TEXAS UNDERGRADUATE RESEARCH DAY 2021

Student Researchers/Abstracts

February 19, 2021

Abilene Christian University
THE EFFECTS OF ACADEMIC EXPECTATIONS ON UNDERGRADUATE STUDENT ANXIETY
Kathyanne Best
Faculty Advisor: Jessica Nguyen

Anxiety is a widespread issue that is heavily discussed and prevalent throughout the community of college-aged individuals. Because of its relevance and frequent occurrences, the topic of anxiety has been studied numerous times, particularly in more recent years, as well as having been linked to several variables, such as parenting, perfectionism, and impostorism. One common theme within these variables is high expectations, which can encourage or discourage students' academic endeavors, depending on how those expectations are perceived. The role that high academic expectations play within these three variables–as well as others–was examined within this study comprised of 44 undergraduate students. The assessment sought to determine the potential relationships that exist between self-imposed expectations of academic success, parental expectations of academic success, adaptive perfectionism, maladaptive perfectionism, and/or anxiety, as well as whether these factors relate to academic certainty. Data analysis indicates that several positive correlations exist between various pairings within the six factors. Implications regarding the relationships of one factor to another are also discussed, as well as how that knowledge can be used to benefit college students.

Angelo State University
SCREENING OF GENETIC MARKERS TO DISTINGUISH MORPHOLOGY SIMILAR SPECIES OF COTTONTAIL RABBIT
Zoey Stormes
Faculty Advisor: Loren Ammerman

The Davis Mountain Cottontail, Sylvilagus robustus, and the Eastern Cottontail, Sylvilagus floridanus, are two morphologically similar but genetically distinct species of cottontail rabbit. Identification of a specimen as one species over the other is currently difficult due to the lack of a single genetic marker capable of conclusively separating the two species. This study aims to address this problem by investigating five nuclear genetic markers of interest (TG, THY, SPTBN1, PRKC1, and MGF) previously used to elucidate a phylogeny for the family Leporidae. This study utilizes both the species of interest as well as the Desert Cottontail, Sylvilagus audubonii, as an outgroup.

Twelve Sylvilagus robustus, thirteen Sylvilagus floridanus, and ten Sylvilagus audubonii samples were obtained and DNA was extracted and amplified for the five markers of interest. Successfully sequenced DNA was aligned and processed using phylogenetic tree software, and the effectiveness of each gene was evaluated based on branch groupings and bootstrap values within the tree. So far, none of the five genes has shown promise in their ability to confirm a specimen as being S. robustus or S. floridanus.

Austin College

USING MATHEMATICS TO OPTIMIZE DISTRIBUTION OF PERSONAL PROTECTIVE EQUIPMENT (PPE) IN NORTH TEXAS

Freyja Coe
Faculty Advisor: Andrea Overbay

During the COVID-19 pandemic, one of the major challenges facing nonprofits is access to Personal Protective Equipment (PPE), especially in rural areas like Grayson County. The Texoma Health Foundation (THF) is working to partner with regional nonprofit agencies to provide access to vital PPE. Using Operations Research (OR), we will work to develop a decision assist function in Excel to help THF efficiently distribute PPE and collect data through surveys. Accurate and up-to-date data is necessary for decision assist software to make meaningful suggestions, so we will also be working to develop a survey to collect the needed data in a format that is easily integrated into Excel.

Concordia University Texas

CROWDING AND FOOD QUALITY SIGNIFICANTLY AFFECT BLOWFLY (LUCILIA SERICATA) LARVAL DEVELOPMENT AND mPMI ESTIMATION

Samantha Hopper, Talia Freeman, Anamika Seth, Eva Thayer, Daniela Gutierrez
Faculty Advisor: Mary Kay Johnston

Insects provide vital clues to help determine the post-mortem interval (PMI) during forensic investigations. Blowflies (Diptera: Calliphoridae) are conspicuous, early colonizers on carrion, and their larval development proceeds through a series of easily identifiable instars. Previous studies have shown that PMI estimation using blowfly larval development is affected principally by colonization rate and temperature. However, the national obesity epidemic may have another unintended consequence--it may affect PMI determination by altering larval food quality. Here, we propose that food source quality and larval density significantly affect developmental rates, and these factors should be considered in PMI estimation using blowflies. In our experiment, we reared wild-caught Lucilia sericata in the lab in a 3x2 full factorial design (N=6), controlling the protein:fat ratios of their food source along with larval densities. Larvae reared on a high protein diet showed significant increases in body size through all instars (potentially leading to underestimating PMI in obese individuals), and larvae reared in crowded environments showed rapid growth and high survival in the first instar relative to uncrowded environments. An additional outdoor experiment illustrates that flies are not always the first nor predominant colonizers in Central Texas, and we show evidence for resource monopolization at baits by the invasive fire ant, Solenopsis invicta. We do not find evidence that insects discriminate based on food quality, but different assemblages of species tend to colonize baits in open meadow versus closed-canopy forest.

East Texas Baptist University
INTERACTION BETWEEN CO-OCCURRING POPULATIONS OF RACCOONS (PROCYON LOTOR) AND VIRGINIA OPOSSUMS (DIDELPHIS VIRGINIANA) IN URBAN SYSTEM
Cameron D. Castles
Faculty Advisor: Troy A. Ladine

Raccoons (Procyon lotor) and Virginia opossums (Didelphis virginiana) have a large niche overlap. As part of a study using trail cameras starting 14 Oct. 2014, the interaction between raccoons and Virginia opossums is investigated. Logistic regression analysis indicates raccoons are more active near permanent water sources and areas with higher canopy cover. The Virginia opossum is more active near roads and areas with higher understory cover. Thus, our study indicates some niche separation based on habitat use. Daily, 24-hr, activity for both species is primarily nocturnal. Although, there is some separation with the Virginia opossum being more active around midnight and the raccoon exhibiting a peak just prior to sunrise and a smaller increase in activity just after sunset. Our data indicate possible niche separation through both spatial and temporal axes. Further investigation of temporal niche separation at a scale of activity pattern greater than 24-hr will be conducted.

Houston Baptist University
COLLEGE GOLFERS WEIGH VARYING PERFORMANCE DUE TO SLEEPING HABITS
Sara Zrnikova
Faculty Advisor: Mary Catherine Harmon

Poor sleep habits along with an athlete's high academic and athletic workload can cause sleep deprivation. Past research has shown sleep deprivation leads to a higher risk of injury and poor performance. The researcher aimed to investigate the nature of sleep and sleep deprivation specifically in college golfers. PURPOSE: The purpose of this study was to examine sleep habits among college golf athletes and perceived effects on their academic and athletic performance. METHODS: The participants for the current study were seven female and four male collegiate athletes from a division one golf team. Each participant was given a modified version of the School Sleep Habits Survey (SSHS) containing 30 questions. RESULTS: The most common sleeping habits among golf athletes were inconsistent sleeping environment, drinking caffeinated beverages during the day, watching TV before sleep, and working or studying in bed. The majority of participants stated that insufficient sleep had a significant effect on both their golf and academic performance. There was no difference in reported sleep deprivation, sleep duration, and time to fall asleep between genders. However, females showed a higher prevalence of daytime sleepiness and erratic sleep-wake behavior. CONCLUSION: This study concludes that poor sleep habits showed to impact both athletic and academic performance. Further studies on a larger sample size should be conducted.

Jacksonville College
TRANSFORMING TEXAS: TRAMMEL'S TRACE
Molly Richey
Faculty Advisor: Patricia Richey

Texas was forever transformed by the migration of Anglo settlers. Trammel's Trace, named for Nicholas Trammell, was the first road to Texas from the northern boundary with the United States and was used for migration before Texas became a republic. Trammel's Trace and the El Camino Real de los Tejas from the east were the earliest two routes through Nacogdoches and across the Sabine River into Louisiana. Native Americans used the trail for many years before Anglos began regularly using it around 1813. The original purpose of Anglo use was for smuggling.

However, in 1821, the main use of the road was for Anglo migration to Mexican Texas. David Crockett and Sam Houston traveled along this 180-mile road. Some of the road was incorporated into the development of an improved road system. Strip mining of the lignite and coal deposits that made the Sabine River base an excellent location for wagons and horses to cross destroyed parts of the trail . Although the strip mining was drastic destruction, other destruction occurs when landowners fill in ruts or plow them level. Because it is important to preserve this landmark, the purpose of this research is to promote awareness among landowners. By using the Google Maps version of the trail on the website (http://www.trammelstrace.org), landowners can see if Trammel's Trace crosses their property. Landowners should recognize their place in Texas history by preserving the ruts that are part of Trammel's Trace.

Lamar University
FABRICATION OF SUPERHYDROPHOBIC ALUMINUM SURFACES
Dylan Palmer
Faculty Advisor: Chun-Wei Yao

The goal of this project was to create superhydrophobic micro-structures on aluminum sheets to test the viability of laser etching as a method for creating surfaces that are resistant to corrosion. The first task of the project was to correlating laser etching parameters with the resulting geometry to enable the creation of prescribed microstructures. A laser etching machine was used to create sketched etchings to better understand factors like effective beam width and the range of power and scanning speed that yielded the most useful results. Samples were then created for the purpose of characterizing the microscopic effects of etching on the structure of the sample surface. The first data set collected consisted of twenty-one samples and sought to correlate both power and scanning speed with resulting geometry. The best results were found at 40% power and a scanning speed of 1000 mm/s. The second task of the project was to link the surface geometry with its hydrophobic properties. Three samples were created with 40% power and 1000 mm/s scanning speed. The results of these tests proved the structures were hydrophobic with contact angle well above 90° and in fact, bordered on and in one case surpassed the superhydrophobic threshold at 150°. Nine more samples were created with progressively wider spacing. A superhydrophobic contact angle of 157° was obtained from a sample which consisted of 100 µm pillars spaced 150 µm apart. This result is even higher than the theoretical value, because of the added roughness introduced by this fabrication method. These results demonstrate that laser etching is a viable method of created corrosion resistant surfaces on aluminum parts.

Lubbock Christian University
OPTIMIZING GREENHOUSE GROWING CONDITIONS FOR ARACHIS HYPOGAEA
Hannah Curtis
Faculty Advisors: Julie Marshall, Josh Thomas

In recent years, advances surrounding genetic modification have prompted further research into genome editing of plants and foods. Soybeans and peanuts are important due to the healthy fats they provide. Previous studies have utilized soybeans to investigate levels of palmitic acid, which has been linked to increased health benefits and shelf stability. Soybeans that have higher palmitic acid contents have been identified as containing polymorphisms that increase palmitic acid levels, but it is currently unknown whether peanuts contain the same polymorphisms. A gene which is involved in fatty acid synthesis and could possibly have an effect on the levels of palmitic acid in Arachis hypogaea is beta-ketoacyl-acyl carrier protein synthetase II (KAS-II). If mutations cannot be found in the KAS-II gene, CRISPR-Cas9 technology could be utilized to generate mutations which could have a desirable impact on fatty acid levels.

This study has a two-fold mission of determining optimal growing conditions for A. hypogaea in order to develop a functioning genome-editing system as well as sequencing the KAS-II gene for specific polymorphisms that would alter enzymatic activity and thus, levels of palmitic acid. DNA was isolated from A. hypogaea and primers were designed based on current KAS-II genetic sequences. The DNA isolates and designed primers were run through polymerase chain reaction (PCR) to be amplified and this was followed by quantification of the PCR product. Samples were then chosen to be run through a 1% agarose gel in order to excise bands and be purified for sequencing. Sequences obtained were compared to the KAS-II gene sequence retrieved from the National Center for Biotechnology Information (NCBI). The collected sequences will provide vital information on the presence of polymorphisms in the KAS-II gene which has further implications for positive effects on palmitic acid levels and subsequent increased health benefits in A. hypogaea.

Midwestern State University
COMMERCIALIZATION DEVELOPMENT IN LOW-EARTH ORBIT: BEGINNING ON EARTH WITH THE LUNAR LANDSCAPE EXPERIENCE
Megan Widner
Faculty Advisor: Jeff Stambaugh

In NASA's efforts to turn over space flight services to the private sector, move from supplier to consumer, and generate an ecosystem in low-Earth orbit (LEO), space tourism is born. Space tourism would drive the cost of flight down, opening the door to economic development in LEO. Previously in our study, we learned that 'openness to experience' is positively related to students' views on an LEO ecosystem's importance. A company named Back To Space (BTS) builds on, if not compliments, those findings by creating a terrestrial location for people to become excited about space. This quantitative study is about how open the city of Jacksboro, the Lunar Landscape Experience educational park's proposed site, is to hosting tourist attractions. We created a survey to measure local attitudes on tourist development, the needs of the community's growth ranging from healthcare-housing, and gauge the current state of businesses. We hypothesize there is a difference in the means of tourism's essential growth, disruptions, opportunity cost, town pride, environment, and justice between different age groups. We also hypothesize a positive relationship between those who want to see an increase in housing development, more local businesses and shopping, and a need to see an increase in tourism. This report provides conclusions and recommendations on these factors to guide relationships between the community, the City of Jacksboro, and Back To Space tourism development.

Our Lady of the Lake University
DO THE DEGREE AND TYPE OF RESPONSIBILITIES PREDICT STRESS AND AGGRESSION DIFFERENTLY FOR WOMEN AND MEN?
Romelia Arredondo Arenas
Faculty Advisor: Kathryn B. Anderson

The COVID-19 pandemic has caused significant stress for women, partly because women comprise two-thirds of caregivers in the U.S. and have been caring for a child and/or an elder at home on top of work and other responsibilities (Centers for Disease Control, 2021). This enhanced workload and stress has been compounded for women of color and those living in poverty due to disparities in access to health care, enhanced exposure risk as essential workers and economic hardship.

A sample of predominantly women (84%), most of whom were of color (60%; 49% were Latinx), college students and staff members (18-80 years of age; median=34 years) completed online questionnaires on: (a) the number and types of responsibilities they had; (b) Life Event Stress (Lynn, 1986); (c) Perceived Stress (Cohen, et al., 1983); (d) Relational Aggression (Hata, 1990); (e) Verbal, Physical, Anger and Hostility Aggression Scales (Buss & Perry, 1992) and Irritability (Caprara, et al., 1985). The study was conducted in June 2020, during the pandemic. Women reported that more people depended on them and that recent life events caused them slightly more stress (p = .057) than did the men in the sample, however men reported more verbal aggression (p = .016). Perceived stress predicted hostility (r = .418), relational aggression and irritability (r = .515). Stress associated with life events similarly predicted hostility (r = .238) and irritability (r = .228). Perhaps most concerning, the number of responsibilities that the respondents had, the more physical aggression they reported engaging in (r = .166; all reported ps are < .05). White women reported slightly more physical aggression than did women of color (p = .084), even though women of color reported experiencing more psychological factors that make a person vulnerable to aggression, including perceived stress, irritability and hostility (all ps < .046).

Sam Houston State University
THE FUTURE OF BIOMETRIC AUTHENTICATION TECHNIQUES AND PRIVACY
Teara Gross
Faculty Advisor: Narasimha Shashidhar

Biometric Authentication systems are gradually taking the place of traditional passwords, with the hope of protecting the data stored on the device and making it harder for adversaries to obtain this information, but not impossible. The implementation of Biometrics to protect a user's data has risen the concern of protection of stored biometric information. In this paper, we will be exploring the future of biometric authentication techniques as it pertains to user privacy and if it is more reliable than traditional password protection.

Southern Methodist University
DEVELOPING A THRIVING STUDENT EXPERIENCE
Hannah Webb, Nikita Kulkarni
Faculty Advisor: Dustin K. Grabsch

This study sought to understand the thriving of first-generation, international, and transfer students. The study utilized a sequential exploratory design using the established 72-item thriving quotient survey to measure students' thriving levels. In addition, the study utilized a qualitative content analysis on an open-ended question asking participants to describe contributory experiences. Our results indicate variation among the three student groups, and our content analysis reveals six emergent categories of experiences contributing to perceptions of thriving. Recommendations for practice are enumerated.

Southern Methodist University
KETAMINE'S ROLE IN SPIRITUALITY: HOW ONE SYNTHETIC DRUG CATALYZES A NATURAL EXPERIENCE
Samiah S Woods
Faculty Advisor: G. William Barnard

This article highlights the potential spiritual effects of a popular anesthetic, ketamine, and how these spiritual effects can be used to help promote the reconciliation of spiritual and physical health. Ketamine, like the prominent psychedelic, psilocybin, has reportedly caused feelings of spiritual revelation and “out of body experiences” that many physicians may not feel qualified to discuss with their patients. This reluctance to address ketamine-induced spiritual experiences may affect the health outcomes of the patient. The primary goal of this project is to bring academic validity to considerations of the spiritual health of patients. This paper (1) investigates the extent that ketamine-induced, non-ordinary experiences can help bring awareness to the compatibility of spiritual and physical health and (2) compares the mechanisms of ketamine and psilocybin, as well as their value to the medical community due to the spiritual experiences that they catalyze. Thus, this research seeks to demonstrate that understanding the spiritual value of ketamine may encourage better communication between the physician and patient and promote more holistic healthcare approaches.

St. Edward's University
STIS AND STIGMA: EFFECTS OF STI DIAGNOSIS AND SEXUAL IDENTITY ON PERCEPTIONS OF POTENTIAL PARTNERS
Rebecca Sanchez
Faculty Advisor: Katy Goldey

Stigma is a topic that is important in our understanding of areas related to health, stereotypes, and its impact on the mind and body. While there is substantial research that suggests STI diagnoses are stigmatizing, little is known about whether stigmatization of potential partners with an STI diagnosis is more versus less prevalent among sexual minority versus majority groups. The goal of the current study is to understand how stigmatization of a potential partner with an STI varies by type of STI and the sexual identity of the participant. Participants (n= 189) were presented with a vignette describing a potential romantic/sexual partner named Jamie. Participants were randomly assigned to one of 5 conditions, which varied in how Jamie's STI status was described. Results found that participants judged Jamie’s personal characteristics (e.g., responsibility, integrity) more harshly if Jamie was never tested for STIs than in any other condition, but that participants were similarly unlikely to want to have sex or a relationship with Jamie in the HSV, HIV, and never tested conditions, deeming Jamie’s STI status as ‘just as bad’ as never being tested. Thus, individuals who are currently receiving treatment for HIV or HSV are perceived to be less desirable as romantic or sexual partners. This suggests a need for public health interventions to decrease stigmatization of individuals with incurable STIs.

Stephen F. Austin State University

DOES INSTALLATION METHOD AFFECT SNAKE ENTANGLEMENT IN EROSION CONTROL BLANKETS?

Kasey L. Jobe, Krista J. Ward, and Nicholas C. Schiwitz
Faculty Advisors: Christopher M. Schalk, Daniel Saenz

At the conclusion of road construction projects, an erosion control product (e.g., blankets, spray mulch) is installed to reduce soil loss and promote plant growth. Wildlife, such as snakes, are prone to entanglement in erosion control blankets that contain polypropylene mesh with fused apertures. Previous reports have noted that the occurrences of entanglements are not uniform in their distribution across an erosion control blanket, but primarily occur where the edge of the mesh is exposed. We conducted an experiment to determine if modification to the installation methods of erosion control blankets affects the likelihood of snake entanglement. We conducted entanglement trials to compare the likelihood of snake entanglement between two treatments: 1) exposed erosion control blanket edge (i.e., perimeter) and 2) buried erosion control blanket edge. Snakes were less likely to attempt to pass through the mesh on the buried edge treatment and all entanglements occurred on the exposed edge treatment.
These results provide support that modification to the installation methods reduces snake entanglement in erosion control blankets in some settings. However, our study was conducted in an experimental setting and should be evaluated under natural field conditions. This research can be used to inform a number of parties including contractors, habitat managers, and agency decision makers on additional steps that can be taken for products that fit their application needs to minimize risks to wildlife.

Sul Ross State University

THE STUDY OF PHENOTYPIC ADAPTATIONS THAT PROMOTE INVASION SUCCESS IN CANE TOADS (Rhinella marina)

Sydney Turner
Faculty Advisor: Crystal Kelehear Graham

Invasive species present many phenotypic changes reflecting selection pressures operating on them during the process of invasion. One very well know model invader is the cane toad and the morphological changes seen in invading populations. Changes in the hind limbs specifically are studied to account for their ever-increasing rate of range expansion in Australia. Here, we study the morphological differences in the hind limbs of toadlets bred under standard conditions in the laboratory but sourced from replicate native and invasive populations. Parent toads were collected from the invasive populations (Bermuda, Hawaii, Australia) and two native populations (French Guiana and Guyana). Toads were bred in the lab to produce 8 clutched of invasive tadpoles and 5 clutches of native tadpoles. Tadpoles were then reared into metamorphs and preserved for measurements. 160 invasive and 88 native toadlets were measured; specifically the body length, femur, tibia-fibula, tarsus, and 4th metatarsus to investigate limb length relative to body size. Results showed that invasive toadlets had significantly longer femurs than the native toadlets. No significant differences were found between populations in any other aspects of hind limb morphology (tibia-fibula, tarsus, and metatarsus).

Tarleton State University
DEVELOPMENT OF A TRIPLEX QUANTITATIVE PCR ASSAY FOR AVIAN RETROVIRUSES
Faith Cox
Faculty Advisor: Dustin Edwards

Reticuloendotheliosis virus (REV) an immunosuppressive avian retrovirus that infects the B cells of Galliformes, Passeriformes, and Anseriformes. Modern REV testing utilizes a duplex quantitative polymerase chain reaction technique (qPCR) developed by the Texas A&M Veterinary Medical Diagnostic Laboratory. We modified this technique to a triplex TaqMan qPCR assay to test simultaneously for REV and an emerging avian retrovirus, lymphoproliferative disease virus (LPDV), which has not yet been detected in Texas but has been found in neighboring states. We designed an amplification for the pan-avian GAPDH gene as a DNA extraction control, and the REV Env and LPDV Env genes to test for viral infection. Primers and hydrolysis probes were designed using IDT PrimerQuest and ThermoFisher Scientific Multiple Primer Analyzer software to determine targeted conserved regions of the DNA and to minimize cross-reactivity and channel cross-talk by using Cy5, FAM, and HEX fluorophores. Probes have double non-fluorescent quenchers to reduce false positives. Target duplexed DNA sequences were synthesized to serve as positive amplification controls and serially diluted to known concentrations to form a standard curve ranging in 1x10^8 to 1x10^1 molecules/µL for the purpose of quantifying proviral DNA in blood samples. Reaction conditions and primer-probe concentrations were optimized and reactions performed in triplicate with a 384-well plate using BioRad CFX384 Touch™ Real-Time Detection System and analyzed with BioRad CFX Maestro software. The optimal annealing temperature was determined using a temperature gradient. The optimal primer concentration was determined by visualization of amplicons by gel electrophoresis and optimal probe concentration was determined by statistical analysis of cycle quantification (Cq) values at varying probe concentrations. The validated triplex assay will be used to test for REV and LPDV proviral DNA in over 300 blood samples collected between 2018-2020 in Texas in collaboration with the Texas Parks and Wildlife Department.

Texas A&M International University
SOFTWARE FOR INCORPORATING TIME AND LOCATION INTO ACCESS CONTROL DECISIONS
Marshal Moncivais, Miguelangel Trevino, Carlos Delgado
Faculty Advisor: Mustafa Al Lail

The increasing dependency on digital technology has made the concept of data security an important concern. Not only how information is accessed, but also where and when have become important considerations in cyber-security. Certain situations exist where it is necessary to restrict access based on time and location. An example is a policy for a medical institution where doctors can only access patient records at hospitals during their shifts. The Generalized Spatio-Temporal Role-Based Access Control model (GSTRBAC) determines users' access to resources based on such information. In this research, we developed a software architecture and its implementation of the GSTRBAC model by using state-of-art technologies in software development.

Texas A&M University

HONEY BEE (APIS MELLIFERA) MACRONUTRIENT REGULATION: NURSE BEE NUTRITIONAL PREFERENCES FOR PROTEINS AND LIPIDS

Cora Garcia, Jordan Gomez
Faculty Advisors: Pierre Lau, Alexandria Payne, Pierre Lesne, Spencer Behmer, Juliana Rangel

Poor nutrition has been linked to declining honey bee (Apis mellifera) populations, as it makes bees more susceptible to pathogens and lowers their survival and productivity. Given the growing prevalence of urbanization and landscape fragmentation, resource availability has become a challenge to honey bees trying to acquire the resources necessary for adequate nutrition. In particular, honey bees are limited in the amount and type of macronutrients that they are able to collect from their surroundings, particularly pollen, which is the colony's main source of proteins and lipids. Not surprisingly, commercial pollen substitutes are widely used by beekeepers in times of pollen scarcity to support colony health. Here, we wanted to determine if there is a target macronutrient intake for nurse bees by creating a range of artificial diets that differed in the macronutrient ratios of protein (P) and lipid (L). Through a series of no-choice and choice cage bioassays, we measured the daily amount of food consumed by nurse bees in each of five diet treatment groups varying in their protein to lipid ratio (P:L): 35:15, 30:20, 25:25, 20:30, 15:35, and unfed diet controls. In the no-choice test, nurse bees consumed the highest amount of the 30:20 P:L diet compared to bees given the other diets. For the choice test, bees regulated their diet intake to an average of 1.4 P:L., preferentially consuming more of the 30:20 diet. The significant changes in the observed ratio of the macronutrient consumption of pollen substitutes suggest that the role of lipids found in pollen and protein substitutes may be underestimated in the field of honey bee nutritional ecology.

Texas A&M University

CHARACTERIZING THE ROLE OF TRANSCRIPTION FACTOR HB9 IN GLIAL CELL DEVELOPMENT

Sunjay Letchuman, Robert Adkins, Ashley Tucker, Amy Leonards, Miriam Aceves, Valerie Dietz
Faculty Advisors: Young il Lee, Jennifer N. Dulin

Hb9 (Mnx1) is a transcription factor described as a spinal cord motor neuron-specific marker in embryonic development and a critical factor for the post-mitotic specification of these cells. As such, transgenic mice with mutations in the Hb9 gene are commonly used for the study of spinal cord motor neurons. To date, the expression of Hb9 in other cell types has not previously been reported. We performed a fate-mapping approach to examine the localization of Hb9-expressing cells and their progeny ('Hb9-lineage cells') within the embryonic and adult spinal cord. We found that Hb9-lineage cells are distributed in a gradient of increasing abundance throughout the rostro-caudal spinal cord axis during developmental and postnatal stages. Furthermore, although the majority of Hb9-lineage cells at cervical spinal cord levels are motor neurons, at more caudal levels, Hb9-lineage cells include astrocytes and oligodendrocytes, the macroglial cells of the central nervous system. In the peripheral nervous system, we observed a similar phenomenon with Hb9-lineage Schwann cells present in an increasing rostro-caudal gradient throughout the body. These observations have several exciting implications. Hb9 may play an important role not only in astrocyte and oligodendrocyte development, but also in development of Schwann cells, which are the glial cells associated with the peripheral nerves. Additionally, characterization of Hb9-lineage glial cells may reveal new functional roles for glia throughout the developing spinal cord. Through characterizing the role of Hb9 in glial cell development, describing the molecular pathways involved, and determining the differences in gene expression between Hb9+ and Hb9- spinal cord glial cells, the developmental function of Hb9 can be better understood.

Texas A&M University - Central Texas
IMAGE ANALYSIS OF CATHODOLUMINESCENCE DATA OBTAINED FROM A PHOTOVOLTAIC CELL
James Sullivan
Faculty Advisors: Mienie Roberts, Taylor Harvey, Aida Torabi

The past year I built an application to analyze and visualize the characterization of the luminescence of solar cells. The Graphical User Interface can import data, create a heatmap to indicate high quality crystal structure, and output several variables of interest. The user can also create an interactive histogram and export the images/tables displayed. We collaborated with the Engineering Technology department to create an interactive application to upload a dataset and facilitate the data visualization process. The application is interactive, visual, dynamic, and assists research related to the development of efficient photovoltaic cells. We used the “Shiny”-package in the R-software to create a tool to improve the speed of the analysis and visualization of a large and messy set of data. The application eliminates routine tasks, allowing more time for higher order thinking. As a result, the researchers can contextualize the data and draw conclusions from the heat maps and other outputs. The strength of the Shiny applications’ framework is its reactive programming, which links input and output data such that changes to the input results in updates to the output area without having to refresh the program, allowing users to seamlessly explore data. Improvements are being made to the algorithms used to optimize the efficiency of the program. We are currently adding more tools to perform statistical analyses on the data, improving the user-experience in visualizing the data, and giving the user additional control over various aspects of the plots. I presented an earlier version of the application at the “2020 International Conference of Advanced Research in Applied Science, Engineering and Technology” and published the work in the “Journal of Education and Social Development”. We anticipate another article submitted to either the ACS Energy Letters journal or the ACS applied energy materials journal.

Texas A&M University - Commerce
EVALUATING TRANSLOCATIONS FOR QUAIL RESTORATION
Brittany Stover, Sarah Currier, Curt Vanderberg
Faculty Advisors: Jeffrey Whitt, Kelly Reyna

Quail populations in the U.S. have been in decline for >150 years. Though rarely successful, the translocation of wild birds by sportsmen and landowners was commonly attempted as a population restoration solution >70 years ago, and has recently garnered renewed interest. Here, we examined 26 published quail translocation studies. 2003–2020 from the U.S. and recorded: (1) species, (2) success rate, (3) distance traveled, and (4) travel conditions. Our investigation revealed inconsistency in translocation methods, even among translocations involving the same species. More than half did not report important details such as holding conditions and rations, and only 2 studies made an attempt to mitigate effects of stress during processing, shipment, or release. While improved and expanded habitat remain key to quail sustainability, greater consistency in translocation protocol is needed to improve success.

Texas A&M University - Corpus Christi

TEMPORAL AND SPATIAL DISTRIBUTION OF THE PATHOGENIC BACTERIUM VIBRIO PARAHAEMOLYTICUS

Elizabeth S. Longo, Hailey R. Wallgren, Danial Nasr Azadani, Reavelyn M. Pray, Ceejay Saenz, David Silva, Jordan Wolfkill
Faculty Advisors: Jeffrey W. Turner, Boris Ermolinsky, Daniele Provenzano

Vibrio parahaemolyticus is a Gram-negative bacterium that is autochthonous to marine coastal areas. The understanding and research of this bacteria is vital to human health and safety because it causes foodborne illness linked to the consumption of undercooked or raw seafood. Vibrio outbreaks are especially important because they can negatively impact the shellfish industry which is an important financial resource around the world. Strains found in the Pacific Northwest (PNW) are of particular interest because they include endemic O4:K12 and pandemic O3:K6 V. parahaemolyticus.1 The O4:K12 strain is the main cause of V. parahaemolyticus infection in this region despite the arrival of the pandemic O3:K6 strain from southeast Asia in 1996.4 What remains unknown is the relative environmental abundance of O4:K12 and O3:K6 strains in the environment which can inform future outbreaks and disease patterns. We hypothesize that O3:K6 strains are abundant in the environment despite the rare occurrence of O3:K6 clinical infections because it is the dominant strain around the world.

Texas A&M University – Kingsville

LEPTIN INFLUENCES VASCULAR ENDOTHELIAL CELL ELONGATION AND SUBSEQUENT TUBE FORMATION IN ADIPOSE TISSUE

Gabriel Platas, Makenzie Lowke
Faculty Advisor: Michelle Garcia

The process of wound healing requires the transportation of substrates needed for the rebuilding of tissue through appropriate vessel formation; angiogenesis. Adipose tissue extract is often used to facilitate the wound healing process, which is attributed to its potent angiogenic properties. Most angiogenic process are regulated through growth factors such as vascular endothelial growth factor (VEGF), angiopoietin, and fibroblast growth factor. Leptin is utilized in the biomedical community to facility the wound healing process. Leptin is just one of the many potent growth factors utilized in the process of angiogenesis. Therefore, it was hypothesized that mature adipocytes augment vascular development in dispersed adipose tissue which is attributed to leptin. Adipose tissue was collected from 4 prepubertal female pigs (gilts) ~150d of age and enzymatically dispersed (collagenase type II). Cells were separated into 2 groups 1) mature lipid-filled adipocytes (MA) and 2) all other cell types (AOC) i.e., vascular endothelial cells (VEC), preadipocytes, fibroblasts, etc. The AOC were incubated for 24 hr in cell culture media with 10% fetal bovine serum (FBS) to promote attachment and angiogenic processes. After the first 24 hr incubation period, media was removed and replaced with 2% FBS and MA were added with or without Leptin (10-11 M) or rabbit polyclonal Anti-Leptin (1:100 dilution) and incubated for an additional 24 hrs. The MIXED procedure of SAS was utilized to determine the effect of treatment on angiogenic cellular processes in-vitro. The addition of MA augments the progression in each stage of angiogenesis. Leptin Ab suppresses the formation of elongation and vessel tube formation (P<0.05). Mature adipocytes augment the angiogenic processes while leptin appears to influence the progression of the morphological process, however leptin Ab suppresses the elongation and vessel tube formation stages.

Texas A&M University – Texarkana
A MULTI-SITE, INTERNATIONAL COLLABORATIVE STUDY OF THE HOSTILE PRIMING EFFECT
Mukunzi Irumva, Catherine Haley
Faculty Advisor: Dana C. Leighton

Highly-cited research showed that when primed with hostility-related words, participants would judge another person's ambiguous behavior as more hostile (Srull & Wyer, 1979). We conducted both a conceptual and close replication of the original research at Texas A&M University—Texarkana as part of a large, multi-site, international, collaborative registered replication attempt. Our replication study recruited 74 participants in a 2 (priming phrase: hostile/control) x 2 (replication type: close/conceptual) between-subjects design. Participants descrambled 30 phrases containing either 80% hostile phrases or 100% neutral phrases. Participants rated how hostile the protagonist in the ambiguously aggressive vignette was acting. The full collaborative study combined data from twenty-eight laboratories with over 1,400 participants to estimate the effect size of hostility priming, all using the same preregistered methods and data analysis (McCarthy et al., in press). The hostile priming effect did not emerge for our study in either the close or conceptual replication; the mean hostility ratings were not statistically different. The meta-analysis for the full collaborative study found no consistently significant hostility priming effect. Standardized effect sizes of .06 and .09 (close and conceptual replications, respectively) were not significantly different from zero, or from each other. Despite extensive methodological controls and high statistical power, both our study and the meta-analysis failed to find a hostility priming effect. This brings into question the validity of the original Srull & Wyer (1979) findings, and points out the importance of replications of other social priming studies.

Texas Christian University
EVALUATING THE PROPERTIES OF COFFEE DERIVED CARBON-BASED MATERIALS FOR REMOVING LEAD FROM CONTAMINATED WATER
Amy Lam
Faculty Advisor: Omar Harvey

The reusing, recycling, and reduction of waste streams are seen as a viable sustainability strategy. One major waste stream is coffee grounds with about 11.5 million kilograms being generated per day in America of which 90% is landfilled. This waste stream can be repurposed into usable carbon-based materials to address issues of climate, pollution, or engineering applications. For my research, I am converting spent (used) coffee grounds into biochars, a type of carbon-based material, with different charring (burning) temperature to measure the removal of lead (Pb2+) from contaminated water. The charring temperature was changed in order to determine the optimal charring temperature for water treatment. This presentation will go into the maximum amount of lead the biochars can remove, how fast the biochars can remove the lead, and the properties of biochars that allow for such removal. Further results, methodology, and modeling applications will be discussed in the presentation.

Texas Christian University
TRACING THE EVOLUTION OF MOLECULAR OUTFLOWS IN MASSIVE STAR FORMATION
Mikayla Wilson
Faculty Advisor: Anna Rosen

Massive star formation can be difficult to observe due to the amount of dust present in molecular clouds. These stars, although rare and relatively short-lived, dominate the amount of stellar feedback in star forming regions fueling all star formation. To be able to locate the sites of these stars, we can look for the emission from the jets, or outflows, they launch as they accrete material.

Molecular material is entrained by these outflows from the core of the protostar, allowing us to observe them through molecular emission. Since obtaining detailed observations is challenging, to study them up close, and in real time, we can use simulations. I have post-processed a simulation using a radiative transfer tool. By looking in depth at the four molecules we have chosen: CO, $C^{18}O$, CS, and NH_3, I have deduced which of these is most capable of tracing the molecular outflows of massive stars. This information will aid in observational studies and gives us more information about massive stars in general. Through data analysis with python and yt, I have concluded that CO is able to trace the entire outflow, $C^{18}O$ and CS trace the edges, and NH_3 traces the more dense gas. In the future, we will continue to plot higher energy transitions for these molecules, look at the dynamic structure of the outflows, and compare directly to observations. This project was supported by the Banneker Institute at Harvard.

Texas Lutheran University

DIETRICH BONHOEFFER: HIS THEOLOGY, ACTIVISM, AND ROLE IN THE COMMUNITY OF SAINTS

Moses Tillman-Young
Faculty Advisor: Norman Beck

On Monday night March 2019, about 100 people filed into the Chapel of the Abiding Presence on the campus of Texas Lutheran University. The occasion is a dramatic presentation entitled: “The Legacy of Dietrich Bonhoeffer: A View From The Underside,” performed by Pastor Al Staggs. Every aspect of the evening’s performance is minimalist and simple, intense and riveting. The chapel is charged with emotion. A narrow beam of light falls on the floor of the shadowed stage, representing the tiny dimensions of a bleak prison cell that is the setting for this presentation. A small metal cot, a writing table, and a broom are the only props on the stage. Bonhoeffer wears a striped oversized prison outfit that droops and hangs from his body, suggesting the weight he has lost in prison. In the ninety minutes that ensue, we get to know Dietrich Bonhoeffer. We learn through bits and pieces of information that Bonhoeffer is a young, brilliant, dynamic Christian theologian-turned-social activist. Before the age of forty he has pastored churches in Germany, London, and Spain; attended seminary in New York City; founded a breakaway church and an underground school of theology; and became a double agent of the German government to overthrow Hitler and the Third Reich. It is this last activity, his undercover work against the German government, that has resulted in his imprisonment and death sentence. As his performance concludes, Dietrich speaks to the guards, approaches his cell door, and exits, knowing his execution is imminent. Pastor Al, through his simple and touching presentation of the life of Bonhoeffer, creates a feeling of community among his audience on this night. The production is short, but it is enough to provide insight into the life of Dietrich Bonhoeffer on an organic level.

Texas Southern University

A SURVEILLANCE SYSTEM FOR THE MATERNAL AND CHILD HEALTH (MCH) POPULATION DURING THE COVID-19 PANDEMIC

Jordan Simpson, Tasha Roshan, Emmanuella Oduguwa, Maresha Jackson, Uyen Nguyen, Igor Vouffo, Deepa Dongarwar, Manvir Kaur
Faculty Advisors: Omonike A. Olaleye, Hamisu M. Salihu, Veronica B. Ajewole, Ahone E. Ngujede

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), the causative agent for coronavirus disease 2019 (COVID-19), and its ensuing mitigation measures have negatively affected the Maternal and Child Health (MCH) population. There is currently no surveillance system established to enhance our understanding of SARS-CoV-2 transmission to guide policy decision making to protect the MCH population in this pandemic. Based on reports of community and household spread of this novel infection, we present an approach to a robust family-centered surveillance system for the MCH population.

The surveillance system encapsulates data at the individual and community levels to inform stakeholders, policy makers, health officials and the general public about SARS-CoV-2 transmission dynamics within the MCH population.

Texas State University
CULTURE, COMMUNITY, AND CONSTRUCTIVISM: EXPLORING THE ELEMENTS OF A SUCCESSFUL CLASSROOM
Madeleine Montgomery
Faculty Advisor: Luz A. Murillo

This work draws on personal experiences in classrooms in various international settings, literature reviews on best educational practices, and interviews with teachers to elicit key components of a culturally sustainable elementary classroom. I analyzed and compared information gathered to determine whether there are universal elements contributing to a successful classroom environment that are applicable regardless of cultural context. There are many differing beliefs about how to best approach certain facets of the classroom, and I aim to outline what has been most effective based on commonalities between my observations, research, and collected data. Cultural practices of students must be included in the classroom, unique to each specific student body; teachers must draw on community and incorporate this as a resource in learning; and constructivist forms of knowledge should be utilized to provide each student with the opportunity to participate in the construction of their own knowledge based on prior experiences. In conducting my research, I drew on past interactive experiences working in elementary classrooms in the United States, South America, and the Caribbean. I developed further questions about certain practices I had observed and opted to interview two elementary teachers in a public school in Central Texas. I supplemented these ideas with published research from academic journals, and compiled my findings to comprehensively discuss the key components of a culturally relevant elementary classroom. My findings demonstrate that regardless of student population or classroom location, there are certain aspects that contribute to an effective classroom environment. I outline three key concepts, culture, community, and constructivism, that teachers should strive to include in their classrooms to further promote the academic success of their students.

Texas State University
ANALYSIS OF DYNAMIC MODE DECOMPOSITION, DMD MODES, AND THEIR CORRESPONDING EIGENVALUES IN RGB
Axel Sanchez Moreno
Faculty Advisor: Iván Ojeda-Ruiz

The application of Dynamic Mode Decomposition (DMD) modes we are studying is based on performing tasks on video surveillance and face recognition. This is important as we want to see a small segment of a person within a video or capture a small glimpse of a person's face at a single moment. However, we will be using a MATLAB program as opposed to using high tech to allow us to have a simpler way of performing video surveillance and face recognition. In fact, the use of Red, Green, Blue (RGB) color pixels allow us to see clips of an image in 3 separate ways. In this study, we apply the DMD algorithm to the three images and combine them to obtain the resulting reconstruction of the video. We have been using both projected DMD and exact DMD by applying these algorithms to further study DMD modes. One outcome from this study showed that there is a form of symmetry in the eigenvalues. The eigenvalues were plotted in the complex plane and the points align with the circle at radius 1. Our goal for this research is to come up with a description of what DMD modes are and show how DMD behaves in RBG images.

Texas Tech University
ANALYZING DNASE1L3 TO EXAMINE ITS STRUCTURE AND ABILITY TO REGULATE INFLAMMATION IN SYSTEMIC LUPUS ERYTHEMATOSUS (SLE)
Britney Mapp, Minal Engavale, Jon McCord
Faculty Advisors: R. Bryan Sutton, Peter Keyel

Systemic Lupus Erythematosus (SLE) is an autoimmune disorder characterized by inflammation that damages the vital organs, skin, and joints. Autoimmune disorders are one of the top ten leading causes of death in women in the United States. In SLE, inflammation leads to the production of autoantibodies that target the patient's own DNA, forming immune complexes that cause organ damage. Inflammation and flare-ups are prevented by the destruction/degradation of inactive DNA in dead cells by the enzyme Dnase1L3. Dnase1L3 deficiency leads to pediatric-onset SLE, starting at a median age of 6. Current SLE treatments focus on regulating symptoms after appearance rather than solving the cause of symptoms and preventing their recurrence. Replenishment of Dnase1L3 levels is one potential treatment for SLE because it will destroy DNA in dead cells and immune complexes, thereby preventing autoimmunity. However, Dnase1L3 has a short serum half-life due to its small size. To improve serum half-life, the size of Dnase1L3 can be increased by adding the inert, bulky molecule polyethyleneglycol (PEG) to Dnase1L3, potentially at the cost of its degradation activity. I purified Dnase1L3 to >90% purity, and the enzyme remained active prior to PEGylation. I added PEG in two locations predicted to minimize Dnase1L3 activity and tested its activity. Current work focuses on PEGylating the protein and ensuring that it remains active. Upon successful PEGylation of active Dnase1L3, we plan to test its efficiency in mice and as a treatment for SLE and therefore potentially saving many SLE patients' quality of life.

Texas Tech University
HANDLING THE PANDEMIC: COVID-19, GLOBAL AND CIVIC LEARNING, AND EMPOWERING STUDENTS TO PROTECT THE WEST TEXAS REGION
Jad Zeitouni, Wooyoung Jang
Faculty Advisors: Aliza Wong, John Carrell

The COVID-19 pandemic caused a global shortage of personal protective equipment (PPE). This was particularly felt in West Texas, as rural hospitals and communities struggled to acquire lifesaving protective equipment. The West Texas 3D COVID-19 Relief Consortium formed to help address this shortage. Community members from across West Texas came together to coordinate the production and delivery of 3-D printed face shields. The West Texas 3D COVID-19 Relief Consortium formed in collaboration between Texas Tech University (TTU) and Texas Tech University Health Science Center (TTUHSC) is a group that has produced thousands of face shields for the medical community in West and North Texas. This consortium engaged faculty, students, physicians, nurses, community members, and business leaders. A manufacturing, production, and distribution hub was created at Texas Tech to make face shields and intubation chambers within a matter of weeks. Student volunteers have run this production operation. Student volunteers within the West Texas 3D COVID-19 Relief Consortium have been informally educated in manufacturing processes, project management, and process planning. Learning outcomes from this volunteer opportunity include specifics in prototyping and production using 3D printing, scheduling, and production responses due to limited material sourcing caused by the pandemic, and facility layout challenges due to required social distancing guidelines. Students also engaged in interdisciplinary scholarship including understanding the needs of rural vs urban hospitals, gathering data on centers of need, re-opening the university campus, and public health policy in West Texas. Overall, students learned of the interconnected relationships between medical and frontline facilities as they relate to TTU/TTUHSC and, at the start of the pandemic, the limited PPE supply chain. More importantly, these students have formed a supply chain that filled the existing limitations provided PPE to frontline workers.

Texas Tech University Health Sciences Center

SELF- MANAGEMENT PRACTICES OF UNIVERSITY STUDENTS WITH A MENTAL HEALTH DISORDER; A NOVICE RESEARCH ASSISTANT PERSPECTIVE

Corinne Berg
Faculty Advisors: Susan Calloway, Cara Young

This exploratory descriptive study is designed to address the research gap related to the transition of college students with a diagnosed mental health disorder to college life and their self-management practices. Aims: 1. Explore participant experiences with self- management practices before and after entering the university; 2. Identify barriers and facilitators to self-management in the university setting; 3. Examine correlations between transition readiness and self-efficacy, anxiety, depression, perceived stress and loneliness.

Texas Wesleyan University

MAKING THE FIRST MOVE: EXAMINING THE DIFFERENCES IN PREFERENCES OF SEXUAL INITIATION BETWEEN THE UNITED STATES AND JAPAN

Michelle Shegedin, Maria Perez
Faculty Advisor: Matthew Hand

Introduction: Expression of sexuality can vary across cultures. Differences in sexual communication are shown between Japanese and Americans; in a U.S. study, most men desired more egalitarian sexual initiation patterns (Dworkin & O'Sullivan, 2005). Contrarily, most men in a Japanese study reported that males should initiate sexual activities (Oki, Momose, & Urabe, 1995). This study examines whether Japanese and Americans react differently toward various sexual initiation patterns. The cultures' expectations on gender roles during sexual advances were also analyzed. We hypothesized that Americans will be more comfortable with various sexual initiations patterns than Japanese, and Japanese will prefer more formal tones in consensual scenarios. Methods: A total of 49 participants, American and Japanese, completed a survey by answering questions on the appeal to sexual advances after watching videos of sexual initiation. The videos displayed either a female or male character initiating sex in varied diction and levels of enthusiasm. Results: Using independent t-tests, both countries showed similar comfort levels in being asked to have sex. However, as hypothesized, Japanese participants in a romantic relationship reported higher levels of loneliness than American participants (t (47) = 2.91, p < 0.01). Japanese participants in a romantic relationship were more likely than American participants to prefer the partner to initiate certain romantic acts, such as hugging (t (47) = 3.25, p < 0.01). With a female initiator, Japanese participants were more likely than Americans to prefer more formal tones in indirect sexual advancements (t (28) = 2.77, p < 0.05). Japanese participants who viewed a female initiator felt more enjoyment in engaging in the scenario than the Japanese participants who viewed a male initiator (t (31) = -2.80, p < 0.01). Overall, results may indicate that Japanese prefer more sexual initiation patterns contrary to the gender norms.

Texas Woman's University
BARRIERS AND FACILITATORS OF ENGAGING PREGNANT AFRICAN AMERICAN AND HISPANIC WOMEN INTO RESEARCH
Sierra Shanahan
Faculty Advisor: Jennifer Woo

African American and Hispanic pregnant women are underrepresented in research, at a higher risk for adverse pregnancy outcomes, and have a higher risk of COVID-19 infection. The purpose of this study is to evaluate barriers and facilitators affecting pregnant African American and Hispanic women's participation in research and assess the effectiveness of social media as a recruitment tool, particularly during the COVID-19 pandemic. Methodology included creating a 63-item survey tool to ask pregnant African American and Hispanic women about their perception of research in light of COVID-19. Participants were recruited through social media posts in targeted groups, on personal accounts, and through paid advertisements on Facebook, Instagram, and Twitter. Participants received a $5 Target gift card for participation funded by the TWU Student Research Grant Program. A total of 100 women were recruited. Sample characteristics include: 47% African American, 53% Hispanic (48% of Hispanics were born in the U.S.), mean age 29.5 (SD=4.7). 83% were in the 2nd and 3rd trimester of pregnancy, and 69% had an education higher than high school. 75% of participants had never been asked to participate in research before. Participants showed more interest in non-invasive studies (e.g. surveys) and less interest in invasive studies (e.g. receiving medication). 94% reported they have access to COVID-19 testing. However, due to the pandemic, 75% do not have access to childcare and only 43% of participants have access to transportation. In addition, 61% of participants reported they would still want to participate in research during the COVID-19 pandemic. Despite a willingness to participate, results from this survey inform researchers on the barriers preventing research engagement of pregnant African American and Hispanic women. Key barriers identified include lack of knowledge, limited access to resources, and concerns of safety during the COVID-19 pandemic.

The University of Texas at Arlington
THE PSYCHOLOGY BEHIND PERSISTENT DEVELOPMENTAL STUTTERING: POSSIBLE CAUSES AND TREATMENTS
Christine H. Abasi
Faculty Advisor: Molly Anne Wiant Cummins

Research fields discussing stuttering span from Biology, Psychology, and Communications, which rarely intermix. The earliest found research document was published in 1964 by M.E. Wingate, stating a definition of stuttering still used today. Stuttering is a speech disorder characterized by word or syllable repetitions or prolongations and silent interruptions in the flow of speech known as blocks. Persistent Developmental Stuttering (PDS) affects about 1% of the world's adult population across all cultures and social classes, and approximately 80% of those who stutter recover in childhood. Previous research published from the 1970s until the early 2000s was scattered across scientific fields and time. The primary theories taught, the Van Riper Modification Therapy in 1973 and Fluency Shaping Intervention in 1980, have been used with no modification since publication. Research fields often do not intermingle and share information to come to one uniform conclusion with issues covering many areas, such as stuttering. People who stutter face adverse reactions and feelings from the public. Methods like interpersonal contact, education, and protesting against false information effectively reduce stigma in the stuttering community.

The University of Texas at Arlington

OUTER MEMBRANE MODIFICATIONS MEDIATE CARBAPENEM TOLERANCE IN GRAM-NEGATIVE BACTERIA

Richard D. Schargel
Faculty Advisor: Joseph M. Boll

Antibiotic tolerance remains a growing, yet understudied, problem in modern health care settings. Tolerant bacteria survive in otherwise lethal antibiotic concentrations. When the antibiotic is removed, tolerant bacteria resume normal growth. Similar to well-studied antibiotic resistance mechanisms, bacterial tolerance contributes to widespread treatment failure. However, the molecular factors that regulate antibiotic tolerance are not well understood. Antibiotic tolerance depends on the strain-to-strain variation as well as the administered antibiotic. Upon exposure to "last-line" carbapenem ß-lactam antibiotics, tolerant gram-negative bacteria form spherical morphotypes devoid of a peptidoglycan cell wall. These morphotypes are commonly known as spheroplasts; furthermore, the molecular mechanisms and factors that mediate antibiotic-induced spheroplasts are mostly unknown. In this study, we examined the role of the outer membrane in drug-tolerant bacterial spheroplasts in order to find an explanation for their ability to continue causing infection despite lacking a fundamental cellular component, the peptidoglycan cell wall. We found that spheroplasts are naturally fragile when cultured in Luria broth (LB) media, suggesting the presence of a stabilizing component in human serum that may promote antibiotic treatment failure. Additionally, we observed that lipid A modification pathways play a large role in spheroplast survival. Here we propose that divalent cations and lipid A modifications support antibiotic tolerance synergistically.

The University of Texas at Austin

EXAMINING THE BIOCHEMICAL ACTIVITY OF THE ANTI-CRISPR PROTEIN, ACRIIA7

Negar Koupaei
Faculty Advisor: Soo Hyun Yang

Bacteria are constantly exposed to microbes and bacteriophages. The race between bacteria and phages resulted in the development of evolutionary mechanisms to prevent infections in bacteria including the CRISPR-Cas system. In return, phages have developed anti-CRISPR activities to reduce CRISPR-Cas proteins' effects. The CRISPR technology can be used to edit DNA/RNA sequences. However, this editing might cause accidental changes in the genome as a result of off-targeting. Therefore, developing a method to allow precise editing of DNA/RNA sequences is critical. ACRs are used as a method to precisely control the DNA/RNA editing of CRISPR enzymes that can minimize the side-effects of off-targeting. There are several genes that have anti-CRISPR proteins (ACRs) activity. Among those, AcrillA7 was shown to exhibit a strong inhibitory effect on Cas9 in vitro. The overall goal of this project was to examine the biochemical activity of the AcrIIA7 on inhibiting the DNA or RNA processing activities of the CRISPR Cas nucleases. The experimental aims of this project are: 1. To clone the genes coding for the Acrll7 anti-CRISPR proteins into the 6XHis-TwinStrep-SUMO-pET19b E.coli expression vector via Gibson Assembly, 2. To optimize the expression and purification condition of the recombinant AcrIIA7 protein, 3. To examine the inhibitory effect of AcrIIA7 on the DNA/RNA processing activities of Cas nucleases. The results of this project could be used to study the effect of anti-CRISPR in inhibiting/removing off-targeting Cas nuclease and potentially become an applicable method to treat genetic disorders.

The University of Texas at Austin
CONSUMER CHOICE AND CONTROL ACROSS STATE PLANS FOR INDEPENDENT LIVING
Yasmine Kayali
Faculty Advisor: Tracie Harrison

Independent living services are funded by the Administration for Community Living. Designated state agencies carry out these services and are required to submit state plans for independent living every three years to maintain their state's funding. This study aims to evaluate which state plans promote the independent living philosophies, as required by the ACL. An evaluation of state plans' inclusion of IL philosophies, specifically the consumer choice and control philosophy, concerns states' eligibility for ACL funding. The results of this paper indicate disparities in consumer control initiatives across states, with approximately only half of all states promoting ACL-consumer control initiatives in their plans. We suggest further, more frequent evaluation of independent living programs and their state plans to protect the consumer control priority.

The University of Texas at Dallas
UNBIASED CHARACTERIZATION OF ECCDNA AND CLINICAL APPLICATIONS
David A. Girata
Faculty Advisors: Massa J. Shoura, Andrew Z. Fire, Stephen D. Levene

Genomes are not static! They are dynamic and modify their content and architecture in response to intrinsic and extrinsic signals. One manifestation of genome dynamics is the formation of Extra-chromosomal circular DNA (or eccDNAs). eccDNA molecules are endogenous circular DNAs that are derived from the linear genome of eukaryotic organisms. Although eccDNA was first detected in plant cells, recent studies show that the existence of eccDNA is a ubiquitous phenomenon and that these DNA circles are conserved in organisms from yeast to H. sapiens1. An important class of eccDNA elements has been associated with cancer and drug-resistant tumors in a wide cohort of cancer patients2-4. Despite the highly sophisticated tools that now exist to isolate and characterize circular DNAs, the field still lacks sensitive techniques that allow for a comprehensive and unbiased purification of eccDNAs that can capture circular molecules regardless of their size and topology. Here we describe the development and use of a novel centrifugation-based protocol with the ability to isolate the complete eccDNA repertoire (or Circulome) from any tissue sample. This technique is performed in small volumes, eliminates the use of carcinogenic and teratogenic chemicals (e.g. Ethidium Bromide), corrosive organic reagents (e.g. butanol), or prolonged (>100 hours) exonuclease V (exoV) digestions. Once enriched, we utilize next-generation sequencing and bioinformatic analysis to characterize eccDNA and map their sequences. This work provides insight into oncogene amplification occurring on eccDNAs as a mechanism by which cancer cells can rapidly adapt to changes in the tumor microenvironment.

The University of Texas at Dallas
A PHARMACOLOGICAL INTERACTOME PLATFORM FOR DISCOVERY OF PAIN MECHANISMS AND TARGETS
Sanjay V. Neerukonda
Faculty Advisor: Theodore J. Price

Cells communicate with each other through ligand and receptor interactions. In the case of the peripheral nervous system, these ligand-receptor interactions shape sensory experience. Nociceptive sensory neurons are responsible for detecting changes in the environment through specific receptors and then transmitting this signal to the central nervous system (CNS) via the generation of action potentials.

These nociceptors innervate almost every tissue in the body, playing a critical role in detecting injury and/or pathology to skin, joints, bones and visceral organs. RNA sequencing (RNA-seq) experiments have defined tissue-wide and cell-specific transcriptomes for much of the body in both mice and humans. Cell profiling experiments on normal and diseased tissues have identified key molecular players in an increasing number of disease processes, including disorders with a strong pain component. Using RNA sequencing datasets from mouse and human, we created an interactome map for how mammalian sensory neurons potentially interact with peripheral cell types. We used this knowledge base to gain insight into how specific cell types and sensory neurons might interact in disease states. We created interactomes of knee joint macrophages from rheumatoid arthritis patients and pancreatic cancer samples with human dorsal root ganglion (DRG). A common theme was heparin binding EGF-like growth factor (HBEGF) interaction with sensory neurons through epidermal growth factor receptor (EGFR), a member of the ErbB family of receptors (encoded by EGFR and ERBB2-4). We validated that HBEGF causes pain in mice, likely acting on DRG neurons through ErbB family receptors. Collectively, these interactomes highlight ligand-receptor interactions in mouse models and human disease states that reflect the complexity of cell to neuron signaling in chronic pain states.

The University of Texas at El Paso
ISOLATION OF CIRCULATING LUNG TUMOR ENDOTHELIAL CELLS USING MICROFLUIDIC DEVICE
Jacob Hooper
Faculty Advisor: Taslim Al-Hilal

Cancer can be easily treatable if diagnosed early. Cases where it is either unseen or misdiagnosed can often be fatal, especially concerning lung cancer. Lung cancer is usually one of the most lethal forms of cancer. It is tough to detect because it does not show up very well on imaging. Once it appears on imaging, it is already at an advanced stage. Liquid biopsies are a common form of identifying cancers, but different factors make the testing unreliable and incredibly invasive. Our research project focuses on creating a small device, a microfluidic chip that uses small amounts of DNA to identify and isolate cancer cells. We hope to isolate these cells by flowing different amounts of cells into the said microfluidic chip. We will capture these cells to find specific markers to identify rare forms of lung cancer. The chip is formed with a polymer-based gel on a prepared model and is cured, cut, and sanitized. We then placed the chips and a small glass coverslip into a pressurized machine that allows us to activate both the glass and chip so that they may attach. We then cultured the cells and constricted the flow of fluid throughout the chip. This process allows us to identify these markers in a much easier, less invasive way. If successful, this process will enable researchers and diagnosticians another form of cancer testing that is much easier than current types like exploratory surgery or different imaging types that sometimes miss cancer altogether.

The University of Texas at El Paso
TRACKING RENEWABLE ENERGY CONSUMPTION IN AN ELECTRICITY MARKET
Kenji Santacruz
Faculty Advisor: Yuanrui Sang

Operating sustainably is a goal of all enterprises with a sense of social responsibility. In recent years, many companies have signed contracts with renewable power plants to make their facility “100% renewable”, including unicorn companies such as Amazon, Google, Facebook, and Walmart. However, the way they define “100% renewable” is that their annual energy consumption equals to the annual production of these renewable power plants, which is very inaccurate, because once the renewable energy is integrated into the grid, it is mixed up with energy produced by fossil fuels, and it is hard to distinguish how much electricity a facility consumes is from renewable energy resources.

Thus, such “100%-renewable” contracts cannot guarantee that 100% of the consumer’s electricity is from renewable energy resources, and there is a need for an accurate renewable energy tracking system.
In this project, we aim to develop a renewable energy tracking system based on a power flow model that considers transmission topology and impedance. This tracking system will closely monitor the power generated by each power plant, and calculate the distribution of the power on each transmission line according to the impedance and topology of the transmission network. Then, at the location of the electricity consumers, the tracking system will be able to calculate the exact amount of power from each generator according to the power flow distribution. This way, the electricity consumers will be able to know exactly how much of their electricity is supplied by renewable energy resources. This project will lead to a novel model for renewable energy tracking. The tracking system will enable electricity consumers to accurately understand their energy portfolio and evaluate their level of environmental sustainability. Due to the demand of such a system, the output of the project may potentially be commercialized.

The University of Texas at Tyler
A COMPARISON OF MACROINVERTEBRATE SAMPLING METHODS ON A STREAM SYSTEM IN TYLER, TX
Briana Aguilar
Faculty Advisors: Marsha G. Williams, Lance R. Williams

East Texas is composed of hardwood and pine forests that contain multiple spring-fed streams with dense canopies. This leads to an abundance and diverse population of macroinvertebrates in stream systems which are utilized to indicate the health of a stream. Analyzing the health of streams is important because they influence the dynamic of downstream systems, like rivers and lakes, which supply clean water for drinking, recreation, and agriculture. This study compares three macroinvertebrate sampling methods which are the Dip net, Surber sampler, and Hester-Dendy. The samples were collected from Quail Creek at TPWD The Nature Center in Tyler, TX to determine the conditions of the stream. The macroinvertebrate communities collected by each method were evaluated by curating a Benthic Index of Biotic Integrity (B-IBI) and an Invertebrate Community Index (ICI). An aquatic life score was calculated ranging from limited to intermediate for each method. Past data collected on Quail Creek was used to determine if our samples were accurate. Our work demonstrates that the samples are inconsistent with past data on Quail Creek. Overall, this means that factors like the season the samples were collected, the water flow, and the geology of the stream, caused the data to reflect low macroinvertebrate diversity.

The University of Texas at Tyler
POLYMER EXCHANGE MEMBRANE FUEL CELL FOR POWER GENERATION
Marco Rodriguez, Jasline Chandler, Austin English
Faculty Advisor: Fredericka Brown

Polymer exchange membrane fuel cells (PEMFC) are compact portable devices capable of producing up to 1 kW of power. As the focus region for hurricane strikes, the Houston and Galveston areas are well known to become isolated from essential life sustaining components such as energy, water, and heat. Through computational fluid dynamics (CFD) modeling, a 72x71 mm serpentine channel model was produced. The validity of the model is evaluated based on current-to-voltage (polarization) curves and the effect of inlet mass flow rate is examined. Compared to experimental tests, the numerical model provides promising trends in the polarization curves while suggesting inlet mass flow rates have significant effects on the current density flowing throughout the fuel cell stack.

The University of Texas of the Permian Basin
HF-FREE EXTRACTION TECHNIQUE OF PARTICULATE ORGANIC MATTER
Samantha James
Faculty Advisors: Mohamed Zobaa, Chao Dong

Concentrated hydrofluoric acid (HF) is conventionally used to break down the silicate fraction of sedimentary rock samples in order to extract their particulate organic matter contents. HF is a severely dangerous acid that requires special equipment and extreme caution to be used safely within the laboratory. Many people have lost their lives, or at least parts of their bodies, due to inadequate handling of this acid. At minimum, minor topical exposure to HF can result in severe burns, tissue damage, and other forms of serious, chronic injuries. In addition to this, digestion of sedimentary rock samples with HF is both hazardous to the environment and time consuming, which negatively affects laboratory output and productivity. To find a safer, environmentally friendly, and time-efficient alternative, we tried combinations of pulverization, and xylene refluxation techniques to separate the different types of particulate organic matter. Results of this trial are herein demonstrated.

The University of Texas Southwestern Medical Center
GENERATING SYSTEMIC ANTITUMOR IMMUNE RESPONSES BY TARGETING VULNERABILITIES IN THE TUMOR MICROENVIRONMENT USING RADIATION AND IMMUNOTHERAPY
Patrick Nnoromele
Faculty Advisor: Todd Aguilera

Recent advances in cancer therapy have revealed a role for immunotherapy in many cancers but response rates are limited to 10-50%. There has been evidence that a specific combination of immunotherapy with chemotherapy and radiotherapy may provide unique and effective opportunities. The goal of cancer immunotherapy is to enhance the ability of the immune system to kill cancer cells and blocking antibodies to PD-1/PD-L1 and CTLA-4 are immune checkpoint immunotherapies (ICI) are now approved for many indications. Limitations of immunotherapy stem in part from cancer's outstanding ability to avoid detection and elimination by multiple mechanisms and effective immune clearance requires multiple steps that can be crippled by cancer. We hope to elucidate molecular characteristics and mechanisms that result in systemic immunity after localized radiation when combined with ICI. It has been observed that in some patients with metastatic cancer, that radiation could trigger a systemic response when patients were progressing on immunotherapy alone. This 'abscopal' effect is rare and molecular mechanisms have been difficult to elucidate and understanding how to induce the response is limited. We use triple negative breast and colorectal cancer mouse models to induce the abscopal effect using various combinations of ICI and radiation. We hypothesize that the quality of antigens expressed by the tumor impact specific adaptive immune pathways that can result in abscopal responses. By understanding these mechanisms, we aim to better predict and enhance systemic immune responses generated by radiation using a combination of immunotherapies that activate critical pathways.

UT Health San Antonio

ASSOCIATIONS BETWEEN LONELINESS AND DAILY HEALTH IN SPOUSAL DEMENTIA CAREGIVERS

Arielle Chinea, Sara Masoud, Ashlie Glassner, Kevin Hamilton
Faculty Advisors: Darpan Patel, Kylie Meyer, Carole White

Loneliness is associated with adverse health outcomes, including cardiovascular disease, depression, and mortality. Spousal dementia caregivers may be at a heightened risk of loneliness due to limited access to respite care and concerns about their dementia care partners' functional and behavioral symptoms that make leaving home difficult. Yet, little research has explored how daily loneliness relates to health behaviors and symptoms in spousal dementia caregivers. Ten spousal caregivers (7 female) between ages 59 to 81, including 8 non-Hispanic White and 2 Hispanic caregivers, completed 14 consecutive days of online diary surveys. Data included a total of 135 days of surveys (an average 91 percent completion rate across participants) on these variables: loneliness, health behaviors, and health symptoms. Health behaviors included: (a) number of alcoholic beverages consumed, (b) completion of at least 30 minutes of moderate to vigorous physical activity, and (c) perceived sleep quality, rated "very bad" (1) to "very good" (5). Health symptoms caregivers experienced were counted and rated on frequency from "none of the day" (1) to "all of the day" (5). We applied multi-level mixed effects models to examine the association between loneliness and health behaviors day-to-day, controlling for age and number of behavioral symptoms of dementia. No differences were found between alcohol consumption or physical activity and loneliness. Days when caregivers felt lonely "some of the time" or "often" were associated with poorer quality sleep (B=-0.46; SE=0.21; p-value=0.03). Additionally, days when caregivers felt lonely "some of the time" of "often" were associated with experiencing more adverse health symptoms, like headache, backache, flu-like symptoms, gastrointestinal issues, and fatigue (B=1.38; SE=0.37; p-value <0.001). This data suggests that loneliness may contribute to poorer sleep quality and more adverse health symptoms day-to-day. Findings, if confirmed, can be translated to develop intervention programs that target loneliness among dementia caregivers.

University of Houston

DEVELOPMENT OF A FLOW VISUALIZATION MODEL FOR APPLICATION IN VERTICAL-AXIS WIND TURBINE ANALYSIS

Vincent Laroche
Faculty Advisor: Di Yang

As wind farms continue to grow in size and number of turbines, the reduced-speed region behind a turbine (its wake) is becoming a significant factor that can affect other turbines in a farm. In order to understand how air speed (thus momentum and kinetic energy) is recovered by a turbine's wake before reaching another downstream turbine, the characteristics of wake flow needed to be examined. The structure of wake flow was studied using the transport tube method, an analysis model that visualizes the transport of mass, momentum, and kinetic energy as three-dimensional tube structures. Numerical integration was used to create transport tubes in velocity, momentum flux, and kinetic energy flux vector fields. These tubes represent regions in 3D space where there is no flow of the corresponding quantity across the boundary of the tube. The transport tube method was implemented using codes developed in both MATLAB and Python. Multiple sample flow fields of varying conditions were used to gauge the method's accuracy before it was further applied to idealized axisymmetric wake flow. Plane Couette flow, laminar round jet flow, and a basic wind dataset were among the sample flow fields analyzed. Our results for these cases indicated that the transport tube method was effective at identifying complex flow features (e.g. eddies) and transport patterns of mass, momentum, and kinetic energy in a variety of flows both 2D and 3D, laminar and turbulent. Additionally, the analysis of idealized wake flow demonstrated the mechanism by which kinetic energy was recovered in downstream flow.

The viscous effect caused a component of kinetic energy flux to direct towards the center of the wake, resulting in transport of kinetic energy from surrounding high-speed freestream flow to the low-speed wake. Analysis of vertical-axis wind turbine wake data yielded similar results.

University of Houston
WHEN WORDS FAIL: NARRATIVE & DANCE IN POSTTRAUMATIC STRESS
Verónica Ordóñez
Faculty Advisors: Steven A. Long, Teresa Chapman

The purpose of my research is to investigate how written and oral narrative can be complemented by dance to aid in coping with posttraumatic stress. Particularly, I focus on how embodied expression, a key characteristic of dance, adds sensory information and a level of abstraction to a narrative that more effectively engages audience empathies than through words alone. Using Bessel van der Kolk's The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma and Room, a contemporary novel by Emma Donoghue, I pinpoint the gaps that exist today in traditional trauma therapy and make a case for alternative and embodied approaches. I then reference Roman Ingarden's The Literary Work of Art to demonstrate how performing arts like theatre and dance can provide sensory concretization for written and/or oral trauma narratives. Through the example of choreographer Bill T. Jones' famed dance work, Story/Time, I introduce the neuroscientific concept of mirror neurons to explain how the human brain processes motor imagery when watching dance and how it triggers our affective empathies to one another. Lastly, I analyze how a level of abstraction in dance produces the peak-shift effect, which appeals to our cognitive empathies and allows us to take in a person's trauma narrative with greater emotional understanding and acceptance. I aim toward eventually producing a holistic therapy practice to aid those suffering from posttraumatic stress that connects traditional narrative and dance and that can supplement traditional talk therapies.

University of Houston-Clear Lake
A DISEASE SIMILARITY TECHNIQUE USING BIOLOGICAL PROCESS FUNCTIONAL ANNOTATIONS
Luis D. Licea Torres
Faculty Advisor: Hisham Al-Mubaid

Disease similarity methods are important for understanding disease mechanisms and relationships. Disease similarity results can be utilized in certain medical applications like drug repurposing and therapy development. In this paper, we present a new method for measuring disease similarity using biological process functional annotation. We measure the similarity between diseases by employing a computational method based on the shared biological processes of disease genes. We evaluated the method in several experimental settings, and the results are encouraging. By calculating the Spearman rank correlation coefficient, we found a strong and positive correlation between the weight of shared biological process functions and the number of shared therapeutic chemicals in diseases that do not share any genes. We also found that our method was able to compute the similarity for more Mendelian diseases than a gene-based method was. This suggests that biological process annotation of disease genes from the Gene Ontology can impart more comprehensive profiles of diseases than the disease genes alone.

University of Houston-Downtown

SLEEP BEHAVIOR OF DROSOPHILA MELANOGASTER IN AN OPEN FIELD ARENA

Christian Y. Beke Onana, Aneeka Khan, Shawn-Dawn Awagu, Amairani Dominike, Ramirez-Rendon, Sydney Jump
Faculty Advisor: Yuan Yuan Kang

Drosophila melanogaster is a powerful model organism to study animal behaviors that are well conserved across species, such as sleep, locomotion, and learning. Understanding the neurological pathways in fruit flies can then be applied in biomedical fields. In this study, we conducted a pilot screen using previously characterized sleep inbred lines to explore how sleep might affect other behaviors, such as locomotion and habituative learning using a simple open field assay. Specifically, flies were set up in an open field arena to evaluate their locomotive activities within a 10-minute time period. Using a FlyTracker software, we were able to trace the fly movement from a video recording. Our results showed that short-sleep inbred lines displayed deficits in exploration and habituative learning, but heightened levels of anxiety. Long-sleep flies, on the other hand, showed no significant differences compared to wild-type controls, in contrast to a previous study that showed that both long-sleep and short-sleep lines displayed learning deficits in a proboscis extension assay, suggesting that sleep affects different types of learning through different mechanisms.

University of North Texas

MITIGATING THE EFFECTS OF HAZARDOUS ORGANIC SOLVENTS ON THE ENVIRONMENT BY USING LINEAR FREE ENERGY RELATIONSHIPS TO DEVELOP A NOVEL MODEL TO GUIDE SOLVENT SELECTION

Jennifer Huang
Faculty Advisor: William E. Acree, Jr.

The goal of this study was to develop a computational method that can be used to predict the chemical properties of various chemical compounds, determine the solute-solvent interactions that occur at the molecular level, and guide the replacement of environmentally hazardous organic solvents with safer yet effective green solvents. Thus, if experimental measures can be used to determine the chemical properties (molar refractivity, electrostatic polarity, hydrogen bond accepting and donating abilities, and gas partition coefficient) of a given organic solvent, then the team can use linear free energy relationships to develop a model that allows for the development of quantifiable metrics for chemical properties. In an intersectional framework between mathematics and chemistry, I analyzed the molecular solute-solvent interactions between fifty solutes and dimethyl carbonate, the solvent, to determine its efficacy in replacing hazardous solvents in industrial use. Specifically, I performed a combination of bench work and computational work, including dilution of saturated solute-solvent mixtures, spectroscopic measurements of said mixtures, and usage of the Beer Lambert's Law, to develop quantifiable metrics for the chemical properties of dimethyl carbonate. I then utilized linear free energy relationships to develop fifty linear equations that, once the team solved using the IBM SPSS statistical software, correlated the logarithms of partition coefficients to within 0.13 log units of the calculated values. The regression analysis gave R^2 values of 0.994 and 0.999, thus indicating that the difference between my observed and expected/fitted values was very small. This further bolsters the accuracy of the experimental results and indicates that the correlation expressions will provide accurate predictions of the chemical properties of additional compounds lacking experimental values. Using the logarithms of the partition coefficients, I ultimately determined that dimethyl carbonate serves as a viable alternative for butyronitrile, propionitrile, methyl acetate, and butyl acetate.

University of North Texas

A NOVEL LINEAR FREE ENERGY PARAMETER MODEL FOR THE PREDICTION AND MAPPING OF THE UPTAKE OF HAZARDOUS ORGANIC POLLUTANTS BY PLANT CUTICLE MEMBRANES

Shrika Eddula
Faculty Advisor: William Acree, Jr.

This project presents a novel end-to-end solution for predicting, mapping, and mitigating the absorption of hazardous organic pollutants by the plant cuticle membrane. The plant cuticle is vegetation's first line of defense against environmental threats such as hydrophobic or volatile organic contaminants. These atmospheric pollutants enter the cuticle through contact with various mediums—industrial air, wastewater pollutants, pesticides, herbicides, and contaminated soil—and pose a threat to the humans and animals who consume the plant. For phase 1, a predictive free energy parameter model was constructed by developing quantitative structure-property relationships between the characteristics of the plant cuticle membrane and absorbed organic contaminants. The properties in which the model takes into account are molar refractivity, polarizability, 3-D structure, dispersion, and hydrogen-bond acidity/basicity. Using the concept of chemical free energy, the model uses structural factors to predict the ratio of absorbed containment. For phase 2, the model was tested on experimental databases of 25 diverse plant species. To construct the databases used in the study, solubility data pertaining to the concentration of hydrophobic contaminants adsorbed by the isolated cuticular membranes (CM) and by the polymer matrix membranes (MX) was mined from published literature and data released by the Environmental Protection Agency. To test the accuracy of the model, a regression analysis was performed using indicator variables. A root-mean-square error (RMSE) of about 0.22 and an R squared value of 0.987 were determined, indicating that the proposed model is much more accurate than previous methods used. The applications of this project are two-fold: first, this project presents a novel solution to quantifying and predicting the amount of organic pollutant any given species of plant will adsorb depending on the terrestrial environment, and second, this approach can be adapted and applied as a remedial tool to heal already damaged crops.

University of North Texas -- Dallas

STRUCTURAL ANALYSIS OF A ZIRCONIUM BASED HYDROGEN STORAGE MATERIAL

Sergio Rocha, Kevin Falcon, Nayeli Garcia Lopez, Christina James Thomas, Joanna Robledo
Faculty Advisor: Muhammed Yousufuddin

Metal borohydride (MBH4) compounds have been studied thoroughly for their potential as hydrogen storage materials. Zirconium borohydrides are one such class of metal borohydrides with hydrogen storage potential, however the interaction between the hydrides from BH4- and Zr is another fascinating feature worth exploring. Cp2Zr(BH4)2 has been investigated for its potential as a hydrogen storage material and as a precursor for other hydrogen storage materials. But, to our knowledge, the structure of Cp2Zr(BH4)2 showing the position of the hydrides is unknown. We present here the synthesis and crystal structure of Cp2Zr(BH4)2 showing, for the first time, the position of the hydrides in relation to Zr.

Wayland Baptist University
COMPARING SOLUTIONS TO FRACTIONAL-ORDER DIFFERENTIAL EQUATIONS RELATED TO THE GOMPERTZ LOGISTIC GROWTH MODEL
Jacob Adams
Faculty Advisor: Charles Nelms

We look at the use of the Gompertz model as a way to model cancer growth. We will project the Gompertz model as multiple different fractional models, and compare the applications, successes and failures of both the original model and the new models. First, we present the history of the use, parameters and applications of the Gompertz model. After fully understanding the model, we can then solve it as an ordinary differential equation. Then, we reformulate the model as a fractional derivative using the Caputo, Caputo-Hadamaard, and Hadamaard definitions of a fractional derivative. Our goal is to compare the initial Ordinary differetial equation model not only to the fractional models, but also to compare the effectiveness of the different kinds of fractional differential equation models. We believe that these reformulations will be more effective in modeling the growth of cancer cells.

West Texas A&M University
PRELIMINARY STUDY OF MATERIAL PROPERTIES FOR POWDER-BED LASER FUSION
Nathanael Solomon, Jacob Martinez
Faculty Advisor: Matthew Jackson

Additive Manufacturing (AM) technology is important to the world of engineering. Similar to 3D printing, AM allows designers to quickly create metal prototypes. This innovation eliminates the geometric restrictions of traditional methods of manufacturing like machining. Laser technology for powder-bed laser fusion (PBLF) for metal fabrication is relatively new and research is needed to understand various laser and material variables that affect the metal material during laser welding. A wide variety of parameters can be manipulated within PBLF; these parameter changes may have an effect on the metal's material properties. Initial research manipulated two parameters while minimizing all other parameters/variables. Laser power (watts) and scan speed (mm/s) were the parameters manipulated in the production of testing samples. Several other factors such as energy adsorption, melt pool dynamics, heat dissipation and evaporation will be considered in future experimentation. The samples went through several material tests including: tensile testing, hardness testing, and grain structure analysis. The data revealed parameter changes in laser power and scan speed affect the material properties of the material produced. This suggests that multiple parameters will have influence over the material property. This project's goal is to develop capabilities of detecting material discontinuities and AM failure modes utilizing existing types of process monitoring such as infrared imaging, powder size, environmental conditions, etc. Once the process issues can be monitored, a closed loop feedback will be developed to modify laser parameters during welding and AM applications in order to immediately identify and fix problems during the build process. Products built with this closed loop feedback process will be compared with products built via traditional machining methods to determine improvement in the build process to meet material requirements. As AM develops to the production stage, proven acceptance methods prior to completion of a finished part are needed and warranted.