



Student Researchers/Abstracts

1. Angelo State University

Cameron Poole

THE EFFECTS OF CHELATED MINERALS ON CONCEPTION RATES IN RAMBOUILLET EWES

Faculty Advisors: Audrey Meyer; Loree Branham, PhD

The objective of this project was to quantify the effects of a chelated range mineral on conception rates in a flock of Rambouillet ewes. The ewes were split into two treatment groups; the first treatment group received the chelated mineral beginning 30 days before the breeding season (C30) and the second treatment group received the chelated mineral 15 days prior to the breeding season (C15). The females were stratified accordingly to ensure that there was an even distribution of 2-year-old ewes, yearling ewes, and aged ewes. All females in the project were exposed to a mature Suffolk ram and a mature Rambouillet ram for 50 days. On day -30 and Day 0 a subgroup of females from each treatment group was selected to gather a blood sample for trace mineral presence. Rams were turned out with all ewes on day 0, and on day 50 and day 80, a jugular blood sample was collected to confirm pregnancy. Data was collected for the lambing season, the dates spanned from October 20 to December 14. Out of the 67 mothers that were positive for pregnancy according to blood samples and ultrasound, 61 ewes had 105 lambs total.

2. Concordia University Texas

Jennie Polus

Additional Student Contributors: Stephanie Quezada; Natalie Cardenas

SHEATH-PRODUCING LEPTOTHRIX OCHRACEA (BETAPROTEOBACTERIA) IMPACTS ECOSYSTEM PROPERTIES AND MAY AFFECT ANIMAL ACTIVITY.

Faculty Advisor: Mary Kay Johnston, PhD

Leptothrix ochracea, a freshwater aquatic bacteria, produces iron-containing sheaths that are the result of iron uptake from the water column. The sheaths can form large, spatially complex mats that are difficult to dissolve, impacting the surrounding environment by reducing iron accumulation in the water column. To investigate the environmental impacts of these sheaths, we conducted a survey of twelve pools within a stream located in the Balcones Canyonland Preserve (Travis County, Texas): six pools with *L. ochracea* present and six pools without. Within each pool, we collected temperature, dissolved oxygen, pH, and depth measurements, as well as estimating the size of the bacterial mats. Additionally, we assessed planarian behavior in the presence of high, medium, low, and zero concentrations of *L. ochracea* sheaths by examining the crawling speeds of the planaria in each solution. Our findings indicated a possible trend in lower temperatures and lower dissolved oxygen concentrations in the presence of *L. ochracea* sheaths, while our observations of planarian behavior provided preliminary evidence for enhanced motility in medium and higher sheath concentrations. We anticipate that our assay will serve as important pilot research for more sophisticated research into the environmental significance of this iron reducing bacterium in natural systems.

3. Jacksonville College

Andrew Tyler Webb

Additional Student Contributors: Jason Gwillim, Sabina Croft, Heather Moore

CURRENCY USED IN THE REPUBLIC OF TEXAS

Faculty Advisor: Patricia Richey, EdD; Brett Eckles

The currency used in the Republic of Texas molded the Republic economically into the state that it is today. Shortly after becoming a Republic, Texas quickly formed an economy. Throughout many trials and hardships such as inflation, the people of Texas survived. They were able to adapt to other forms of currency such as bartering food and exchanging goods for precious metals like gold and silver doubloons. The Republic of Texas currency was a key factor in the way the currency is today. Because each county had its own currency, banks started to print their name on different bills. Shortly after Texas joined America, banks across the country printed their names onto bills. To make the process easier, the government changed the style of bills into a smaller design that would enable tellers to stamp the bank's name onto the bill's face rather than print it onto the currency. The then barren land became one of the top five largest states and the second most populated state in America. By printing their own currency, the Republic of Texas provided a unique and entertaining history, and contributed to the current design of currency.

4. Lamar University

David Matherne

MODELLING OF FAST INTERPLANETARY MAGNETIC CLOUDS

Faculty Advisors: Cristian Bahrim PhD; Evgeny Romashets, PhD

Interplanetary magnetic clouds (MCs) are generated by powerful coronal mass ejections, from eruptive flares or disappearing filaments. They can be as large as one third of the Sun-Earth distance. It takes 2-4 days for MCs to reach Earth's orbit. They usually trigger geomagnetic storms if the component of interplanetary magnetic field oriented perpendicularly to the ecliptic plane, B_z , is 20 nT or larger for 10-20 hours during the MC' passage through Earth's magnetopause. The larger B_z , the stronger the geomagnetic storm. The storms are harmful for GPS satellites as well as for power grids on Earth. The storms' strength is measured with the Ap-index, which represents an average fluctuation of the horizontal component of terrestrial magnetic field measured by magnetometers in a chain of observatories located at latitudes more than 50 degrees. We model the dynamics of an April 1999 MC with $AP = 47$ nT, as it moves from the Sun to the Earth's orbit. Numerical code uses initial boundary conditions taken from solar observations. We compare our results with satellites measurements of solar wind speed at the Earth's orbit. Our theoretical speed is 440 km/s, 16% larger than actual measurements. This study gives a benchmark for future work.

5. McMurry University

Courtney Mayo

Additional Student Contributor: Mateo Herrera

CORRELATION AND CROSS CONTAMINATION BETWEEN GRAM NEGATIVE BACILLI IN VERTEBRATE AND SURFACE WATER

Faculty Advisor: Gary Wilson

Water samples and vertebrate feces samples were collected to test for gram negative rods within them. An assessment of correlation between them was completed. As expected, vertebrates were numerous in Escherichia coli isolates, while surface water was numerous in Pseudomonas species. E. coli, Pseudomonas, and Aeromonas species were found in both vertebrates and surface water. From these species we've found certain diseases correlated with these cultures from the waste products and how they harm the environmental health of the population around these areas tested. From the animals tested, we've found commonality between birds and mammal species such as they both have the capabilities of producing E. coli O157. However, there are many differences between these species such as mammals are more commonly known to produce E. coli than E. coli O157. Mammals analyzed contained potentially more dangerous bacterial species, such as Salmonella and Enterobacter aerogenes. We've also found water sources with higher densities of wildlife had a higher chance with collecting samples that had E. coli O157. Furthermore, certain species of vertebrates are more likely to harbor E. coli O157 H7.

6. Midwestern State University

Ernuel Tonge

Additional Student Contributors: Elijah Portmann; Isaac Sekanyo

ON THE DESIGN OF A FEASIBLE FIRE PROOF ENERGY STORAGE SYSTEM WITH SUSTAINABLE ENERGY RESOURCES

Faculty Advisors: Sheldon Wang, PhD; Salim Azzouz, PhD

After a thorough investigation into current and developing renewable energy technologies, issues associated with storage have been identified as needing the most development. To further that area, we have decided to focus on lithium-ion as one of the most widespread forms of energy storage. Despite the large-scale integration of Lithium Ion technology, many are still unaware of the potential dangers this technology can pose while left unattended or mishandled. As household Lithium Ion storage becomes more prevalent, an accessible monitoring system must be available to predict and help prevent potential fires. Our objective is to design such a system using a raspberry pi and other sensor components to monitor renewable energy storage systems for danger indicators. The developed companion app will receive system data in real-time sending alerts or taking preventative measures when necessary. We believe that this streamlined user-focused approach is the solution to many safety issues faced by this technology.

7. Prairie View A&M University

Faith Guice

Additional Student Contributor: Daniela Ruiz

A COPPER SULPHATE NANOPARTICLE COMPLEX SENSITIZES HUMAN CANCER CELLS TO PARP INHIBITORS AND RADIATION TREATMENT

Faculty Advisors: Gloria Regisford, PhD; Huichen Wang, PhD; Gururaj Neelgund, PhD; Premkumar Saganti, PhD

Many cancer treatments are not effective, hence novel treatments are being explored. Nanoparticles can deliver the drug directly to the tumor site in an efficient manner, without damage to neighboring normal cells. The objective of this study was to determine the effect of PARP inhibitors, a cancer-targeting drug, combined with nanoparticles and radiation on cancer cells *in vitro*. We hypothesized that the efficacy of nanoparticles, PARP inhibitors and radiation will significantly decrease cancer cell proliferation and increase cell death. We examined the effects of a heparin-copper sulphate-folic acid (HP-CuS-FA) nanoparticle, a PARP inhibitor, and HP-CuS-FA /PARP inhibitor in human cervical (HeLa) and human skin fibroblast (AG1522) cancer cell lines. An MTT assay was used to assess the toxicity of the synthesized and characterized HP-CuS-FA nanoparticles on HeLa and AG1522 cells. Clonogenic assays were used to determine the radio-sensitizing effects of HP-CuS-FA nanoparticles. Our results indicated that the combination treatment of HP-CuS-FA/PARP inhibitor enhances the efficacy of radiation therapy by increasing the reactive oxygen species, inducing apoptosis and DNA damage. This study suggests that HP-CuS-FA nanoparticles and a PARP inhibitor have a synergistic effect on cancer cell death and are potential nano-radio-sensitizing agents for the treatment of cancer.

8. Sam Houston State University

Makenzie Hesse

THE ECONOMIC IMPACT OF A LARGE COLONY OF BRAZILIAN FREE-TAILED BATS IN WALKER COUNTY, TEXAS

Faculty Advisor: Christian Raschke, PhD

An abandoned warehouse owned by the Texas Department of Criminal Justice in Huntsville, Texas is home to an estimated 750,000 to 1,000,000 Brazilian Free-tailed Bats (*Tadarida brasiliensis*). The building is in significant disrepair and efforts to relocate the bats have failed so far. There is active public debate in the community about how to balance public health concerns, animal conservation efforts, public safety concerns, as well as the needs of the Texas Department of Criminal Justice. This research informs the public debate by investigating the economic impact of bats through tourism and agriculture. The bats emerging from their roost at night has attracted spectators, and we conducted a one-week survey of the bat visitors in September 2022. Based on this survey, we estimate the direct economic impact from tourism to be \$8,820 annually. Bats also reduce the need for pesticides in agriculture and prevent larvae from damaging crops. On a peak night in June, the bats provide up to \$11,962 per night in avoided crop damage through the consumption of corn earworm moths.

9. Schreiner University

Kailyn Yeisley

USING BACTERIA TO TRIGGER THE INNATE IMMUNE RESPONSE IN DROSOPHILA TO EXAMINE THE POTENTIAL ROLE OF DYNACTIN IN TOLL SIGNALING

Faculty Advisor: Susan Klinedinst

The immune response is the body's initial non-specific defense against pathogens. It is initiated through the Toll signaling pathway which leads to production of certain antimicrobial peptides. In *Drosophila*, the Toll pathway is involved in both dorsal/ventral axis specification as well as immunity. Dorsal, an NF- κ B related protein, a component of the Toll pathway, is expressed in both larval and adult fat body, an organ that functions like a liver. After larval injury, the Toll pathway is activated, resulting in a rapid translocation of Dorsal from cytoplasm to the nucleus. Once there, Dorsal activates the transcription of defense genes. The transport of biological materials throughout the cell requires molecular motors Dynein and Kinesin. Dynein associates with the protein complex Dynactin, which is known to promote Dynein function by serving as an adaptor for cargo and enhancing processivity. We hypothesized that Dynactin could be involved in the transport of Dorsal from cytoplasm to nuclear envelope. To test this, *Drosophila* dynactin mutant larvae were challenged by feeding with bacteria to stimulate an innate immune response and the fat body was examined under a fluorescent microscope to compare the amount of Dorsal protein found in the nucleus in the unchallenged vs. challenged larvae.

10. Southwestern Adventist University

Alessandro Franchini

VERTEBRATE MICROFOSSILS FROM THE HANSON BONEBED, LANCE FORMATION (MAASTRICHTIAN), NIOBRARA COUNTY, WY, USA

Faculty Advisors: Jared P. Wood, PhD; Arthur V. Chadwick, PhD

The Lance Formation is an extensive deposit of Mesozoic vertebrates located in Wyoming. Despite thousands of fossils having been recovered from this formation, little is known about Lancian microsites. During our 2021 excavation, we discovered over 50 teeth from *Pectinodon bakkeri* and other microfossils in an ant's nest near the Hanson Bonebed, located in Niobrara County. To explore this site further, we sampled 90 liters of substrate from 12 plots, located 8 meters apart around the ant nest. Approximately 700 elements, representing nearly 30 taxa were collected. The groups represented with the largest number of elements were the Lepistosteidae ($n = 109$), *Edmontosaurus annectens* ($n = 65$), *Pectinodon bakkeri* ($n = 53$), Amiidae ($n = 37$), and Crocodylians, such as *Brachychampsa* sp. ($n = 43$) and *Leidyosuchus* sp. ($n = 12$). Teeth comprised 55% of the identifiable elements followed by scutes and scales (22%), vertebrae (15%), jaws (7%), and avian claws and theropod long bones (1%). This new microsite represents a complex paleo-environment, consisting of a varied assemblage of aquatic and terrestrial creatures. Continued work on this site will better enable us to understand the taphonomical processes involved in constructing this microsite and facilitate comparisons between microsites from similar formations.

11. St. Edward's University

Julia Saavedra

Additional Student Contributors: Gina Guidone; Rebecca Terrazas

FUNDRAISER INFLUENCE TACTICS AND DONOR ORIENTATION: FINDING THE RIGHT MATCH

Faculty Advisor: Wesley Pollitte, PhD

This research focuses on influential tactics used by a fundraiser for a non-profit to suit the orientations of potential donors. The research was performed for Camp For All, a barrier-free camp for people with special needs located in Burton, Texas. Ingratiation and inspirational appeals were the influential tactics used in this research with task, self, and interaction donor orientations. The model was tested with a convenience sample of fifty people in Austin, Texas. The results indicate that ingratiation is not related to any of the three orientations. In contrast inspirational appeals are significantly related to task and interaction orientation. It is recommended that inspirational appeals for potential task oriented donors be informational in nature. For potential; donors having an interaction orientation, it is recommended fundraiser events be used to allow interaction oriented donors to mingle and interact with people from Camp For All.

12. St. Edward's University

Matilda Soric

Additional Student Contributors: Deautun Ross; Moran Allen

SPATIOTEMPORAL BAYESIAN MODELING OF ARSENIC RISK FROM WATER AND RELATION TO BLADDER CANCER

Faculty Advisors: Paul Savala, PhD; Montserrat Fuentes, PhD

Bladder cancer has been shown to be correlated with smoking, and to a lesser extent arsenic consumption through water. While a relationship between arsenic consumption and bladder cancer has been established, the precise temporal relationship is still not well explained. To make matters worse, not only are high levels of arsenic intake thought to be needed in order to contribute to risk of bladder cancer, but often arsenic intake is studied in combination with smoking and/or drinking from an unconsolidated well, all while considering various temporal lags. This splitting of the data causes small sample sizes, which makes statistical significance hard to detect. To this end we utilize a Bayesian mixture model which models total arsenic intake as a temporal mixture, while adjusting for relevant covariates. We apply this model to case-control data from the New England bladder cancer study. In doing so we demonstrate the precise temporal relationship between arsenic intake and bladder cancer. We then investigate the spatiotemporal trends in arsenic intake, weighting intake by the mixture components fit by our model, in order to identify key areas and times that contributed to cancer risk.

13. Stephen F. Austin State University

Siena Stassi

FROM BOTTOM TO TOP: MICROPLASTICS DIVERSITY IN AQUATIC FOOD WEBS OF RURAL-URBAN STREAMS IN EAST TEXAS

Faculty Advisor: Carmen G. Montaña

This study aims to help fill the gap in knowledge of the abundance and diversity of microplastics found in streams of East Texas. We analyzed samples of water, sediment, and fish stomach contents from streams in urban and rural areas in East Texas. Higher prevalence of microplastics was expected from urban streams due to closer proximity to anthropogenic activity, higher rates of plastic pollution, and contaminated run off and wastewater. Samples were collected from two urban streams within La Nana Bayou and three rural streams within the Big Cypress Bayou. Water and sediments were examined using standard protocols and fishes were placed into trophic guilds and examined. Microplastics found in samples were identified, sorted by shape and color, and counted. Overall, samples from urban streams contained a higher abundance of microplastics. Fishes at higher trophic position (Carnivorous) appeared to ingest a diverse range of microplastics. Findings from this project provide new insights into microplastic contamination in our local streams of East Texas and how they are moving up in the aquatic food webs. Streams in East Texas contains the highest freshwater biodiversity, yet microplastic contamination and their transfer pose potential ecological impact on wildlife and ecosystem health.

14. Tarleton State University

Avery Campbell

Additional Student Contributors: Gavin McIntosh; Melanie Little

MODELING SUPRAVENTRICULAR TACHYCARDIA USING DYNAMIC COMPUTER-GENERATED LEFT ATRIUM

Faculty Advisor: Bryant Wyatt, PhD

Supraventricular Tachycardia (SVT) is when the heart's upper chambers beat either too quickly or out of rhythm with the heart's lower chambers. This out-of-step heart beating is a leading cause of strokes, heart attacks, and heart failure. The most successful treatment for SVT is catheter ablation, a process where an electrophysiologist (EP) maps the heart to find areas with abnormal electrical activity. The EP then runs a catheter into the heart to burn the abnormal area, blocking the electrical signals. Much is not known about what triggers SVT and where to place scar tissue for optimal patient outcomes. We have produced a dynamic model of the right atrium accelerated on NVIDIA GPUs. An interface allows researchers to insert ectopic signals into the simulated atria and ablate sections of the atria allowing them to rapidly gain insight into what causes SVTs and how to terminate them.

15. Texas A&M International University

Hannia Tejeda

Additional Student Contributors: Cheryl Breland; Alexandra Mendoza

HISPANIC SERIAL KILLERS

Faculty Advisor: Brittany Hood

A considerable amount of scholarly work has been devoted to examining serial killers. However, most of this research has focused on black and white serial killers and has largely excluded Hispanics. Outside of their prevalence in serial homicide, critical characteristics of Hispanic serial killers are missing from extant research. The present study explores how Hispanic serial killers differ from their non-Hispanic counterparts. Findings related to the geography of the homicides, victim types, method(s) of killing, how they were adjudicated, and policy implications are discussed.

16. Texas A&M University

Yilin Li

EFFECT OF CRIME VICTIM'S COMPENSATION GRANTS ON REPORTED SEXUAL ASSAULT ACROSS TEXAS COUNTIES THROUGHOUT THE COVID-19 PANDEMIC

Faculty Advisor: George Naufal, PhD

This research studies funding given by the Texas Attorney General's Office through the Crime Victim's Compensation Program and the relationship with reported cases of sexual assault. We studied the effect of victim services grants that are given to counties in Texas to aid survivors and provide resources. We hypothesized and found a positive and statistically significant relationship between the funding that flows into a county and the number of cases reported. Additionally, we found that during 2020, the relationship between funding and reporting was weaker, demonstrating the effect of the pandemic.

17. Texas A&M University

Brandon K. Watanabe

THE IMPACT OF WORKING MEMORY LOAD ON ERROR MONITORING

Faculty Advisor: Annmarie MacNamara, PhD

Error monitoring is an essential cognitive function that helps people optimize their behavior. This study aimed to examine how depletion of central processing resources (via working memory load) effects error monitoring. Changes in brain activity associated with erroneous behavior were measured using event-related potentials, like the error-related negativity (ERN) and error positivity (Pe). Prior work has shown that the ERN is associated with the immediate error detection, while the Pe reflects elaborative and conscious error processing. Given that past research had found that working memory load reduces the elaborative processing of salient stimuli and the Pe reflects the elaborative processing of errors, we hypothesized that working memory load would reduce the Pe but not the ERN. Fifty-four participants completed a working memory task (low load versus high load) with an interspersed arrowhead flanker task (correct responses versus error responses). Results showed that while ERN amplitude was not impacted by working memory load, working memory load effected the Pe such that there was a greater difference between error and correct responses under low load versus high load. These results indicate that working memory load may inhibit the elaborative processing of errors, but might not influence more immediate error detection processes.

18. Texas A&M University – Central Texas

Jasmine Mason

MAKE NEW FRIENDS BUT KEEP THE OLD: COLLEGE FRIENDSHIPS, SHYNESS, AND MENTAL HEALTH.

Faculty Advisor: Madelynn Shell, PhD; Walter Murphy, PhD

During the transition to college, significant social changes may affect mental health. This study examined changes in high school and college friendships, and how these relationships and shyness may impact loneliness and depression during the college transition. First-year college students ($N=91$) named their most important high school and college friend and reported on friendship quality, shyness, loneliness, and depression at the beginning and end of their first semester. High school friendships were more stable than college friendships (72% vs. 35% stable) and higher in quality. Nonetheless, college (but not high school) friendships predicted loneliness at the end of the first semester. Shyness also predicted depression and loneliness in men, but not women. Overall, high school friendships remain important during the college transition, but new friendships may significantly impact mental health and well-being. Furthermore, shyness negatively impacted men's (but not women's) mental health, highlighting the importance of considering individual differences in mental health. Providing support for friendship formation and increasing awareness of mental health resources may help facilitate the transition to college.

19. Texas A&M University – Corpus Christi

Allison Wilkins

Additional Student Contributor: William McGlaun

CURRENT POPULATION ABUNDANCE ESTIMATION OF BOTTLENOSE DOLPHINS IN THE TEXAS COASTAL BEND

Faculty Advisor: Dara N. Orbach, PhD

Bottlenose dolphins (*Tursiops truncatus*) are the only marine mammal residing in the inshore Texas Coastal Bend (TCB). Despite exposure to several natural and anthropogenic threats, there has not been published research on this population in three decades. The population abundance of dolphins inhabiting the TCB was determined using photo-identification and the Cormack-Jolly-Seber mark-recapture model. Individuals were distinguished by unique markings on their dorsal fins captured in photographs. Boat-based surveys were conducted each quarter of the year using a closed model design to sample (mark) and resample (recapture) dolphins (2018-2022, $n = 56$ surveys). Photographs were quality control checked, matched, and cataloged in FinBase for subsequent population size modeling. The estimated population abundance is 1,280 in Corpus Christi Bay, 1,105 in Redfish/Aransas Bay, and 1,356 for both areas. The population appears to have grown when compared to the 300 dolphins reported in 1987. However, previous research used different sampling methods than our robust design. We provide insights into the size and stability of the population of dolphins inhabiting the TCB that can be used as baseline data for future research and conservation actions.

Texas A&M University – Kingsville

Brissa Acevedo

MICROALGAE: THE FUTURE OF BIODIESEL & WASTEWATER TREATMENT

Faculty Advisor: Matthew L. Alexander

Microalgae are an excellent vehicle for significant triglyceride production, which can be transformed chemically into biodiesel fuel. However, large volumes of water are necessary for successful microalgae cultivation. With ever-increasing demands for clean potable water, it makes sense to investigate using non-potable waters, such as wastewater and brackish waters, for microalgae culturing. The current research aim is to investigate whether the microalgae strains *Dunaliella salina*, and *Neochloris oleoabundans* are good candidates for industrial triglyceride production and treatment of wastewater by comparing their growth in the basic media versus growth in wastewater media. As seen in Figures 6-8, the *N. oleoabundans* experimental group showed significant growth, decreased the levels of nitrate and phosphate (Table 3), and had a lipid percent of 21.45 (Table 4). At the same time, for both the control and experimental group of *D. salina* it appears that this set did not culture at all (Figures 6 & 8). The reason behind the species *D. salina*, not harvesting is still unknown. However, based on the seed culture results, it is predicted that it would also be a good candidate for industrial triglyceride production. Similarly, *N. oleoabundans* would also be a good candidate for industrial triglyceride production and wastewater treatment.

20. Texas A&M University – San Antonio

Dezeree Leak

THE ANOLIS LIZARDS OF DOMINICA: DISTURBANCE, INVASION, AND DIVERSITY IN AN ISLAND ECOSYSTEM

Faculty Advisors: Charles Watson, PhD; Ashley Teufel, PhD

Our laboratory has been working on the Island of Dominica since 2016 to better understand how invasive species and hurricanes affect populations of Anoles. Studies of lizards in this genus on the larger Caribbean islands has provided insight into broad ecological phenomena such as adaptive radiation, sexual selection, and rapid evolution. Unlike these larger islands, Dominica has historically harbored a single species of Anole. This anole, The Dominican Anole, has at least four distinct populations that differ in size and physiology. Another species, The Puerto Rican Crested Anole was introduced in the late 1990's and has since spread across Dominica aided by habitat alteration from humans and hurricanes. Earlier research from our lab show that the invasive Anoles share many aspects of their habitat and coexist primarily by partitioning food resources. Hurricane Maria in 2017 devastated the island and completely changed the landscape for both anole species. These lizards experienced deleterious effects of the hurricane for years following the event. Through an analysis of historic hurricane data across the Caribbean, we show that hurricane frequency and intensity may play an important role in maintaining the population structure of these smaller Caribbean islands.

21. Texas A&M University – Texarkana

Pornphiphat Saiboonchan

ANALYTICAL SOLUTION FOR EFFICIENCY AND TEMPERATURE PROFILE OF THE DOVETAIL FIN UNDER WET OPERATING CONDITIONS

Faculty Advisor/s: Sulaman Pashah, PhD; Sushil Sharma, PhD

The research aims to find an analytical expression for the performance of dovetail fins, considering the effects of humidity. Dovetail fins have a rectangular cross-section with a greater thickness at the tip than the base, and fins enhance heat transfer rate by increasing surface area. The study seeks an analytical solution for the temperature profile and efficiency of the fins, with a focus on wet fin applications. The research found that higher humidity leads to a lower temperature difference, and the fin's efficiency improves by increasing the fin thickness ratio. As a result, dovetail fins perform better than other fin shapes for the same length and base thickness and can be beneficial in double-pipe heat exchangers.

22. Texas Lutheran University

Linden Williamson

BEHAVIORAL AND BRAIN MEASURES CORROBORATE CHROMESTHESIA: A CASE STUDY

Faculty Advisors: Scott Bailey, PhD; Elizabeth Woods, PhD

Chromesthesia is a neurodiverse trait characterized by the induction of phantom visual experiences, photisms, from listening to music. Photisms are automatic, consistent, and are reported as indistinguishable from actual visual experiences by people with chromesthesia, or chromesthetes. Both the prevalence of chromesthesia and the assessment of perceptual experiences pose methodological challenges but advances in diagnostic tests and functional imaging offer insight into the formerly illusive phenomena. Assessments of chromesthesia include two formal online batteries developed by neuroscientists Eagleman (Synesthesia Battery) and Simner (Synaesthesia Toolkit). Conventional brain measurement instrumentation including functional magnetic resonance imaging, positron emission tomography, and others have been unreliable at measuring cortical activity to substantiate reports of chromesthetic experiences. The present study compared the reliability of the two formal synesthesia assessments in identifying chromesthesia and used functional near infrared spectroscopy (fNIRS) to measure cortical characteristics of one chromesthete. The online assessments both corroborated the participant's chromesthesia. fNIRS data collected when the participant was blindfolded revealed visual sensory activity in response to chromesthesia-inducing music but not other auditory stimuli. These findings support fNIRS as a noninvasive, ecologically valid, novel tool for the measurement of chromesthesia.

23. Texas State University

Sebastian Velez

ENGINEERING A NEW EXPRESSION SYSTEM FOR PURIFICATION AND ANALYSIS OF PHASE-SEPARATING PROTEINS

Faculty Advisor: Karen Lewis, PhD

La-Related Protein 6 (LARP6) is a protein known to bind to collagen mRNA. It is comprised of multiple domains; my domain of interest, the C-terminal domain (CTD), is predicted to undergo a phenomenon called liquid-liquid phase separation in which many of these proteins come together to form droplets within a solution, similar to oil in water. My research aims to characterize what properties influence the formation of these droplets, such as salt concentration, pH, presence of and concentration of RNA, etc., and how the formation of these droplets is used by cells to regulate LARP6 activity. In order to analyze the CTD and test these conditions, biochemical quantities of the protein need to be expressed and purified. However, the ability of this protein to phase-separate also makes them difficult to purify. Our initial attempts to purify the LARP6 CTD have resulted in low and inconsistent yields. Therefore, I have engineered a new expression system that will enable us to purify these proteins under denaturing conditions where phase-separation behavior cannot occur. Once purified, the LARP6 CTD will be slowly transitioned into more cell-like solution conditions, enabling us to analyze its biophysical behavior using microscopic and spectroscopic methods.

24. Texas State University

Madelyn Mezzell

I'VE BEEN WORKING ON THE RAILROAD: A DIGITAL RECONSTRUCTION OF A SITE OF LABOR ON THE SOUTHERN PACIFIC RAILROAD

Faculty Advisors: David Kilby, PhD; Louie Valencia, PhD

This project explores the archaeology of the Southern Pacific Railroad, focusing on a bridge abutment along an abandoned section of track located near Langtry, Texas. Previous archaeological investigations looked into the camp life of railroad labor groups, often composed of Chinese immigrant workers. However, less is known about the conditions of labor at the work sites and craftsmanship of the construction of railroad features. By analyzing the abutment through these lenses, I contribute to a greater understanding of how skilled labor was conducted during the rise of industrialism. I use photogrammetry and computer graphics (SfM) to create a 3-D, digital reconstruction of the abutment. Additionally, I inventory and analyze railroad artifacts, collected from the site, to increase comprehension about tools and objects utilized during construction. The reconstruction of the abutment and artifact analysis is compiled into an online platform to inform on the experiences of laborers and examine the product of their labor. Because the creation of the railroad and use of largely immigrant labor are intertwined with the spread of immigrants across the American West, studying a site of labor is indicative of working-class treatment and its intersection with issues of immigration and ethnicity.

25. Texas Tech University

Trevor Wilkinson

THE IDEOLOGY OF FREEDOM AS EXPLORED THROUGH THE WORKS OF JAMES BALDWIN, FYODOR DOSTOEVSKY AND TIMOTHY SNYDER

Faculty Advisor: Joseph Hodes, PhD

In the aftermath of the second world war, four nationalist movements sought to create liberation movements for their peoples. Those movements of the Israelis, Palestinians, Indians and Pakistanis threw off the colonial yoke and embarked on vastly different political enterprises. This was an experiment in freedom for peoples who had not governed themselves in centuries. Through the examination of acknowledged experts in the field, we can begin to understand the ideologies of freedom as they pertain to nations, minorities, and political processes. Through an understanding of the language of freedom and its mechanisms, we can have a deeper understanding of the four peoples who although attained freedom, did not attain peace. India, Israel, Pakistan, and Palestine were created within nine months of each other. India and Pakistan on Aug 14 and 15 1947, Israel Palestine on May 14, 1948. These nations were all born out of partition and out of violence. Because the nations were born out of violence, they would know liberation but not peace. How do theories of freedom as espoused by Baldwin, Dostoevsky and Snyder inform our understanding of freedom.

26. Texas Tech University

Tina E. Greene

Additional Student Contributors: Megan A. Keen, Cole M. Morris, Ashlinn S. Peters

USING THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY–3 (MMPI-3) TO ASSESS INDIVIDUALS WITH POSTTRAUMATIC STRESS DISORDER (PTSD) USING A CLINICAL INTERVIEW

Faculty Advisors: Paul Ingram, PhD; Jon Crider, PhD

This study examined the ability of the recently released Minnesota Multiphasic Personality Inventory–3 (MMPI-3)'s ability to differentiate individuals diagnosed with posttraumatic stress disorder (PTSD) from those without such diagnosis. Previous research has provided robust support for earlier versions of the MMPI in PTSD assessment. Emerging work on the MMPI-3 suggests similar support; however, research has not yet examined the MMPI-3's classification accuracy of PTSD groups derived from formal diagnostic criteria. This study expands previous work on PTSD classification from the MMPI-2-RF (Sellbom et al., 2012) and the MMPI-3 (Keen et al., in review). College students were given the MMPI-3, collateral measures, and the Clinician Administered PTSD Scale–5 (CAPS-5) interview, from which PTSD/no-PTSD groups were created. Data collection started September 2022, with a current sample size of 44 (Age M = 18.52). Of these, 10 met diagnostic criteria for PTSD (CAPS-5 M = 35.60, PCL-5 M = 47.20). Preliminary results indicate moderate relationships between internalization scales and both self-report PTSD symptoms (e.g., $r = .68$, $p < .001$ [ARX]) and CAPS-5 score (e.g., $r = .63$, $p < .001$ [ARX]). Sensitivity, specificity, predictive utility of the MMPI-3 scales, and mean substantive scale differences between PTSD/no-PTSD groups will be presented.

27. Texas Tech University Health Sciences Center

Roni McPeek

MEDICATION SAFETY: IMPLEMENTATION OF BEST PRACTICES

Faculty Advisor: Alyce Ashcroft, PhD

Medications are given every hour of every day to patients cared for by clinicians in the acute care setting. Of note: 28% of medical errors are from medication errors in the United States (Hines et al., 2018); 80% of the medication errors are preventable (Woo et al., 2019); Medication errors are the 3rd leading cause of death in United States (Aljabari & Kadhim, 2021); and Medication errors are also known as Adverse Drug Events (Udi, 2021). What is of continuing concern is error rate and preventability. The purpose of this presentation is to discuss best practices, how errors occur, and safety measures that are evidence based. Two cases recently highlighted by the media will also be discussed.

28. Texas Woman's University

Shalom Anyiam

LISTENING TO BLACK PREGNANT AND POSTPARTUM WOMEN AND THEIR KNOWLEDGE AND EXPERIENCES WITH MIDWIFERY CARE AND BIRTH CENTERS IN TEXAS

Faculty Advisor: Jennifer Woo, PhD

Key themes that emerged from this qualitative study involving interviews with Black women in Texas on access, knowledge, and use of midwifery and birth center care were financial barriers, social media, and poor maternal care experiences respectively. Affordability of birth center and midwifery care was a very important factor for women impacting their access to these services. Women interviewed identified social media as an important tool in marketing and increasing awareness of birth center and midwifery care. Women also explained that their past or present negative experiences with maternal care providers especially in the hospital setting influenced their decision to use or consider using birth center and midwifery care. Findings from the study emphasize the need for equitable access, so Black women can have all resources necessary to make an informed choice on their birth setting and provider. This knowledge highlights the needs of Black women to maternal healthcare providers in Texas and increases understanding of ways to promote access and possibly improve maternal outcomes for Black women.

29. The University of Texas at Arlington

Jose Perez Vela

SUPPORTING ENVIRONMENTAL JUSTICE: TRANSFORMATIVE LEADERSHIP DYNAMICS OF RESIDENTS IN INFORMAL SUBDIVISIONS

Faculty Advisors: Ariadna Reyes, PhD; Ericka Roland, PhD

Residents in low-income informal subdivisions are commonly abandoned by neoliberal municipalities that avoid the financial costs of providing access to essential services, exposing them to environmental and climate injustices. Community leadership is critical for communities of color living in low-income informal subdivisions to develop resiliency against environmental injustices that absent governments have intensified. Fieldwork in Floral Farms and a Freedmen Settlement in Southeast Dallas County were used to document the leadership of each community. Historical accuracy was strengthened through interviews with residents in tandem with participatory mapping techniques and historical archives collected from county data. Community relationships developed through the interviews guided research findings and exposed the opportunities community leaders offer informal subdivisions in resisting environmental injustices. This study shows that the Freedmen Settlement faces high poverty levels and lives without access to clean water or basic infrastructure. Successful examples, like how Floral Farms came together to clear the dumping that harmed their neighborhood, provide communities of color a chance to confront systemic failures that endanger their health and well-being. By filling in for absent political leaders and inviting everyone to the table, community activism offers low-income communities of color a compelling adaptation strategy for addressing precarity and environmental injustices.

30. The University of Texas at Austin

David C. Park

Additional Student Contributors: Ling-Kai Shih

HYPOXIC REGULATION OF GLIOBLASTOMA TUMOR GROWTH THROUGH L(3)MBTL1

Faculty Advisor: Daniel J. Brat, MD, PhD

Studies using *Drosophila* brain tumor models have revealed pathways that control tumor growth similar to Glioblastoma (GBM) in humans. Our research using *Drosophila* led to the discovery of a potential tumor suppressor called Lethal-(3)-Malignant Brain Tumor (L3MBT), which causes the overgrowth of tumors in the optic lobes when mutated. Like the *Drosophila* version, the human counterpart L3MBTL1 acts to compact chromatin and suppresses gene activity to inhibit cytokinesis in GBM cells. The microenvironment in GBM, which is often hypoxic, contributes to the tumor's progression and recurrence. However, it is not known if L3MBTL1's activity is affected by this environment. Our research suggests hypoxia directly influences L3MBTL1 to promote GBM growth. Analysis of TCGA data for IDH-wildtype GBM revealed that L3MBTL1 gene expression is downregulated in GBM, which are necrotic and severely hypoxic, compared to gliomas that do not contain necrosis, indicating that hypoxia could potentially suppress L3MBTL1 to enhance glioma progression. TCGA data also revealed several HIF-pathway and hypoxia-inducible genes strongly correlating with L3MBTL1 expression. Using patient-derived GBM neurosphere cultures, we exposed glioma cells to hypoxia and found that L3MBTL1 protein levels were suppressed compared to normoxia. Under these same conditions, we found more rapid cell proliferation under hypoxia.

31. The University of Texas at Austin

Sucharita Banerjee

ANALYSIS OF MECHANICAL AND MICROSTRUCTURAL PROPERTIES FOR MO ALLOYS

Faculty Advisor: Eric Taleff

Molybdenum (Mo) is a refractory metal with a high melting point of 2896 K (2623 °C), which allows it to be used at elevated temperatures. Many applications of Mo involve high-temperature service, such as furnace hardware and heating elements. Like many refractory metals and their alloys, Mo retains some room-temperature ductility in the worked (plastically deformed) condition but loses most ductility at room temperature after it recrystallizes. Therefore, this study investigates the mechanical and microstructural properties of a commercial-purity Mo sheet material and two Mo alloy sheet materials. The Mo alloys tested were either lanthanated (La) or combined with titanium and zirconium (TZM). First Vickers Hardness tests were conducted on Mo specimens which were annealed at temperatures ranging from 1400C- 1700C. This experiment indicated that all the Moly compositions experienced a hardness drop by 1700 C alluding to all the Moly alloys being recrystallized. However, when coldworked metals are annealed, their microstructure evolves due to the processes of recovery, recrystallization, and grain growth. Then, the hardness values combined with microstructural analysis showed that all the alloys had undergone some degree of recrystallization by 1700C. Furthermore, tensile tests were conducted to determine the strengths of the Mo alloys at the annealing temperatures.

32. The University of Texas at Dallas

Ben Walker

NEAR-LANDAUER REVERSIBLE SKYRMION LOGIC WITH VOLTAGE-BASED PROPAGATION

Faculty Advisors: Joseph Friedman; Felipe Garcia-Sanchez

Magnetic skyrmions are topological quasiparticles whose non-volatility, detectability, and mobility make them exciting candidates for low-energy computing. Previous works have demonstrated the feasibility and efficiency of current-driven skyrmions in cascaded logic structures inspired by reversible computing. As skyrmions can be propelled through the voltage-controlled magnetic anisotropy (VCMA) effect with much greater efficiency, this work proposes a VCMA-based skyrmion propagation mechanism that drastically reduces energy dissipation. Additionally, we demonstrate the functionality of skyrmion logic gates enabled by our novel voltage-based propagation and estimate its energy efficiency relative to other logic schemes. The minimum dissipation of this VCMA-driven magnetic skyrmion logic at 0 K is found to be ~6x the room-temperature Landauer limit, indicating the potential for sub-Landauer dissipation through further engineering.

33. The University of Texas at Dallas

Jyotsna Tera

CHARACTERIZING CHRONIC IL-1 IN BREAST CANCER GROWTH AND PROLIFERATION

Faculty Advisor: Nikki Delk, PhD

Chronic inflammation promotes breast cancer (BCa) progression, but the effect on BCa cell behavior and intracellular signaling are not fully elucidated. Our lab studies the effects of chronic interleukin-1 (IL-1) exposure on cancer cell tumorigenicity. IL-1 is an inflammatory protein that is upregulated in BCa patient tissue and serum, and pharmacological inhibition of IL-1 blocks BCa metastasis in mouse models. To better understand the range of effects chronic IL-1 has on BCa cell behavior and intracellular signaling, we chronically exposed BCa cells to IL-1 for several months. Preliminary observations reveal that chronic IL-1 exposure has context-specific anti- and pro-tumorigenic effects on BCa cell proliferation and intracellular signaling. We will perform sequencing and bioinformatics analyses on our novel cell line models to elucidate the molecular mechanisms regulating chronic IL-1 effects on BCa proliferation and intracellular signaling. Long-term, our studies will help to identify patients that would benefit from anti-IL-1 therapy and to identify alternative therapeutic targets for patients resistant to anti-IL-1 therapy.

34. The University of Texas at El Paso

Leslie Sullivan

Additional Student Contributors: Diana Olivas, Samantha Ramirez

AGONISTS FOR GPCR'S AID IN THE UNDERSTANDING OF MECHANISMS INVOLVED IN NEURODEGENERATION

Faculty Advisor: Sukla Roychowdhury, PhD

Neurodegeneration is a pathological condition that results in the progressive loss of neuronal structure and function, which occurs in neurological disorders including Alzheimer's disease (AD), Parkinson's disease (PD), and Dementia. The cause of this disorder is largely unknown, and no effective drugs are available to treat the disease process. Therefore, the goal of the current study is to identify new target(s) and strategies for therapeutic interventions. It is known that microtubule (MT's, protein filaments that constitute cell structure) dysfunction occurs at early stages of neurodegeneration. Microtubules have demonstrated to be regulated by G protein-coupled receptors (GPCRS), the largest family of cell surface receptors, where drugs exert their effect. Thus, in the present study, the possible involvement of two important classes of GPCRS (beta-, and alpha2- adrenergic receptors) in neuronal SHSY5Y cells, were evaluated using agonist (receptor activator) treatments such as Isoproterenol and UK14,304. Neuronal characteristics and MT's were analyzed through high-resolution imaging (confocal microscopy). The results reveal that UK14,304 increased the outgrowth of neurites compared to the control sample. In contrast, Isoproterenol disrupted neurite formation significantly. Based on these results, we can conclude that UK14,304 and Isoproterenol play a significant role in highlighting the mechanisms that occur during neurodegeneration.

35. The University of Texas at El Paso

Nicole Jimenez

Additional Student Contributor: Aibhlin Esparza

MULTICELLULAR 3D CARDIOVASCULAR TISSUE MODEL WITHIN A CLOSED-CIRCUIT CAPILLARY-FLOW MICROFLUIDIC PLATFORM

Faculty Advisor: Sylvia Natividad-Diaz, PhD

Cardiovascular disease (CVD) is the leading cause of death in the United States and Worldwide. CVD affects the heart or blood vessels and can refer to various conditions, including heart attack, stroke, and heart failure. In 2020, mortality rates for the U.S. and globally were about 700,000 and 17.9 million respectively. Human cardiovascular tissues are difficult to study for novel drug discovery due to limited availability of physiologically-relevant models in vitro. Animal models may resemble human heart structure, however there are significant differences including biochemical signaling and gene expression. In vitro microfluidic tissue models provide a less expensive, more controlled, and reproducible platform for better quantification of isolated cellular processes in response to biochemical or biophysical stimulus. The overall project goal is to develop a multicellular 3D human cardiovascular tissue model that includes a bioinspired fibrin matrix within a dynamic, closed-circuit microfluidic (CCM) platform. Our hypothesis is that combining human cardiovascular cells within a fibrin hydrogel and CCM will create a functional, more physiologically relevant 3D heart tissue model for improved preclinical CVD drug screening studies. Currently, device optimization and preliminary data was obtained with HUVEC (vein cells) and AC16 cardiomyocytes (heart muscle cells) encapsulated within fibrin hydrogels.

36. The University of Texas at San Antonio

Miranda Boggan

THE EFFECT OF ANTECEDENT INTERVENTIONS ON ESCAPE BEHAVIORS IN AUTISM: A PILOT STUDY

Faculty Advisors: Hannah Macnaul, PhD; Darrell Balderrama

Elopement, or the act of a person leaving a particular area without permission, is a very dangerous and common behavior exhibited by children with autism. Behavior-analytic interventions have been successful at reducing elopement, but those that prevent the behavior from ever happening are specifically advantageous for this behavior. Functional communication training is an antecedent intervention that has wide applicability for various forms of challenging behavior, but little research has been conducted on the use of FCT for elopement. Therefore, the purpose of this study was to evaluate the effectiveness of FCT on decreasing elopement in a child with autism and increasing functional communication (e.g., asking for permission to travel to an area). The functional behavior assessment revealed elopement to be maintained by access to preferred tangibles. Therefore, blocking and a choice board of preferred items was introduced. Over the course of treatment, elopement decreased significantly, and the client began to independently communicate with the choice board. This study allows for further elaboration into whether replacing challenging behaviors with FCT and visual prompts can be a generalized method for decreasing elopement.

37. The University of Texas at San Antonio

Ernesto Flores

Additional Student Contributor: Alejandro Morales Betancourt

SETE NANO-ALLOYS FOR REGULATION OF REDOX REACTIONS IN CANCER CELLS

Faculty Advisor: Kelly Nash

Nanomaterials are one of the most promising technologies of the 21st century. They are widely used in fields of science, health care, agriculture, technology, and industries. Their physical, chemical, magnetic, and conductive properties differentiate them from their bulk counterparts. These physical characteristics make them the focus of different scientific studies. The synthesis of nanomaterials is currently being studied due to the restrictions relevant to translating these materials from laboratory to fabrication. Pulse Laser Ablation in Liquids (PLAL) has been shown to be optimal. It is a versatile technique that allows the production of most nanomaterials, is low-cost, and is environmentally friendly. To overcome the challenges of the oxidative effects of traditional liquid phases (water, acetone), we are working on synthesizing SeTe nanoalloys utilizing deep eutectic solvents with Ch-Cl as the hydrogen bond donor. The hydrogen bond acceptor will be sugar-based to increase biocompatibility. We analyzed the size, shape, and charge of SeTe synthesized in deep eutectic solvent. Our goal is to regulate redox activity in cancer cells by reducing the toxicity of SeTe by using Deep Eutectic Solvents.

38. The University of Texas at Tyler

Linda Steele

Additional Student Contributors: McKenna Wehrmann; Jaci Adams

EFFECT OF GAIT SPEED ON KNEE EXTENSOR ECCENTRIC CONTROL DURING UNPREDICTABLE ABRUPT GAIT TERMINATION

Faculty Advisor: Woohyoung Jeon, PhD

Knee extensor eccentric control plays an important role in balance recovery as the initial defense against falling during unpredictable abrupt gait termination. Since required walking speeds are unpredictable in real-life scenarios of sudden gait termination, we aimed to examine the effects of gait speed on knee extensor eccentric control during this event. Ten healthy younger adults participated in this study (20.7 ± 1.8 years old). Participants performed unpredictable abrupt gait termination at various gait speeds (slow, preferred, and fast) for each trial. In response to a visual light cue, participants were asked to stop and freeze their motion for 3 seconds. Knee extensor eccentric control of the stopping leg during the freezing phase was analyzed. The outcome variables are 1) vastus lateralis (VL) and vastus medialis (VM) electromyography (EMG) burst duration, 2) area under EMG curve, 3) knee flexion angle, and 4) knee joint power. Our findings showed that walking speed is positively correlated with knee extensor eccentric control during unpredictable abrupt gait termination, and fast walking speeds require greater knee extensor eccentric control compared to slow speeds. The outcomes may support interventions integrating knee extensor eccentric strengthening to improve dynamic balance controls for fall prevention.

39. The University of Texas Health Science Center Houston

Ava Garrett (Sam Houston State University Undergraduate)

AUTOETHNOGRAPHIC EXAMINATION OF DATA-DRIVEN, COMMUNITY-TAILORED COVID-19 RESPONSE IN BROWNSVILLE, TEXAS

Faculty Advisor: Christine Blackburn, PhD with co-authors: Michelle Jones; Miryoung Lee, PhD; Cici Bauer, PhD; Arturo Rodriguez; Roberto Garcia; Susan P. Fisher-Hoch, MD; Joseph B. McCormick, MD; Kehe Zhang; Johanna Esteves

The City of Brownsville was made vulnerable to the COVID-19 pandemic due to high rates of obesity and diabetes, high rates of poverty, and adverse social determinants of health. To address the unique challenges faced by the community, Brownsville's COVID-19 response brought together the skills of academia with the local understanding and health expertise of the city's public health department to craft a pandemic response that addressed the specific needs and unique challenges of the residents. This article explores the response partnerships formed and the data-driven, community-oriented campaigns that were designed by the Brownsville Public Health Department. The collaborative partnership of the COVID-19 working group and the innovative dissemination strategies designed by the health department provided an effective method of disease mitigation among the city's most vulnerable residents. The article demonstrates the impact of the response campaigns by including a resident's perspective on the impact of the response, specifically how the health department tailored their efforts to meet the needs of the Brownsville community.

40. The University of Texas of the Permian Basin

Evelyn S. Guerrero

Additional Student Contributors: Emilia Gutierrez; Chelsea J. Rodriguez; Sarai Badillo; Jeffrey Brown; Maggie Bullard; Calli R. Davis; Jackie De Santiago; Alexis R. Morales; Alondra Pando; Jose Zapata; Daniel A. Garcia; Kaylee Garcia; Jenny B. Hunt; Jacquelyn Lopez

STRUCTURE OF A PLANT-POLLINATOR NETWORK AT AN URBAN WETLAND PRESERVE IN MIDLAND, TEXAS

Faculty Advisors: David H. Hembry, PhD; Erica A. Newman, PhD

Species interaction network approaches have the potential to inform conservation efforts, and reveal how native and introduced species interact with each other in ecosystems. Furthermore, many recent studies have underscored the importance of conserving native plant and pollinator populations for their benefits to biodiversity conservation and agriculture. This study investigates plants and their pollinators of the seasonal wetland (playa lake) of the I-20 Wildlife Preserve in Midland, Texas. Our study asks whether introduced insects and plants are connected to each other, and whether they are also connected to native species within the network of plant-pollinator interactions. In weekly observations, we recorded insect interactions with all flowering plant species and collected, pinned, and identified insect specimens. We have collected more than 500 insect specimens, observed 60 plant species, and recorded over 1,600 interaction events between pollinators and plants. Using these data, we will analyze the structure of the plant-pollinator network using software packages in the R programming language. Our results will reveal how non-native species interact with native species and provide baseline information on ecosystems in a region where most land is used for industrial purposes but little ecological research has been conducted, thus informing the conservation of biodiversity in Texas.

41. The University of Texas Rio Grande Valley

Juan Antonio Amieva, Jr.

Additional Student Contributors: Marco A. Arriaga; Jaqueline Quintanilla; Angela Jimenez

THE APPLICATION OF ELECTROSPRAYED MINOCYCLINE-LOADED PLGA MICROPARTICLES FOR THE TREATMENT OF GLIOBLASTOMA

Faculty Advisors: Sue Anne Chew, PhD; Karen S. Martirosyan, PhD

It was determined that DCM:MeOH was the optimal solvent combination for minocycline and that higher amount of methanol present (i.e. 70:30 ratio) would result in higher drug loading. All three solvent ratios investigated resulted in microparticles both smooth and spherical, with no porous surfaces. The hydrophilic nature of minocycline presented a challenge in encapsulating a high amount of drug and resulted in a burst release of the drug, however, in the future, the incorporation of the microparticles in a scaffold or depot can help minimize burst release and prolong sustained release of the drug. The electrospayed minocycline-loaded microparticles showed a significantly higher cytotoxic response in U-87 MG glioblastoma cells compared to minocycline delivered alone and thus, suggests the possibility of microparticles to protect the bioactivity of the drug. In conclusion, electrospaying is a promising method to fabricate minocycline-loaded PLGA microparticles with high drug loading and loading efficiency, but further optimization of the fabrication parameters needs to be investigated to increase the drug loading and sustained drug delivery.

42. The University of Texas Southwestern Medical Center

Kritika Ramesh (University of Texas at Dallas Undergraduate)

ASSESSING THE STABILITY OF OBSERVATIONAL FEAR RESPONDING NEURONS IN THE ANTERIOR CINGULATE CORTEX

Faculty Advisor: Takashi Kitamura, PhD

Observational fear (OF) is an evolutionarily conserved empathic behavior in which an observer expresses fear while witnessing a demonstrator in an aversive situation. Previous studies have shown the anterior cingulate cortex (ACC) to be implicated in the OF response. This region is also known to contain “emotional mirror neurons”, or neurons active when observing and experiencing a stimulus, that respond to OF. However, the stability of specific OF responding neural subpopulations in the ACC has yet to be studied, along with whether these subpopulations are associated with fear responses when the observer itself is shocked. Here, we use in vivo calcium imaging to visualize neuron specific activity in the ACC during repeated instances of OF. We expect to see a consistent neural subpopulation respond to repeated OF exposure, as the persistence of specific neural ensembles has been observed in the ACC when an individual is subjected to recurrent painful stimuli. Moreover, we speculate that this subpopulation will also exhibit mirror-like properties and respond to the observer’s pain as well. Our study allows for further insight into the specific neural ensembles involved in empathy, which may be targeted in future therapies for neuropsychiatric disorders associated with emotional impairment.

43. Trinity University

Taylor Black

THE EVOLUTION OF LIZARD DENTITION: LONG AND SHORT FACED ANOLIS LIZARDS

Faculty Advisors: Michele Johnson, PhD; Thomas Sanger, PhD

Vertebrate teeth serve a variety of functions, including initiating the digestive process, serving as weapons, or acting as tools to manipulate objects. Despite their importance, we know little about how tooth morphology evolves as the dimensions of the jaw evolve. Anolis lizards offer an excellent model to address this question, as all anoles are insectivores who utilize their teeth to capture and manipulate prey, and species in this group have evolved remarkably variable jaw lengths. To determine how tooth number, shape, and spacing have evolved with jaw size, we focus on 30 Caribbean species exhibiting diversity in snout lengths. We use the program 3D Slicer to measure CT scans from 3 specimens of each species. We collected total tooth count from the upper jaw of each specimen. From the left and right sagittal positions of each scan, we measured the length and width of five of the back (tricuspid) and front (unicuspid) teeth, and the distance between these teeth. Preliminary data suggest that snout length is not correlated with tooth number. Through analysis of tooth morphology in a comparative framework, these data will provide a novel understanding of how dentition evolves in the vertebrate jaw.

44. University of Houston

Nikki Marie Hammond

Additional Student Contributor: Nhi Hoang

MODELING THE EFFECTIVENESS OF Pd/Cu AS A DIESEL OXIDATION CATALYST

Faculty Advisor: Lars C. Grabow, PhD

Diesel engine emissions are a major cause of air pollution producing carbon monoxide (CO), hydrocarbons, nitrogen oxide molecules (NO_x), and particulate matter (PM). Low temperature combustion engines offer a promising solution for reducing NO_x and PM emissions, but in turn, the lower temperature interferes with the diesel oxidation catalyst (DOC) causing an increase in CO and hydrocarbon emissions. To combat this, the development of new catalysts is critical. Recent studies show that a Pd/Cu alloy could lead to inhibition-free low temperature oxidation reactions, but the mechanistic origin of the improvement over Pd/Pt alloys remains unknown. To elucidate the mechanism, we first used SurfaceEP, a machine-learning package to rapidly estimate binding energies and identified certain ensembles with promising oxygen binding properties. For isolated Pd atoms in the surface of Cu, we obtained density functional theory (DFT) data for all CO oxidation steps. We are currently incorporating this information into a kinetic Monte Carlo (kMC) model, which will allow us to study the mechanism and activity of well-defined site ensembles. This will provide the necessary fundamental insight that is required to further improve the composition and surface architecture of Pd/Cu diesel oxidation catalyst.

45. University of Houston

Gabrielle Kostecki

FENTANYL VACCINE PREVENTS OPIOID OVERDOSE IN RATS

Faculty Advisor: Colin Haile, PhD

According to the latest figures from the AMA's Advocacy Resource Center, there has been a sharp increase in opioid related deaths in over 40 states. Research on potential treatments addressing the present emergence of Opioid Use Disorder (OUD) and opioid-associated death crisis in the United States is of extreme priority. Our lab is developing an anti-fentanyl (FEN) vaccine to prevent relapse and overdose. Here, we used a rodent model of overdose to test if our conjugate vaccine generates anti-fentanyl antibodies that block FEN from entering the brain and depressing heartrate, blood oxygen saturation and activity associated with FEN-induced overdose. Rats received FEN-CRM (5ug) conjugate with the adjuvant dmLT (1ug) at 0, 3 and 6 weeks. Serum samples were obtained at 6, 8 and 10 weeks and amounts of anti-FEN IgG antibodies were determined using ELISA. Rats were then administered FEN and physiological measures obtained over time. Vaccination with CRM-FEN produced appreciable amounts of anti-FEN antibodies that completely blocked FEN-induced decreases in heartrate, oxygen saturation and activity. Significant anti-FEN antibodies were produced that completely prevented fentanyl overdose in vaccinated but not in unvaccinated rats. These data support further development of this vaccine to address OUD and opioid-associated overdose deaths in humans.

46. University of Houston – Clear Lake

Felipe Trujillo-Wheeler

Additional Student Contributors: James Wheeler, Edgar Castillo, Ramiro Maldonado, Juan Cedillo, Brock Zayas

EVA ZIP TIE INSTALLER FOR THE INTERNATIONAL SPACE STATION

Faculty Advisor: Jeffrey R. Mountain, PhD

The current method of tying cables on the International Space Station (ISS) is physically fatiguing and inefficient. A small handheld device functioning as a zip tie installer would make this task easier and more efficient. The Hawk was designed to be a small tool that can increase installation efficiency for zip ties during extravehicular activities on the ISS.

47. University of Houston – Downtown

Jennifer Rodriguez

Additional Student Contributors: Sara Alba, Michelle Guillen, Victor Leyja

ABNORMALITIES IN D. MELANOGASTER EYE DEVELOPMENT OBSERVED THROUGH THE DOWN REGULATION OF THE DOR GENE UNDER THE GAL4-UAS SYSTEM

Faculty Advisor: Adriana Visbal, PhD

After analyzing gene expression studies from Sam Houston State University collaborators, the Diabetes and Obesity Regulated gene (Dor) has been seen to potentially be involved in eye development in *Drosophila melanogaster* and plays a large role in metamorphosis. Gene down regulation of the Dor gene was achieved through the Gal4 UAS system utilizing a UAS driven Dor RNAi line (Bloomington Stock number 57770) to observe the effects in eye development, results were recorded observing the F1 progeny. A second cross between the eyeless-Gal4 females and UAS driven RNAi against Luciferase (Luci) males was created as a control for comparison. The F1 progeny of the experimental Dor knockdown line displayed extreme phenotypic abnormalities in comparison to the control and other RNAi Dor stock number lines. The abnormalities consisted of asymmetry in eye development (misshapen or missing eyes) and differences in body and head shape and size. The experimental cross also resulted in a smaller sample size. Replication experiments conducted at Sam Houston State University also resulted in misshapen eyes and small sample size due to headless pupa. Results suggest that downregulation of the Dor gene might be related to not only eye development but also head malformations and body weight regulation.

48. University of Houston – Victoria

Abigayle Morgan Glenn

Additional Student Contributors: Thanh Le; Jose Ricardo Ramirez

THE ROLE OF COMMENSAL BACTERIA BY-PRODUCT, BUTYRATE, ON THE GLAUCOMATOUS TRABECULAR MESHWORK

Faculty Advisor: Humberto Hernandez, PhD

Primary Open Angle Glaucoma (POAG) is one of the leading causes of blindness worldwide. With limited therapeutics targeting the site of pathogenesis at the trabecular meshwork (TM) site, new molecular targets are greatly needed. The human microbiome has been implicated in the development of many diseases. Recently, microbial by-products of commensal bacteria such as short-chain fatty acids (acetate, butyrate, and propionate) have been shown to have therapeutic effects on ocular tissues. We treated trabecular meshwork cells with (TGFB-2, 5ng/mL) in the presence or absence of butyrate (1.25 uM) and evaluated the expression of extracellular matrix proteins. We performed immunofluorescence imaging and qPCR to evaluate the expression of extracellular matrix proteins. Our results show that, butyrate, a byproduct of commensal bacteria, has anti-fibrotic properties. We show that cells exposed to TGFB-2 are protected by butyrate by blocking the production of extracellular matrix. These important findings provide a novel role for butyrate as a potential therapeutic for the treatment of POAG. Current studies are underway to elucidate the molecular target of butyrate and the potential use of other short-chain fatty acids in TM cells.

49. University of North Texas

Etash Bhat

CONVERSION OF SPECIFIC SINGLE-CARBON COMPOUNDS TO Γ -AMINOBUTYRIC ACID (GABA) VIA HETEROLOGOUS EXPRESSION IN THE METHYLOCOCCUS CAPSULATUS METABOLIC BIOCHEMICAL CASCADE

Faculty Advisor: Calvin Henard, PhD

Nylon-4 is a polyamide thermoplastic utilized in materials for its durability, chemical resistance, and biodegradability. This polymer is synthesized from 2-pyrrolidone, which can be generated from petroleum or the metabolite γ -aminobutyric acid (GABA). Current petroleum-based production of 2-pyrrolidone is unsustainable, emitting greenhouse gasses; thus, bio-based GABA production represents a sustainable route to create nylon-4. The methanotrophic bacterium *Methylococcus capsulatus* is an ideal biocatalyst for GABA production from renewable substrates due to its ability to convert methane (CH₄) and carbon dioxide (CO₂) to multi-carbon compounds. To develop a platform for GABA production, two biosynthetic pathways were constructed and expressed in *M. capsulatus* for (1) increased carbon flux to the GABA precursor, glutamate, and (2) GABA synthesis and export. The glutamate pathway consisted of the *Chlorobium tepidum* oxoacid:ferredoxin oxidoreductase and glutamate synthase. GABA production and export consisted of the *Escherichia coli* GABA synthase and transporter. Genetic constructs for the two pathways were designed, built, and transferred to *M. capsulatus*; engineered strains were confirmed by PCR and sequencing. Experiments to verify the GABA and glutamate production by the genetically modified strains are ongoing. Biological conversion of single-carbon compounds to GABA presents a sustainable route to manufacture commodity chemicals while mitigating pollutants.

50. University of North Texas

Jathin Singaraju

GRAPHICAL USER INTERFACE-BASED MULTIFUNCTIONAL, CONSOLIDATED, AND SIMPLIFIED IMAGE PREPROCESSING AND ANALYSIS SOFTWARE FOR HUMAN ORGANOID STUDIES

Faculty Advisor: Huaxiao Yang, PhD

To optimize cardiac organoid images for both machine learning and statistical analysis, I developed a novel Python-based software that comprises five preprocessing and analysis functions. I built the platform from a Python API called Tkinter, which allows for full-stack application development. I used OpenCV to create (1) a brightness/contrast adjustment function, which enhances raw image quality, and (2) a noise removal function, which removes erroneous marks in images. I also (3) developed a fractal analysis algorithm to output the fractal dimension, (4) an area/intensity technique to calculate pixel-based organoid data, and (5) a feature-importance function to validate drug treatments. With a simplified graphical user interface, this innovative application processes batches of cardiac organoid image data with minimal human interaction. Such methods rapidly amplify inconsistent data, promising to accelerate the development of regenerative medicine.

51. University of North Texas at Dallas

Sheareazade Pena

Additional Contributors: Gustavo Gomez; Ysidro Motta; Perla Rivera

EXPOSURE TO SUBLETHAL ALKYL TRIMETHYLAMMONIUM BROMIDE CONCENTRATIONS LEADS TO ANTIMICROBIAL TOLERANCE AND ANTIBIOTIC CROSS-RESISTANCE

Faculty Advisor: Aubrey Frantz, PhD

Alkyl trimethylammonium bromide (CTAB) compounds are group of quaternary ammonium compounds (QACs) with broad-spectrum antimicrobial activity that are frequently used as the active ingredient in antimicrobial products and are thus routinely in contact with the skin. While the human skin functions as a physical barrier between the external environment and the body proper, it is also colonized by a diverse microbiota that actively influence health and disease. To investigate the impact of CTAB compounds on commensal and opportunistic bacterial species of human and public health importance, selected bacterial species were exposed to purified CTAB compounds in short and long-term cultures. While alkyl chain length directly affected the antimicrobial activity of the CTAB compound, sensitivity to CTAB-inhibition was observed to be species specific. Repeated exposure to sublethal CTAB concentrations significantly reduced antimicrobial susceptibility and antibiotic effectiveness. These results suggest that prolonged exposure to sublethal concentrations of CTAB compounds can lead to the development of QAC tolerance and antibiotic cross-resistance that may render these antimicrobials ineffective at the directed use concentrations. This work highlights the need to better understand the risks associated with increased QAC use and to focus more attention on the formulation, selection and application of QAC-containing products.

52. University of the Incarnate Word

Aracely Castro

NOVEL ROLE OF DUAL OXIDASE 2 AS A MEDIATOR OF PODOCYTE INJURY IN THE DIABETIC ENVIRONMENT

Faculty Advisor: Bridget M. Ford, PhD

Glomerular injury is a prominent pathological feature of diabetic nephropathy (DN). In glomerular epithelial cells, or podocytes, hyperglycemia alters slit diaphragm proteins and causes foot process effacement, apoptosis and cell detachment. Oxidative stress has emerged as an important pathogenic mechanism in the development of glomerular injury in DN. We provide evidence that Dual oxidase 2 (Duox2), a member of the NADPH oxidase family, is present in podocytes. Exposure of podocytes to high concentrations of glucose (HG) elicited a rapid upregulation of Duox2 protein expression. Inhibition of Duox2 with specific siRNA prevented the HG-induced increase in intracellular reactive oxygen species (ROS) generation and hydrogen peroxide (H₂O₂) production in cultured podocytes. In additional experiments, we established a functional link between Duox2-derived ROS generation and podocyte injury in response to HG. Impairment of Duox2 function nearly abolished HG-mediated DNA fragmentation, apoptosis and decrease in/reorganization of slit diaphragm protein expression in podocytes, indicating that Duox2 is required for the deleterious effects of glucose in podocytes. Our study demonstrates that Duox2 is responsible for increased ROS generation and subsequent alteration of podocyte function in response to HG, helping to establish the benefit of targeting Duox2 as a future therapeutic intervention in the reduction of diabetes-mediated glomerular lesions.

53. Wayland Baptist University

Ilan Joffe

Additional Student Contributor: Alex Spencer

DOES GENRE MEAN ANYTHING: CLASSIFYING MUSIC WITH ARTIFICIAL INTELLIGENCE

Faculty Advisor: Scott Franklin, PhD

Music is notoriously difficult to classify. It is an integral part of the human experience and yet each person has their own impressions, preferences, and opinions on what makes music great. Typically, music is classified using genres. In this work, we explore an alternative classification method: using clustering algorithms to identify similar music pieces, based on the waveforms themselves as well as features extracted from the waveforms. We then compare the performance of a variety of artificial intelligences algorithms in classifying music into both new and pre-existing groups. Using Decision Trees, Random Forests, and Artificial Neural Networks (ANN) we train machine learners to classify music into known genres and compare the results with our clustering approach. We have found that Random Forests outperform Neural Networks in our experiments.

54. West Texas A&M University

Andrea Mata

FEMALE EDUCATION IN DEVELOPING ECONOMIES

Faculty Advisor: Ryan Mattson, PhD

Macroeconomic growth theory suggests that developing human capital, either male or female, through quality education, health care, training, etc. counteracts poverty and stimulates economic growth and development. But these effects can be unevenly distributed, leading to gaps between different groups and demographics. We focus on the gaps in secondary education enrollment of boys and girls over time and in various emerging economies. Investing in female education should decrease the gap in enrollment between boys and girls and lead to better productivity outcomes. Hypothesizing that government expenditures on education and health have the most significant effects to increase female enrollment in secondary education, thus being the more efficient variables to close the gap between males and females enrolled in secondary education. After running a two-way fixed effect panel linear model, we found that expenditure on education and health do have a significant effect on increasing female enrollment in secondary education, however, there is not sufficient evidence to say that either efficiently close the gap. Further work would need to determine and account for endogeneity of the independent variables and account for previous years effects on current levels.