Physics

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Study on Mechanical Behavior of Thermoelectric Bi$_2$Te$_3$/CNTs Composite Films

Introduction

Statistics have shown that during transmission as much as 60% of energy is lost, mostly in the form of waste heat. Developments in thermoelectric power generation all for an increasing amount of waste heat to be recovered for use. The efficiency of this energy conversion process relies purely on the material(s) of the generator. Thermoelectric composite materials are of great interest to research institutes and government agencies alike. Today, NASA and the U.S. Air Force use radioisotope thermoelectric generators in applications where the duration of power generation is not economically feasible by other means. Examples of these applications include satellites, space probes, rovers and remote facilities. At the forefront, the properties of thermoelectric materials are being heavily optimized through the embedding of multiple materials into nanostructured matrices. Bi$_2$Te$_3$ w/ CNT exhibits desirable thermoelectric properties with a high electrical conductivity and Seebeck coefficient at room temperature as well as various mechanical properties allowing for sustained use. Further investigation into electronic transport (Hall coefficient, charge carrier density, mobility and electrical conductivity) within this material is needed to understand the mechanisms behind its properties.

Objectives

To investigate the stress dependence of the electrical conductivity, Hall coefficient, charge carrier density, and charge carrier mobility in Bi$_2$Te$_3$ w/ CNT using the single carrier type model.

Methods

Electrical conductivity and Seebeck Coefficient measurements are used to determine the effects of repeated stress cycles on the thermoelectric properties of Bi$_2$Te$_3$. Thin films of Bi$_2$Te$_3$ are fabricated as thin films onto a polyamide substrate. The samples undergo repeated stress in the form of multiple bends at a specified frequency. The thermoelectric properties are remeasured at increments of 200 bends up to 1200 bends.

Results

Initial thermoelectric properties are inversely proportional to the thickness of the sample. It is also noted that thicker samples retain more of their initial thermoelectric properties when subjected to repeated stress.

Conclusions

Thinner samples possess more desirable thermoelectric properties, which is in agreement with current literature. It is hypothesized that for this material, the initial properties are better for thinner samples because the nanotubes are aligned in the direction of the temperature gradient as the material comes closer to a two-dimensional structure. Thinner samples are more susceptible to fatigue as they possess a higher Young's modulus. Thinner films show better promise for static thermoelectric power generation where the generator will not be exposed to mechanical stress, while thicker films would find better application in wearable devices.

Alexandra Zmuda

Biological Sciences

Rochelle M Hines, Ph.D., Assistant Professor, Department of Psychology

The Synaptic Adhesion Molecule Neuroligin-3 is Expressed in Astrocytes

Introduction

Autism spectrum disorder is a neurodevelopmental condition characterized by communication issues and difficulty interacting with others in society. Individuals with this disorder may range on the spectrum of severity depending upon the extent of these behavioral issues. Most are diagnosed at a young age, however, older individuals can be diagnosed later in life since sometimes symptoms may go unnoticed. Genetics, parental age, and the environment are some of the many factors that contribute to the development of Autism spectrum disorder. In terms of genetic factors, past studies have shown that mutations in synaptic adhesion molecules in the neuroligin (NLGN) and neurexin (NRXN) families may contribute to the development of Autism spectrum disorder. Neuroligin proteins are commonly enriched in neuronal cells, particularly at the site of contact between two neuronal cells, known as synapses. In this study, we are examining the presence of NLGN-3 in non-neuronal glial cells due to indications of expression by RNAseq studies. Glial cells are the most abundant cells of the brain and play important roles in regulating homeostasis and supporting neuronal cells and synapses. Two major types of glial cells are astrocytes that have important metabolic roles, and microglia that have important immune roles. We would like to examine the extent of NLGN-3 expression and the localization of its expression in astrocytes and microglia.

Methods

In order to examine the expression of NLGN-3 in glial cells we used immunohistochemistry followed by confocal imaging. The immunohistochemistry staining was performed on brain tissue sections from mice. Antibodies directed against GFAP and Iba 1 were used to identify astrocytes and microglia respectively, along with an anti-NLGN-3 antibody, followed by fluorescently labelled secondary antibodies. After sections were mounted onto slides, we used a Zeiss LSM 510 Meta microscope in order to obtain images of the specimens.

Results

We have found that NLGN-3 is expressed in astrocytes and microglia in both the dentate gyrus (DG) as well as the cornu ammonus 1 (CA1) layer of the hippocampus. The localization appears to be concentrated on the cell body as well as present at the end feet, however, more analysis with Image-J must be performed to precisely identify the prevalence of NLGN-3 expression in glial cells, as well as its specific subcellular localization.

Conclusion

The findings support that the synaptic cell adhesion molecule, NLGN-3, can be found in glial cells. Further research will involve the quantitative examination of NLGN-3 adhesion molecule expression in typical and atypical development, such as in a mouse model relevant to Autism spectrum disorder. These studies are expected to advance our understanding of the role of NLGN-3 in normal brain function, as well as provide a platform to assess NLGN-3 dysfunction in Autism related disorders. Ultimately, these findings may help to advance novel therapeutic strategies for symptom alleviation in Autism.