



HONORS COLLEGE

The University of Texas at Arlington

HONORS RESEARCH SYMPOSIUM POSTER PRESENTATION ABSTRACTS

APRIL 22, 2021

COLLEGE OF SCIENCE

10:00 AM – 12:00 PM

OLIVIA ANCHONDO, PSYCHOLOGY

The Effects of Frequent and Infrequent Recreational Drug Use on Convergent and Divergent Performance Scores in UTA Students

Faculty Mentor: Dr. Matthew Robison

This study focuses on examining the relationship between convergent and divergent performance scores and frequency of illicit drug use in UTA students. Convergent thinking focuses on establishing a single, logical response to a problem whereas divergent thinking focuses on generating various, creative solutions. Popular illicit drugs amongst students include cannabis, MDMA, LSD, cocaine, and legal substances: alcohol and tobacco. Surveys indicate that 69% of college students report experiencing consequences from prolonged illicit drug use. Previous research demonstrates that specific drugs can impair or enhance convergent/divergent thinking performance. Participants were given the Compound Remote Associates Test and the Alternative Uses Test, to examine convergent and divergent performance respectively. Participants then responded to a questionnaire, providing details regarding illicit drug use and frequency of use. It was hypothesized that frequent drug use would show correlation to higher divergent performance scores and infrequent drug use would show correlation to higher convergent performance scores.

MICHELLE BLAND, BIOLOGY

Anxiolytic Factors of Pregabalin in the Investigation of a Preclinical Acidic Saline Model of Fibromyalgia

Faculty Mentor: Dr. Perry Fuchs

Fibromyalgia is a prevalent pain disorder characterized by noninflammatory, musculoskeletal chronic widespread pain that is often comorbid with negative emotional affect. Preclinical studies have successfully modeled long-lasting, bilateral mechanical hyperalgesia in rodents using repeated, intramuscular injections of acidic saline, though few have studied affective pain components using this technique. The present study used the open field test to measure anxiety-like behavior in rats following pain induction with acidic saline compared to that of a normal saline vehicle control, as well as the utility of subsequent pregabalin treatment. No significant difference was found for the distance or velocity traveled between pain conditions regardless of the area of the chamber measured. Animals reared more at baseline, though there was no significant difference between conditions. Interestingly, analysis of simple effects of distance and velocity revealed pregabalin exhibited anxiolytic effects but did not significantly differ whether the acidic saline model was present or not.

CATHERINE CARRANZA, BIOLOGY

Trachemys Scripta as an Invasive Species Outcompeting Native Species in a South Arlington Lake

Faculty Mentor: Dr. Corey Roelke

The knowledge of the composition of freshwater turtle communities is important to understand the impacts of invasive species. In this study conducted we recorded information based on the population by using routine methods to capture, tag, and release individuals. In the process we recorded information such as sex, weight, and shell length. In this particular population we focused our analysis on the red eared slider population which showed a clear dominance. We aimed to investigate physiological parameters that allow them to outcompete the other freshwater turtles. We found the population size of sliders estimated to be approximately 200, in comparison with the entire population size of 233. Red-eared sliders showed a 59% survivability, in stark contrast to their counterparts which showed a 14% survivability. Understanding the aspects that contribute to red-eared sliders outcompeting native species will allow us to better help the negatively impacted species that are endangered by sliders.

NABIN CHAPAGAIN, PHYSICS*Computational Geometry Insights into Monte-Carlo Simulation Methods*

Faculty Mentor: Dr. Amir Shahmoradi

Monte Carlo methods are a broad class of computational algorithms that rely on repeated random sampling to obtain numerical results to solve deterministic problems. To sample data uniformly from a random n-dimensional dataset, the algorithm divides points into clusters completely unsupervised and samples points with probabilities proportional to the volume of their parent clusters. Dynesty package for python has been used as a black box to compare and contrast the functioning of the algorithm. The algorithm has successfully worked for the n-dimensional dataset passed to it. The algorithm returns a uniformly distributed point from a cluster of the dataset and its acceptance ratio, which is the inverse of the number of clusters that includes the point. There is a discussion of future steps to be taken to make the algorithm more universal at the end.

JOSHUA JOSEPH, BIOLOGY*Testing the Link Between Brain Size and Trophic Position in Fish*

Faculty Mentor: Dr. Matthew Walsh

Large organismal size allows for fish to act in a mobile, predatory manner by opening them up to the possibility of foraging in distinct trophic levels. This may allow for ecosystem stabilization. However, the environmental pressures that select for large and mobile organisms to act in this way have not been identified. Given that this is most likely a behavioral trait, it has been hypothesized that an increased cognitive ability, marked by a larger brain size, would be required by predators to occupy the upper trophic levels of ecosystems. By expanding on food web theory through microscopic analysis, it has been found that fish brain size positively correlates with an increased ability to forage across trophic positions in a food web, thereby indicating that larger brains allow for enhanced cognitive capacity to exploit new feeding niches.

CHARLENE MANDIMUTSIRA, BIOCHEMISTRY*Crystallographic Studies using an Inactive F₄₂₀-dependent Glucose-6-phosphate Dehydrogenase Variant from *M. tuberculosis**

Faculty Mentor: Dr. Kayunta Johnson-Winters

Mycobacterium tuberculosis (*Mtb*) is the causative agent of one of the deadliest diseases in the world, Tuberculosis (TB). F₄₂₀ cofactor-dependent Glucose-6-Phosphate Dehydrogenase (FGD), which is found within *Mtb*, is a prime target for potential treatments. The conversion of glucose-6-phosphate (G6P) to 6-phosphoglulactone and concurrent reduction of the F₄₂₀ cofactor is carried out by FGD (Figure 1). Generally, F₄₂₀-dependent enzymes have not been subjected to rigorous enzymological investigation until our work. Although information regarding FGD's hydride transfer mechanism has been resolved, the binding location of G6P within FGD's active site is unknown. FGD's crystal structure was solved in 2008 in the presence of citrate, a competitive inhibitor of G6P. Therefore, the objective of this project is to solve the crystal structure of the enzyme-substrate complex in the absence of citrate. Optimized crystallization conditions using the inactive FGD variant, H40A, have been isolated and will be discussed.

LAURA MARQUEZ, BIOLOGY*Determining the Correlation of Local Field Potentials from Several Brain Sites During Pain*

Faculty Mentor: Dr. Yuan Bo Peng

Pain is significantly complex and has been treated widely with opioids. Understanding the pain pathway is essential for adequate treatment. Prior research was utilized to understand the effects of pain on several brain structures. The main structures of interest in this project included the tail region of the ventral tegmental area and the anterior cingulate cortex. Four groups of three rats each were used for experimentation. Formalin, a solution causing inflammation, was injected into two groups. One of these was additionally treated with morphine to reduce pain. Two control groups were injected with only saline or morphine respectively. The local field potentials for delta, theta, beta, alpha, and gamma waves of each region were compared between the groups. The Formalin group is expected to have a higher response, indicating pain. The morphine and formalin injections should cause a lower response than formalin. The two control groups should show similar responses.

AUTUMN MORGAN, BIOLOGY

Production of Educational Videos Regarding the Female and Male Reproductive Systems

Dr. Nicholas Pollock

Human physiology is filled with complex mechanisms driving the functionality of the organ systems. Studies have shown that a combination of visual and audio representation is a more efficient way to study when learning a new concept. Therefore, to make human physiology more understandable, two videos were made to explain the human reproductive systems. This was done using Microsoft Whiteboard, Screencast-O-Matic, and a video editor. These videos entail a brief explanation of male and female anatomy, the physiology behind the reproductive cycles, and the control of hormones over the cycles. The videos will be an excellent example of the way other organ systems synchronize to produce effects within another organ system, for example, how the endocrine system plays a role in the reproductive system. These videos will be posted on Canvas and YouTube for human physiology and anatomy & physiology students to use as supplemental study materials in future courses.

KATELYN MORRIS, PSYCHOLOGY

Linking Attachment Theory and Pain-Related Empathy: The Biology of Social Processing

Faculty Mentor: Dr. Jared Kenworthy

Social Pain Theory has shown that adverse social experiences activate the same neural circuits as physical pain. Attachment Theory posits that most people use one of three attachment styles – anxious, avoidant, or secure – to cope with and mentally model the ups and downs of social interaction. This experiment examines how Social Pain Theory and Attachment Theory overlap in the context of pain related empathy. Participants completed an online survey measuring their attachment styles. They were then assigned a writing prompt designed to invoke states of belongingness, exclusion, or to serve as a control. Afterwards, they were shown a picture of a painful injury and asked to rate the individual's pain. Expected results include an interaction effect of attachment style and exclusion. Within the exclusion condition, participants with avoidant attachment should exhibit lower levels of empathy and those with anxious attachment should have higher levels of empathy, compared to controls.

PRISHMI NAGARAJAN, BIOLOGY

Putrescine Catabolism with CuCy as a Form of Cancer Therapy

Faculty Mentor: Dr. Wei Chen

There are several types of cancer treatments, but, unfortunately, many types also target healthy, non-tumorous cells. This possible treatment therapy would only target cancerous cells with the use of the nanoparticle Copper Cysteamine (CuCy) and its effects on the polyamine known as Putrescine. Putrescine is a positively charged cation that plays an important role in balancing out negatively charged components of our cells. Though usually tightly controlled by feedback mechanisms, putrescine in cancerous cells are at high levels. This experiment looks at using CuCy to lower the levels of putrescine in a cell as a form of cancer treatment. Variables such as pH, H₂O₂ concentration, temperature changes, etc. will also be observed. Changes will be observed via absorbance peaks from a UV-Vis spectrometer. CuCy was found to be an influential factor in controlling putrescine levels in certain environments. Future studies could test this relationship with other variables and in cells.

CELINE PHAM, BIOLOGY

The Benefits of Activity-Based Learning Tools for Human Physiology Students in an Online Environment

Faculty Mentor: Dr. Nicholas Pollock

With the transition to virtual learning, some students are finding difficulty in adapting to the online environment, where there is a lack of face-to-face interactions and physical infrastructure. Therefore, alternative strategies need to be implemented for students to gain the most value out of their online education. To better enrich the learning experience, I created educational activity booklets, a type of teaching-learning strategy, for students taking courses in human anatomy and physiology. These booklets contain visual aids, crossword puzzles, flow charts, questions and other active-learning tools to reinforce lecture material. This project is divided into 14 booklets, with each encompassing a different human body system. The combination of visual activities with active-learning tools enhances the learning experience. For example, crossword puzzle activities expand terminology, boost confidence, and accelerate learning capacity. Overall, these activities have been shown to improve student assessments in an online learning environment.

HAILEY PHILLIPS, BIOLOGY

Shifting Education to Online Platforms: Creating Educational Videos to Supplement Learning Experience

Faculty Mentor: Dr. Nicholas Pollock

Working, short-term, and long-term memory are three of the essential brain functioning required to understand and master new material, whether online or in-person. My project is constructed to supplement Dr. Pollock's Anatomy and Physiology lecture for additional online reinforcement or independent study. The videos I have created strike the correct cognitive load balance for easy understanding while maintaining learning objectives. Videos were created via OneNote and additional effects were edited with I-movie. The narration is recorded separately on a H2n Handy recorder and edited in Audacity. The goal is to captivate and educate the viewer on the three assigned subtopics of special senses: Smell/taste, vision, hearing. Educational videos will become an integral part of our education system and can supplement in person classes or allow any student with a laptop device and access to Wi-Fi an educational opportunity.

SHERISSA SERRANT, BIOLOGY

The Correlation between Food Deserts and Increased Risk of Cardiovascular Disease

Dr. Walter Schargel

As the leading cause of death in the United States, cardiovascular disease has been considered a growing public health concern. Various behavioral risk factors, including sedentary lifestyles, physical inactivity, and unhealthy diets are directly connected to an increased risk of cardiovascular disease. Food deserts, defined as low-income areas with limited access to nutritious and affordable food within a one-mile radius, are shown to encourage behavioral risk factors in residents of low-income, low-access communities. The alarming rates of cardiovascular diseases demonstrates the need for understanding the role the environment plays in increasing the risk of cardiovascular diseases. This study examines which characteristics of food deserts are contributors to increasing the risk of cardiovascular disease in food deserts residents. A cross-sectional study was conducted to analyze the effects of income levels, access to supermarkets and vehicles on the rates of cardiovascular diseases in all 254 Texas counties.

JULIE TRINH, BIOLOGY

Random Forest Analysis of Factors Contributing to Myopia in Children

Faculty Mentor: Dr. Walter Schargel

Progressive myopia resulting from axial elongation contributes to a greater risk for a wide variety of ocular conditions, such as retinal detachment and myopic macular degeneration. High myopia is especially a concern for children, who are more susceptible to the development of ocular diseases due to an early onset of myopia. To further understand myopia progression, a random forest analysis was performed on a subset of data from the Orinda Longitudinal Study of Myopia to determine what factors are the best predictors of myopia development in children. Random forests function by utilizing bootstrapped data and machine-learning algorithms to create a series of decision trees that compare the predictive ability of different variables. The starting spherical equivalent was found to be the greatest predictor of whether or not children in the study became myopic. This highlights the importance of early eye exams for children, even before corrective lenses are needed.

SARAH WOLFF, BIOLOGY

Examining the Effects of a Case-Study Curriculum in a Culturally Diverse Science Classroom

Faculty Mentor: Dr. Melissa Walsh

Although students of all ethnicities and races enter STEM programs at the same rate on college campuses, minority students leave STEM disciplines at twice the rate that white students exit the field. Specifically, 40% of black students and 37% of Latin students switch out of STEM disciplines before earning their degrees. This study seeks to understand these ethnic disparities among college completers while analyzing the challenges presented to students in STEM. By introducing a case-study curriculum into a Toxicology classroom and examining student performance while collecting data through a series of surveys, we sought to record student feedback concerning these obstacles in their education. Data analysis revealed an increase in confidence using various scientific skills throughout the semester and elucidated the challenges presented to minority students in STEM. This study seeks to contribute to the body of research dedicated to meeting the needs of students of all cultures and backgrounds.

COLLEGE OF SCIENCE

12:30 PM – 2:30 PM

HANNAH BOVERMANN, BIOLOGY

Transcriptional Regulation of LD-transpeptidases in the Nosocomial Pathogen, Acinetobacter baumannii

Faculty Mentor: Dr. Joseph Boll

Carbapenem resistant *Acinetobacter baumannii* has been classified as a high-level threat to public health by the Center for Disease Control (CDC). Typically, the antibiotic polymyxin E (colistin) is prescribed for carbapenem resistant *A. baumannii* infections, but unfortunately colistin resistance has also emerged. In order to develop resistance to colistin, *A. baumannii* inactivates lipooligosaccharide (LOS) biosynthesis. While the underlying molecular mechanisms are not yet understood, we previously found that two LD-transpeptidases (Ldts), LdtJ and LdtK activities are essential for *A. baumannii* survival without LOS. Here, we constructed *ldtJ* and *ldtK* transcriptional reporters to measure gene expression, which will enable us to screen for regulatory elements. We describe cloning each promoter (P_{ldtJ} and P_{ldtK}) to create a *lacZ* fusion, which serves as a reporter to visualize differential transcriptional activation.

VERONICA CAMACHO, BIOLOGY

Evaluating the Impact of Educational Videos on Higher Level Education: A Creative Research Project Approach

Faculty Mentor: Dr. Nicholas Pollock

With increasing technological advancements, online resources such as educational videos have become an essential study tool for college students. Educational videos deliver information in the form of visual representations, animations and text which is organized in a condensed and organized manner. In this creative research project, two educational videos were created for a Human Physiology course at the University of Texas at Arlington. One video was over systemic and pulmonary gas transport/exchange and the other was over hemodynamics. The program Procreate was utilized to create the illustrations and Explain Everything Whiteboard was used for screen casting. This research paper evaluates the characteristics of an effective educational video and how students use videos as a study tool. From current research, it is seen that the accessibility, time efficiency, and creativity of educational videos make them widely utilized by college students.

ACHYUTH MANOJ, PHYSICS

Using Machine Learning to Predict Band Gaps of Metal-Oxides

Faculty Mentor: Dr. Muhammad Huda

Theoretical band gaps for transition metal oxides are mostly calculated by Density Functionals Theory, which may be considered computationally expensive. Machine Learning algorithms are explored as a more efficient alternative. The hypothesis is that the band gap of a material can be predicted by multiple linear regression based on its atomic and structural properties, known as features. Data is gathered for the experimental band gaps and the features of binary 3d and 4d transition metal oxides, and the dataset are split into a training set and validation set. The training set is used to train the Support Vector Machine and the validation set is used to obtain the prediction of the Machine, then compared with the experimental band gaps of the validation set. The band gaps from the validation set are expected to show a good agreement with the experimental values.

HAYDEN MCKEE, BIOLOGY

Description and Comparison of Oreosaurus bisbali, Oreosaurus rhodogaster, and Oreosaurus luctuosus using Drishti Modelling Software

Faculty Mentor: Dr. Walter Schargel

Immense diversity exists across the animal kingdom. Even among animals that have already been classified, new discoveries and observations prompt continuous reevaluation in the pursuit of more accurate classification. This study looked at three species of lizards in the genus *Oreosaurus*--*O. bisbali*, *O. rhodogaster*, and *O. luctuosus*--to determine if any significant differences exist that merit further phylogenetic classification. The primary focus of this study was on the heads of these lizards. CT scans of the skulls were obtained and uploaded into Drishti, a modelling software. Drishti was used to construct models of the skulls that were scaled to an analyzable size and showed accurate topographical features of the bone structure. Preliminary results indicate that further classification may be necessary based on noticeable differences. A similar study conducted with other major skeletal structures in these lizards would also give more clarity in classification.

JOSPHIN MOURIS, BIOLOGY

Video Presentations of the Hypothalamic-pituitary-somatotropic (HPS) and Hypothalamic-pituitary-gonadal (HPG) Axes

Faculty Mentor: Dr. Nicholas Pollock

The endocrine system is essential for it controls growth and development, metabolism, reproduction, mood and many more functions of the body. Yet due to its vast functions it can be difficult to grasp and because most of the activities of the system are not seen, it can be difficult to visualize. To mitigate the difficulty of learning the endocrine system, information was collected from the human physiology course PowerPoints as well as various textbooks and lectures in order to create visually engaging educational videos for students. Specifically, two videos were created using iMovie and PowerPoint to cover an overview of the endocrine system, how it compares to the nervous system, and a comprehensive overview of the hypothalamic-pituitary-somatotropic (HPS) axis and hypothalamic-pituitary-gonadal (HPG) axis. The videos will be used as an additional tool for the human physiology course as a flexible and engaging opportunity for students to solidify learned information.

BIBEK SINGH PARAJULI, BIOLOGY

The Influence of Consistent Exposure to Environmental Signals on the Strength of Transgenerational Plasticity in Daphnia

Mentor: Dr Matthew Walsh

Transgenerational plasticity (TGP) occurs when environment signals influence the expression of traits across multiple generations. TGP allows for organisms to survive until genetic changes occur over multiple generations. This study examined the influence of consistent exposure to environmental signals on the induction and strength of TGP. It also examined the expression, behavioral, and life history traits in *Daphnia* from lakes in Wisconsin, USA that have experienced the invasion of a novel predator spiny water fleas (*Bythotrephes*). All clones were reared in the presence and absence of predator cues and the TGP was assessed at regular intervals over the course of the five-generation experiment. It is expected that after multiple generations of exposure to predator cue, *Daphnia* will exhibit stronger TGP, which will manifest as an increased phototactic response, as well as a larger eye and smaller body size.

NATASHA POORAN, PSYCHOLOGY

Investigating Stereotypes: The Relationships between Intrinsic and Extrinsic Academic Motivation among Children of Immigrant Parents

Faculty Mentor: Dr. Jared Kenworthy

An unrecognized component of the stereotype that Asian students achieve at a higher academic level than their counterparts is that many have immigrant parents; students may be affected by cultural differences in parenting styles and values, which in turn affects their motivations to succeed in school and unknowingly perpetuate the stereotype. To determine if differences exist in intrinsic, extrinsic, and amotivation among children of immigrant parents (CIPs), a 28-item seven-point Likert scale survey adapted from the Academic Motivation Scale (AMS) was used. Survey data collected from 183 undergraduate students at the University of Texas at Arlington was analyzed through three chi-square tests of independence comparing the three types of motivation in CIPs and non-CIPs, and no significant differences were found. It can be concluded that no relationship exists between types of academic motivation and CIP status, however further research with a larger, more ethnically diverse sample should be considered.

KAYLA ROBB, MATHEMATICS

The Effect of Hausdorff Dimension on the Security of Fractal-Based Image Encryption

Faculty Mentor: Dr. Theresa Jorgensen

Chaos-based image encryption, an area of cryptography that has seen recent interest, often depends on a fractal as the cryptographic key of the scheme. These fractals can have a varied range of Hausdorff dimensions, ranging from less than 1 to greater than 2 or above. The effect of the Hausdorff dimension of the system key is not known. However, the Hausdorff dimension is hypothesized to affect the degree of randomness in the encrypted image. To test this hypothesis, images were encrypted using a variety of fractals with various dimensions as keys. Next, the security of the encryption was evaluated using common security metrics. By using the Fisher's z-transformation for comparing correlations, a correlation was found between two of the metrics and the dimension of the fractal. In conclusion, the fractal's dimension does have a nontrivial effect on the security of a fractal-keyed encryption system.

WILLIAM TEDDY, BIOLOGY

Representing Different Shades: A Prediction for the Presentation of Various Skin Diseases in Darker Complexions

Faculty Mentor: Dr. Malgosia Wilk-Blaszczak

Medical literature in the area of skin disease largely relies on images of patients with lighter skin tones while containing minimal references to the way disease states of the skin present on patients with more pigmented skin. In fields such as dermatology, where these image references are repeatedly critical for diagnosis, these disparities can hinder proper treatment and/or increase misdiagnosis for patients presenting with darker skin tones. The goal of the following project is to ultimately guide discussion and build awareness of these evident limitations while introducing to medical professionals the possibility of digitally enhancing symptoms. The project takes images of various skin diseases as found in medical literature and utilizes adobe photoshop software to adjust for factors such as saturation, hue, vibrance, etc. to make predictions for how these disease states would present in individuals of color. An informational graphic was created to present these results.

AUSTIN TRUONG, BIOLOGY

*Investigating the Duration and Effect of Cycloheximide of on *Gnatocerus cornutus* Undergoing Loser Effect*

Faculty Mentor: Dr. Jeffrey Demuth

The loser effect is a phenomenon that occurs when an individual who loses an aggressive encounter with a conspecific has an increased probability of losing future encounters. Behaviors associated with the loser effect include self-isolation, avoidance, and submissiveness, eventually leading to a shutdown of physical activity. Cycloheximide (CHX) is a protein synthesis inhibitor often used in behavioral experiments to test long-term memory. The losers of aggressive competition were tested for their response under the effects of CHX. Specifically, we exposed male broad horned flour beetles who recently lost in male-male competition to CHX for 16 hours. Following treatment, we retested these “loser” beetles. Typically, males of this species display loser effects for up to 3 days after losing contests. However, our preliminary results show that losers treated with CHX do not display the typical loser behaviors. Our results suggest that CHX blocks the synthesis of proteins that perpetuate loser behaviors.

JUAN VILLEGAS, MATHEMATICS

Sensitivity Analysis and Mathematical Modeling for Tailored Colon Cancer Treatment

Faculty Mentor: Dr. Daniel Warren

Based on the American Cancer Society, colon cancer is the third leading cause of cancer-related deaths amongst men and women. A data-driven Quantitative and Systems Pharmacology model is used to provide treatment for each individual patient using gene expression data from primary tumor samples. Using uncertainty and sensitivity analysis, a prediction of the efficacy of a personal treatment could be obtained. A Latin hypercube sampling-partial rank correlation method, using a Normal distribution, was used to conduct the sensitivity analysis. It was found that the most sensitive parameter was the day⁻¹ of cancer. This allows us to suggest an optimal treatment strategy for each colon cancer patient and predict the efficacy of the proposed treatment.

ABDUL WAHAB, PHYSICS

Photodynamic Therapy Using Cu-Cy Nanoparticles for Cancer Treatment

Faculty Mentor: Dr. Wei Chen

Photodynamic therapy (PDT) has been viewed as a promising cancer treatment, but it has been limited due to poor tissue penetration by the light that can potentially be solved by photosensitizers activated by microwaves that can penetrate further to reach deeper tissue. Copper-cysteamine (Cu-Cy) is a novel photosensitizer that can be excited using microwave (MW), ultra-violet (UV) light, and X-rays to generate highly reactive oxygen species (ROS) for the destruction of cancer cells. The purpose of the study is to present the process of photodynamic therapy and a method for synthesizing of Cu-Cy nanoparticles. Current studies *in vitro* and *in vivo* on a rat osteosarcoma cell line have shown significant tumor destruction using Cu-Cy nanoparticles with microwave activation. The main mechanism for ROS generation is the release of copper ions and the heating effects upon MW stimulation of Cu-Cy nanoparticles that lead to cell destruction.

HEBA ZAKARIA, BIOLOGICAL CHEMISTRY

Identification and Characterization of a Mutation that Enhances the Mitochondrial UPR Resulting from Loss of Methionine Synthase in C. elegans

Mentor: Dr. Mark Pellegrino

Mitochondria have vital cellular functions, notably the generation of energy dysfunctional mitochondria can activate the mitochondrial unfolded protein response (UPR_{mt}), a conserved transcriptional response that regulates the expression of several mito-protective genes. Research has shown that UPR_{mt} activation promotes lifespan extension and increases resistance to infection. We recently discovered that loss of methionine synthase gene *metr-1* activates the UPR_{mt}. We performed a forward genetics screen to isolate modulators of the UPR_{mt} caused by the *metr-1* mutant. This was performed in order to determine how loss of methionine synthase impacts the UPR_{mt} and longevity. Interestingly, one mutant was isolated from this screen (named *osa51*) which enhanced the UPR_{mt} in the *metr-1* mutant background. The goal is to characterize this new mutant and attempt to identify the causative gene. Lifespan and developmental analyses yielded data showing the *osa51* mutant strain had a significantly shorter lifespan and developed slower than the wild-type strain.

LESLIE ZUNIGA, PSYCHOLOGY

Personality Traits of SMIs and their Effect on Predisposition to Stress Online

Faculty Mentor: Dr. Amber Schroeder

As social media platforms are growing and becoming more popular on a global scale, social media influencers (SMI) are targeted for reaching audiences for product promotion. The current study will evaluate whether personality characteristics and stress differ across SMIs and non-SMIs. It is hypothesized that SMIs will have higher levels of extraversion, agreeableness, openness, conscientiousness, and neuroticism than non-SMIs. It is also hypothesized SMIs will demonstrate more stress on social media than non-SMIs. In the current study, participants will consist of 75 randomly chosen SMIs and 75 non-SMIs on Instagram. The LIWC software will be used to analyze frequencies of terms used by the users to determine the levels of each characteristic. The results showed that SMIs had higher levels of conscientiousness, however the results for stress, openness, neuroticism, agreeableness, and extraversion were not significant. In conclusion, SMIs did not show higher levels of stress in comparison to non-SMIs.

COLLEGE OF ENGINEERING

3:00 PM – 4:30 PM

COLTON BASS, MECHANICAL ENGINEERING

Dynamic Simulation of Surgical Drill End-Effector

Faculty Mentors: Dr. Raul Fernandez and Dr. Bob Woods

Often, companies invest significant research into determining the fatigue life of new products. Medtronic has requested an end-effector design for gripping a newly developed surgical drill during fatigue testing. Further, the end-effector must mimic grip stiffness of human hands. This work simulates the deflection experienced by the surgical drill while being gripped by the end-effector. To simulate the deflection, the modulus of elasticity of the foam was determined using a cantilever beam experiment. Then, using this value and the density of the foam, a new material was created within the modeling software to correctly simulate the deflection. The outcome of this work was a comparison between the deflection experienced within the modeling software and experimental results. The model of the end-effector correctly simulated the deflection of the surgical drill during surgical operations within an acceptable range of error.

AHMED E GURE, BIOMEDICAL ENGINEERING

Comparison of Various Complementary and Alternate Medicines for Their Wound Healing Properties In Vitro

Faculty Mentor: Dr. Kytai Nguyen, PhD

Currently, healthcare providers face challenges within the field of wound treatment. In United States its reported that \$25 billion was costed for 6.5 million wound treatment and thus, cause significant burden on public health. Comprehensive review of global chronic wound pervasiveness found that pooled prevalence of chronic wounds is approximately 2.21 per 1000 individuals. One particular niche is complementary and alternative medicines (CAMs), or treatments that are not involved in standard medical practice. While CAMs generally do not possess bodies of evidence similar in magnitude to standard medical treatments, some compounds do show promising results in preliminary research. Here, we investigated the comparative impacts of boric acid (BA) and curcumin with respect to wound healing. These compounds propose alternative wound healing treatments on improving migration and proliferation stage of the wound healing process. This will expand the available repertoire of compounds for wound healing treatment methods along with cost efficiency.

GARRETT HADLEY, MECHANICAL ENGINEERING

Extendable Tread Mechanism

Faculty Mentor: Dr. Ashley Guy

The Vertically Enabled Cargo Transfer Robot is a machine capable of carrying a load up a flight of standard stairs. To ensure that the robot can function in a confined space, the footprint of the robot must be sufficiently small. The robot uses treads to move. Longer treads will mean a more stable robot, but they must be able to fit in the confines of a 36x36 inch area. Thus, a tread extending mechanism was designed. This mechanism is able to adjust the length of the treads using a linear actuator to compress the treads horizontally while taking up the slack that is formed by applying spring tension. The mechanism provides an alternative to the current tread arm design. Kinematic and structural analysis was performed to ensure proper motion and structural integrity of the mechanism, and the structure was found to be sound with a minimum 1.5 safety factor throughout.

ARCHIT JAISWAL, COMPUTER ENGINEERING

Autonomous Unmanned Aerial Vehicle Systems

Faculty Mentor: Dr. Christopher McMurrugh

Drone technology has a wide spectrum of implications ranging from recreational purposes to military purposes. We are developing an autonomous drone to perform several tasks at the Unmanned Aerial System (UAS) Innovation Showcase. Several universities will participate, in partnership with Raytheon Technologies, in the UAS Showcase Event. This competition requires the participating teams to develop a drone and enable it to perform several autonomous tasks. The drone needs to perform in three phases of the event. The first event requires the drone to take off and land autonomously after flying straight 30 yards distance on a football field. The second event requires the drone to find the university's logo placed anywhere in a football field and land on it. The final event requires the drone to search the randomly placed university's logo while avoiding obstacles during the flight. There will be no human controlling the drone in any showcase events.

COLE JOHNSON, MECHANICAL ENGINEERING

Active Load Leveling System Implementation on Stair Climbing Vehicle

Faculty Mentor: Dr. Ashley Guy

The VECTR Stair Climbing Robot team has designed a product to take loads up a stairway in a safe and stable manner. This device carries the load in a large basket, whose rotation is impeded by a set of parallel rotational dampers. This setup is sufficient to retard the oscillation of the load but is passive and slow to respond to inputs. A system was designed to actively control the load orientation. This system provided a better response time in comparison to the current passive system and consisted of three basic elements: gyroscope; a processor with the ability to interpret data from said sensor and issue a command in response; and a brushed DC motor. A mathematical model of the problem was proven and a control system established as an approximation of the physical system. The final result was a physical model of the system demonstrating the concept.

ASHWITHA KASSETTY, COMPUTER SCIENCE

PotSpot Mobile Application

Faculty Mentor: Dr. Chris Conly

Many beginner planters face difficulties in choosing suitable plants for their home environment. Our mobile application 'PotSpot' is designed to make this process easier. The application calculates the amount of sunlight based on the picture of the user's desired planting area at home. Once the user uploads a picture of the possible planting location and its surroundings, the device's orientation sensors help determine its geographic location. These stored pictures are then overlaid with the sun's path and converted to black and white images. Our algorithm analyses these pictures and calculates the amount of sunlight present in the area. These results are then displayed to the user, helping them make an informed choice in choosing a suitable plant. PotSpot application will be available on both Android and iOS platforms.

ADARSH YOGESH PAI, COMPUTER SCIENCE

Facilitating Gitraffe Interactions through Software Modules and in Intent Detection Microservice

Faculty Mentor: Dr. Christopher Conly

Git is an open source distributed source control system designed to facilitate programming collaboration efficiently, enabling decentralized teams and developers to simultaneously contribute to software engineering projects of varying scale. Despite its effectiveness and wide-scale adoption among both the professional and open source community, its features are often underutilized, stemming from its steep learning curve, unintuitiveness, and general lack of direction at times. In short, Git suffers from an inconvenient user experience (UX) problem. This in addition to complicated Git workflows adds significant overhead to the software development process. Gitraffe, a free, opinionated, cross-platform Git GUI client, plans to help users maximize Git's utility with increased focus on interactivity, simplification, and natural language understanding. This paper focuses on the development of the Gitraffe module that powers all the features of the GUI client, the command line tool, and the English2Git API.

HEATHER PAVLIK, MECHANICAL ENGINEERING

Extended Kalman Filter Implementation on a Load-Carrying, Stair-Climbing Robot

Faculty Mentor: Dr. Raul Fernandez

For a load-carrying, stair-climbing robot, it is critical that the robot moves accurately for the safety and well-being of the users and observers nearby. Most systems in the world are nonlinear, including the dynamics of the robot, so having the ability to represent nonlinear systems with linear approximations is an important part of engineering. An extended Kalman filter can perform linear approximations, so it will be used to linearize the robot's position in space, as sensed by sonar sensors that are on the robot. The extended Kalman filter will be designed to filter out noise on a set of test data as well as provide an improved estimation of the robot's position. The end result is that the robot's capabilities will be improved, and the filter will in turn provide a valuable addition that would make this robot even more attractive in the market for customers.

SHISKA RAUT, BIOMEDICAL ENGINEERING

Image Segmentation Application for efficient 3D Reconstruction of a Hypertrophic Heart

Faculty Mentors: Dr. Khosrow Behbehani and Dr. Jun Liao

Hypertrophic cardiomyopathy (HCM) is a genetic condition that causes abnormal thickening of myocardium leading to obstruction of blood flow to the left ventricle outflow tract. To restore adequate blood flow, Septal Myectomy, an open-heart surgery is carried out. Creating a 3D model of the diseased heart using CT scans enables surgeons to visualize the degree of obstruction and develop a surgical plan with minimized risk. To decrease the total time required for 3D reconstruction (about 9.5–160 hours) and increase model accuracy, an image segmentation application was developed. The purpose of the application is to decrease the total time of reconstruction by isolating the heart from other anatomical parts (liver, lungs, ribs, etc.) present in the scans. Upon carrying out five reconstruction trials using the application, an average decrease in total reconstruction time by 4.5 hours was observed. This was due to a significant decrease in manual segmentation required after using the application.

CHRISTIAN TEEPLES, SOFTWARE ENGINEERING

Chat Application Integration

Faculty Mentor: Dr. Shawn Gieser

Chat applications have proven to be effective tools for boosting software customer engagement. Tools like Discord are often used while playing online with friends and can provide an organic incentive to stay online. Using a firebase backend and a React JS frontend, chat functionality will be implemented within team Synaptic's educational game suite web application. Similar to other functionality within the application, the chat functions will be implemented using the React useContext() hook. An additional route for the chat application will be added to the application's router to support simple navigation between the chat page, the game suite page, and the user info page. Users will not only be able to chat with other users but will also have access to achievement stickers that can be shared. By implementing this additional functionality, the game suite application will naturally foster future communities to actively participate with the provided educational games.
