SUMMER UNDERGRADUATE RESEARCH POSTER SESSION

ABSTRACT BOOK

Wednesday, August 2, 2023

Interdisciplinary Life Sciences Building Lobby

Morning Session

10:00 AM – 12:00 PM

Afternoon Session

2:00 PM – 4:00 PM

LAUNCH
UNDERGRADUATE RESEARCH

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MORNING SESSION

10:00 AM – 12:00 PM

1. Proposed Active Target Device in DAPPER for Transfer Reactions

Sebastian Regener (Texas A&M University)
Cyclotron Institute REU
Research Advisors: Sherry Yennello, Alan McIntosh

The DAPPER TopHat TPC is a proposed active-target time projection chamber(TPC) that is being developed as an upgrade to the DAPPER array at the Texas A&M Cyclotron Institute. DAPPER is the Detector Array for Photons, Protons, and Exotic Residues that is designed to measure the gamma rays from the products of (d,p) reactions in inverse kinematics using BaF2 scintillators. TopHat is a cylindrical Time Projection Chamber (TPC) at the center of DAPPER. With the measured gamma rays, the measured proton energy, and proton track information from micro pattern gas detectors we will be able to extract the photon strength function of the heavy residue. The addition of TopHat will allow for higher yield, lower background, and improved E* resolution which will allow us to find the photon strength function with improved accuracy.

2. Developing and Investigating the Response of an SRAM Dosimeter for Use in Radiation Effects

Grace Metz (Case Western Reserve University)
Cyclotron Institute REU
Research Advisors: Cody Parker, Henry Clark

The Texas A&M University Cyclotron Institute's Radiation Effects Facility (REF) provides engineers and scientists with protons and a wide variety of heavy ion beams to test their electronics for use in terrestrial, aerospace, and space applications. Reliable dosimetry is currently provided at the REF through the use of scintillator detectors, but a more mobile option would be beneficial to users at the REF and other laboratories to verify their beams. A mobile dosimeter system has been developed by characterizing the response of a particular brand of SRAM chip to heavy ions. It was found that the SRAM chips demonstrate both cross section and multiplicity dependence on linear energy transfer (LET), allowing for two distinct ways of characterizing the incident beam. In this project, improvements to the original dosimeter printed circuit board (PCB) were implemented, including a new mounting solution for quicker set-up, a reduction of electronic signal noise, and a simplified system that holds a single SRAM chip rather than four. The response of the redesigned dosimeter was tested using 40 MeV/u 78Kr ions at full energy, which were degraded to lower energies to obtain a series of LETs, to confirm its LET-dependent behavior. Additionally, part-to-part variation was investigated by exposing multiple SRAM chips of the same brand to the beam.

3. Investigating New Methods for Neutron Multiplicity Identification

Dylan Johnson (University of Nebraska - Kearney)
Cyclotron Institute REU
Research Advisors: Michael Youngs, Kris Hagel

Neutron detectors are important to accurately measure free neutrons emitted from nuclear collisions. The 4π neutron ball can observe and detect a large geometric range of neutrons from in-beam experiments. Previous experiments have been limited in their detection capabilities, and consequently operated using simple assumptions for determining neutron multiplicities. Recently, the neutron ball electronics were upgraded to save the signals from photomultiplier tubes using waveform digitizers. Saving the waveforms also presents an opportunity to identify neutrons that were previously unaccounted for. A variety of analysis techniques are used in this pursuit. The results of these techniques will be shown.

4. Micromegas Gain Mapping

Avery Pilot (The Catholic University of America)
Cyclotron Institute REU
Research Advisors: Grigory Rogachev, Yevgen Koshchiy

A Micromegas (Micro-MEsh GAseous Structures) is a novel, highly segmented gas-gain detector often used in Time Projection Chambers (TPCs). At the Cyclotron Institute, Texas A&M University, Micromegas are utilized in active target detectors TexAT and TeBAT, which are used for experiments with rare isotope beams to study the structure of exotic nuclei and nuclear astrophysics measurements. A facility is being developed to perform automated tests of Micromegas detectors to produce a gain map across the large area of the detector to improve energy resolution, which is essential for particle identification. Both the data taking and the analysis are completely automated using and controlled by the Python scripts. This allows for an efficient, accurate, and highly reproducible gain map to be constructed. Note that the map is unique for each realization of the Micromegas, even if they are built using identical blueprints. These maps will be applied to the future experimental data obtained with TexAT and TeBAT active target detectors.

5. Linking Sub-Barrier Fusion with Double Beta Decays

Naeem Roberts (Francis Marion University)
Cyclotron Institute REU
Research Advisor: Aldo Bonasera

This work analyzes sub-barrier nucleon transfer during heavy ion elastic scattering events and compares them to $\beta\beta^{+ / -}$ decays. It is postulated that correlations can be found between the transforming nucleon and nucleon transfer using a classical form of the Hartree Fock method (neck model). Data taken from the Nuclear Data Services (NDS) is used to derive information from $\beta^{+ / -}$ to calculate the nuclear matrix element for each decay. By calculating the Q of the decay by means of

the Weizsacker Formulation and comparing to the nuclear matrix element, determination of $\beta\beta^{+ / -}$ will be revealed and cross sections for each are calculated. Using the neck model the cross sections for heavy ion elastic scattering events are calculated, and correlations within the cross sections between the two may be found.

6. Measurement of Beam Intensity for Cross Section Measurement Normalization

Monika Fouad (Middle Tennessee State University)
Cyclotron Institute REU
Research Advisor: Brian Roeder

Beam intensity measurements play a major role in the normalization of cross section measurements, which are vital in nuclear structure and nuclear astrophysics. By developing a technique to measure beam intensity in cases where Faraday cups cannot be used, this work will improve cross section measurements with the MARS spectrometer, where most measurements are made close to 0°. In addition to beam intensity determination, this setup will also be used in future experiments with reaccelerated beams at the Texas A&M Cyclotron Institute. In this work, the elastic scattering resulting from the collision of a 40-Ar beam of 15 MeV/nucleon onto a 197-Au target of thickness 0.1 mg/cm^2 was measured. This was done by setting up a detector mount with specified angles inside the target chamber of the MARS. Silicon and diamond detectors were positioned at various angles to measure particles' elastic scattering, while utilizing a Faraday cup positioned at 0° to normalize the measurements made by the detectors. By measuring the 40-Ar at fixed angles, a comparison of the yield measured to charge collected on the FC can be made, providing a needed normalization for cross section measurements. The analysis will be done using ROOT, and the experimental cross section will be compared to the Rutherford scattering model.

7. Developing Position-Information Readout Capabilities for a Pepper-Pot System

Keslyn Stonum (Texas Lutheran University)
Cyclotron Institute REU
Research Advisor: Dan Melconian

A microchannel plate is a detector that offers the timing and resolution for detecting charged particles one at a time. Utilizing microchannel plate detectors enhances the performance of an ion beam by providing valuable information such as the geometry and size of an ion beam. This information allows knowledge of the limits of an ion beam for better manipulation for controlling where the beam travels through a beamline and improving injection optics setup. Characterization of an ion beam from the pepper pot system is critical because this method can apply wherever an ion-sourced beam is irradiated to maximize the efficiency of beam performance. These detectors are useful for locating the position of charged particles emitted from a pepper pot system. This system includes a mask over the microchannel plate and the detector itself. Data acquired from the pepper-pot system is invaluable to current and TAMU's upgrade to the HE6-CRES experiment at the University of Washington.

8. Characterizing Efficiency Limitations Caused by Space-Charge Effects in the TAMUTRAP System

Maddison Ellis (University of Colorado Boulder)
Cyclotron Institute REU
Research Advisor: Dan Melconian

Radio-frequency quadrupoles (RFQs) are crucial in accelerating, bunching, and focusing continuous beams of charged particles by their utilization of alternating electric fields. The larger objective of this research is to develop an RFQ that produces bunches of 106 ions for the He6CRES (Cyclotron Radiation Emission Spectroscopy) experiment at the University of Washington. With their focus on accurately measuring beta-decay spectra, the higher ion bunching rate aims to significantly reduce the runtime required for sufficient data collection, which calculations previously expected to take over a year of continuous operation. This upgrade will enable the incorporation of a Penning trap and, if successful, could improve the sensitivity of measurements looking beyond the standard model. This specific project focuses on measuring and optimizing the efficiency of the RFQ by manipulating electrode values within the beamline. To assess efficiency, we positioned Micro-Channel Plates (MCPs) before and after the RFQ utilizing high-resolution imaging and timing techniques. By comparing the event rates captured by the front MCP (located before the RFQ) and the back MCP, we derived the RFQ's efficiency. Prior measurements with similar systems have yielded an efficiency of 60-80% with a constant ion beam, providing a baseline for comparison. This poster will show our system's preliminary findings, shedding light on the efficiency achieved. Moving forward, the subsequent steps of this research focus on studying the effects of bunching and examining the relationship between efficiency and intensity. We investigate these aspects to understand how they might restrict the RFQ's overall efficiency.

9. Studying the Effects of Heavy Ions Bombardment on SONOS Chips

Sharanya Palit (University of Dallas)
Cyclotron Institute REU
Research Advisor: Michael Youngs

Recently, it has been proposed that SONOS (Silicon Oxide Nitrogen Oxide Silicon) chips, which are generally commercially available, might have the potential to be used for radiation detection. If true, these devices may have relevance to various applications, including dosimeters, satellites, and military checkpoints, where such detection systems are necessary. When a heavy ion passes through one of these chips, the voltage across certain sites within that chip changes and can be measured. By systematically investigating this voltage change an enhanced understanding of the behavior of these chips can be achieved. An experiment was run where a 78Kr beam of energies 40 and 36 MeV/u was directly applied to the chips and the voltage before and after exposure were compared. These results will be shown in comparison with previously acquired data using 4He and 14N beams. Other systematic behaviors of these chips will also be demonstrated.

10. It's Wrong but How Wrong? Studying the Effects of Assumptions about Cross Sections in Experiments and Theory

Tiara Anderson (Florida State University)
Cyclotron Institute REU
Research Advisor: Philip Adsley

When nuclear reactions occur in stars, nuclei fuse together and make new ones . To understand these processes, we need to know the likelihood of interaction for different colliding systems at different energies. Experiments are conducted to recreate these reactions, with beams colliding with targets. For many important reactions, one of the reactants is unstable and the beam intensity which can be provided for these cases is often too low to measure the cross sections of interest. One approach often used is to measure at higher energies where the cross section is higher and to use statistical models to extrapolate the important energies . However, these statistical models make a number of approximations, most importantly they often do not include resonance behavior which are observed in many experiments . Furthermore, many modern experiments using gas targets have poor energy resolution and do not observe the strong resonance structures which can exist . The purpose of this project is to investigate what systematic uncertainties result from these experimental and theoretical assumptions. To do this, a program is being built using C++ and Python to simulate these reactions numerically with and without the model assumptions, allowing us to make the comparisons necessary to estimate the extent of the systematic uncertainty. Results from these studies will be shown.

11. A T-Matrix Approach to the Bound and Scattering States of Charmonium

Thomas Hardin (Texas A&M University)
Cyclotron Institute REU
Research Advisor: Ralf Rapp

This paper will give an overview of the temperature evolution of the charmonium particle in the Quark Gluon Plasma. This evaluation was done through the use of a Transition (T-) Matrix incorporating a BlankenbeclerSugar (Bbs) two particle propagator in the S wave channel and a momentum dependent interacting potential. The temperature dependence manifests itself in the potential coupling constant, single particle effective mass, and single particle self-energy. The T-Matrix aptly demonstrates the in medium effects on the bound state, namely where it occurs and the dissolution into the continuum at high temperatures. The T-Matrix is then further applied to calculate the charmonium Spectral Function and Euclidean Time Correlator with a zero energy mode contribution. By normalizing the Euclidean Time Correlator with a reference function, the sensitivity of the bound and scattering states to temperature is demonstrated.

12. Discriminating Between Direct Photon and Neutral Pion Triggers Using Multilayer Perceptrons

Iain Morton (Seton Hall University)
Cyclotron Institute REU
Research Advisor: Saskia Mioduszewski

Direct photon and neutral pion triggers indicate different kinematics in an event. Discrimination between direct photon and neutral pion triggers allows for the comparison of different jet populations. Machine learning techniques have been introduced as a useful tool to classify trigger particles. The purpose of this research is to use the TMultiLayerPerceptron class in the ROOT programming language to discriminate between direct photons and neutral pions using transverse shower profile and other trigger particle information. The techniques and findings of the implementation of the TMultiLayerPerceptron class will be documented throughout this study.

13. Age-Dependent Analysis of Behavioral Deficits and Dopaminergic Neurodegeneration in a Parkinsonian Rat Model of 6-hydroxydopamine

Aryan Shaik (Texas A&M University)
School of Medicine Summer Undergraduate Research Program
Research Advisors: Rahul Srinivasan, Farida Sohrabji

Parkinson's disease (PD) is a neurodegenerative disorder characterized by loss of dopaminergic (DA) neurons in the substantia nigra pars compacta (SNc). As of 2023, PD affects approximately 500,000 individuals in the United States alone and is generally thought to be a disease of aging. However, we do not know if 6-hydroxydopamine (6-OHDA), a commonly used neurotoxin for PD animal models has similar neurodegenerative effects in young and older rats. To address this question, young adult (5-7m) and middle-aged (9-11m), male Sprague Dawley rats were stereotaxically administered 6-OHDA to the dorsolateral striatum. Subsequently, we quantified the number of contralateral rotations in these rats for 15 minutes following intraperitoneal administration of 1mg/kg apomorphine. Rotations were recorded at pre, 7 days post (DP), 14DP, 21DP, and 28DP. At 30DP, animals were sacrificed and tyrosine hydroxylase (TH), a marker for DA neurons, ionized calcium-binding adapter molecule 1 (Iba-1), and glial fibrillary acidic protein (GFAP) were quantified using immunohistochemistry in the midbrain SNc to assess dopaminergic cell loss, microglial presence, and astrocytic activity, respectively. We observed a progressive increase in the number of apomorphine-induced contralateral rotations in both age groups. Additionally, in both age groups of rats, we observed similar levels of DA cell loss, increased microglial activation, and enhanced astrocytic reactivity in both age groups following 6-OHDA. These findings demonstrate that 6-OHDA causes similar levels of DA neurodegeneration in young adult and middle-aged male rats.

14. Nanoluc/NanoBRET Reporters for the Investigation of Mycobacterial Gene Expression

Lyle Tobin (University of Mississippi)
School of Medicine Summer Undergraduate Research Program
Research Advisors: Brett Mitchell, Jeffrey Cirillo
Other Contributors: Diana Estrada[1], Kent Koster[1], Aaron Benjamin[1], Kevin P. Francis[1,2]

Two putative autoinducers have been identified in *Mycobacterium tuberculosis*. Their influence on mycobacterial gene regulation remains unclear. To interrogate the effects of these mycobacterial inducers of gene expression, we seek to integrate a NanoLuc/NanoBRET reporter construct into the mycobacterial genome. These reporters will allow us to quantify gene expression that is upstream of the transposon and affected by the autoinducers. Due to their slow growth and recalcitrance to genetic manipulation, the transformation of mycobacteria is extremely difficult compared to other bacterial species. Here, we present studies on a shuttle phasmid that utilizes phage transduction of the Himar1 transposon to insert reporters into the rapid-growing mycobacterium, *Mycobacterium smegmatis*. Once validated, this method can then be applied to the slow growing and pathogenic *Mycobacterium tuberculosis*.

[1]Department of Microbial Pathogenesis and Immunology, Texas A&M School of Medicine

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15. Polarizing Macrophages Towards an Anti-Inflammatory (M2) Phenotype Attenuates Blood Pressure and Inflammation in Mice with Salt-Sensitive Hypertension

Robert Montalvo (Texas A&M University-Corpus Christi)
School of Medicine Summer Undergraduate Research Program
Research Advisors: Brett Mitchell

Hypertension (HTN) affects about half of the U.S. population and leads to end organ damage. We recently reported that HTN is associated with testicular inflammation, inflammation-associated lymphangiogenesis, and dysfunction. However, it is unclear whether the increase in pro-inflammatory (M1) macrophages in the testes causes reproductive dysfunction. We hypothesized that polarizing macrophages towards an anti-inflammatory (M2) phenotype will reduce testicular inflammation and damage. Male mice of 10–14 weeks of age were made hypertensive by providing nitro-L-arginine methyl ester hydrochloride (L-NAME; 0.5 mg/ml), in the drinking water for 2 weeks, followed by a 2-week washout period, and a subsequent 3-week high-salt diet (SSHTN). Another group received AVE0991 (0.58 nmol/g) through daily i.p. injections during the last 3-week highsalt diet (AVE). Control mice received a normal diet and tap water ad libitum. We observed a significant decrease in systolic blood pressure in the AVE group when compared to the SSHTN group. Flow cytometric analysis showed a significant decrease in M2 macrophages in the SSHTN group when compared to the control group, whereas M2 macrophages were increased in the AVE treated mice compared to the SSHTN group. Gene expression analysis revealed a significant reduction in the inflammation and inflammation-associated lymphangiogenesis in the testes of AVE mice when compared to SSHTN mice. In addition, testicular function was also improved in AVE treated mice. Together, these results support our hypothesis and

could be a basis for the development of therapeutic strategies to improve the reproductive health of male patients with SSHTN.

16. Targeting Adipose Tissue Volume Expansion in Lymphedema

Sydney Criscitiello (Case Western Reserve University)
School of Medicine Summer Undergraduate Research Program
Research Advisor: Joseph Rutkowski

Approximately 20-30% of breast cancer survivors in the United States will develop lymphedema in their lifetimes. Lymphedema is a debilitating condition that results from disrupted lymphatic transport resulting from lymph node dissection during cancer surgery. Due to lymphatic insufficiency, the patient's arm exhibits chronic swelling and is prone to increased inflammation and infection; pain and quality of life are also significant clinical problems. One aspect of the tissue swelling is expansion of adipose tissue (fat) in the affected tissue. Here, we wanted to target adipose tissue reduction and health specifically to remediate limb volume. We utilized a well-established model of lymphedema in the mouse tail by making a circumferential incision that severs all dermal lymphatics while preserving the blood vasculature and underlying tendons of the mouse tail. First, we utilized "AdipoChaser" mice to genetically pulse label fat cells to determine if adipose expansion occurs due to increased fat cell number or increased fat cell size. Four weeks post-surgery tail samples were collected and immunolabeled for the genetic tag to define adipose hyperplasia versus hypertrophy. Second, we then utilized a pharmacological approach to either (a) improve adipose fatty acid oxidation with the PPARa agonist fenofibrate or (b) improve adipose health with the PPARg agonist rosiglitazone. Fenofibrate had a significant effect on reducing overall lymphedema swelling and significantly reduced fat cell size while rosiglitazone had no impact on lymphedema volume. Pharmacologically-targeting adipose tissue could therefore be a potential therapy to reduce lymphedema-associated tissue mass in breast cancer patients.

17. High Frequency dMSN Stimulation Triggers Local Dopamine Release Via Cholinergic Interneurons

Harish Sontam (Texas A&M University)
School of Medicine Summer Undergraduate Research Program
Research Advisor: Jun Wang

The neural mechanisms underlying repetitive behaviors in the absence of a reward are not well understood. In rodent-based behavioral studies, It has been shown that stimulation of striatal direct pathway medium spiny neurons (dMSNs) is reinforcing; however, the reason why the animal chooses to progressively self-administer dMSN stimulation is unclear. This study is aimed to investigate whether the dMSN self-stimulation behavior, which is a reward free behavior, utilizes the dopaminergic system. We hypothesize that dMSN stimulation can trigger local dopamine release by the transient excitation of cholinergic interneurons. Additionally, we hypothesize that this local dopamine release supports the dMSN self-stimulation behavior. Firstly, we found that D1-Cre rats, infused with AAV-FLEX-Chrimson in the dorsomedial striatum exhibited robust optogenetic self-stimulation of striatal dMSNs. Slice

recordings from D1-Cre;Ai32;ChAT-eGFP mice revealed that burst stimulation of dMSNs causes a picrotoxin-dependent pause rebound firing in cholinergic interneurons. Additionally, dMSN stimulation also caused a substance P dependent increase in cholinergic interneuron activity. Separately, inChAT-Cre;Ai32 mice, we found that excitation of cholinergic interneurons leads to local dopamine (DA) release via nicotinic receptors on the dopaminergic terminals. This suggests that dMSN excitation can trigger local dopamine release via potentiating the activity of cholinergic interneurons, which facilitates the dMSN self-stimulation behavior.

18. Novel Protein HNRNP F Plays a Critical Role in Regulating Antimicrobial Response in Macrophages

Nina Castaneda (The University of Texas at Austin)
School of Medicine Summer Undergraduate Research Program
Research Advisor: Kristin Patrick

Macrophages are professional innate immune cells that are able to respond to pathogen associated molecular patterns (PAMPs) and damage associated molecular patterns (DAMPs). There are many factors involved in regulating antimicrobial responses in macrophages. Of the modified splicing regulatory proteins that belong to the SR and hnRNP families, heterogeneous ribonucleoprotein F (hnRNP F) has shown an increase in phospho-peptide (pSer104) during bacterial infection of macrophages. We believe that the lack of hnRNP F in macrophages leads to the inability to upregulate pro-inflammatory cytokines and interferon stimulated gene (ISG) during lipopolysaccharide stimulation (LPS). LPS represents a gram negative bacteria that triggers the transmembrane protein, toll-like receptor 4 (TLR4) which is responsible for the production of cytokines. To further explore the relationship between this phenotype and antimicrobial responses during macrophage activation, hnRNP F knockdown (KD) RAW 264.7 macrophage-like cell lines and human U937 cell lines were stimulated with various innate immune agonists. The pro-inflammatory cytokines and ISGs were measured at both transcript and protein levels at 0, 2, 4, 6, and 8 time points hours post LPS-stimulation. This was compared to scramble control cell lines (SCR). After characterizing the cell lines, the findings suggest how innate immune response is affected by the absence of hnRNP F. NC was supported by a Fellowship from Texas A&M School of Medicine.

19. Female and Male Self Administration of the Cannabanoid CB1 Receptor Agonist WIN 55,212-2 in Mice

Mallory McDaniel (Harvard College)
School of Medicine Summer Undergraduate Research Program
Research Advisor: Laura Smith

We have established a baseline mouse model of cannabinoid addiction using both male and female mice, as well as using the CB1 receptor agonist WIN 55, 212-2. While this model has previously been established in male mice, the use of female mice is a novel method. This model allows testing of similar cannabinoid agonists in order to evaluate addictive properties. Male and female C57BL/6J mice were surgically catheterized and trained to intravenously self-administer (IVSA) either WIN 55, 212-2 or a

vehicle solution. Each mouse completed a ten-day acquisition period, where comparative frequencies of responses were recorded. Persistence of drug-seeking behavior was then measured during an extinction period. During a progressive ratio program, motivation to receive WIN 55, 212-2 was measured. During each of these programs, significant differences were found between mice receiving WIN 55, 212-2 and vehicle, as well as differences between sexes of mice. Future directions for this project including using this model to investigate addictive properties of experimental compounds that also bind to the CB1 receptor, in the hopes of developing a non-opioid method of relieving pain.

This work was supported by NIH grant #1UG3NS128439-01. MM was supported by Texas A&M School of Medicine.

20. Impairments of Lymphatic Vessel Structure and Function are associated with Duchenne Muscular Dystrophy

Ilse Paredes Mares (West Texas A&M University)
School of Medicine Summer Undergraduate Research Program
Research Advisor: Mariappan Muthuchamy

Duchenne Muscular Dystrophy (DMD) is a genetic disease characterized by progressive muscle degeneration due to lack of functioning dystrophin protein; DMD affects 1 in 5000 boys worldwide. The continued muscle cell damage distinctive of DMD leads to chronic inflammatory pathogenesis because of prolonged exposure to intracellular leakage after muscle contraction. Impairment of the normal lymphatic vessel functions, including the transport of immune cells as part of immune responses, is correlated with the pathogenesis of inflammatory diseases. The importance of lymphatics in the inflammation typical of DMD is least explored. We analyzed the structure and function of lymphatics in a D2.mdx mouse model. Quantitative RT/PCR analyses showed an increase in inflammation markers and in lymphatic markers in the 8 weeks old D2.mdx mice when compared to DBA controls. Micro-lymphangiography and isolated lymphatic vessel studies exhibited a delay in lymph transport and found that lymphatic function was impaired in the D2.mdx mice. Immunohistochemistry staining of skeletal muscles further revealed an increase in Lyve1+ lymphatic vessels, demonstrating inflammatory lymphangiogenesis present in DMD. Thus, our data show first evidence that lymphatic structure and function are compromised in DMD animals.

21. Holistic Nursing in Oncology Settings

Morgan Langlais (Texas A&M University)
School of Nursing Honors Program
Research Advisors: Jodie Gary, Muna Bhattarai

Holistic nursing is a very interesting type of nursing that has shown immense benefits in smaller settings. I wanted to look indepthly at the full extent of how the holistic nursing approach affected patients in the oncology setting. The studies included were; qualitative research and quasi experimentals. In one study the author defines holistic nursing as caring for the whole person. In another study, it found holistic nursing as a non-invasive intervention which allows cancer patients to relax and improve the therapeutic

effects of their treatment. I also found a study that compared holistic nursing and routine nursing interventions on gastric cancer patients. The study concluded Holistic nursing can improve the psychology of patients and improve their self-nursing ability and quality of life. Similarly Wen, evaluated the influences of narrative nursing and holistic nursing combined for gastric cancer patients they found systematic holistic nursing plus narrative nursing enhances quality of life . The next three studies, I focused more on end of life care, communications around difficult topics in cancer care, and how oncology nursing differs compared to other types of nursing. In conclusion, by looking at these studies I have concluded that holistic nursing care in the oncology setting is vital to patient outlook and treatment. It helps the patients endure the intensity that cancer treatment entails. Having a nurse that cares for your mind, body, and spirit can help during times when the outlook looks bleak and the patient needs someone to lean on and comfort them.

22. Water Quality and the Detrimental Effects on Health

Sarah Green (Texas A&M University)
School of Nursing Honors Program
Research Advisor: Arica Brandford

Background: Cancer ranks the second highest cause of death in the United States. One factor that contributes to this increase in cancer cases is carcinogenic substances in drinking water. Such chemicals include disinfectant byproducts (DBPs), halo acetic acids (HAAs), and heavy metals (HMs). They are associated with cancer occurrence, organ damage, and death when consumed in large amounts. These substances are present throughout the food chain, which heightens the chance of human exposure.

Methods: The Environmental Working Group (EWG) conducted studies to measure the levels of HAAs, HMs, and DBPs in water throughout the US. In addition, they established their own safety guidelines that were tested and compared to their findings of carcinogens in tap water. The EWG collected tap water samples from over 50,000 water systems in the US to provide the public with accurate information on chemicals present in their water.

Results: At the College Station-Wellborn Special Utility District, the EWG found 34 contaminants in the drinking water harmful to human consumption. They compared these rates to their EWG Health Guidelines and found chemicals like arsenic, bromochloroacetic acid, haloacetic acids, nitrate, and 30 other chemicals.

Conclusion: Due to these findings, it's important to implement water quality standards that ensure safe consumption for humans. The EWG's valuable information shows how carcinogens found in tap water can lead to cancer, including renal, liver, and hematologic. By reducing consumption of contaminated tap water and educating the public about its carcinogenic properties, we can potentially lower the risk of associated cancers.

23. A Review on Sleep in Critical Care Settings

Elizabeth Newport (Texas A&M University)
School of Nursing Honors Program
Research Advisor: Jodie Gary

Sleep is an essential part of human health and well-being. In times of stress and sickness, sleep becomes an even greater determinant of comprehensive health. For critically-ill patients in Intensive Care Units (ICU), sleep and restorative rest are vital to positive patient outcomes, and contribute to the prevention of ICU psychosis. This literature review provides a summary of current interventions at the forefront of sleep promotion in critical care settings. Primarily focusing on non-pharmacological methods, some interventions include the use of eye masks, earplugs, music and aroma therapies, nursing education, the minimization of nursing care, and prophylactic melatonin.

24. Examining the Role of the School Nurse for Teen Pregnancy Prevention and Support in Texas Schools

Madeline Feen (Texas A&M University)
School of Nursing Honors Program
Research Advisor: Robin Page

Teen pregnancy is a nationwide issue, with Texas having the ninth highest teenage birth rate in the country, according to the CDC. Teenage pregnancy has high social and financial costs, and contributes to poor health outcomes for both mother and child. Some of these health outcomes include increased risk of preeclampsia, infection, and gestational diabetes for the mother. The children of teen parents are more likely to become teen parents themselves, creating a cycle. Additionally, teen mothers are less likely to graduate from high school, which puts them at a disadvantage educationally and economically. Teenagers currently in high school typically have access to a school nurse, which could be a potential support and source of information and care for them. This literature review aims to identify some best practices for school nurses to prevent teen pregnancy, as well as support teen mothers and promote graduation.

25. Comprehensive AI Model for Rat Pain Detection

Sushruti Vasireddy (University of Texas at Austin)
School of Dentistry Summer Undergraduate Research Program
Research Advisors: Phillip Kramer, Mikhail Umorin

Rats are significantly used in scientific research to understand the mechanisms of pain. Failing to recognize points of pain in a rat can lead to the presence of confounding variables, which can affect the validity and reliability of the results. However, depicting pain in rats with manpower is arduous as it requires the consistent analysis of various behaviors that indicate pain. Through this process, accurate pain detection might be debilitated because pivotal behaviors that indicate a certain course of action are missing. The subjectivity of pain detection with human observation can make an AI Model much

more standardized and objective in serving as a pain assessment to ensure there is a consistent source of pain detection amongst various studies. Throughout this research study, various rats were injected with two pain inducing drugs, CFA and formalin. Then, videos were created to gain a visual gauge of the behaviors the rats display. My contribution to this project was then to note common behaviors that occur amongst each rat with and without the drug, such as rearing, face wiping, and licking. By doing this initial analysis, the data points collected are going to be eventually spliced into video clips, which will be fed into a neural network to develop an AI model that has the capability of detecting these behaviors on its own. The model will be further trained to visually recognize pain symptoms that will be fed into it via the same data analysis done for regular behaviors.

26. Masking White-Spot-Lesions Color Using ICON, Curodont Repair Plus, and MI-Paste Plus

Yasaswi Gogineni (Texas A&M University)
School of Dentistry Summer Undergraduate Research Program
Research Advisor: Amal Noureldin

A white spot lesion (WSL) is a subsurface enamel porosity due to demineralization, manifested clinically as a milky white opacity, located on smooth surfaces. They are non-cavitated caries that are a result of the imbalance of mineralization. The lower mineral content under the enamel changes the light reflectivity of the normally translucent enamel and the appearance of these lesions can vary from no perceptible change in color to white spots on the enamel. As the demineralization starts and progresses, the inter-crystalline space fills with air and water, scattering more light than in sound enamel, resulting in visual enamel opacity.

Before cavitation of the enamel takes place, remineralizing therapeutic agents can be used to remineralize or reverse the caries process. However, even after remineralization has occurred and the caries process has been arrested, the unsightly white spots often persist leaving a white scar. As such, even though there may be a decrease in the size of the lesion after remineralization treatment, the lesion may remain clinically visible.

The purpose of this in vitro study is to assess and compare the ability of three current white spot lesion minimally invasive treatment modalities; Self-Assembling Peptide (Curodont Repair Fluoride Plus, vVARDIS Professional) (CRF), Resin Infiltration (ICON, DMG, Hamburg, Germany), and MI Paste Plus (GC America); in improving light reflectivity and the appearance of artificially in-vitro created white spot lesions using spectrophotometric analysis.

27. Assessment of Changes in Bone Health as a Result of XBP1 Overexpression

Mariana Paz (Texas A&M University)
School of Dentistry Summer Undergraduate Research Program
Research Advisor: Hongjiao Ouyang

Osteoporosis, a common bone disease in which bone density and bone mass decreases, is often associated with the aging population. As advanced age is a prominent risk factor for osteoporosis, premature aging influenced by cell senescence is significant in causing a reduction of bone health.

Senescence is characterized by cell cycle arrest, and is the cell's attempt at protecting against DNA damage. Previous studies have suggested that accumulation of DNA damage advances bone aging through adverse effects on osteoblasts and osteoclasts. Our study focuses on XBP1, a gene involved in the IRE1α-XBP1 pathway. The IRE1α-XBP1 pathway is one of three signaling pathways associated with activating the unfolded protein response (UPR). The UPR responds to a build-up of unfolded proteins, allowing for homeostasis and normal protein folding to resume. We used doxycycline to induce XBP1 overexpression in mice. Two male pairs and two female pairs were used, with each pair having an XBP1 overexpressed mouse and a control group. Our results show that mice with XBP1 overexpression have an increase in bone volume fraction (BV/TV), when compared to their control counterparts. This suggests that an overexpression of XBP1 in mice enhances bone formation, and could potentially be used to improve bone health in the aging population.

28. The Long-term Effects of High Fat Diet on the Transdifferentiation of Condylar Chondrocytes

Stephanie Naguib (The University of Alabama)
School of Dentistry Summer Undergraduate Research Program
Research Advisor: Yan Jing

Obesity is a severe health problem in children, afflicting several organ systems including bone. However, the role of obesity on bone homeostasis and bone cell function in children has not been studied in detail. The aim of this study was to investigate the effect of high fat diet on the transdifferentiation of condylar chondrocytes during the development of temporomandibular joint. 3-week-old male Aggrecan-CreERT2; R26RtdTomato; 2.3Col1a1-GFP compound mice were randomly divided into three groups, fed with normal fat food (10% of energy as fat), moderate high fat food (45% of energy as fat), or high fat food (65% of energy as fat). One time tamoxifen injections were given to mice at 3 weeks. Radiographic and histomorphometric analyses were performed. The uCT results showed a dramatic reduction in the size of the condyle head. Moreover, the bone quality decreased along with the increase of fat in diet, including lower BV/TV ratio, less and thinner trabecular bone but larger trabecular space. Cell lineage tracing data revealed numerous chondrocyte-derived bone cells in the condylar process in normal diet mice, whereas few chondrocyte-derived bone cells were found in 45% or 65% fat food group. According to the previous publication and the preliminary data from the present study, we conclude that a high fat diet has a significant effect on TMJ condyle via the regulation of chondrocyte transdifferentiation.

29. Evaluation of Flexible Electrodes/Substrates for Wearable and Lab-on-a-Palm Electrochemical Platforms

Aryan Patel (Texas A&M University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisors: Hatice Koydemir, Majed Althumayri

This study presents the influence of substrate material and thickness on the performance of electrodes fabricated using screen-printing and laser-engraving techniques targeted explicitly for low-cost wearable and lab-on-palm devices. Carbon and silver/silver chloride were used to print working, counter, and

reference electrodes on polyethylene terephthalate (PET) of varying thicknesses (0.04", 0.01", and 0.001"), stretchable polyurethane film, and polyimide layers (0.003" and 0.0003"). Resistance measurements, taken at various angles (0°, 45°, 90°, and 135°), showed a significant change in resistance values with alterations in substrate thickness and material, indicating that these factors considerably influence electrode performance. The preliminary findings reveal an increase in resistance based on both the substrate material and thinner thicknesses, with resistance values ranging from 492 ohms for the 0.04" PET to 1428 ohms for the 0.01" PET. This research underscores the importance of substrate selection in designing and developing wearable devices, aiming to optimize electrode performance and functionality in wearable electronics. As a next step, durability and cost-effectiveness will be incorporated further to refine the electrode design and material selection process, aiming to minimize production costs.

30. Polyelectrolyte Complexation for Wearable Medical Adhesives

Andrei Proca (Texas A&M University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisors: Jaime Grunlan, Maya Montemayor

The demand for wearable adhesives has experienced an increase over recent years due to the expansion of wearable medical devices such as continuous glucose monitors. However, current market adhesives often are expensive, do not operate efficiently in the presence of moisture and ionic compounds (sweat), and can irritate the skin due to movement and chemical interactions. Previous studies suggest that coacervates, a type of polyelectrolyte complex, hold promise as a potential substitute for current medical adhesives. Coacervates exhibit non-toxic properties and increase peel strength when exposed to ionic compounds. This study aims to identify a coacervate formulation with a strength similar to current market bioadhesives. To test this, we created lap joints on PET, coating them with a specific thickness, and bonded them together using varying applied weights. Some samples underwent a curing process involving heat and a 1M citric acid buffer cure. Tensile tests were performed on these samples to find the maximum shear stress strength before deformation. The coacervates used were: PEI/PAA, PEI/PAA/KAO, and PEI/PSP.

31. Automated Synthesis System of SERS-Active Nanoparticles

Jacob Quintero (Texas A&M University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisors: Samuel Mabbott, Nhu Vu

This project aims to develop an automated synthesis system for Surface-Enhanced Raman Scattering (SERS)-active nanoparticles. As part of the broader effort, the focus of this study is to optimize the data analysis phase, an essential but often time-intensive element in the overall synthesis process. By leveraging advancements in machine learning and data science, we propose novel methodologies to streamline the analysis of complex particle formation data sets. This involves designing programs to improve pattern recognition in spectral data and developing automated systems to expedite quantitative analysis of nanoparticle characteristics. Our methods are designed to efficiently analyze

numerous variables involved in nanoparticle synthesis such as size, shape, aggregation, and surface chemistry. The targeted outcome is to significantly reduce the computational burden on researchers, allowing for more time to be spent on optimizing production and refining the properties of the SERS-active nanoparticles. This work thus contributes to a two-pronged innovation: a) improving the efficiency of the automated synthesis system and b) refining data analysis techniques, both of which aim to accelerate the development of more efficient and cost-effective SERS-active nanoparticles.

32. How Does Employment Impact App Usage for the Self-management of Diabetes?

Taylor Brinson (Georgia State University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisor: Sherecce Fields, Rachel Smallman

Diabetes is an escalating and chronic global health problem that affects over 425 million people (Nazarov et al., 2019). There are 62% of people with diabetes in the workplace between the ages of 16 and 44 and 29% between the ages of 45 and 64 (Detaille et al., 2005). The increasing prevalence of this disease implies that more studies should focus on how the work environment affects diabetes self-management (Weijman et al., 2004). Multiple activities are needed to achieve glycemic control, such as monitoring blood glucose levels, medicating, monitoring food intake, and exercising (Detaille et.al., 2005). Time is limited, and for people with diabetes, it creates another barrier to maintain their health. For example, planning meals, thinking about how much insulin to take, and preparing for any emergencies are all very time-consuming. These tasks make it difficult and stressful for people in a workplace environment where it is less flexible to respond to non-work demands. The purpose of this study is to focus on how people's job conditions and work schedules influence their blood glucose management and the level of support they receive from their workplace. Ultimately, implications for future research and development of useful diabetes management applications for people in the workplace will be enlightened.

33. Anisotropic Conductive Self-Rolling Multilayer Hydrogels for Stimulation and Recording

DangNghi Bui
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisors: Limei Tian, Saifur Rahman

Anisotropic conductive self-rolling multilayer hydrogels represent an innovative class of materials with immense potential for applications in stimulation and recording. This abstract explores the unique properties and capabilities of these hydrogels, highlighting their ability to enable targeted electrical stimulation and precise recording in diverse biological and biomedical contexts.

Hydrogels, three-dimensional networks of hydrophilic polymers, offer excellent biocompatibility and tunable mechanical properties, making them ideal candidates for biomedical applications. By introducing anisotropic conductive properties and self-rolling behavior into multilayer hydrogel structures, researchers have unlocked new possibilities for stimulating and recording electrical activity within biological systems.

34. Flexible Epidermal Electronic Interface for a Cuffless Blood Pressure Monitor

Joanna Hernandez (Texas A&M University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisor: Limei Tian

Monitoring blood pressure (BP) is a common clinical practice that helps diagnose, prognose, and manage cardiovascular disease. Conventional inflatable cuff blood pressure monitors have time limitations and can be uncomfortable. A continuous cuffless blood pressure monitor would allow long term BP monitoring which would help better diagnose and manage cardiovascular disease. Furthermore, wearable sensors are necessary for this type of monitoring. Previous research in this lab developed soft add-on electrodes that essentially eliminated a wire connection which removed mechanical mismatch between the skin and the electrode, increased SNR of bioimpedance better than standard gel electrodes, and monitored continuously the heart rate and quantified systolic BP (SBP) and diastolic BP (DBP) of a male subject. The foam that they were made from needs pressure to achieve high SNR thus eliminating the foam and designing a flat stretchable adhesive structure could achieve eliminating the pressure needed making it simpler and would also allow more wearability to the user without excessive mechanical deformation. A thin film substrate was designed to substitute the bulkiness of the soft-add on electrodes and pressure with silver and poly (3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) to record bioimpedance. This resulted in an overall better bioimpedance signal without pressure, decreased production time, and had better contact to the skin. This will help for the overall goal of the medical device and for underserved populations to be able to wear and monitor their health.

35. Investigation of Nondegradable Bovine Serum Albumin Hydrogels

Rebekah Lindblade (Louisiana Tech University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisor: Mike McShane

Phosphorescence lifetime-based sensing instruments are being developed for minimally invasive, continuous analyte monitoring for chronic diseases. The development of these instruments necessitates a bio-compatible, nondegradable material to function as the supporting framework for the sensors. The current material used is PEGDA, which is bio-compatible and nondegradable. However, this option is also costly. Creation of a nondegradable Bovine Serum Albumin (BSA)-based hydrogel would alleviate this issue as BSA is inexpensive and easy to source. Approaches taken to making a nondegradable gel included thermal denaturation, UV-crosslinking, oxidative refolding, and multiple crosslinkers. The hydrogels from the different methods were then compared by testing the rheological and mechanical properties, the optical properties, and the degradability.

36. Automated Synthesis System of Sers-active nanoparticles

Bolutife Idowu (Texas A&M University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisor: Nhu Vu

This study presents an automated synthesis system for the production of surface-enhanced Raman scattering (SERS)-active nanoparticles. SERS is a powerful analytical technique that utilizes the unique optical properties of nanoparticles to enhance the Raman scattering signal of molecules adsorbed on their surface. However, the synthesis of SERS-active nanoparticles typically involves complex and time-consuming procedures. To address this challenge, we developed an automated system that streamlines the synthesis process, enabling efficient and reproducible production of SERS-active nanoparticles. The system incorporates precise control over reaction parameters, such as temperature, reaction time, and reagent concentrations, ensuring consistent and optimized nanoparticle synthesis. Additionally, the system incorporates real-time monitoring and feedback mechanisms to enhance process control and product quality. Experimental results demonstrate that the automated synthesis system produces SERS-active nanoparticles with enhanced sensitivity and stability, enabling their application in various fields, including chemical sensing, bioimaging, and environmental monitoring. This automated synthesis system offers a promising approach to expedite the production of SERS-active nanoparticles and facilitate their widespread use in analytical and research settings.

37. Evaluating Effects of Physical Activity and Nutrition on Individualized Postprandial Glucose Response (PPGR) through Gradient Boosting and Linear Mixed Effects

Namila Rahmani (University of Texas at Austin)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisors: Bobak Mortazavi, Sicong Huang

Maintaining glycemic control is a key treatment matter for diabetic patients, often addressed through nutrition and diet monitoring. However, generalized nutritional recommendations are often inaccurate as the same meal produces varying postprandial glucose responses (PPGR) in different individuals. For this reason, defining the relationships between PPGR, nutrition, and other factors that impact glucose responses could significantly improve diet monitoring technology and glycemic control. Physical activity has been linked to reduced glucose responses, so we aim to enhance machine learning models to better predict PPGR and macronutrients through expansion of feature selection. Our group has previous work on the relationship between PPGR and metabolic equivalent of tasks (METs), but meals are controlled and only METs area and PPGR peak height are considered. This project extends that field to include variable dinner meals as well as activity data such as heartrate and active minutes, personal data, and other PPGR metrics to see how these affect glucose prediction. The utilized data is from a clinical study where participants consumed set breakfasts and lunches with varying dinners for 10 days while wearing two types of CGM sensors (Dexcom and Libre) as well as a wearable activity sensor (Fitbit Sense). Through gradient boosting and linear mixed effects, this project models the relationships between blood glucose, physical activity, individual data, and macronutrient content. Both forward and backward predictions of PPGR and macronutrients were tested, finding an RMSRE of 0.187 for predicting peakheight and 0.15 for predicting PPGR area with inclusion of variable dinner meals.

38. Predicting Individualized Postprandial Glycemic Response through Gut Microbiome Profile and Meal Nutrition

Lucy Yang (University of Rochester)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisors: Bobak Mortazavi, Sicong Huang

The development of metabolic diseases and type 2 diabetes in adults is an increasing issue in the US, and even more for underserved populations. While diet monitoring is a common tactic in treating/preventing diabetes, traditional diet methods rely on one-size-fits-all nutrition advising, and doesn't account for how different peoples' blood glucose levels react to the same foods. To this end, the final goal of this research is to build inverse metabolic models (IMM) that can predict meal macronutrient content from individual post prandial glucose responses (PPGR), and identify potential contributing personalization measurements. Previous studies reviewed how post-meal activity levels, anthropometric features, and metabolic characteristics explain individual variance in PPGRs. Personal bio-vitals are an important, diverse feature set that have not been used in IMMs; its composition differs significantly between individuals, making it imperative to consider for individualized recommendations. This work considers the integration of processed patient data via Viome gut microbiome test kits to a study of participants eating standardized meals while wearing continuous glucose monitors for 10 days. We consider a forward linear mixed effects model approach to identify the influence of individual elements in a large group of mixed effects. This model is constructed with PPGR measurements, meal macronutrient content, participant HbA1c (percentage measure of average blood sugar levels), and gut composition. Preliminary results suggest that the presence of different bacteria in the gut could signify changes in the blood glucose levels. These features will be selected for use in XGBoost-trained IMMs to predict meal macronutrient composition.

39. Investigating the Design of a Diabetes Self-management Mobile Health Application

Abby Somich (Texas A&M University)
Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) REU
Research Advisor: Farzan Sasangohar

As of 2023, diabetes affects over thirty-seven million adults in the US. [1]. Self-management of diabetes is essential for favorable health outcomes. Mobile health (mHealth) has shown promise in providing a platform for empowering self-management. This study aims to systematically analyze mHealth apps for diabetes self-management using the Mobile Application Rating Scale (MARS) and provide design guidelines for such apps, including GlucoseCoach, which was recently developed by the Applied Cognitive Ergonomics lab. MARS is a validated tool for app quality appraisal and includes nineteen items across four categories (engagement, functionality, aesthetics, and information). The Apple App Store and Google Play Store were searched using diabetes-related terminology. The twenty apps with the greatest number of features from a developed list were chosen and further reviewed using the MARS method. Each category in MARS received an average score (1 [poor] to 5 [excellent]), and the average of the category ratings was calculated as the app quality score. Apps received moderate quality scores (M = 3.632, SD = 0.307) with Health2Sync receiving the highest quality score of 4.101. Apps scored best in the functionality category (M = 3.950, SD = 0.477), followed by the information category (M = 3.787, SD =

0.410), aesthetics category (M = 3.600, SD = 0.617), and engagement category (M = 3.190, SD = 0.578). Shortcomings in the information and engagement categories may be improved upon by adding interactive and entertaining elements and increasing the quality and quantity of educational information in the apps.

[1] “What is Diabetes?,” Centers for Disease Control and Prevention, Apr. 24, 2023. https://www.cdc.gov/diabetes/basics/diabetes.html (accessed Jun. 27, 2023).

40. Rhamnose Inducible R388-based Type IV Secretion System can Mediate Bacterial Antagonism

Taylor Aaron (Prairie View A&M University)
Independent Research Project
Research Advisor: Xujen Zhu

Conjugative plasmids are extrachromosomal DNA molecules that can confer special traits to bacteria. The most notorious being antibiotic resistance. The Zhu lab found that conjugative plasmids like RP4 and R388 possess an inherent antimicrobial trait that is amplified when the plasmid’s ability to transfer DNA is stripped.A current problem with these systems is that they are constitutively expressing an indiscriminate antimicrobial. As such, placing this antimicrobial under more strict genetic control is a necessity. Using the antimicrobial type IV secretion system isolated from plasmid R388, our goal is to modify it by incorporating genetic switches that would turn on the antimicrobial when in the presence of an inducer, allowing for more precise control of the antimicrobial.

45. Novel Techniques for Realigning a Stimulated Brillouin Microscope

Jack Lee (Rice University)
Undergraduate Summer Research Grant Program (USRG)
Research Advisor: Vladislav Yakovlev, Christopher Marble

Brillouin scattering is an imaging technique used to assess the mechanical properties of materials by detecting light scattering off of acoustic waves in the material. There is substantial interest in using this noninvasive technique to find the borders of cancerous tissues and detect Alzherimer’s plaque formation in the brain by quantifying the stiffness of tissues. In a stimulated Brillouin scattering microscope, two laser beams must be precisely overlapped in the sample to generate Brillouin scattering, requiring a labor-intensive alignment process. Two techniques are developed to more efficiently realign a pre-built, misaligned Brillouin microscope. The first technique uses a lightweight neural network to autonomously search for one of the two laser foci and align a pinhole to it. The neural network is trained on a procedurally generated dataset and is able to be run on an desktop computer. The second technique combines a smartphone augmented reality system with an inexpensive web camera to project the invisible infrared laser as a false color image. A laser operator can visualize the laser and environment simultaneously using a VR-headset which covers the eyes preventing exposure to the laser while in use. Remote viewing using a camera on the headset allows an operator to visualize the laser from the operator’s point of view unlike other camera alignment systems. This technology

represents the first-ever documented demonstration of augmented-reality aided 360 degree remote viewing applied to laser physics and engineering. Both techniques represent new resource-inexpensive, scalable methods to more efficiently realign complex optical systems.

46. Fabrication of Three-Dimensional Chitosan-Gelatin Scaffolds for Studying Viral Infections

Timothy Stout (Texas A&M University)
Undergraduate Summer Research Grant Program (USRG)
Research Advisors: Feng Zhao, Te-An Chen

Despite the eradication of smallpox, re-emergence remains a serious biothreat. Poxviruses are prevalent in many countries, with current mpox outbreaks and more to be expected. In order to develop vaccines and antiviral treatments, it is crucial to understand how viruses infect host cells and spread throughout the body. The common two-dimensional (2D) cell culture in a petri dish lacks the three-dimensional (3D) extracellular matrix structure present in tissue structures, and the animal model is also costly and does not fully replicate human physiology. To better replicate 3D tissue structures, 3D highly porous scaffolds were fabricated using a freeze-drying method to test the viral infection of cells and 2D membranes were used as controls. The scaffolds were composed of chitosan (poly-1,4-D-glucosamine), which is a partially deacetylated derivative from chitin, and gelatin, a partial derivative of collagen. Chitosan is structurally similar to glycosaminoglycan (GAG), found in mammalian tissue. Being that chitosan and gelatin are similar to GAGs and collagen, the combination highly mimics natural tissue extracellular matrix. The porous, interconnected structures of the chitosan-gelatin (CG) scaffolds are also highly tunable. These porous CG scaffolds offer a better replication of the 3D in vivo environment of natural tissue, which is a much-needed method in studying viral infections.

47. The Structural and Functional Maturation of Human Induced Pluripotent Cardiomyocyte Stem Cells (hiPSC-CMs) on Cardiac-Specific Extracellular Matrix (ECM) Scaffolds

Brandon Zhao (Texas A&M University)
Undergraduate Summer Research Grant Program (USRG)
Research Advisors: Feng Zhao, Te-An Chen

Cardiac tissue engineering presents extensive opportunities for advancement in cardiovascular disease treatments, especially regenerative medicine approaches like stem cell-based therapies. Specifically, human induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs) have been identified as a foundational element in engineering cardiac tissue with potential for clinical research applications. Unfortunately, applications of hiPSC-CMs are limited by their structural and functional immaturity. Nevertheless, laboratory manipulations of culture environments have been attempted to identify optimal culture practices and conditions. 3D ECM-based scaffolds have been introduced as a systematic biological vessel for attempting stimulation of hiPSC-CM maturation. The extracellular matrix (ECM) culture environment hiPSC-CMs plays an inherent role in cardiac homeostasis and is a highly variable condition. The varying characteristics of ECM considered when constructing the 3D scaffold include cell type (fibroblast derivative), culture time, and alignment pattern. This study focuses on the role of fibroblast cell-types in the fabrication of ECM environments and hiPSC-CM maturation. The aim was to

investigate the degree of maturation achieved by hiPSC-CMs when cultured on cardiac specific ECM. Cardiac fibroblasts were cultured on patterned polydimethylsiloxane (PDMS) hydrogel for construction of an 3D ECM scaffold and hiPSC-CMs were then seeded onto the scaffolding. Finally, various markers of maturation (myofibril assembly, ion/Ca2+ handling, and sarcomere contractility) were measured and evaluated via antibody immunostaining: connexin (CX40, CX43), myosin light chain-2 (MLC2V), cardiac troponin T (CTnT), actin filaments (F-actin), serum amyloid A (SAA), and sarcomere length.

48. Comparison of Feeding Techniques for Rectangular Microstrip Patch Antennas (RMPAs) for Optimal Impedance Matching and Bandwidth

Ryon Oates (Texas A&M University)
Undergraduate Summer Research Grant Program (USRG)
Research Advisor: Linda Katehi

Microstrip patch antennas are the most widely used for their cheap cost, lightweight and ease of use on printed circuit boards (PCB). Correctly matching a patch antenna to a receiver/transmitter is crucial for full power transfer. There are three main types of feeding, using an inset design, a quarter-wave transmission line, or fed by a coaxial cable. Using Advanced Design Software (ADS) this paper analytically compares the different types of feeding methods including the reflection coefficient, gain, bandwidth, polarization and the radiation pattern. This paper shows designs resonant at 2.4 GHz and 5 GHz. The substrate material for all of the designs was made of FR-4 with a dielectric constant of 4.6. The results include the radiation pattern, impedance, VSWR, and reflection coefficient graphs. The paper also includes optimal design conditions such as the optimal height of the substrate and length of the transmission line. There contains figures of the substrate design, layout schematic, 3D radiation patterns, and graphs of all parameters. The results concluded that the coaxial cable-fed antenna had a wider bandwidth and higher gain for both frequencies than the other designs.

49. Utilizing a High Power Broadband Light Source to Measure Throughput and Focal Ratio Degradation Efficiency of Fiber Optics

Noah Siebersma (Texas A&M University)
AggieSTAAR: Aggie Scholarships for Technology Advancements in Astronomical Research
Research Advisors: Jennifer Marshall, Luke Schmidt

Accurately measuring the nights sky is imperative for large, ground based astronomical telescopes; the goal is to subtract the spectrum of the sky background from the target spectrum and reach reliable scientific results in an effective manner. The Fiber Optic Characterization for Unprecedented Sky Subtraction (FOCUSS) project aims to measure the throughput and focal ratio degradation (FRD) in multiple fiber optic cables to inform design choices for future fiber fed astronomical spectrographs. Throughput efficiency measures absorption as a function of wavelength in a fiber optic, while FRD measures the change in angular distribution of the light after passing through a fiber as a function the initial incident angle. The FOCUSS project measures these two parameters between wavelengths of 350nm and 1000nm with an 18nm step size, equal to the band-pass of the monochromator. The desired parameters are acquired between two respective tests, one to measure the FRD where a photo-diode

and CMOS sensor are utilized to align a five axis motor to the most optimal position and step through incident angles and wavelength. While the other measures the throughput efficiency by utilizes two identical CMOS sensors capturing images of the same integrated sphere of light at the same moment in time. The Python programming language is used to interface with the testing hardware and automate the data collection and reduction process. Validation of the experimental setup is almost complete and testing of various fiber optic samples will begin soon.

50. Spectral Reduction with the CTIO Spectrograph

Nathan Sala (Texas A&M University)
AggieSTAAR: Aggie Scholarships for Technology Advancements in Astronomical Research
Research Advisors: Jennifer Marshall, Luke Schmidt

My project goal this summer was to test spectral data from a ~50 year old CTIO Spectrograph, and see if it can still be beneficial for the TAMU Physics Department.

51. Calibration Measurements of Two Scientific Grade Astronomical Cameras

Jared Bull (Texas A&M University)
AggieSTAAR: Aggie Scholarships for Technology Advancements in Astronomical Research
Research Advisors: Ryan Oelkers, Luke Schmidt

We present the results of a calibration analysis of two scientific grade cameras: a SBIG ST-8300 CCD and a APOGEE-ALTA F16M CCD. Analysis of the dark current, linearity, and flat fields suggest the two cameras are within design specifications. Additionally, observations of Landolt standard star fields can be conducted with both cameras in order to determine the photometric zeropoint and a typical color term. These cameras may be used as part of future scientific equipment built by the Munnerlyn Instrumentation Lab.

52. Exploring Stellar Kinematics Near NGC 772's Central Massive Black Hole

Christian Lambert (Texas A&M University)
AggieSTAAR: Aggie Scholarships for Technology Advancements in Astronomical Research
Research Advisor: Jonelle Walsh

In order to better understand the relationship between galaxies and their supermassive black holes (BHs), we are conducting a Large and Long Program (LLP) at the 8-meter Gemini North Telescope in Hawaii. Using the Near-infrared Integral Field Spectrometer (NIFS) assisted by adaptive optics (AO), we are measuring the masses of BHs in nearby (<100 Mpc) galaxies, focusing on galaxies that span a range of sizes and luminosities. The galaxies in our sample are more representative of the local galaxy population than the objects that have been studied previously. In this work, we examine the spiral galaxy NGC 772 and measure stellar kinematics on small scales, comparable to the region where the BH's gravity dominates over the rest of the galaxy. We extract kinematics, parameterized with Gauss-

Hermite (GH) moments, from the K-band CO bandheads using the penalized pixel fitting method and we measure statistical uncertainties using a Monte Carlo procedure. We find that the stars in the galaxy are rotating with radial velocities of +/- 60 km/s and the stellar velocity dispersion decreases from 115 km/s at a projected radius of 1.3" (206 pc) to 90 km/s at the center. The third GH moment (skewness) exhibits an anti-correlation with the velocity, as is expected for rotating, flattened systems. We further vary the manner in which we extract the GH moments in order to assess possible systematics in our kinematic measurements. In the future, we will fit dynamical models to these stellar kinematics to obtain a reliable BH mass measurement.

53. Simultaneous Multi-Color Observations of Planetary Nebulae with ETSI

Nhu Ngoc Ton (Texas A&M University)
AggieSTAAR: Aggie Scholarships for Technology Advancements in Astronomical Research
Research Advisor: Ryan Oelkers

We present simultaneous multi-color observations of 12 planetary nebulae with taken with the Exoplanet Transmission Spectroscopic Imager on the 2.1m Otto Struve Telescope at McDonald Observatory in the Spring of 2023. These photometric observations are similar to low resolution (R~60) spectroscopic data and provide useful information about the emission features of each nebulae. Additionally, these observations map the morphological features of each element within the nebulae in a single 10 minute observation. We analyze the various emission features of each nebulae and describe a pathway for similar observations using ETSI on a larger telescope.

54. Efficacy of Reinforcement Learning on Autonomous Vehicles Using a Coordinate System

Francisco Cavazos (University of Texas at El Paso)
Applied Computational Robotics REU
Research Advisors: Jason O'Kane, Guni Sharon

This paper addresses the problem of training autonomous vehicles in real-world environments using reinforcement learning (RL). Traditional RL training methods are time-consuming, and simulators often suffer from the sim-to-real transfer problem. To overcome these challenges, this study proposes a real-time RL model for autonomous vehicles to navigate a pre-mapped 2-dimensional plane. Equipped with sensors providing information on position, pose, velocity, and steering, the vehicle's objective is to accurately and efficiently navigate a figure 8 track using throttle and steering actions. The RL model learns an optimal policy by observing the environment, taking actions, and receiving rewards based on resulting states. Evaluation metrics include staying within the track boundaries and minimizing time or step counts. By training the RL model in a real-world environment with reduced information, such as using coordinates instead of images, this approach aims to improve training efficiency. The proposed methodology has the potential to enhance the training process, allowing autonomous vehicles to better understand and interact with their environment, collect accurate data, and improve decision-making skills.

55. A Spiral Coverage Path Planning Approach for Surveying Small-Scale Coral Reefs with an Autonomous Underwater Vehicle

Benjamin McCalmon (College of the Holy Cross)
Applied Computational Robotics REU
Research Advisor: Jason O'Kane

We introduce a method that produces coverage paths for small-scale coral reefs. The solution utilizes a highly-maneuverable autonomous underwater vehicle (AUV) without previous knowledge of the reef's size or shape. The solution has two stages. First, using camera and pose estimates from a localization system, the AUV circumnavigates the boundary of the reef, forming a polygonal target which may be convex or non-convex. Second, an algorithm plans a spiral-like path that covers every point in the target space. We present an implementation in a simulated environment and outline the solution's strengths and potential drawbacks.

56. An Experimental Robotic Test Bed for Resolving Observation Grounded Queries

XiMing Zhang (Texas A&M University)
Applied Computational Robotics REU
Research Advisor: Jason O'Kane

This research aims to create a robotic system capable of answering boolean observation-grounded queries using a physical robot operating in a static controlled environment. The robot is a differential drive system with two encoders and a front facing camera. The system's computer stores a weighted directed edge graph encoding known locations and a set of properties related to each location. ArUco markers placed at known locations facilitate localization, an onboard PID controller enables precise movement, and a custom trained object detector identifies objects of interest along with their properties in the environment. The paper evaluates the system's performance based on correctness of the answer and efficiency of the environmental traversal.

57. Radar Dynamic Object and Camera Detection Fusion

Junnan Shimizu (Colby College)
Applied Computational Robotics REU
Research Advisors: Jason O'Kane, Dezhen Song

When implemented independently, both radar and camera sensors have noticeable limitations. Specifically, radar sensors can determine the position and radial velocity of objects, however cannot accurately classify objects. On the other hand, camera sensors can accurately classify objects, however cannot accurately determine the position of objects. Through radar-camera fusion, the strengths of each sensor can fill the weaknesses of the other, allowing for a comprehensive imaging of the environment and its objects and their corresponding characteristics. In this paper, we explore the fusion of radar data collection and processing utilizing a grid-based DBSCAN clustering algorithm to determine the position of dynamic objects and their characteristics (e.g. position, radial velocity, object velocity) and camera

data collection and processing utilizing the YOLOv3 real-time object detection system to determine the class of each object (e.g. vehicles, pedestrians, animals). Through radar-camera fusion, we aim to produce a stream of information that can be valuable within many contexts such as autonomous driving, smart vehicles, and robotics, among others.

58. Developing a Flexible Radar Simulation for Dynamic and Static Object Tracking

Tiare Delgado (Trinity University)
Applied Computational Robotics REU
Research Advisors: Jason O'Kane, Dezhen Song

This project proposes a configurable radar simulator. The purpose of this simulation is to study how the radar system behaves in different scenarios. By configuring the simulation, any number of real world scenarios can be generated and tested. This simulated model tracks both static and dynamic objects in a radar's path, and simulates random points to act as noise. Through this virtual system, radar models can be trained and closely studied before real world testing and implementation.

59. Preliminary Progress Toward Creating An Autonomous Assistant

Nazar Oladepo (Texas A&M University)
Applied Computational Robotics REU
Research Advisors: Jason O'Kane, Dylan Shell

The long-term vision of this project is to enhance the capabilities of the LOOMO Segway robot, transforming it into a competent office assistant. Our approach to creating an office assistant will build upon existing research devoted to robot navigation, human-robot interactions, and Artificial iIntelligence. Our aim is to improve the robot such that it can have a friendly and helpful presence in the workplace. The robot integrates a multitude of sensory inputs and algorithms to amicably interact with humans and navigate effectively in an office environment. These features will require a number of complex subsystems, including speech recognition, speech synthesis, facial & motion detection, object detection, and reliable mapping and navigation abilities.

60. Examination of Reward Functions for Reinforcement Learning Cars

Akhil Kalakota (University of California San Diego)
Applied Computational Robotics REU
Research Advisors: Jason O'Kane, Guni Sharon

Autonomous vehicles have spurred significant research in Reinforcement Learning (RL) to develop efficient control algorithms. This study investigates the effects of various reward functions on the learning performance of RL agents in a simplified autonomous car control task. By analyzing how reward functions influence the learning process, we aim to enhance the effectiveness of RL algorithms for training autonomous vehicles. To accomplish this, we design a track as the real-world learning

environment, enabling the vehicle to acquire driving skills. Within this environment, RL algorithms (DQN) and reward functions train the agent to drive efficiently. The reward function serves as a quantitative measure of desirable behavior, guiding the learning process and enabling the agent to maximize cumulative rewards while achieving its driving objectives on the track. These reward functions encompass a range of factors, such as track adherence, speed optimization, path following, and efficient navigation. By varying the reward functions, we analyze how different learning objectives influence the agents' behavior and overall performance. Extensive experimentation is conducted, collecting and analyzing data on performance metrics, including convergence speed, task completion rate, and overall driving efficiency. This enables us to quantify the effects of each reward function on the learning process and subsequent behavior of the RL agents. By understanding how different reward functions impact learning performance, we can identify the most effective approaches to enhance the driving capabilities of autonomous vehicles. These findings contribute to the advancement of more efficient and safer autonomous driving systems, leading to technological progress in transportation.

61. Radioactive Stacked Foil Analysis for Nuclear Cross-sections

Leonith Rodriguez (The University of Texas at El Paso)
Texas Research Expanding Nuclear Diversity (TREND)
Research Advisors: Sherry Yennello, Jerome Gauthier

A very innovative method for cancer treatment is emerging, known as targeted alpha therapy (TAT). The goal is to target alpha-emitting radionuclides to cancerous tumors without injuring healthy tissue, using targeting vectors. One potential isotope to target carcinogen tumors is terbium-149. This isotope is of particular interest due to its unique property of having both beta (83.3%) and alpha decay (16.7%). This project aims to discover what other isotopes were created during the production of terbium-149 which consisted of a beam of lithium-6 on a natural samarium target at different energies. Some predictions can be made by looking at the chart of nuclides and focusing on the isotopes' half-lives, stabilities, and properties. After a single night of beam, the foils were counted a day after irradiation, using three high-purity germanium (HPGe) detectors. Background, natural samarium foils (with thicknesses of 100 and 250 micrometers), europium-152 source, and gold foils (with a thickness of 5 micrometers) data was collected on the HPGes. To analyze these spectra, the python toolkit called Curie was used to simplify the identification and fitting of the peaks. After calibrating the spectra using the europium-152 source in Curie, the resulting isotopes can be identified. With this data we can conclude that the isotope production of terbium-149 via this method may be possible, but more measurements will need to be performed in order to confirm the optimal production pathway.

62. Producing Radioisotope 99Mo

Njeri Edwards (Prairie View A&M University)
Texas Research Expanding Nuclear Diversity (TREND)
Research Advisors: Aldo Bonasera, Marcia Dias Rodrigues

The present work's purpose is to determine the cross-section of the 99Mo radioisotope produced from the 27Al(100Mo,99Mo)28Al reaction, through the method of inverse kinematic method. Previously, we

successfully obtained 99Mo by conducting the 4He(100Mo,99Mo)28Al reaction. However, analysis of previous experimental data suggests that the observed activities of 99Mo may originate from both the gas and the Al catcher, depending on the trend of activity change with increasing density.

To separate the contributions of gas and Al catcher activities and calculate the accurate cross-section, it was necessary to directly collect data on the 100Mo beam impinging on the Al target, bypassing the 4He gas. The Al target was placed in a Geranium detector, enabling the retrieval of spectra for peak analysis.

The experimental data revealed a pattern of both decreasing and increasing activities for 99Mo, indicating contributions from both the gas and the Al catcher. By isolating the gas activity and utilizing it for cross-section calculations, we aim to achieve a comprehensive understanding of the production process for 99Mo via the 27Al(100Mo,99Mo)28Al reaction using inverse kinematics.

63. Indirect Study of the 7Be(α,γ)11C Reaction

Daniel Rascon Romo (The University of Texas at El Paso)
Texas Research Expanding Nuclear Diversity (TREND)
Research Advisors: Grigory Rogachev

The chemical evolution of Carbon-12 in nature is of great interest due to its importance in the formation of organic compounds. The production of carbon-12 occurs naturally in low metallicity stars through the so-called Hot P-P chain. This process is described by the chain 7Be(α,γ)11C(p,γ)12N(β,ν)12C. However, the reaction rates for this process remain uncertain. In particular, the first reaction of the chain has significant uncertainties at the lowest energies due to the presence of the subthreshold resonance in 11C (3/2+ state at 7.5 MeV) which dominates the α-capture at energies below a few hundred keV. One way to constrain this reaction rate is to apply an indirect method and populate the subthreshold state in 11C using the 7Be(6Li,d)11C α-transfer reaction. We developed a new high-efficiency experimental setup that allows low-energy measurements of the α-transfer reactions to sub-threshold states. This is done using an efficient γ array and a silicon detector placed at zero degrees on the beam axis after the 6Li which is thick enough to absorb the 7Be beam, but still thin enough to allow for transmission of deuteron recoils. Deuterons are measured in coincidence with the γ-rays. The cross-section for the α-transfer reaction measured this way will then be used to determine the α-asymptotic normalization coefficient of the 3/2+ state at 7.5 MeV in 11C, constraining the 7Be(6Li,d)11C reaction cross section at the lowest energies. Developing results in the Monte Carlo simulation of these measurements will be presented to discuss the feasibility of the proposed technique.

64. Is the Signature of Shell Effects in the Giant Dipole Response an Artefact of Experimental Data?

Aaron Salinas (Texas Lutheran University)
Texas Research Expanding Nuclear Diversity (TREND)
Research Advisor: Phillip Adsley

To further understand the complexity of neutron stars, giant dipole reactions of nuclei aid in determining symmetry energy within these compact objects. Neutron-capture cross sections in various cases include nucleosynthesis and nuclear reactors also greatly rely on the nuclear dipole response. Ngwetshemi and Orce have published an evaluation of the nuclear dipole polarizability based on photo absorption data suggesting that there are continuing effects of the nuclear shell model even at high excitations. The IAEA Photonuclear Data Library suggested updates to the dipole strength distributions of the nuclei based on systematic discrepancies in historical photo absorption data. This project is to investigate whether the influence of the shell effects at high excitation energies may be an artifact of the systematic discrepancies or whether it persists despite the revisions to the data. This will be done by using the IAEA Photonuclear Data Library data to generate results that could be compared to Ngwetshemi's and Orce's data.

65. Selective Laser Sintering of Rapid Release Pharmaceutical Printlets

Hailey Bates (Scripps College) and Adithi Chitiprolu (Boston University)
Metrology/Inspection REU
Research Advisor: Mathew Kuttolamadom

Selective Laser Sintering (SLS), a powder bed additive manufacturing process is a novel means to create on demand, custom pharmaceutical pills (printlets) for various ailments. The goal of our project is to investigate the effects of process parameters and the resulting thermal signatures on the performance of rapid release printlet designs; these designs primarily involve unsintered powder within a tablet chamber that break apart in solution to provide a sudden release of drug. For our investigation, a mixture of Carbamazepine (drug), Kollidon SR (polymer) and Ruby red (sheen) was used to produce tablets meant to treat those with bipolar I disorder. The experimental design considered various combinations of laser scan speeds and chamber heights, while maintaining all other parameters constant, besides minimizing variability. During the prints, a thermal sensor captured powder bed surface temperature data which was later correlated with printlet performance, namely dissolution rates and printlet hardness. Altogether this study is expected to drive rapid release printlet designs that will help link the manufacturing process with printlet performance.

66. Determining Stress Patterns in Thin Films using Photoelasticity

Ryan Shipp (Case Western Reserve University)
Metrology/Inspection REU
Research Advisor: Jyhwen Wang, Dan Feng

The manufacturing processes of flexible electronics typically leave stress concentrations in the substrate films. Characterizing the patterns and values of the stresses in these films is important for understanding the material properties of them and the electronics that are built on top of them. Using the photoelastic properties of some such films, it is possible to directly observe these patterns and compute the associated stress values. This project focused on developing software that is able to compute the stress distributions in these films.

67. Enhancing Nanoparticle Detection and Classification in Liquid Media through Color Space Transformation and Fluorescent Imaging

Kyani Jemmotte (Lehigh University)
Metrology/Inspection REU
Research Advisor: Cha Bum Lee

The detection and classification of nanoparticles in liquid media are crucial for various scientific and technological fields. This research project aims to enhance our understanding of nanoparticle detection and classification in liquid media using Color Space Transformation. By converting images from one color representation (such as RGB, HSV, YCbCr, etc) to another, valuable information can be extracted, improving the visibility and distinguishability of nanoparticles in any given medium. The objective is to develop a methodology for effectively identifying, characterizing, and quantifying nanoparticles ranging from 1nm to 100nm in a liquid medium using Color Space Transformation. Nanoparticles will be fabricated using detergent and fluorescent dye, which will be used to increase the visibility of nanoparticles once illuminated. The research will involve a four-step process: Nanoparticle Fabrication, Image Extraction, Color Space Transformation, and Algorithm Development. This research will investigate dish detergent residuals left over on plates in order to explore color space transformations suitable for nanoparticle detection. The findings will contribute to advancing detection models for nanoparticle detection in a range of other liquid media, benefiting larger-scale applications such as biomedical diagnostics for cancer biomarker detection.

68. Modeling and Manipulating Ferromagnetic Microparticles Using Copper Coils

Jacob Frishman (Penn State)
Metrology/Inspection REU
Research Advisor: Cha Bum Lee

The remote control of microparticles using precisely manipulated magnetic fields is used in biomedical sciences and clinical medicine for targeted drug delivery, precision separation, and more. Magnetic transport offers many advantages due to its contactless, adjustable, and biocompatible nature.

However, the precise generation of multiple magnetic fields often requires specialized, expensive equipment and technical expertise. This project proposes a simple, cost-effective alternative by employing a sinusoidal alternating current through a copper coil to generate the necessary magnetic field. The approach is designed to induce controlled oscillations and guide a ferromagnetic magnetite sphere in deionized water to a stable location for analysis. The research aims to solve and numerically simulate the particle trajectory along the axis of the coil to quantify and study the relevant factors affecting magnetic transport. The theoretical findings are then experimentally validated using an impedance analyzer to measure the impedance oscillations resulting from particle movement. Phase space and finite element method analysis indicate that the ability to induce oscillatory motion or trap the particle is possible around the center of the coil but highly dependent on the initial condition, the coil height and radius, and the physical and magnetic properties of the particle to generate enough force to overcome the dominating drag forces of the deionized water.

69. Fracture Toughness of Mixed Mode Bilayer Graphene via Displacement Methods

Trigun Tellakula Chandrashekar (Rutgers University)
U.S. Army Educational Outreach Program (AEOP)
Research Advisor: Mohammad Naraghi

The mechanical properties of graphene such as fracture toughness and strength are prone to changes due to any flaw in the material. The fracture toughness of bilayer graphene is studied and measured here under various conditions. A transmission electron microscope(TEM) grid of bilayer graphene, with cracks purposefully made in the center of the graphene, is stretched under a scanning electron microscope (SEM). As the TEM grids are slowly stretched via displacement, they are monitored constantly to keep track of any changes in the cracks and their propagation. Once finished, the graphene and its crack propagations are computationally simulated under displacement methods and already measured elastic properties. The results have shown that mixed mode bilayer graphene is extremely dependent on the angle of the crack, the size of the crack, the displacement and even buckling. Mode I fracture toughness of graphene has been calculated to be approximately ≈28.06 ± 7.5 MPa√m. Mixed mode fracture toughness has shown to be an average of the values that would be found in pure mode I and mode II fracture toughness. The process and calculations are also analyzed and discussed.

70. Role of Anion-Specificity and Water in Solubility and Gelation of PVA in Salt Hydrate Phase Change Materials

Sebastian Haney (University of California, Berkeley)
MSEN REU
Research Advisor: Svetlana Sukhishvili Rajagopalan

Phase change materials (PCMs) are increasingly popular in thermal energy storage research due to the industrial motivation to reduce fossil fuel consumption and carbon dioxide emissions. As PCMs, inorganic molten salt hydrates address the demand for materials with cost-efficiency, high cyclability, and sufficiently high volumetric heat storage capacity. To address the leakage problem of molten salt hydrates, several studies have been performed using encapsulation and mixing of salt hydrates in

covalently-bonded hydrogels. However, these methods either cannot shape stabilize the PCM for a considerable number of cycles or reduce the heat storage capacity of the material. Leakage of salt hydrates has been successfully addressed with the introduction of salogel networks, in which the salt hydrate is the solvent environment of solute polymers, polyvinyl alcohol (PVA) and polyacrylamide (PAAm). The resulting gelation network demonstrates significant shape stabilization, thermo-reversibility, and latent heat capacity retention. Very little is understood about the solubility behavior of the polymer chains based on the ions' degree of saturation (DS) and the anion-specificity. In order to demonstrate the dependency of gelation and mechanical strength on these two factors, we apply vial inversion and Fourier Transform infrared spectroscopy (FT-IR) on two salogels with different anions. As expected gel strength diminished with increase of moles of water in both samples. Wavenumber shifting in the hydroxyl bond stretch region for both salts due to increasing moles of water indicates water concentration reduces both polymer-polymer interactions and polymer-ion interactions.

71. Understanding Surface Topography Evolution During Rolling of Steel Strips Produced Using Tooled Metal Peeling

Matthew Renfroe (Texas A&M University)
Low-Cost Ultra-High-Speed Imaging for High-Speed Machining
Research Advisor: Dinakar Sagapuram

In this project, our end goal is to shorten and optimize the machining and cold-rolling process for a peeled strip of metal into rolled sheets; the sample material we will use is 1018 low-carbon steel. The process to roll any metal is a lengthy process requiring many steps (melting, casting, annealing, etc.) and a lot of workshop space to make it feasible. With this project, we are seeking to produce and cold roll sheet metal in a single-step process. This new process would leave the final product with a surface finish that conforms to industry standards while greatly reducing the steps needed for the task and saving on shop space. To produce industry-grade sheets, the rolling process needs to be optimized and research must be done to a scaled down version of the operation. We will use metrological and optical microscopy techniques on rolled steel samples with varying methods of rolling processes to determine the most optimal method of producing industry grade sheet metal.

72. A Parametric Study on the Thermal Effect of Drilling Low Diffusivity Material

Emely Leiva Martinez (California State Polytechnic University) and
Hunter Tallichet (Texas A&M University)
Metrology/Inspection REU
Research Advisor: Bruce Tai

During Orthopedic surgery, surgeons drill into bone, which produces a heat response. When human bone reaches 40 degrees Celsius, it undergoes osteonecrosis, which causes bone cell death. Currently, there is no way to measure this exact heat response of the bone at the drilling site, which increases the risk of osteonecrosis in the patient during surgery. Machine learning can be used to visualize the thermal response of a given drilling process in real-time, allowing surgical trainees to see the thermal effect of their drilling in training and even during surgery in order to avoid osteonecrosis. An input surface heat

flux must be defined to produce the resulting instantaneous heat map, however, surface heat flux cannot be experimentally measured. Instead, an inverse method can be used to determine a suitable heat flux to represent a given feed rate and spindle speed. Collecting drilling data and the corresponding thermal response is necessary for the inverse heat transfer method for determining the relationship between surface heat flux and drilling parameters.

73. Maternal Postpartum Depression & Its Affects on Infant Failure to Thrive

Allison Lamm (Texas A&M University)
Independent Research Project
Research Advisor: Alison Pittman

Postpartum depression is a global issue affecting millions of women annually that can potentially lead to long-term consequences in infants. One significant factor seen in society is infant growth and failure to thrive. Infant failure to thrive is defined as insufficient height or weight growth during the child's first year of life. Previous research has observed a potentially significant relationship between the presence of maternal postpartum depression and infants experiencing failure to thrive due to this deficit in height and/or weight gain. It has also linked postpartum depression to many other infant health concerns involving emotional, physical, social, and psychological aspects. Therefore, early detection and treatment are crucial to promoting the health of both mother and baby. However, there has been minimal recent research that examines maternal postpartum depression and infant failure to thrive. This lack of research on these issues discourages discussion of these medical conditions and inhibits individuals from seeking proper treatment. This literature review will serve as a foundation for the Nursing Honors Project I will be completing this year by highlighting previous research connecting these two conditions. My research project aims to explore the relationship between maternal postpartum depression and infant failure to thrive and raise awareness of these health concerns.

74. Transforming Nursing Education and Empowering Students in the World of Substance Use Disorder Interventions

Sarah Hassan (Texas A&M University)
Independent Research Project
Research Advisor: Elizabeth Wells-Beede

Background: Substance use disorders (SUDs) have affected individuals, families, and communities, making them a pressing public health concern. To address this issue, the integration of Screening, Brief Intervention and Referral to Treatment (SBIRT) into healthcare professionals' training, particularly nursing students, has been crucial. It equipped nursing students with the necessary knowledge and skills to recognize and respond to substance use cases promptly.

Objective: This research investigated the impact of a virtual reality (VR) simulation-based learning experience on nursing students' knowledge of SUD and their confidence in performing SBIRT. Specifically, the study focused on assessing the effectiveness of VR role-playing and therapeutic communication with virtual patients to improve students' competency in conducting SBIRT.

Methods: Collaboratively developed using Meta Quest 2 - Oculus™ and the Unity platform, the VR environment replicated a real-world clinic setting. Through faculty guidance, students engaged in immersive role-playing activities and therapeutic communication exercises with virtual patients. Data collection involved administering online questionnaires via Qualtrics™, which were analyzed using descriptive tests, chi-squared tests, one-way ANOVA, and linear regression analysis.

Conclusion: The implementation of a VR simulation-based learning experience holds great potential for shaping nursing education. By utilizing virtual environments, students can develop skills related to SUD recognition and SBIRT, equipping them to provide comprehensive care in real-world settings. Further integration of VR technologies and collaborative development efforts can lead to more effective and immersive training experiences for all healthcare professionals.

75. Rhythmic Regulation of Synaptogenesis by Astrocyte Secreted Proteins

Delaram Moradpour (Texas A&M University)
Independent Research Project
Research Advisor: Isabella Farhy

Many neurodegenerative diseases such as Alzheimer's disease, accelerate as an aging person's sleep cycle shorten. Similarly, chronic shift work as well as genetic dysregulation of circadian clock manifest cognitive deficits in learning and memory. The biological and physiological processes that explain a possible link between cognitive deficits due to circadian clock dysregulations are not well understood.

Astrocytes secrete various proteins that regulate synapse development and function. Yet whether secretion of these is rhythmic and/or clock dependent is unknown. The focus of this project is to investigate whether the rhythmicity of cognitive functions is in part due to rhythmicity of astrocytic synapse-regulating secreted proteins. To identify rhythmically secreted astrocytic proteins, we have established a primary rodent astrocyte culture system, and developed a protocol for entraining cultured astrocytes to exhibit synchronized rhythmic expression of clock genes such as Bmal1. Using qPCR and protein gel electrophoresis we show that treatment of astrocytes with the synchronizing factor forskolin promotes synchronized oscillation of Bmal1 mRNA levels. Our future work will include utilizing mass spectrometry analysis to identify the proteins whose secretion from astrocytes oscillates, and determine whether any synapse-regulating proteins exhibit rhythmic oscillations. This work is expected to uncover astrocytic synapse-regulating proteins that are rhythmically secreted to facilitate regulation of synaptic and cognitive rhythms, and reveal strategies to manipulate synaptic rhythmicity through astrocyte-targeting, to mend clock-associated cognitive deficits prevalent in neurological disorders.

76. Confirming Molecule Dynamics Through Time Resolved Coherent Anti-Stokes Raman Spectroscopy

Alina Zhang (Texas A&M University)
Aggie Research Program
Research Advisor: Vladislav Yakovlev

A Time-Resolved Coherent Anti-Stokes Raman Spectroscopy (TR-CARS) system was developed to investigate the molecular vibrations of various chemical systems. It provides femtosecond time resolution of the molecule's behavior in solution. The TR-CARS system uses multiple femtosecond laser pulses to excite the target molecules and probe the molecules' vibrations. By probing the vibrational state of molecules over time, we can deduce information about the molecular bonding, energy transfer, and reaction kinetics of the molecules.

The purpose of this presentation is to underline the applications of TR-CARS and how it provides detailed information and understanding of chemical structures. Serial dilutions of ethanol were used in this study to observe how the TR-CARS signal of ethanol changes with concentration in a binary solution of water-ethanol. By observing the changes in the TR-CARS signal with ethanol concentration, we can understand how the environment influences the vibrational properties of this chemical. Changes in the signal provides significant information of how the water environment modifies the hydrogen bonding of ethanol with itself and with water molecules in solution.

AFTERNOON SESSION

2:00 PM – 4:00 PM

1. The Direct and Indirect Effects of PGPR on Maize Plants' Defense to the Fall Armyworm

Shravya Kolli (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisors: Henry Fadamiro, Caixing Xiong

The Fall Armyworm (Spodoptera frugiperda) is a devastating pest that poses a significant threat to maize crops worldwide. In recent years, there has been a growing interest in exploring sustainable and environmentally friendly strategies to mitigate the damage caused by this insect. One promising approach involves the use of plant growth-promoting rhizobacteria (PGPR) to enhance maize plants' defense mechanisms against the Fall Armyworm. PGPR is shown to contribute to the soil fertility because they can break down the macromolecules into nutrients that can be assimilated to the plants, while also enhancing the plant defense responses. This research aims to investigate the direct and indirect effects of PGPR on maize plants' defense responses to the Fall Armyworm. The study involves a series of controlled experiments including the no-choice oviposition assay and two-choice olfactometer bioassay using mated female moths, and the larval feeding assay. We further investigated the mechanisms behind plant-induced insect behavior change by analyzing and comparing volatiles of plants treated with PGPR versus plants that were not treated with PGPR. This is an effort towards contributing to the development of a new method to promote sustainable agriculture.

2. Indirect Defense in Sorghum? How Natural Enemy Attraction Varies Among Sorghum Cultivars

Kassandra Gonzalez (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisors: Micky Eubanks, Emily Russavage

The sugarcane aphid (Melanaphis sacchari Zehntner) is an invasive pest that can cause substantial yield loss and a reduction in grain quality in sorghum. Insecticides are currently the most effective way to suppress sugarcane aphids, but this strategy is costly and likely to lead to insecticide resistance. Instead, our study focuses on herbivore-induced plant volatiles (HIPVs) as a mechanism for improving biological control provided by resident natural enemies and reducing insecticide use and the cost of aphid suppression. Our previous work has shown that a parasitoid wasp, (Aphelinus nigritus), varied in its attraction to aphid-infested sorghum varieties. Some varieties, for example, produced extremely attractive HIPVs, while other varieties were not attractive to the parasitoid. Here, we wanted to explore the response of an aphid predator, green lacewings (Chrysoperla rufilabris), in choice experiments (plants with or without aphids) with a Y-tube olfactometer. We screened two sorghum varieties for variation in attraction of natural enemies to HIPVs induced by the aphid pest. Green lacewing larvae were significantly attracted to aphid-infested DKS3707, but were repelled by aphid-infested ATx3408/RTx436. Interestingly, the parasitoid responded in the same way to both of these varieties. The results of these experiments indicate that natural enemies from different taxonomic groups are attracted to HIPVs produced by specific varieties of sorghum, but repelled by other varieties. These results also suggest that HIPVs play an important role in the attraction of natural enemies and the suppression of sugarcane aphids.

3. Mosquito Community Composition in Two Natural Areas of South Texas

Alexandra Encina (University of Texas at San Antonio)
Diversity in Entomology
Research Advisors: Gabriel Hamer, Francisco Ferreira

Understanding mosquito diversity globally is vital to support the control of diseases affecting humans and domestic animals such as malaria and heartworm, respectively. There are 85 mosquito species in Texas, all of which vary in their contribution to the transmission of disease-causing agents, but knowledge about community composition and abundance is often limited. The goal of this study is to assess the mosquito community composition and the risks for mosquito-borne human and animal disease in two natural areas of south Texas. We used CO2-baited CDC traps to collect mosquitoes in Laguna Atascosa National Wildlife Refuge (LANWR) and Resaca De La Palma State Park (RDLPSP) for two nights in each park in June 2023. Mosquitoes were identified using morphological keys and a subset were confirmed using molecular barcoding of the Cytochrome c oxidase I gene (COI). We identified 500 specimens so far, and the most common species included Anopheles pseudopunctipennis, Culex erraticus, and Ochlerotatus nigromaculis. The COI gene was sequenced for these and other species and compared with the gene sequence available on GenBank, confirming morphological mosquito identifications. This study documents abundant populations of An. pseudopunctipennis, a highly competent vector of human malaria, concurrent with the first autochthonous case of human malaria occurring in the same region for the first time in Texas in 29 years. This study helps improve our understanding of mosquito community composition in South Texas to assess disease risk from mosquito-borne pathogens

4. Preliminary Screening for Toxicity of Solvents on Unfed Rhipicephalus sanguineus Adult Female Ticks for Use in Bioassays With Candidate Acaricidal Molecules

Elyana Ruiz (Texas A&M University Kingsville)
Diversity in Entomology
Research Advisors: Patricia Pietrantonio, Waleed Ahmed

This preliminary study aimed to investigate the toxicity of different solvents (DMSO, MERO, and JEFFSOL AG1555) against unfed Rhipicephalus sanguineus adult female ticks with the purpose of using these solvents in future bioassays with candidate acaricidal molecules. Ticks were purchased from ECTO SERVICES, INC. (North Carolina, US). For evaluations, the pyrethroid permethrin 1% in ethanol was applied as a positive control for mortality, and water was used as a negative control. MERO (Bayer) concentrations: 1X (4µl stock and up to 10 ml DMSO 1%, 10X (40 µl stock and up to 10 ml DMSO 1%), 20X (80 µl stock and up to 10 ml DMSO 1%), 50X (200 µl stock and up to 10 ml DMSO 1%) were prepared. MERO is rapeseed oil, methyl ester(s) 0.9 g/ ml. The 1X concentration of MERO was equal to 0.392 mg/ml in DMSO 1%. JEFFSOL (Huntsman Corporation) solvent solutions at 40%, 20%, 10%, 5%, 2.5%, and 1.5% were prepared in DMSO 1%. For each treatment and solution, 2µl were applied topically on the dorsal surface of five unfed ticks per treatment. Ticks were incubated at 27-29 °C and 85% RH for 24 h. Tick mortality was recorded. Permethrin caused the expected 100% mortality within 24 h, while DMSO was non-toxic. MERO-DMSO applications were not lethal to ticks even at the highest concentration (50x). Similarly, JEFFSOL AG1555 was non-toxic even at the highest concentration 40%. In

conclusion, MERO and JEFFSOL AG1555 are non-toxic solvents, and can be used in the proposed tick bioassays.

5. Evaluation of Tick Trapping and Drag Sampling in Different Habitats of East Texas

Sebastian Flores (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisors: Gabriel Hamer, Yuexun Tian
Other Contributors: Francisco C. Ferreira

Ticks are one of the most important vectors of pathogens that cause disease in humans and other animals as they are responsible for about 95% of vector-borne diseases reported annually in the United States. Different tick species are capable of carrying different pathogens. Therefore, surveillance of the tick populations and species composition is critical for the management of ticks and tick-borne diseases. In this study, we explored the tick abundance and species composition in different habitats by collecting ticks in four forest plots and four pasture plots using both dragging and trapping. In each plot, twelve traps were deployed and dragging was conducted across three 60-meter linear transections. Trapping and dragging were performed alternately for 10 weeks. More than 1,100 ticks were collected from both methods over the 10 weeks with more ticks collected from the forest habitats than the pasture habitats. The collected ticks are mainly in the genera of Ixodes and Amblyomma, which are capable of transmitting multiple pathogens. This study provides insight into the tick populations and composition in habitats utilized by humans and domestic animals, which can potentially be used as a guideline for the public to avoid contact with ticks and exposure to tick-borne disease. By evaluating the tick abundance and species collected by trapping and dragging, the results from this study can assist standardize tick surveillance for different environmental conditions.

6. Do Predating *C. rufifacies* Have a Sex Bias?

Joshwa Gandy (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisor: Aaron Tarone

I am writing to propose my participation in the poster presentation, with a specific focus on studying blowflies and their predating sex bias. Specifically, I will be investigating the blowfly species Chrysomya rufifacies and exploring whether there is an observable predating sex bias under laboratory conditions. This research is crucial for identifying behavioral patterns that may be linked to specific neurological or chemical mechanisms governing hormonal signals in C. rufifacies. Understanding these mechanisms could shed light on how this species identifies and avoids same-sex individuals, ultimately avoiding intraguild predation through facultative predation.

The results of this experiment hold significant implications, particularly in the forensic field. C. rufifacies is a facultative predator that lacks sex chromosome differences, making it a unique case for study. By determining the blowfly's behavior and its timeline for decomposition, this research can provide

valuable information for forensic investigations. It can help establish a timeline for decomposition and adjust it based on the presence of other forensics-species.

Furthermore, this research on blowflies presents an opportunity to explore the effects of observed evolutionary pressures that prevent them from consuming individuals of the same sex, such as avoiding the consumption of their own siblings. The unique monogenic sex determination system in C. rufifacies, where the maternal genotype determines sex, sets it apart from other blowflies that employ the XX/XY sex-determination system based on chromosome pairs. Studying these evolutionary pressures can contribute to our understanding of the complex interplay between genetics, behavior, and survival strategies.

7. Expression of Collagen Formation and Degradation Genes During Infection with *Anaplasma phagocytophilum*

Marcus Delgado (Texas A&M University Kingsville)
Diversity in Entomology
Research Advisor: Adela Oliva Chavez

Ticks are important ectoparasites capable of transmitting deadly pathogens to wildlife, domestic animals, and human beings. One of the pathogens being transmitted is Anaplasma phagocytophilum, which causes Human Granulocytic Anaplasmosis, a disease with symptoms that can range from mild infections to mortality. When a host is infected, collagen in the skin can serve as a physical barrier that may protect the host from potential pathogens. While previous studies have explored the transcriptional changes that occur during infection at the tick bite site; how it affects the expression of genes for collagen formation and degradation factors in the organs is still not clear. This project aims to investigate whether A. phagocytophilum infection affects the expression of these genes in the heart, lungs, liver, and spleen in mice. Specifically, we are evaluating the expression of metalloproteinases, which are enzymes capable of degrading collagen, as well as collagen type 9 alpha 1 chain, collagen type IX alpha 2 chain, and collagen alpha 1(II), key genes involved in general collagen formation. To achieve this, we are isolating the RNA from organs of infected and uninfected mice, followed by quantitative polymerase chain reaction analysis of complementary DNA. We hypothesize that during infection there will be a significant upregulation of the metalloproteinases and a significant downregulation of the general collagen formation genes. The knowledge generated by this research can contribute to the development of alternative treatment therapies for individuals or animals infected by A. phagocytophilum.

8. Plant Domestication and Geographic Origin Modify Resistance to Insect Herbivory

Jeremy Garces (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisor: Anjel Helms

Plants rely on innate defenses to resist attackers such as insect herbivores. As plants interact with herbivores over evolutionary time, plants become more familiar with attackers and optimize defenses

accordingly. However, defense optimization can be disrupted by selecting for growth trats over defense during plant domestication or introducing plants to novel geographic regions. Little is known about how plant domestication or novel geographic regions modify defenses. To fill this knowledge gap, we investigated resistance across different plant species in the gourd family (Cucurbitaceae). We included a range of domesticated and wild cucurbit species with shared or different geographic origins from our focal herbivore species, squash bugs (Anasa tristis). Squash bugs are a major pest of cucurbit crops, causing economic loss through direct feeding damage and transmission of a lethal plant pathogen. We evaluated plant resistance to squash bug herbivory across 6 different cucurbit species. For 3 days, we measured bug mass gain every 24 hours. Our findings revealed notable differences in resistance between both domesticated and wild cucurbit species, as well as those that did or did not share a geographic origin with squash bugs. Wild cucurbits exhibited higher levels of resistance, while domesticated species were more susceptible to herbivory, suggesting a potential loss or alteration of defenses during domestication. Furthermore, among domesticated species, cucumber plants were highly resistant to squash bugs potentially due to their geographic origin in Asia rather than Mesoamerica, where squash bugs originated. Overall, our findings contribute to improving crop resilience and developing sustainable agricultural practices.

9. Lipid Regulation in Fire Ants

Mark Santana (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisor: Constance Lin Eubanks

Insects are amongst the most important facilitators of vertebrate carrion decomposition. Ants have been observed recruiting vertebrate carrion and actively removing tissue and consuming exuded liquids. Previous experiments on the red imported fire ant (Solenopsis invicta) showed that a dietary supplement of vertebrate carrion was attractive to foragers but had no influence on overall colony performance. We thus hypothesize that while vertebrate carrion is the source of attractive volatile compounds used by the ants for recruitment, only the insect carrion feeders (like maggots) carry a significant nutritional value to the ant. The main objective of this study is to compare the nutritional value of vertebrate carrion (Mus musculus) and fly maggots (Macellaria rufifacies) that developed on vertebrate carrion. While carrion and maggots are similar in their overall protein and lipid content, the lipid fraction differs in its relative saturated (SFA) to unsaturated fatty acids (UFA). In this study, we manipulated the SFA and UFA composition of artificial foods to mimic the composition of vertebrate carrion (high SFA, low UFA) and maggots (low SFA, high UFA). We aim to determine which SFA-to-UFA content is most nutritious to ants, with the prediction that larger amounts of UFA will be associated with better colony performance (measured survival of workers , the lipid content within the workers, and the brood mass). This study will increase our understanding of the importance of carrion feeders as part of the ant food network.

10. Effects of *Nosema ceranae* Infections on European Honey Bee (*Apis mellifera*) Worker Behavior

Abigail Martinez (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisor: Juliana Rangel Rangel

European honey bees (*Apis mellifera*) are eusocial insects used in agriculture for pollination services and honey production, this makes their energy and health a subject of interest. *Nosema ceranae* is a unicellular fungal pathogen which attaches itself to a honey bees midgut causing cellular damage and digestive issues when ingested. The internal damage dealt by Nosema ceranae has in the past been seen to cause lethargy and sharp declines in honey bee adult worker populations which negatively impacts the productivity of colonies. In this study we observe the behaviors and survivorship of worker honey bees that are either uninfected or infected with *Nosema ceranae* spores. The behaviors of interest will be the movement and retinue response of the experimental and control groups of worker bees. After the marking, infecting and introductions of worker bees into observation hives, the marked bees were observed daily to record their movement, retinue response, and attendance over the span of two weeks. The purpose of this research is to better understand the impact of the Nosema ceranae on the life spans and productivity of worker honey bees within their hives. The results of our research should provide useful information regarding the identification and future treatment of worker honey bees suffering from a Nosema ceranae infection.

11. Glucose- 6- Phosphatase (G6P): Does it Affect Mosquito Fertility?

Ramon Villarreal (The University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisors: Zach Adelman, Xiangyu Shi

Mosquitoes are responsible for the transmission of the world's deadliest diseases like the Zika virus, malaria, and the Chikungunya virus. Since several ecosystems rely on mosquitoes as a food source, we can't necessarily wipe them out from existence. Instead, sterile insect techniques can be used to control the population of mosquitoes by slowly sterilizing them to a manageable number. G6P, a gene that controls glucose in the body of the mosquito, could be used to do just that. In this study, we were curious if a mutated G6P had an adverse effect on male fertility. To determine if this was true, we injected mosquito embryos with a CRISPR mixture to induce deletion of base pairs. Once fully grown, they are crossed with wild type mosquitos. These are considered G1. Once G1 mosquitos are fully grown they are crossed with mosquitos of the same generation. From these offspring, the mosquitos with the complete mutation on G6P are crossed with wild type mosquitoes to observe any differences regarding fertility. If any changes are observed, then further studies can be made to make the mutated G6P a viable weapon against slowing the transmission of diseases from mosquitoes.

12. Salivary Gland Surface 2 Protein and its Implications on Mosquito Blood Feeding

Joan Garza (University of Texas Rio Grande Valley)
Diversity in Entomology
Research Advisors: Sydney Velasquez, Collin Valentin

The method mosquitos use to obtain and safely consume blood is unclear. A study done by Parasites and Vectors has shown that the saliva of mosquitos, particularly in Ae. aegypti, contains potential immunosuppressant factors that allow safe consumption of blood to start their reproductive cycle; Salivary Gland Surface (SGS2) protein is theorized to produce this immunosuppressant factor. The purpose of this study is to create a gene knockout using CRISPR/Cas9, a gene-editing protein on SGS during the embryonic development of the mosquito to prevent them from utilizing this protein and to observe its effects on mosquito blood feeding, which will be done by measuring the fertility and fecundity of mosquitos after they have been blood-fed.

13. Topographic Effects on Tree Growth, Size, and Distribution and Relationship to Soil Characteristics in a Premontane Rainforest

Jenna Baljunas (Chatham University)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisors: Anthony Cahill, Kelly Brumbelow

Future climate changes may have a significant impact on ecosystem composition in montane tropical rain forests. Because of the relationship between elevation and microclimate, potential future impacts can be investigated through the present effects of elevation and topographic gradients on landscape characteristics such as vegetation and soil texture. While there is a general understanding of species migration in response to microclimate changes, site-specific analyses are still required, especially given underlying geologic differences. With knowledge that topography influences hydrologic processes and patterns as well as species distributions and traits, this study used geostatistical analysis to discover current elevational impacts on soil and vegetation in an undisturbed premontane tropical rainforest in Costa Rica. Data were collected from a gridded 40 x 40 meter plot that was established using a clinometer, and using azimuth, horizontal distances, and vertical distances between grid points, a land surface elevation model was generated. We performed 25 soil moisture, bulk density, and texture analyses, along with determined the diameter at breast height (DBH), heights, and locations of previously tagged trees. Soil properties and tree locations were then mapped. Empirical variograms for the soil textural properties were calculated and used to develop a kriging model for the soil characteristics field. Preliminary results show associations between the soil field and the vegetation field, although the spatial intermittency of large trees at the site led to sampling issues. Some potential implications of the results on future changes in landscape are discussed, as well as limitations of the modeling approach.

14. Education Extension in Costa Rican Agriculture

Dylan Dannecker (University of Lynchburg)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisors: Cara London Rushing Rushing, Janie Moore

This study aimed to assess the adoptability of a novel food sanitation technology amongst Costa Rican plantation and exporting managers. This new technology, atmospheric cold plasma, sanitizes and promotes the growth of crops without the harmful effects on human and environmental health held by traditional chemical methods. Between product loss and the potential contamination of consumers, these industries need alternative solutions to current practices. This project aims to demonstrate the effectiveness of educational materials toward improving both product design and adoption rates to provide benefits to the food industry and consumers. Educational modules were created containing content on four interrelated technologies or practices related to plasma-based technology: atmospheric cold plasma treatment, ozone treatment, plasma-activated water, and post-harvest dangers. The modules were created with input from experts, piloted in the US, then translated and delivered by native Spanish speakers. Participants were surveyed before and after the training. The response rate for pre-surveys and post-surveys respectively were 83 and 67%. Sessions were hosted both in-person and online and lasted anywhere from 60 to 90 minutes. Engagement during sessions was high despite translation difficulties. Without concern for actual adoption, the effectiveness of education extension was the primary goal. These technologies are still in development and have not been utilized yet in Costa Rica, nor most of the world, so any participants would have had no prior knowledge bias. Based on feedback from the participants, the educational modules were effective in motivating behavior toward adoption of the new technologies.

15. Effectiveness of a PES Plantation for Carbon Storage and Cycling in a Tropical Premontane Forest in Costa Rica

Anna Dunnebacke (Michigan State University)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisor: Salvatore Calabrese

Costa Rica holds some of the world's most productive forests, making it a target for research focused on conservation and carbon (C) sequestration. As the climate warms, improving land management practices to preserve or capture atmospheric C in aboveground biomass and soils remains critical for mitigating climate change. "Natural climate solutions" are an example of these improved practices, one of which is the payment for ecosystem services (PES) program, which pays landowners to reserve a portion of their land to be used for contributions to ecosystem services. This study aims to compare ecosystem C storage and fluxes of a PES tree plantation and a native primary forest located in the Northern region of Costa Rica in San Isidro de Peñas Blancas, near Texas A&M's Soltis Center for Research and Education. Ecosystem C stores are estimated through a combination of in situ tree measurements, allometric equations for tree biomass, and soil C measurements, while C fluxes are calculated integrating soil respiration measurements and remote sensing data on primary productivity. Remote sensing data on evapotranspiration and precipitation are also used to investigate potential differences in the water cycle between the two forests. Interestingly, preliminary results reveal higher

ecosystem C stores in aboveground biomass and soil in the PES plantation than in the native forest. However, further analyses of water and C fluxes at the two sites are needed to investigate differences in water and C fluxes in C cycling and the potential of PES tree plantations for C sequestration.

16. Canopy Heterogeneity Shapes Canopy Soil Properties and Accumulation

Fabiola Prieto-Rivera (University of Puerto Rico)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisors: Peyton Smith, Katherine Quinonez

Canopy soil is organic matter that accumulates on top of tree branches in association with epiphytes in tropical rain forests. While canopy soil may be one of the most biodiverse ecosystems worldwide, little is known about their properties or the role they play in the global carbon (C) and hydrologic cycle. Land use change may alter the role canopy soils play in global C and water cycles. To assess land use effects and spatially variability on soil hydrologic properties and C dynamics, we analyzed soil depth, hydraulic conductivity (Ksat) and CO2 production in canopy soil collected from different canopy positions (low, middle, and high branches) and locations along a branch (near, middle, and far from the trunk) in both pasture and forest trees. Our results show that land use had no effect on soil physical and hydrological properties: average soil depth was 2.6 to 9.9 cm in each tree regardless of being in a pasture or forest. The angle of branch and branch position in the canopy influenced Ksat values highlighting the importance of spatial heterogeneity within individual tree canopies. Canopy soils from forest trees respired 36% less CO2-C than pasture trees suggesting that land use may alter the role canopy soils play in the C cycle. Challenges arose from using methods designed for mineral soils signifying that current methods must be modified to determine physical and hydrologic properties of canopy soils, in order to accurately represent the role canopy soils play in global hydrologic and C cycles.

17. Rainfall Pauses in a Pre-Montane Rainforest Drive Fermentive Degradation of Organic Carbon from Tropical Andisols

Carleigh Wachtel (State University of New York College at Geneseo)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisor: Peter Knappett

Soils of tropical rainforests store more carbon than the living biomass they support. The intensity and frequency of rainfall events may impact the mode of soil organic carbon (OC) degradation within the soil. The objective of this study is to assess whether oxidative or fermentative degradation is occurring across three distinct soil horizons during steady-state flow (462 mm/day) and following a 12-hour stagnant period. Three packed columns simulated rainfall infiltration through leaf litter, soil, and weathered bedrock. Under flowing conditions, the rate of DIC production was produced (+)/removed (-) +33.8, +13.0, and -2.2 mg/day in the leaf litter, soil, and saprolite, respectively. But for 48 hours post-stagnation, these rates were +31.7, +9.2, and -10.1 mg/day, respectively. The pre- and post-stagnation carbon-to-nitrogen molar ratio in the soil effluent decreased from 8:1 to 3:1. Measured ammonium production rates increased post-stagnation. These observations can be explained by a switch from aerobic oxidation to anaerobic fermentation of OC following a break in the rainfall. These breaks likely

produce methane, a potent greenhouse gas through fermentation, from rainforest floors. During active rainy periods, produced CO2 is trapped in aqueous solution as HCO3 by pH buffering from silicate mineral weathering in soils. This DIC will either discharge to the ocean, where it is precipitated in marine organisms and buried, or stored locally in saprolite as first generation silicatic calcite. This may be a temporary sink, however. This calcite could be dissolved by organic acids during dry periods thereby releasing CO2 back into the pore spaces.

18. Respiration and Infiltration Rate Contribution as a Result of the Distribution and Extent of Atta cephalotes in a PES Plot

Alexander Torres (Georgia Southern University)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisor: Felipe Aburto

Leaf-cutter ants are a group of foraging ants that cultivate a fungus for consumption. Leaf-cutter ants are among the chief agents introducing and translocating organic matter into soils in many tropical and subtropical forests. The activity of the fungus farms accelerates organic matter decay and transformation, and their respiration can drastically alter the CO2 soil efflux dynamics. Additionally, the pedoturbation of the soil by leaf-cutters can drastically change the soil properties distribution and microtopography, leading to changes in many soil properties, like moisture and infiltration, which can further affect CO2 respiration and water dynamics. This study aims to assess changes in soil physicochemical properties, CO2, and short-term hydrological dynamics in ant nests in a payment for ecosystem services (PES) forest in Costa Rica. We measured infiltration rates with an infiltrometer and daily CO2 respiration rates, and bulk density at five nest and five non-nest sites for three colonies (n=30). At each colony soil samples were collected at three depths (0-20 cm, 20-40 cm, 40-60 cm) at a nest and non-nest location. These were analyzed for total C/N, pH, available nutrients, texture, and water-extractable organic carbon (WEOC). Substantial differences were observed between mound vs non-nest sites in most measured parameters. Significantly higher infiltration rates were observed at nest sites. This can be explained by pedoturbation by ants. Further data analysis on CO2 respiration and efflux is needed as data is collected.

19. Assessing Annual Growth of Rainforest Trees Across an Elevational Gradient Using Isotopic Tracers

Trevor Woodyard (Georgia Southern University)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisor: Georgianne Moore

Costa Rican tropical montane rainforests (500m-1500m) are some of the most biodiverse and productive ecosystems on the planet. Within this ecosystem, climate-related variability across elevational gradients is poorly understood, due to lack of formation of identifiable annual growth rings. To understand how the changing climate might affect these forests, advancements are needed to differentiate annual growth using biogeochemical tracers. To assess this gap in knowledge we re-surveyed six permanent forest plots at two sites at 450-600 and 900 meter elevations. Diameters were

compared to past surveys to estimate annual growth increments. Tree cores were collected from a subset of trees at each site to detect the presence of seasonal fluctuations of O-18 isotopes in the wood and how isotopic values differ between sites. Locally-known seasonal variation in O-18 of rainfall and climate data was to create a model for predicting expected O-18 fluctuations in the tree wood. This research was done at the Soltis Center (450m-600m) and the Childrens Eternal Rainforest preserve, Estación Pocosol (900m) which share a connected border. At the Soltis Center, we resurveyed 3 permanent native forest plots and a PES plantation farm planted in 2005. For our high elevation site we surveyed two permanent native forest plots. We found that the three native forest plots at lower elevations had an average annual growth rate of 1.20%. Trees at the two high-elevation plots had a significantly higher annual growth rate of 1.41% which is contrary to expectations.

20. Using Fluorescence Spectroscopy to Track Changes in Dissolved Organic Carbon in a First-Order Stream in a Premontane Tropical Rainforest

Emily Everton (California State University, Chico)
Costa Rica REU: Ecohydrology of Tropical Forests
Research Advisors: Garrett McKay, Peter Knappett

Dissolved organic carbon (DOC) represents a heterogeneous fraction of organic matter (OM). The structural and behavioral complexity of DOC make identifying its specific properties difficult, yet it plays a pivotal role in global carbon cycling. Fluorescence spectroscopy is a growing tool among researchers for the efficient characterization of DOC quality and source, but fewer studies have applied this technology to explore DOC in tropical forest ecosystems. In this study, we used fluorescence spectroscopy to investigate changes in DOC character, quantity, and source in a forested, first-order stream across varied hydrologic regimes in Alajuela Province, Costa Rica. A sequential flow column experiment and stream grab sampling were utilized to sample under baseflow, drought, and stormflow conditions. We hypothesized that DOC concentrations would increase in the columns and stream during precipitation events immediately following dry periods. We also predicted that column DOC would be primarily labile and autochthonous from in-situ DOC production while stream DOC would show increased signs of recalcitrance due to recurring influxes of terrestrially derived, allochthonous DOC from frequent precipitation. Preliminary results reveal absorbance values from the leaf litter and mineral soil columns spiked immediately following drought, potentially indicating in-situ DOC production or shifts in DOC character. Absorbance values were consistently highest where fresh spring water enters the stream, suggesting highest DOC concentration out of all three sampling locations. Understanding changes in DOC character and quantity in a highly productive tropical rainforest could help us more accurately quantify carbon fluxes, potentially improving our understanding of global climate change.

21. Click Display: A Rapid and Efficient in Vitro Protein Display Method for Directed Evolution

Ramya Bathala (Texas A&M University)
Independent Research Project
Research Advisors: Zhilei Chen, Karuppiah Chockalingam, Michael Woolley

Protein therapeutics have revolutionized the medical field, by providing effective and precise treatment options to diseases that were previously considered hard to treat. Our lab utilizes Directed Evolution which refers to the process of creating a large library of proteins and isolating variants with desirable traits by applying selective pressure. In order to discover these proteins, we need to link genotype (DNA) to phenotype (protein) through a method of protein display . Our research involves the creation of a diverse library and subsequent steps, including screening, amplification, selection and optimization. We are using a novel method, called Click Display, as tool for discovering new binding proteins called DARPins (Designed Ankyrin Repeat Proteins) that have therapeutic potential. Click Display is an in vitro method that involves transcription, crosslinking of a modified linker and mRNA, translation and reverse transcription- all of which is done within 2 hours. This process was developed in our lab and from the input of a DNA template it produces an output of a protein- cDNA complex that also contains a piece of mRNA. After click display, we use biopanning against a target protein to generate a panel of multiple binders after which quantification and quality check is conducted through qPCR. Compared to its counterparts, click display is more efficient, faster and easier to implement and serves as a powerful tool in protein therapeutics discovery.

22. Long Slit Spectrograph using Asymmetric Offner

Evan Batteas (Texas A&M University)
Independent Research Project
Research Advisors: Luke Schmidt, Darren DePoy

Spectrographs are a key instrument in astronomical observation. A design for a long slit spectrograph with relatively low cost and commercially available parts is presented. The design incorporates a generalized Offner relay with an accessible pupil, with a grating placed in the pupil.

23. Molecularly Imprinted Polymers (MIPs) as Bio-recognition Elements for Biomarker Sensing

Sathwika Samudrala (Texas A&M University)
Independent Research Project
Research Advisors: Limei Tian, Mayank Garg

Biosensors are devices that contain bioreceptors or biorecognition elements to detect sample analytes and produce an appropriate signal. Molecularly imprinted polymers (MIPs) have shown to be a promising alternative to other conventional biorecognition elements such as enzymes, antibodies, aptamers, and nucleic acids. MIPs are synthetic bioreceptors, therefore they are not prone to denaturation like the other natural biorecognition elements. MIPs have advantages in terms of cost,

stability, and ease of development that their counterparts lack. MIPs are versatile receptors that can be modified for a variety of analytes like proteins, ions, and other small molecules. This research aims to use MIPs as artificial antibodies for cardiac troponin and cortisol detection. Screen-printed carbon electrodes and laser-imprinted graphene polyimide (PI) electrodes are electrochemically prepared for sensing and characterization. A range of concentrations is then tested for analyte binding and detection. Further, metal loading and pH refreshing experiments are conducted to develop the reusability of the biosensor.

24. Experimental Validation of Archaeal Viperin Defense in Delta-ISCR E. coli Against the T7 Bacteriophage

Sashi Kulatilaka (College Station High School)
Welch Summer Scholars Program
Research Advisors: Ilya Finkelstein, Mary Arnold

Viperins are protein catalysts that, in humans, have been shown to confer immune defense against prominent viruses such as HIV, West Nile, dengue, and Zika. Recent phylogenetic data driven by DNA sequencing has led to the claim that antiviral viperin-producing genes found in all eukaryotes are evolutionary descendants of homologous sequences found in a newly-discovered species of prokaryotes called Asgard archaea. However, gene evolution, mutation, missing taxon data, and long-branch attraction over millions of years can all weaken these phylogenetic conclusions. The aim of this project was to counteract these potential weaknesses by providing experimental validation for these claims. A plasmid containing one of the archaeal viperin-like gene sequences, asVip11, was transformed into a delta-ISCR E. coli host. The delta-ISCR host was then assayed against the T7 bacteriophage. The asVip11-containing bacteria showed significantly more antiviral defense than control cultures containing either a non-antiviral GFP gene insert or no gene insert. Because asVip11 was shown to perform the same antiviral role in Asgard archaea that human viperin genes perform in humans, the evolutionary link between archaeal and eukaryotic viperin-driven immune systems was strengthened. In addition, this study of viperin proteins and their antiviral mechanisms can lead to exciting steps toward clinical applications that can combat HIV, West Nile, and other deadly pathogens.

25. Chemogenetic Silencing of Nociceptive Signaling to Enhance Functional Outcomes After Spinal Cord Injury

Yahya Kharbat (Texas A&M University)
Independent Research Project
Research Advisors: Jennifer Dulin, Prakruthi Amar Kumar

Between 50-80% of individuals with spinal cord injuries (SCI) experience chronic neuropathic pain (CNP). CNP arises shortly after injury from overactive peripheral pain-sensing neurons known as nociceptors, which are located in the dorsal root ganglion (DRG). Our study utilizes a chemogenetic approach that directly addresses the hyperactive nociceptors, silencing them in the acute phase, with the goal of alleviating neuropathic pain. Additionally, we investigated whether silencing the nociceptors would enhance the recovery of locomotor function. To test this, we targeted lumbar DRG (L4-L6) nociceptors

by introducing inhibitory Designer Receptors Exclusively Activated by Designer Drugs, or Gi-DREADDs, and used adeno-associated-6-viral-vector (AAV6) as the delivery mechanism. Bilateral intra-sciatic nerve injections to deliver AAV6-Gi-DREADDs were performed 4 weeks before the thoracic spinal cord contusion in rats. Afterwards, we orally administered the ligand CNO (clozapine-N-oxide) for up to 14 days to activate the Gi-DREADDs. Subsequently, we conducted weekly assessments of sensory and locomotor behavior over a 10-week period following SCI. The results of the behavioral tests revealed that early chemogenetic silencing of nociceptors enhanced the recovery of hindlimb locomotor function and significantly reduced thermal hyperalgesia during the subacute stages of the injury when compared to the control group. Histological assessments of the thoracic spinal cord tissue showed trends of an increase in neuronal sparing and CGRP+ axon sprouting as well as reduced lesion volume in experimental subjects compared to control SCI subjects. This suggests that silencing nociceptors early after SCI may improve neural plasticity and promote better long-term functional outcomes.

26. Role of Corticostriatal Plasticity in Long-Term Memory Formation during Lever-Pressing Behaviors

Emily Yu (Texas A&M University)
Independent Research Project
Research Advisors: Jun Wang, Xueyi Xie

Striatum is a major subcortical brain region that mediates over 90% of voluntary behaviors. There are two types of striatal projection neurons: direct-pathway medium spiny neurons (dMSNs) promoting “Go” actions and indirect-pathway medium spiny neurons (iMSNs) promoting “No-Go” actions. Classical theories propose that rewards (e.g., food, drugs, etc.) induce dopamine-dependent corticostriatal plasticity into dMSNs, facilitating long term memory and future behaviors. Previous studies suggest pairing a lever-pressing behavior with dMSN stimulation can drive rodents to learn behavior and acutely reinforces actions. However, such stimulation cannot generate long-term memories, presumably because there is no corticostriatal long-term synaptic plasticity (LTP) during learning. In this study, we will investigate whether pairing a lever-pressing behavior with an LTP-inducing corticostriatal stimulation enables rats to form a long-term memory. We will use optogenetics by infusing AAV-Chronos-GFP into medial prefrontal cortex (mPFC) and AAV-FLEX-Chrimson-tdT into dorsomedial striatum (DMS) of D1-Cre rats. Animals will undergo training to associate lever pressing with delivery of optical stimulation, while an inactive lever has no consequence. Additionally, a cue light is turned on during light stimulation. We will have a control oPSD and experimental oLTP group, with oLTP receiving stimulation to facilitate LTP induction between mPFC and dMSN synapses. Extinction and cue-induced reinstatement tests will assess memory, with c-Fos immunohistochemistry to quantify striatal neurons co-express Chrimson and c-Fos in activation of dMSNs during training and retrieval. This study will provide a detailed understanding of how reward memory is formed at the cellular and synaptic level.

27. Developmental Neuropsychiatric Outcomes of Pediatric Nerve Agent Neurotoxicity and its Mitigation by Novel Neuroprotectants

Abhinav Vadassery (Texas A&M University)
Independent Research Project
Research Advisor: Samba Reddy

Children are more susceptible to nerve agent neurotoxicity, leading to developmental risks. Pediatric nerve agent exposure can lead to neuropsychiatric sequela including developmental disabilities and cognitive impairments. However, there are a few epilepsy models that use pediatric nerve agent exposure for studying neuron developmental consequences and interventions. In this study, we investigated the long-term developmental impact of neonatal exposure to the nerve agent soman (GD) that induced neurotoxicity in pediatric rats. P28 pups were exposed to GD and were treated neurosteroid ganaxolone (GX). Developmental outcomes were assessed 1-10 months after exposure. Animals displayed significant deficits in mood and anxiety behavior at 1-, 3-, 5-, and 10 months post-exposure compared to age-matched controls. Animals displayed marked aggressive traits and deficits in object recognition memory. Animals treated with GX showed reduced deficits in mood, cognition, and memory. Pediatric exposure to GD produces many features of nerve agent toxicity in children. This model is a viable option for therapeutic screenings of developmental pathology and neuroprotectant interventions.

28. Comparative Analysis of Intron Structure in the Loblolly Pine Genome

Carlos Suarez Sthein (Texas A&M University)
Independent Research Project
Research Advisor: Tomasz Koralewski

Loblolly pine (Pinus taeda L.) is a commercially and ecologically important tree species of the southeastern United States forests. It was the first pine species with a sequenced and assembled genome. Better understanding of the structure and complexity of the loblolly pine genome has stimulated further intriguing research questions. For instance, previous studies found loblolly pine introns over 100 kbp long and identified intronic expression-enhancing regions. In this study we aim to further investigate loblolly pine intron sequences to identify potentially informative intronic regions and to investigate whether the identified patterns vary with intron position or size. Our results may consequently further improve understanding of the role of conserved intronic regions in gene expression in conifers and, more broadly, in plants.

29. Elucidating the Regulation of Hemoglobin in T-lymphocytes After Psychological Trauma

Valeria Silva (University of Texas at El Paso)
Summer Undergraduate Research in Genetics and Genomics (SURGe)
Research Advisor: Adam Case

In addition to behavioral symptoms, post-traumatic stress disorder (PTSD) leads to an increased risk of developing inflammatory conditions such as autoimmune diseases. Previous work from our laboratory has demonstrated T-lymphocytes become pro-inflammatory after PTSD, but the mechanisms regulating this are unknown. Using a preclinical murine model of PTSD called repeated social defeat stress (RSDS), we surprisingly found that the hemoglobin-alpha 1 gene (Hba-a1) was highly upregulated in T-lymphocytes after psychological trauma ($p<0.0001$), and that mice lacking Hba-a1 in T-lymphocytes displayed increased oxidative stress and inflammation compared to wild-type animals after RSDS. Therefore, we hypothesized Hba-a1 may regulate oxidative stress in T-lymphocytes. To test this, we exposed a T-lymphocyte cell line to the pro-oxidant hydrogen peroxide and observed a dose-dependent increase in Hba-a1, which confirmed Hba-a1 is responsive to oxidative stress in T-lymphocytes. Next, we cloned several known regulatory regions of the Hba-a1 gene into luciferase reporters to understand the genetic regulation of Hba-a1 in T-lymphocytes. After transfection of these reporters into the T-lymphocyte cell line, we have been able to conclude that the 1,000 bp region immediately upstream the Hba-a1 transcription start site is not responsible for the oxidative stress-related upregulation of Hba-a1 in T-lymphocytes, indicated by the lack of luminescence after hydrogen peroxide exposure. Ongoing studies are currently testing other regulatory regions that may be crucial in the upregulation of Hba-a1 in T-lymphocytes, which will provide critical information as to how this novel protein regulates these adaptive immune cells after psychological trauma.

30. Engineering Nanoparticles for Biomedical Applications

Luke Bamrud (Grand Canyon University)
Summer Undergraduate Research in Genetics and Genomics (SURGe)
Research Advisor: Akhilesh Gaharwar

This summer, I am working on two main projects. All of the projects focus on answering two main questions. The first being are there common practices in modern research and medicine that can be optimized and if so how do we address them? The second is are the limits of current therapeutics that could be fixed by biomedical engineering? My first project revolves around Vitaphil, a replacement for Fetal Bovine Serum. Then benefits of Vitaphil is that it is ethical conscious, cheaper, and its ingredients are consistant and characterized. My second project focuses on gold nanoparticles. I am testing 5 differently shaped AuNPs, that all have the same size. I am looking at the upregulation of certain genes and the affects they have on cell proliferation and cell cycle.

31. Genome Assembly of the North American Giant Stag Beetle (Lucanus elaphus)

Elexys Peoples (Northwest Missouri State University)
Summer Undergraduate Research in Genetics and Genomics (SURGe)
Research Advisor: Heath Blackmon

The North American giant stag beetle (Lucanus elaphus) inhabits temperate forests in the United States. L. elaphus live and reproduce in damp, rotting wood and play a vital role in wood decomposition. These beetles exhibit striking sexual dimorphism with the males having mandibles that can make up as much as half of the total body length, while the females have small mandibles in comparison. Despite being a well-known example of sexual dimorphism and male weaponry, we lack a genome sequence for this species. We sequenced this species using PacBio HiFi sequencing. Our initial assembly has a size of 314 MB, 4,527 contigs, and a contig N50 of 99.306 kb. This assembly is far more fragmented than was anticipated. Further investigation revealed that the number of reads for this species are fewer and have a distribution that includes far more short reads than other datasets in the lab.

32. Factors Contributing to Streptococcus mitis Colonization and Invasion in Treated Cancer Patients

Erin Horack (Penn State)
Summer Undergraduate Research in Genetics and Genomics (SURGe)
Research Advisor: Jessica Galloway-Pena

Streptococcus mitis are natural oral colonizers, but are known to translocate across the epithelial barrier and cause severe infections. Cancer patients, especially those undergoing cytotoxic chemotherapy are at high risk for developing S. mitis infections. The emergence of S. mitis as a frequent infectious agent among patients with malignancy is positively correlated to use of prophylactic antimicrobial drugs. Despite clinical significance, the pathophysiology of streptococcal infections remains poorly understood. Two potential factors contributing to S. mitis translocation and infectious risk are pathogen genetic factors and the microbiome community. In previous research our results suggested potential competition between S. mitis and Pseudomonas aeruginosa, in the microbiome of acute myeloid leukemia (AML) patients with bloodstream infections (BSI). To investigate further, I performed comparative whole genome analyzes on 16 commensal (oral) and 41 infectious (non-oral) S. mitis strains. The analysis found 3 predicted proteins with greater odds of being in infectious vs commensal isolates and 17 statistically enriched in commensal vs infectious isolates. Currently, I am completing competition assays in vitro between clinical and commensal strains of P. aeruginosa and S. mitis. The aim is to determine specific strains and conditions where competitive phenotypes emerge. Through fractionation, LC/MS, and RNAseq assays, I hope to identify exclusion factors hindering growth when P. aeruginosa and S. mitis coexist. Analyzing the microbiome and genetic factors around commensal and pathogenic S. mitis can determine potential microbial and genetic factors contributing to greater risk for S. mitis infections, resulting in potential novel therapeutics and treatment strategies.

33. Effects of Chronic Paternal Exposure to Acetaminophen on Fetoplacental Development

Abigail Clopton (Angelo State University)
Summer Undergraduate Research in Genetics and Genomics (SURGe)
Research Advisor: Michael Golding

Cytochrome P450 E1 (CYP2E1) is an enzyme that is highly expressed in the liver. It is activated by substances that humans are exposed to daily including ethanol, acetaminophen, acrylamide, a common compound found in carbohydrates cooked at high temperatures, and MSG, a common food additive. Our lab has previously reported fetoplacental and craniofacial changes in offspring resulting from paternal exposure to alcohol. Alcohol metabolism by CYP2E1 leads to oxidative stress, which may alter the small RNA profile of the sperm that is then transmitted to the embryo during fertilization. This leads to our hypothesis that activation of CYP2E1 results in the observed fetoplacental phenotypes mediated by sperm-borne small RNA. To test this, we worked to determine if activation of CYP2E1 by acetaminophen would cause similar fetoplacental and craniofacial defects. We used a model of paternal acetaminophen consumption in a C57BL/6J mouse model. The mice received a daily dose of 355.9 mg/kg ± 20.73 based on the 2021 ACLAM formulary, and no changes in food intake, fluid consumption, or body weight were observed. The males received this treatment for six weeks before being mated to females that had not been exposed to acetaminophen. The males were dissected at week ten to assess liver damage and epididymal changes. The fetal mice were imaged and dissected at gestational day sixteen to evaluate changes in fetoplacental development and craniofacial features. Through this study, we hope to gain a mechanistic insight into the role of CYP2E1 in intergenerational epigenetic inheritance of fetoplacental dysfunction.

34. Generation of a Mesenchymal Stem Cell Derived Extracellular Matrix with Angiogenic and Osteogenic Properties

Leila Martinez (Texas Lutheran University)
Summer Undergraduate Research in Genetics and Genomics (SURGe)
Research Advisors: Kayla Bayless, Carl Gregory

For diabetics, the risk of developing a foot ulcer is between 20-35%. These ulcers are the major cause of amputation in the U.S. Currently, there is a larger focus toward wound care, with some options for moderate cases such as Regranex. This medication stimulates angiogenesis and skin cell replacement. Nevertheless, ulcers commonly reappear even with treatment, and the 5-year mortality rate for diabetics with ulcers is 2.5x the risk of those without. More effective skin regeneration strategies would help reduce the mortality rate and have a greater impact on the growing at-risk diabetic community in the U.S. Our group has developed a mesenchymal stem cell derived extracellular matrix (ECM) with osteogenic properties. We hypothesized that this matrix might be effective in skin healing due to its unique composition. To test this hypothesis, we used a human umbilical cord vein endothelial cell (HUVEC) invasion assay to measure angiogenic responses. These are observed as measured cell migration and sprouting into the collagen gel. Statistical analyses are still underway to measure the invasion and sprouting of the HUVEC's. One notable observation was that the frequency of contraction in the collagen gels increased as the concentration of matrix increased over time. This was encouraging because tissue contraction is a major downstream event in skin healing and wound closure. In summary,

this in vitro work suggests ihECM may have therapeutic potential in the treatment of diabetic skin lesions. Further work would include additional analysis of HUVEC morphology, and testing in animal models.

35. Determining the Safety and Efficacy Profile of the Copper-Transporting Drug Elesclomol

Adriana Okonkwo (Texas A&M University)
Biochemistry REU
Research Advisors: Vishal Gohil, Mohammad Zulkifli

Copper (Cu) is an essential trace element required for the activity of many cuproenzymes involved in a diverse array of physiological processes. Genetic mutations that prevent Cu transport to cuproenzymes result in lethal human disorders such as Menkes disease, for which no FDA-approved treatment is available. Recent studies have uncovered the therapeutic potential of elesclomol, a Cu-transporting drug, for Cu-deficiency disorders by demonstrating its efficacy in yeast, zebrafish, and mouse models of Cu-deficiency. However, elesclomol was originally developed as an anti-cancer drug that induces cuproptosis at higher doses. To fully realize the therapeutic potential of elesclomol in Cu-deficiency disorders, it is crucial to identify the minimal dose of elesclomol that is both safe and effective. To investigate this, we used the Cu-deficient H9c2 rat cardiomyocyte cell line to determine the toxic (IC_{50}) and efficacy (ED_{50}) dose of elesclomol-Cu. We tested elesclomol-Cu concentrations at which Cu toxicity is manifested by measuring the biochemical targets of Cu toxicity, including the levels of Fe-S cluster proteins, aggregation of lipoylated proteins, and upregulation of metallothionein gene expression. We found that these markers of Cu toxicity were elevated only at a ten-fold higher dose than the maximal effective dose of ES-Cu. These observations were validated in an elesclomol-Cu-treated mouse model of severe Menkes disease. Our study has identified a safe and effective dose of ES-Cu for Cu-deficiency diseases.

36. Loss of Erbb2 Triggers Compensatory EGFR Activation in a Mouse Model of Colorectal Cancer

William Leach (Centre College)
Biochemistry REU
Research Advisor: David Threadgill

ERBB2 is a receptor tyrosine kinase within the ERBB family (EGFR, ERBB3, ERBB4) of transmembrane proteins. Due to its open conformation, Erbb2 supports higher ligand binding efficiency upon heterodimerization with other members of the ERBB family and provides more potent signals to its downstream targets. This heterodimerization causes cell signaling cascades in many pathways which regulate cell proliferation, survival, differentiation, angiogenesis, and apoptosis. ERBB2 has been previously identified to be involved in many cancers including breast cancer, gastric cancer, and ovarian cancer. Erbb2 has also been shown to be amplified in around 7% of all colorectal cancers, but many of its primary oncogenic functions are unknown. To better understand the effects of Erbb2 ablation during CRC progression, tumors were isolated from a transgenic knockout mouse model and control mice. Ingenuity pathway analysis (IPA) and gene set enrichment analysis (GSEA) predictions were confirmed

through reverse transcription quantitative polymerase chain reaction and differential gene expression analysis. Heterodimerization patterns upon loss of ERBB2 were studied through protein detection assays. Elucidating the heterodimerization compensation in the absence of ERBB2 and identifying potential downstream targets through differential gene expression, will partially reveal the role of ERBB in CRC progression. As such, these results allow for more targeted therapeutic approaches in the context of precision medicine and establish a better understanding of the role of ERBB2 in colorectal cancer.

37. Growing, Purifying and Phosphorylating HIS tagged Ubiquitin to Determine Parkin Activity involved in Parkinson's Disease

Jazmin Chavarria (University of the Incarnate Word)
Biochemistry REU
Research Advisor: Josh Wand

Parkinson's Disease is a brain disorder that causes unintended body movements and other symptoms that progress over time eventually making it hard for an individual to execute daily practices. The main cause of these symptoms is the loss of dopamine in the midbrain. About 1 million people in the United States are affected by Parkinson's Disease today, and although there are treatments to help suppress the symptoms, there is no known cure for the neurodegenerative disorder. Parkin is an E3 ubiquitin ligase that initiates destruction of damaged mitochondria. Mutations in Parkin have been associated with early onset Parkinson's disease. Parkin is highly regulated. Phosphorylated ubiquitin (pUb) is an allosteric activator. A goal of the Wand Lab is to understand how human Parkin is regulated. In particular, we are studying the interaction of phosphorylated ubiquitin and Parkin using NMR spectroscopy. HIS- tagged Ubiquitin is produced by expression in E. Coli culture in 15 N isotopically enriched M9 media. The protein pellet from the bacterial culture is then solubilized by sonication and purified by affinity chromatography using a nickel column. The purified HIS- tagged ubiquitin is then phosphorylated with the kinase PINK1 to create pUb. Purified pUb is then used to study binding to Parkin by isothermal titration calorimetry and by NMR spectroscopy. In the future, we plan on using this information to engineer protein drugs and overall contribute to finding a cure for Parkinson's Disease.

38. Kinetic Analysis of the DAG Binding C1B Domain from Protein Kinase C (PKC)

Steven Rimmasch (Weber State University)
Biochemistry REU
Research Advisor: Tatyana Igumenova

Activation of Protein Kinase C (PKC) is a popular drug target because of its role in cancer, neurological diseases, and metabolic complications. A common domain targeted by prospective drugs is the C1 domain, a regulatory domain of PKC. Although classical structural approaches to drug design have been successful, they do not give the complete picture of complex protein-ligand interactions. C1B activation is dependent on intricate interactions with the protein, ligand, and plasma membrane. Because of this, more in-depth techniques need to be used to explore drug efficacy. Kinetics experiments and MD simulations help researchers understand the dynamics of drug interactions while better mimicking the membrane environment. This area of inquiry is becoming the preferred method for assessing a drug's

validity as a protein target. In this study, the binding kinetics of C1B was studied with two different ligands. Association and dissociation kinetics were measured using Bio-layer Interferometry for both PDBu, a cancer promoting agent, and AJH-836, a drug candidate for PKC. Additionally, an MD simulation of the C1B-AJH-836 complex was conducted to understand how AJH-836 binding affects C1B's positional relationship with a lipid membrane.

39. Production of a Screening Platform for Next Generation Antimycotics

Abigail Allworth (Salem State University)
Biochemistry REU
Research Advisor: Vytas Bankaitis

Fungal pathogens are an increasingly relevant topic of research as species such as Candida albicans and 'fungal superbug' Candida auris develop resistance to all classes of clinically available antimycotics. Such infections are especially hazardous for immunocompromised individuals, a population that has grown due to COVID-19 and related hospitalizations. Fungi are eukaryotes; therefore, new antimycotics must be specific to the fungal target and present no off-target toxicities. Previous research has demonstrated that Sec14 is an ideal target for small-molecule inhibitors (SMIs) because it is necessary for fungal cell viability and virulence factors while lacking sequence homology with similar mammalian proteins. Sec14 is a phosphatidylinositol-transfer protein (PITP) essential for phosphatidylinositol-4-phosphate (PtdIns-4-P) signaling pathways. PtdIns-4-P signaling is critical for membrane trafficking and intracellular signaling, so when blocked, secretion of virulence factors in fungal pathogens is compromised. Thus far, SMIs have been unsuccessful at targeting Sec14 PITPs of many pathogenic fungi due to di-valine motif (V154 V155) polymorphisms, prompting the need to identify new inhibitory molecules. This project utilizes structural and molecular biology techniques to develop a framework for the screening of potential next-generation SMIs. To begin, the C.auris F154 T155 polymorphism was introduced to Saccharomyces cerevisiae Sec14 and the protein was purified. Subsequent crystallography will be utilized for preliminary in-silico trials, focusing on steric and electrostatic interactions with valine 154. Next, S.cerevisiae was genetically modified for expression of pathogenic Sec14 to produce a cellular screening system for SMIs that progress to chemical synthesis.

40. Investigation of Cysteine Protease Binding Partners for the Ubiquitin-Like Protein UFM-1 Using Activity-Based Probes

Emma Parker (Westminster College)
Biochemistry REU
Research Advisor: Wenshe Liu

Deubiquitinases (DUBs) and other Ubiquitin Specific Proteases (USPs) are critical members of the regulatory mechanisms for post-translational modification pathways. Despite this vital role, few proteases have been identified for ubls. Characterizing Ubls and their proteases, their molecular interactions, and their roles in regulatory or degradation pathways will support the development of potential new therapeutic targets. In this project, activity-based probes are used for the targeted detection of Ubl-specific proteases using a modified substrate or substrate analog. The probe contains a

reporter tag on the N-terminus to allow for the visualization of the molecule and a C-terminal functional group for covalent attachment to the protease active site. One manner of probe preparation follows the activated cysteine-directed protein ligation (ACPL) technique to activate a site-specific C-terminal cysteine residue to create an acyl substitution that functionalizes the probe with a C-terminal alkyne. Here, we demonstrate a targeted investigation to identify UFM-1 binding partners using an activity-based probe containing an N-terminal FLAG tag, a UFM-1 recognition element, and a C-terminal alkyne. Following incubation with HEK298 cell lysate, the probe, conjugated to protease binding partners, is isolated by co-immunoprecipitation with an anti-FLAG antibody. The immunoprecipitated UFM-1 specific proteases are then visualized using Western blotting. Preliminary results demonstrate the success of these methods, resulting in the observation of multiple binding partners for UFM-1. These binding partners will be identified using a mass-spectrometry-based proteomics approach.

45. Characterization of TDG on R-loop Substrates

Eduardo Rosario (University of Puerto Rico at Cayey)
Chemistry REU
Research Advisors: Jonathan Sczepanski, Baiyu Zhu

Thymine DNA glycosylase (TDG) is involved in several biological processes including Transcriptional activation and DNA demethylation. In recent studies, there has been a growing interest in R-loops, which are RNA-DNA hybrids detected within the CpG sequences of Promoters. The R-loop binding protein GADD45A plays a crucial role in facilitating DNA demethylation by recruiting the oxidizing gene TET1. Working in collaboration with TDG, this concerted action promotes the process of DNA demethylation. Single Turnover Kinetics were performed to identify the protein's dissociation constant (Kd) and therefore it's affinity to the ligand. The binding affinity of TDG in this project was also investigated using a range of concentrations employing Electrophoretic Mobility Shift Assay (EMSA) techniques. It has been recognized that TDG exhibits an equivalent binding affinity to these R-loop hybrids as it does to double stranded DNA. However, it's been acknowledged in this experiment that the glycosylase activity of TDG becomes less active when binding to a DNA hybrid. The objective of this study was to characterize the activity of TDG on R-loop substrates using these Single Turnover Kinetics and EMSA techniques. Furthermore, it was important to recognize these interactions to determine how they may contribute to the functional depletion of the protein's glycosylase activity.

46. New Conjugation Approach for Site-Specific Protein Immobilization and Application in Peptide Phage Display

Alyssa Toner (California State University San Marcos)
Chemistry REU
Research Advisors: Wenshe Liu, Demonta Coleman

Phage display is a potent technique employed for identifying peptide binders that target various proteins. However, it often necessitates laborious purification methods for the target protein prior to the selection process. To address this issue, we propose the utilization of strain-promoted azide-alkyne cycloaddition click chemistry (SPACC), which could reduce the need for extensive purification by

enabling a shorter time gap between target expression and phage display selection. In this study, we introduced azidophenylalanine (AzF) at three distinct positions within our model protein, ZNRF3 extracellular domain, in a site-specific manner. We then immobilized the modified protein onto dibenzocyclooctyne-coated magnetic beads and examined the relationship between the positioning of AzF (referred to as the anchor site) and the peptide binders obtained through phage display selection. The F101 protein mutant was expressed, and azidophenylalanine (AzF) was incorporated. To verify the successful incorporation of azidophenylalanine, several analytical techniques were used. SDS-PAGE was employed to assess the migration pattern of the expressed proteins. The presence of azidophenylalanine induces a specific molecular weight shift, confirming its incorporation into the target protein. Additionally, western blotting was employed to further validate the presence of azidophenylalanine within the protein of interest. Once it was confirmed, three rounds of phage display selection were then performed using a phage library and the mutant protein.

47. Bio-inspired Zinc Complex to Model the Structure and Function of Carbonic Anhydrase

Fiona Roche (The College of Wooster)
Chemistry REU
Research Advisor: Alison Fout

The zinc-containing metalloenzyme carbonic anhydrase plays a vital role in homeostatic maintenance in many organisms. The enzyme mediates CO2 transfer in blood by means of reversible hydration of CO2 to dissolved bicarbonate (HCO3-) and maintains physiological pH through regulation of CO2/HCO3- equilibrium.1 The Fout group has designed a tripodal ligand scaffold featuring a secondary coordination sphere allowing for hydrogen bonding to axial metal bound ligands. The ligand arms are capable of tautomerizing from the pyrrole-imine (pi) form to the azafulvene-amine (afa) form which affords flexibility to the primary coordination sphere (anionic to neutral) and secondary coordination sphere non-covalent interactions (hydrogen bond acceptor or donor). The goal of this work is to generate a library of Zn(II) complexes featuring tripodal ligand frameworks in order to model the reactivity of carbonic anhydrase.

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(2) Drummond, M. J.; Ford, C. L.; Gray, D. L.; Popescu, C. V.; Fout, A. R. Radical Rebound Hydroxylation Versus H-Atom Transfer in Non-Heme Iron(III)-Hydroxo Complexes: Reactivity and Structural Differentiation. J. Am. Chem. Soc. 2019, 141 (16), 6639–6650. https://doi.org/10.1021/jacs.9b01516.

48. Incorporating Sulfur-Containing C-1 Feedstocks Into Stereochemically-Diverse Carbohydrates to Expand the Properties of Next-Generation Sustainable Polymer Materials

Katherine Peters (University of Central Arkansas)
Chemistry REU
Research Advisor: Karen Wooley

Plastics are one of the most versatile materials used in modern society; however, current production methods rely significantly on the use of fossil fuels which has an extensive negative impact on the environment. One method to combat this persisting issue is to synthesize functional, biodegradable polymers derived from naturally abundant products, such as carbohydrates, which have high degrees of functionality and stereochemical diversity. Over the last decade, the Wooley Lab has continued to innovate the use of D-glucose, developing methodologies that take advantage of the five available hydroxyl groups to transform glucose into various monomers, including six-membered bicyclic carbonates to be subjected to organobase-catalyzed ring-opening polymerization (ROP). Increasing interest has focused on the substitution of oxygen atoms with sulfur to provide compositionally-diverse polymer backbones yielding materials with varying chemical, physical and mechanical properties. Previously reported literature has demonstrated the use of CS2 insertion into a D-xylose derivative to produce five-membered cyclic xanthates and dithiocarbonates. This study will expand upon this work, targeting the formation of trans-fused six-membered cyclic xanthates from D-glucose and cis-fused six-membered cyclic xanthates from D-galactose to study how the stereochemistry of the sugar impacts the stability of the resulting monomer and the kinetics and degree of regiochemical control of the ROP. The thermal properties and degradation patterns of the resulting stereochemically-diverse sulfur-containing polymer materials will be explored to provide insight into the relationships among polycarbonates and their sulfur-analogs.

49. Synthesis of Bio-Based Epoxy Monomers From Natural Eugenol Derivative for Copolymerization of CO2 and Epoxides

Tristan Roland (Prairie View A&M University)
Chemistry REU
Research Advisor: Mani Sengoden

The reduction of carbon dioxide (CO2) has gained much attention since the increasing environmental concerns about global warming associated with carbon emissions from industrial effluents, public transport, etc. In this regard, over the past few years, considerable attention has been made to the development of the chemical conversion of CO2 and its incorporation into synthetic materials. Among various efforts on the utilization of CO2 as a C-1 feedstock, the copolymerization of CO2 and epoxides has gained much interest from both academia and industrial communities because of its atom-economic and greener approach. The potential use of bio-based monomers as sustainable alternatives to replace the currently used petroleum-derived products represents an outstanding alternative to reduce their impact on the environment. In this presentation, we will describe the synthesis, and characterization of bio-based monomer derived from eugenol and our attempts towards copolymerization with CO2 as a C-1 source to access degradable polymeric materials.

50. Ppv Synthesis

Arthran Fonjweng (Prairie View A&M University)
Chemistry REU
Research Advisor: Quentin Michaduel

Poly(p-phenylene vinylene) (PPV) has gained popularity because of its use in organic light-emitting diodes (OLEDS). However, ever since PPVs have been discovered, there have been only a few methods to synthesize poly(naphthylene vinylene) (PNV). Using a method known as cyclopolymerization, we attempted to make ortho-substituted PNV which could give rise to new compounds with potentially intriguing optical properties . A benzene containing diyne monomer has been formed in four steps from catechol; First, an alkylation was performed with 2-ethylhexyl bromide to help with solubility. Then, the product underwent bromomethylation followed by substitution with trimethylsilylacetylene. A fluoride source was then used to remove the silyl group to provide the monomer. Then, the monomer was polymerized with Grubbs third-generation catalyst. Oxidation of the polymer was attempted with DDQ to form PNV. However, data supporting PNV formation was not obtained. Future efforts will be directed towards finding new ways to form the polymer using other oxidizing agents.

51. Optimization of Tetrapodal Textured Janus Textiles for Accessible Menstrual Health

Angely Morales (University of Puerto Rico at Cayey)
Chemistry REU
Research Advisor: Sarbajeet Banerjee

Challenges in menstrual health affect menstruating individuals who lack affordable and safe access to menstrual hygiene products due to residing in low-income environments, thus often resorting to inadequate alternatives that pose risks to their health. This issue can be attributed to financial limitations, availability of clean water, and social factors. Hence, this study aims to optimize the investigation of a menstrual health product that offers a solution encompassing qualities such as dryness, discretion, washability, safety, and ease of production. The product features a Janus fabric top layer, enabling unidirectional permeability into the absorptive layer, and is constituted of a superhydrophobic side and a hydrophilic side. The textile is a polyester mosquito netting, which is spray-coated with ZnO tetrapods (ZnO-t); the tetrapods are then adhered to the fabric with polydimethylsiloxane (PDMS). The objective is to identify a more cost-effective adhesion agent and replace toluene as the solvent for PDMS. Thus, we conducted solubility and adhesion tests with polyvinyl chloride (PVC) as a potential candidate. However, our findings indicate that while PVC is an economic polymer; it presents certain drawbacks and complexities, including issues related to plasticity, efficient solvent accessibility, and adhesion capabilities. Conversely, ethyl acetate underwent testing as a solvent, aiming to explore an eco-friendly alternative, and demonstrated promising results as a replacement solvent for toluene to dissolve PDMS. The overall product remains suitable for affordable reusable pads or underwear menstrual health design.

52. Creation of a Homemade DESI Platform for High-Throughput Mass Spectrometry

Adrian A. Rodriguez Torres (University of Puerto Rico at Cayey)
Chemistry REU
Research Advisor: Xin Yan

Desorption electrospray ionization (DESI) is an ambient ionization source typically coupled with mass spectrometry (MS), enabling the quantitative analysis of surface analytes. DESI-MS requires little to no sample prep making this technique vastly useful and applicable to a wide array of research scenarios such as imaging, reaction monitoring, and reaction acceleration. Previous iterations of DESI ionization sources were commercially manufactured under Prosolia until the company was acquired by Waters Corporation, allowing for use only with Waters instruments. In this work, we describe the creation of a homemade, low-cost DESI stage compatible with low or high-resolution Thermo Scientific mass spectrometers to allow for high-throughput (HT) MS analysis. HT-DESI-MS reaction screening enables the analysis of multiple analytes with little to no sample prep, only requiring a minuscule amount of sample and ionization solvent. Using conventional DESI-MS, we accomplish a fast analysis of multiple lipid derivatization products used to characterize glycerophospholipid structural properties and identify lipid isomers. With this, we aim to translate this rapid analysis HT-DESI-MS to the homemade, low-cost DESI platform. The revolution of a low-cost platform for DESI-MS overcomes the disadvantages of instrument incompatibility and lack of resources, allowing for easier exposure to the applications of MS.

53. Characterizing Road Kills of the Endangered Florida Panther (Puma concolor coryi): Association With Panther Demographic Characteristics and Road System Structure

Javier Garcia Saldana (Texas A&M University)
Ecological Systems Laboratory
Research Advisors: Hsiao-Hsuan Wang, Miranda Peterson

The road system in Florida restricts movement and reduces habitat of the endangered Florida panther (Puma concolor coryi) and reports of road kills are common. Our goal is to identify Florida panther demographic characteristics and road system characteristics that affect road kills. We collected Florida panther mortality data from the Florida Fish and Wildlife Conservation Commission, mapped (using ArcGIS Pro) the locations of road kills from 1972 to 2021, and analyzed selected demographic attributes (age, life stage, and sex) of the road killed panthers. Preliminary results showed that road kills accounted for 386 out of 598 (64.55%) of all reported mortalities. Of the 386 road kills, 157 (40.67%) were female, 227 (58.81%) were male, and 2 (0.52%) were of unknown sex. Male panthers between 2-3 years old were the most numerous group. Our preliminary results support past research on the negative impacts of roads on Florida panthers. We are in process of relating road kills to characteristics of the road system structure in Florida and will summarize project results by suggesting potential road system improvements to reduce road kills.

54. Anthropogenic Effects on Fusconaia mitchelli

William Flack-Robinson (Texas A&M University)
Ecological Systems Laboratory
Research Advisor: Hsiao-Huang Wang

The rapid expansion of agriculture and urban development along the Guadalupe River basin has caused detrimental changes to the natural terrain that once existed, resulting in disrupted water flow and increased runoff. Such changes have affected the critically endangered freshwater muscle, Fusconaia mitchelli (Bivalvia: Unionida) or False Spike. F. mitchelli are aquatic invertebrates that contribute important ecological benefits to freshwater environments such as stabilizing benthic habitat and improving water quality via filtration. Thought to be extinct, F. mitchelli was discovered in the Guadalupe River in 2011 during a survey and has since been classified as critically endangered as it is endemic to the river. Like other mussels, F. mitchelli is sensitive to anthropogenic changes to the natural flow of streams as well as pollution from differing sources. To determine the effects of urban and agricultural runoff on F. mitchelli, both live and dead samples were collected and counted over a three-year period, with most of the samples coming from downstream areas in Gonzales and DeWitt counties. We will use these samples along with their associated environmental variables to develop a species distribution model. We hope the information gained from the model will aid in identifying the best conservation action to implement for this species.

55. Assessment on La Copita Ranch Using Camera Trap Surveys

Caleb Williamson (Berea College)
Agriculture & Life Sciences REU
Research Advisor: Stephen Webb

Effectively managing wildlife on a ranch requires a thorough assessment and understanding of species richness, especially in southern Texas where wildlife is very diverse. La Copita Ranch is a 2,726-acre research ranch that is managed by the Department of Rangeland, Wildlife, and Fisheries Management of Texas A&M University. The ranch has not been managed for the past decade, so steps are being taken to gather baseline data on the ranch's wildlife to allow for well-informed management decisions and plans in the next few years. We deployed 16 camera traps on the ranch from October 2022 to May 2023 to investigate species richness. This project also provides data that can be compared to future camera trap survey assessments to estimate occupancy, relative abundance, habitat selection, and sex ratios of certain wildlife. We obtained 2,659 wildlife photos and identified 18 species with certainty, including 11 mammal species and 7 bird species. Eastern cottontail had the most detections, followed by white-tailed deer, then coyote. These 3 also had the highest number of detections per day. White-tailed deer had the greatest distribution across the ranch, occurring at 14 of the 16 sites. White-tailed deer also had the highest naïve occupancy, 0.88 (i.e., number of sites detected at divided by total number of sites), while eastern cottontail and collared peccary followed with 0.69 and 0.56, respectively. Our results suggest that La Copita has a diverse wildlife community that is distributed across the ranch. These results will provide the basis for future camera survey efforts on La Copita to understand the distribution and abundance of wildlife populations.

56. Fine-Scale Landscape Features Influence Fox Squirrel Presence on Urban Campus

Daniel Whitman (Macalester College)
Agriculture & Life Sciences REU
Research Advisor: Ty Werdel

Urbanization and urban sprawl generally degrade and diminish wildlife habitat, threatening to extirpate local populations. However, certain synanthropic species (e.g., coyotes, white-tailed deer, squirrels) are able to persist in urban environments and may even occur at higher densities than they do in their natural habitats. Eastern fox squirrels (Sciurus niger) are large tree squirrels that are known to be present in high densities within urban areas. To determine how landscape characteristics may affect fox squirrel presence, we conducted line transect surveys along sidewalks on the Texas A&M College Station campus, recording presence of fox squirrels, their behavior, and the microhabitat substrate. Preliminary findings show that fox squirrels were not evenly distributed across the college campus. Fox squirrels were closely associated with large, mast-producing trees, such as live oak (Quercus fusiforms/virginiana) or post oak (Q. stellata), and preferred shaded patches of grass over exposed concrete or asphalt sidewalks and roads. These results suggest that even when urban areas contain suitable habitat, use of urban environments by wildlife is still highly selective and dependent on specific habitat requirements. Further research could examine potential effects of decreased predator densities or increased artificial food sources on urban fox squirrel population densities and compare behavior and habitat use of urban squirrels with those in rural, natural habitats.

57. Using Bayesian Additive Regression Trees (BART) To Predict Factors of Periodontal Disease: Analyzing Oral Health Risk Behaviors Through a Public Health Lens

Irene Jun (Claremont McKenna College)
Biomedical Informatics and Behavioral Sciences (BIBS) Summer Research Program
Research Advisors: Pati Debdeep, Peggy Timothe

Periodontal disease develops from the inflammation and infection of the gums and bones that support a tooth, and if left untreated, can result in tooth loss and even develop into serious health conditions. Studies have been conducted on linear regression models of specific risk factors, but few have covered complex nonlinear relationships between the response and the predictors as well as relational interpretations of multiple variables. Bayesian Additive Regression Trees (BART) is a flexible prediction model that is unique in its ability to handle non-linear assumptions and analyze complex multi-way interaction effects. Hence, the objectives of our research study were to implement BART to analyze 10,000 subjects from oral health data in NHANES, a data set assessing the health and nutritional status of adults and children in the U.S., and determine which combinations of oral health risk behaviors were most indicative of periodontal disease and whether correlations could be drawn with risk factors such as race/ethnicity, healthcare accessibility, and financial income. Indicators of periodontal disease were captured in the data set as pocket depth (PD) and clinical attachment loss (CAL). We expect to see factors of alcohol intake, tobacco intake, and frequency of healthcare visits to most significantly predict risk. Periodontal disease is common, but it is preventable and understanding the statistical interactions and trends of specific health and accessibility factors can help dentists identify at-risk populations, and formulate personalized treatment plans and appropriate preventative measures.

58. An Analysis of Oral Health Risk Factors Using Variational Inference

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A variety of factors are involved in the maintenance of one's oral health beyond personal hygiene. Regarded as a silent epidemic, millions of Americans suffer from undiagnosed and untreated caries and periodontal disease, increasing the risk of more systemic diseases including cardiovascular disease, diabetes mellitus, and stroke. Untreated dental disease can also lead to tooth loss, pain, and infection, often resulting in the preventable utilization of emergency services. Aiming to enhance prevention efforts, we analyzed data from the National Health and Nutrition Examination Survey from 2009-2014, a group of studies including both physical examination and personal interviews of American children and adults. We focused on a selection of 50,000 individuals aged 30-80 approximately representative of the national population in terms of race/ethnicity, education, and socioeconomic status. The data set included more than 20 covariates, from demographic information to self-reported personal habits, while response variables included periodontal measures of pocket depth and clinical attachment loss as measured by licensed dentists. As standard approaches involving variable selection are difficult with such a large sample size, we instead utilized VARBVS, a function performing fast Bayesian variable-selection for large scale regression using variational inference. Significant risk factors identified by the analysis including tobacco use, alcohol use, education level, and household income are consistent with the findings of smaller analyses found in a literature review. We aimed to identify and compare the impact of key factors in one's oral health such that clinicians might prioritize addressing these factors during routine preventative visits.

59. Barriers in Access to Dental Care for Special Needs Patients in East Texas: A Mixed Method Research

Taylor Butler (North Carolina Agricultural and Technical State University)
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Research Advisor: Peggy Timothe

Oral health care is limited for adults and kids with cognitive, physical, or developmental challenges in rural areas of Texas. This study aims to explore access to dental care in East Texas for individuals with disabilities and explore the dental practices, attitudes, and barriers to access for this vulnerable population. A Simi structured interview was used to collect data from a random sample of 44 dental practices in the 22 cities in East Texas. The interview questioned whether the private practice accepted patients with Medicaid insurance, patients with disabilities, and wheelchair-accessible patients. Furthermore, descriptive statistics were computed using the chi-squared tests and logistic regression models which analyzed the association between predictor and key outcome variables. My results indicated that oral health services are limited to patients with disabilities in East Texas, mainly due to most East Texas general dental practices not accepting patients with disabilities. Addressing provider-related access barriers like training and reimbursements might help motivate dentists to provide services to patients with disabilities.

62. Following Mechanochemically Driven Reactions of Graphene with Water

Ulisses Braga (University of Texas at Austin)
Center for Mechanical Control of Chemistry (CMCC) REU
Research Advisor: James Batteas

The use of mechanical force in chemical reactions has been gaining wide interest serving as an alternative to solvent-based, high temperature reactions which have excessive byproducts and comparably lower energy efficiency. In this work, mechanochemical reactions involving single layer graphene membranes were executed and analyzed through Raman spectroscopy. By observing changes over time in the intensities and positions of characteristic Raman bands associated with graphene, it was found that the application of pressure to the graphene significantly drove its reactivity with water when compared to the same reaction in the absence of a mechanical force. The intensity of the D band - arising from changes in local bonding - was compared to that of the G band - a fixture of all graphitic systems - to monitor the extent to which the reaction occurred. Interestingly, initial growth of the D band representative of reaction progress was found to peak and then subsequently decline over the course of the reaction. Tracking of the graphene G and 2D peaks allows for the strain applied to the membrane to be concomitantly quantified in order to understand the relationship between the two. Density functional theory calculations suggested that the likeliest reacting species was hydrogen ion with increased reactivity found for graphene when under strain, consistent with the experimental results.

63. Text Messaging as a Data Collection Tool for Public Health Studies

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Research Advisor: Peggy Timothe

Mobile text messaging has become a major communication method, with potential applications in public health data collection. This study evaluates text messaging's effectiveness as a tool in gathering data from participants of the Texas Oral Health Coalition's Tooth Steps program. Data were obtained from 110 perinatal participants who attended a health education meeting and later responded to questions sent by text regarding their infant's oral health at the ages of 4, 5, and 7 months post-birth. Using chi-square tests and logistic regression, we will analyze the participants' text message response rates over time, focusing on age-based demographic differences. Given the technological familiarity of younger people, we expect higher response rates among younger participants. We also anticipate declining participation over time. These findings could offer valuable insights for dental public health, assessing if text messages are a useful tool for data collection in future studies, which can support strategy development in addressing public health issues.

64. Barriers to Preventive Care for Children with Special Health Care Needs

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Research Advisor: Peggy Timothe

Children with special health care needs (CSHCN) face many barriers to receiving preventive medical and dental care due to unique obstacles from both the patient and provider perspective. CSHCN experience challenges such as sensitivity, processing deficits, and physical limitations that cause these children to require more complex care to fully satisfy their needs. However, research examining the differences between why CSHCN fail to receive preventive medical care and preventive dental care is a niche that has yet to be explored. This study aims to use biomedical informatics to analyze what barriers CSHCN face in receiving preventive dental care and how those barriers compare for CSHCN who do not receive preventive medical and dental care. Of the 40,242 responses obtained from the 2009-10 National Survey of Children with Special Health Care Needs from the Data Resource Center for Child & Adolescent Health, 1,194 parents or caregivers of CSHCN indicated that their child did not receive all needed preventive dental care. Their responses specifying the reasons for not receiving preventive medical and dental care were visualized with cross-tabulation techniques and compared using a Chi-square test to determine whether a significant association exists between each reason CSHCN failed to receive preventive medical and dental care. Access- and knowledge-related barriers are expected to have varying degrees of association among responses in failure to receive preventive medical and dental care, but financial-related barriers are expected to have a high association in failure to receive both types of preventive care.

65. Investigating Facilitative Relationships Between Spartina Alterniflora and Infauna in the Low Marsh of Galveston Bay

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Ocean and Coastal Research Experiences for Undergraduates (OCEANUS)
Research Advisors: Anna Armitage, Brooke Torjman

Positive interactions between species in salt marsh ecosystems contribute to ecosystem function. Salt marsh plants such as the cordgrass Spartina alterniflora (hereafter, Spartina) play a crucial role in ecosystem health by acting as a habitat, spawning grounds, and food source for other organisms. One beneficiary of Spartina are invertebrates living within the marsh sediment, known as infauna, who are important prey and cyclers of organic matter. While it is generally assumed that infauna facilitate Spartina health, there is a lack of quantified evidence that supports this assumption, particularly in Galveston Bay. We wanted to know if infauna benefit Spartina health, seeking to quantify plant growth and morphological responses of Spartina to nutrient addition. We hypothesized that Spartina will demonstrate better health and respond differently to an enriched environment when infauna is present, compared to enriched treatments without infauna. To test this, we created a mesocosm study to replicate natural conditions in a controlled environment and thereafter measured plant health. We had 4 different treatments: those with infauna and enriched with nutrients, without infauna and enriched, with infauna and not enriched, and those without infauna and not enriched. We measured plant height, number of new leaves, and chlorophyll production weekly. The results of this study will be useful in

furthering our understanding of the type of interactions that exist between infauna and Spartina in Galveston Bay, which will provide broader knowledge in the importance of infauna in ecosystem function.

66. Movement and Habitat Use of Bull Sharks and Alligator Gar in Sabine Lake Estuary

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The population dynamics of many fish species are linked to events that occur during the period of estuarine residency. Although some species complete their life cycles in estuaries, many rely on these ecosystems for more limited periods (e.g., first few years of life as a nursery), migrating later into freshwater (rivers) or coastal ecosystems as they mature. These ontogenetic migrations are often linked to spawning, foraging, or physiological constraints. Research being conducted at the recently founded Gulf Research Institute for Highly Migratory Species (GRIHMS) is also primarily concerned with the ecology of predatory fishes in estuarine and coastal waters. Understanding linkages of populations between estuarine-freshwater and estuarine-marine ecosystems as well as the environmental drivers that influence movements in and out of estuaries are critical to the conservation and management of estuarine-dependent species. The goal of this project is to use acoustic telemetry to investigate the movement and habitat use of bull sharks (Carcharhinus leucas) and alligator gar (Atractosteus spatula) in the Sabine Lake estuary. Detailed habitat use and movement data will provide valuable information on the location and environmental conditions associated with high quality habitat for each species. Also, characterizing primary movement pathways or corridors, along with the timing of these behaviors, will improve management strategies. Results linking bull shark and alligator gar habitat use and movement to environmental conditions will help identify habitat attributes that may influence the population dynamics of both species.

67. Mixing in the Gulf of Mexico: The Impact of 6:2 FTS and PFOS on Photophysiological Health of Natural Phytoplankton Communities

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Research Advisor: Antonietta Quigg

PFAS (Perfluroalkyl substances) are chemicals widely used in industrial products, which through product use, ultimately runoff into ecosystems. Two PFAS compounds, 6:2 FTS (Fluorotelomer Sulfonic Acid) and PFOS (Perfluorooctane Sulfate) are commonly detected in aquatic environments. Subsequently they may impact phytoplankton which make up the base of the food web and produce over 50% of the world’s oxygen, but there's a lack of studies that assess natural phytoplankton communities and the toxicity of PFAS mixtures. This study focuses on photophysiological health in phytoplankton communities from exposure to mixtures of 6:2 FTS and PFOS. Natural communities were collected from coastal Gulf of Mexico (29.26496489031152, -94.82526564295938) on July 10, 2023, and exposed to increasing concentrations of PFOS [250 ng/L, 2.5 mg/L, 5 mg/L, 10 mg/L] and 6:2 FTS [1500 ng/L, 2.5

mg/L, 5 mg/L, 10 mg/L]. Fluorometry was used to understand photophysiological health and growth. Based on fluorometric data, there was a negative impact on the photosynthetic efficiency (Fv/Fm), photosynthetic machinery (sigma), and growth on phytoplankton communities at higher mixture concentrations (250 ng/L, 5 mg/L, 10 mg/L, 20 mg/L). The mixture of 6:2 FTS and PFOS, and only PFOS exposure showed similar impacts on all parameters studied. Due to the limited studies on the toxicity of PFAS mixtures, this research will give insight to understanding the true health impacts on phytoplankton communities undergoing complex pollutant pressures.

70. Sampling and Examining Ecosystem Indicators of Pelagic Communities of Estuaries

Tucker Ellis (Tufts University)
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Research Advisor: Hui Liu

Ctenophores are uniquely important members of estuarine ecosystems. They serve as a key intermediate in the biomass transfer between lower and higher trophic levels, as they consume zooplankton, ichthyoplankton, and euphausiids, and are consumed by larger fishes, jellyfish, and sea turtles (Alvarino, 1985; Purcell, 1985; Mianzan and Sabatini, 1985; Monteleone and Duaguay, 1988; Hoffmeyer, 1990). Since they prey on copepods, they provide estuarine ecosystem regulation, preventing copepod populations from experiencing unrestricted growth and depleting phytoplankton populations (Granéli and Turner, 2002).

Globally, estuarine ecosystems have become increasingly susceptible to the effects of anthropogenic climate change and environmental disasters (Lotze et al., 2006; Hallett et al., 2018). Galveston Bay, Texas, the seventh-largest estuary in the United States, has been of particular interest to marine ecologists in recent decades, as it has experienced extreme disasters such as Hurricanes Ike (2008) and Harvey (2017), which have significantly affected the ecosystem's community structures and trophic interactions (Liu et al., 2021).

Preliminary studies have been completed about the impacts of fluctuating environmental parameters on pelagic populations in the Gulf of Mexico (Liu et al., 2017; Liu et al., 2021), but a study quantifying the impacts on ctenophore populations in the Gulf has not yet been undertaken. This study will examine how pelagic temperatures and salinity affect ctenophore density in Galveston Bay.

It was found that ctenophore density is positively correlated with temperature and negatively correlated with salinity. Information produced in this study can show how climate change may alter estuarine trophic interactions and ecosystem health.

71. Assessing Stakeholder Response to Climate Change Impacts on Galveston Island and the Bridges and Barriers to Coastal Adaptation Strategies

Thomas Raglow (University of Dallas)
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Research Advisor: Jenna Lamphere

Galveston Island is experiencing some of the fastest sea level rise in the world, a catalyst behind accelerated erosion, loss of wetlands, flooding, and increased risk of hurricane strikes. This study investigates the impacts of climate change on Galveston, what is being done about it and by whom, and challenges to creating a climate-resilient community. Galveston is a historic and diverse community of 50,000 residents and consists of a diverse set of local, regional, and national interests, being a popular tourist destination, the home of a large medical institution, and the gateway to the Houston shipping channel. While multiple studies on individual adaptation projects on Galveston Island have been conducted, there exists no comprehensive analysis for the island which factors all existing adaptation strategies, and the organizations performing them, on the island. Our research addresses this gap by examining local stakeholder response to climate change impacts on Galveston Island and identifying bridges and barriers to successful adaptation. This research is multi-methods, including a thorough literature review, interviews, and document analysis. After reviewing past research on adaptation in coastal communities to identify different strategies, challenges and opportunities, an analysis of local news articles pertaining to climate change response was conducted, and interviews with community leaders were conducted. A possible shortcoming of this research was that no systematic collection of public opinion was conducted. The information from this study will be used to factor into policy recommendations pertaining to sustainability and coastal adaptation on Galveston Island.

72. Sea Level Variability in the Western Subtropical North Atlantic During the Last 50,000 Years

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Research Advisor: Pete van Hengstum

Holocene sea-level change in the western subtropical north Atlantic has been anchored by mangrove and coral reef sea-level indicators distributed across the Bahamian Archipelago. Prior to the Holocene, speleothems in submerged caves commonly provide a maximum sea-level indicator during the glacial periods. However, limited availability of sea-level proxies prior to the Holocene limits our absolute knowledge of glacial sea level change and position. Stratigraphy collected from Drinkwater Sinkhole on Abaco Island (Little Bahama Bank) is continuous during the last 50,000 years, providing a record of a groundwater-fed lake forced by regional sea-level and climate variability during its history. The stratigraphy was investigated with Loss on Ignition, in which we heat the sediment at 550°C to measure the amount of organic carbon originally present in the sample. During the late Pleistocene (50 to 20 ka), stratigraphy alternated between carbonate-rich vs. organic-rich intervals, indicating the sinkhole lake alternated between oxic and anoxic settings. As global sea-levels rose after the last glacial maximum (20 ka), a mangrove ecosystem colonized Drinkwater Sinkhole, which deposited a 1-2 m thick peat lithofacies that is characterized by abundant organic matter. This peat unit is a new diagnostic sea-level

indicator for the region at ~60 m below sea level, the age of which must still be refined with further radiocarbon dating.

73. Evaluating the Toxicity of 6:2 Fluorotelomer Sulfonate on Natural Phytoplankton Communities: Validity of 6:2 FTS as an Alternative PFAS

Marshall Coppage (University of South Carolina)
Ocean and Coastal Research Experiences for Undergraduates (OCEANUS)
Research Advisor: Antonietta Quigg

Perfluorinated alkylated substances (PFAS) are a group of over 14,000 unique chemical compounds, some of which are toxic, cause adverse health effects, do not degrade, and have the ability to bioaccumulate. PFAS compound, 6:2 fluorotelomer sulfonate (6:2 FTS) has been introduced to replace toxic PFAS that have been used in the manufacturing of copious industrial and commercial products. Previous research has documented the effects of various PFAS on aquatic organisms, but there is a lack of sufficient research regarding the effects of 6:2 FTS on natural marine phytoplankton communities. This research seeks to determine the effects of 6:2 FTS on natural phytoplankton communities of the Gulf of Mexico. Natural communities were sampled from the Gulf of Mexico (29° 15 '54.2"N 94° 49' 31.0"W) and exposed to 0-80 mg/L dissolved 6:2 FTS. Over four days, communities were contained in a floating corral submerged at surface level to undergo natural fluctuations in light, temperature, and tide. Samples were monitored daily to assess photophysiological health via fluorometry and biomass was monitored to assess community abundance. Stress response was determined by measuring presence of reactive oxygen species. Data collected in this study found that tested concentrations of 6:2 FTS did not result in significant ($p<0.05$) changes to the investigated parameters. This suggests that 6:2 FTS is a less toxic alternative PFAS, as previous research with toxic PFAS have shown significant negative effects at similar concentrations.

74. Characterizing Virus-Host Interactions in Galveston Bay Using Viral Production and Viral Tagging

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Research Advisor: Jessica Labonté

Viruses are an integral part of the marine environment. Through microbial mortality, they maintain the stability of the ecosystem and are involved in nutrient cycling. By influencing the fluctuation of organic matter, energy, and nutrients, they are major players in the geochemical cycles, affecting carbon and nitrogen levels. Interactions between viruses and bacteria are important, but the specifics about the interactions are not well understood. The goal of this project is to calculate viral production, infection rate, and microbial mortality in Galveston Bay. To do so, we performed viral production experiments to obtain an approximation of how many viruses were produced over a 24 hour period. We then used viral tagging to stain viruses and track their infections, providing a more precise estimate of the infection rate. Our results show that Galveston Bay is comparable to other coastal environments. The viral tagging experiments, which are still ongoing, will support the viral production data from the viral production

experiments by providing a precise estimate of the infection rate. This project will gain beneficial insights of the importance of viruses and their impact on the geochemical cycles in marine environments.

75. Chemically-Induced Bleaching of Cassiopea (Upside-Down Jellyfish)

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Research Advisor: Sheila Kitchen

Some jellyfish, sea anemones, and corals (phylum Cnidaria) form symbiotic relationships with photosynthetic dinoflagellates. This relationship is based on nutrient exchange, allowing the host to thrive in nutrient-poor environments while the symbiont receives waste products used for photosynthesis. Under thermal stress, these symbiotic cnidarians bleach, meaning they expel their symbionts turning the organism white. In obligate species, like reef-building corals, the loss of symbionts leads to stunted growth and eventual death. To study cnidarian-dinoflagellate symbiosis in the lab, we use two model systems, the sea anemone Exaiptasia and jellyfish Cassiopea. In order to address questions on different symbiont interactions with the host, we need to find non-stressful methods to remove symbionts. In Exaiptasia, treatment with menthol is an effective and rapid treatment to produce symbiont-free animals in under three days. Here, we tested chemicals – specifically menthol and SKII, a lipid signaling inhibitor– to bleach Cassiopea polyps. We also tested the impact of those chemical treatments on symbiont growth and survival. We found that Cassiopea does bleach in response to SKII treatment, but not when exposed to menthol. Moreover, SKII treatment has no impact on symbiont growth or survival. We propose that differences in chemical-induced bleaching between Exaiptasia and Cassiopea is related to where they house their symbionts. Exaiptasia stores symbionts in their gastroderm, while Cassiopea's symbionts enter the mesoglea via amoebocytes. The information from this experiment could aid us in understanding how to manipulate symbiosis in model systems such as Cassiopea and Exaiptasia.

76. Reduce, Reuse, Reclaim: A Comparative Analysis of Wastewater Treatment Systems

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Reuse Water Quality Research and Extension Experiences for Undergraduates (REEU)
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The utilization of On-Site Sewage Facilities (OSSF) work to improve wastewater quality before being discharged into the environment. Although, 99% of wastewater is composed of water, the 1% of waste prevents it from being suitable for human use. The goal was to analyze the effectiveness of treatment methods to determine if treated wastewater met Type I or II water quality standards. This was achieved by testing the physical, chemical, and biological properties of the wastewater. Additionally, energy consumption for each treatment method was calculated. The percent reduction and overall treatment level served as an effective measure of treatment methods. Also, there was a comparison among the

overall treatment level and energy consumption for each method. The assessment can be used to implement improved methods into OSSFs to produce high quality water and to meet reuse standards.

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