



Discover Undergraduate
Research Program

SUMMER UNDERGRADUATE RESEARCH FORUM

JULY 28, 2023

WELCOME TO THE LSU SUMMER UNDERGRADUATE RESEARCH FORUM 2023

The Summer Undergraduate Research Forum showcases the numerous undergraduate students who have engaged in summer research projects this year at institutions throughout the LSU System.

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ABOUT THE COVER PHOTO

Location: Grand Isle, LA

Brooke Chouest

Brooke Chouest, born and based in southern Louisiana, is a documentary photographer best known for her work exploring and preserving the unique culture and threatened coastline of the United States' Gulf region. Her work often focuses on the fight of these communities combating environmental and emotional hardships due to economical and climate crises.

Brooke is currently a senior BFA student at Louisiana State University

GUEST WIFI

Wi-Fi Name: lsuguest

Username: SURF2023

Password: 982592

PROGRAM QR CODE

TO VIEW ABSTRACTS PLEASE VISIT THE QR CODE



SCHEDULE OF EVENTS

All locations in the LSU Student Union

<u>Time</u>	<u>Event</u>	<u>Location</u>
8:00 a.m. - 9:00 a.m.	Check-In Desk Open	Cotillion Ballroom, Room 250
9:00 a.m. - 9:05 a.m.	Opening Remarks	Cotillion Ballroom, Room 250
9:10 a.m. - 11:00 a.m.	Poster and Visual Display Session	Cotillion Ballroom, Room 250
11:00 a.m. - 12:00 p.m.	Presenter Lunch Break & Keynote Speech	Atchafalaya, Room 339
12:00 p.m. - 1:00 p.m.	Lightning Talks	Atchafalaya, Room 339
1:00 p.m. - 1:30 p.m.	Closing Remarks & Group Photo	Atchafalaya, Room 339

ABOUT LSU DISCOVER

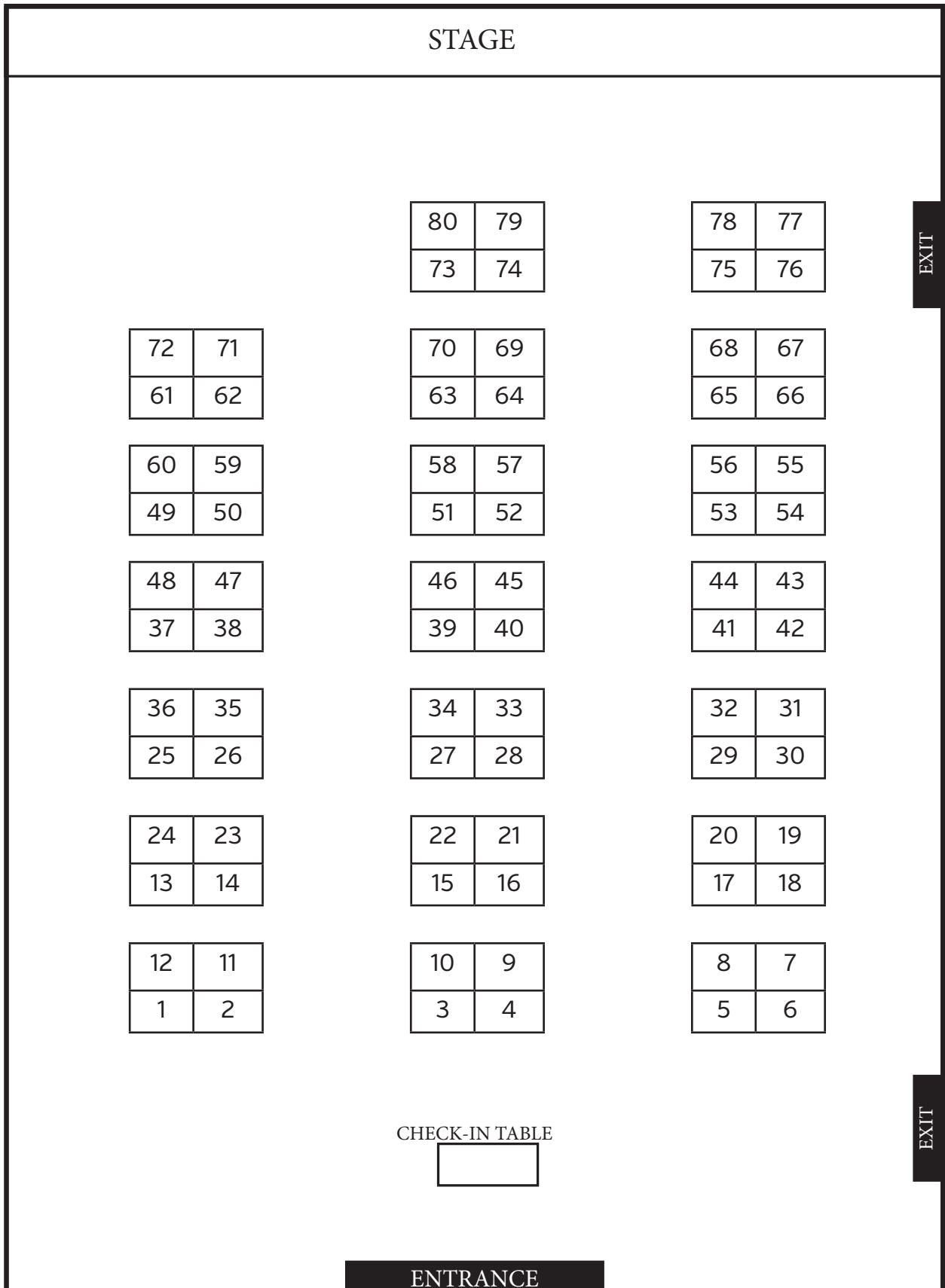
The LSU Discover Undergraduate Research Program, which hosts the Summer Undergraduate Research Forum, promotes and supports student participation in faculty mentored research and creative activities. For students looking to become involved in undergraduate research, we offer assistance in finding a mentor, events to learn more about undergraduate research, and opportunities to talk to research students about their experiences in any major. For students who are currently involved in undergraduate research, we offer funding for research and travel, workshops, and the Distinguished Undergraduate Researcher Program.

To learn more about LSU Discover, visit lsu.edu/discover

SPECIAL THANKS

- ASPIRE Undergraduate Research Program supported by the LSU College of Humanities & Social Sciences
- Beckman Scholars Program supported by the Arnold and Mabel Beckman Foundation
- Center for Computation and Technology - REU - National Science Foundation #OAC-2150491 and the LSU Center for Computation & Technology
- Dr. Christie's Research Group supported by the Louisiana Board of Regents Research Competitiveness Subprogram grant # LEQSF[2023-26]-RD-A-08
- The Louisiana Biomedical Research Network is supported by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20 GM103424-21
- Maximizing Access to Research Careers supported by the National Institute of General Medical Sciences of the National Institutes of Health [award T34GM136452]
- Ronald E. McNair Research Scholars Program, a TRIO program
- Physics & Astronomy - REU supported by the National Science Foundation
- Smart Polymer Composite Materials and Structures REU supported by the National Science Foundation
- LSU Special Collections Library

ROYAL COTILLION BALLROOM MAP POSTER & VISUAL DISPLAY PRESENTATIONS



POSTERS AND VISUAL DISPLAYS

ASPIRE

- 1 **Gabrielle Mellor, Colette Mouton & Don Zhang** "Are Risk Takers Happier?" **Louisiana State University**

Despite recent research supporting the notion that risk propensity is correlated with both happy (e.g., high extraversion) and unhappy (e.g., low conscientiousness) personality traits, the role of risk propensity as a personality predictor of happiness has been often overlooked in psychological research (Anglim et al., 2020; Joseph & Zhang, 2020). Relatedly, risk propensity has been found to individually predict both adaptive and maladaptive real-world outcomes separate from the Big Five personality traits (Highhouse et al., 2022). Extending this research, the present study examines the relationship between scores on multiple measures of wellbeing (e.g., Subjective Wellbeing, Psychological Wellbeing, Life Satisfaction) and measures of risk propensity. The study sample consisted of 465 participants from the LSU SONA participant pool who were tasked with completing a 20-minute Qualtrics survey. This research intends to generate crucial insights into the ways risk propensity uniquely contributes to the happiness and wellbeing of individuals and uncover whether risk takers are happier than their non-risk-taking peers.

BECKMAN SCHOLARS PROGRAM

- 2 **Lexi Cheramie** "Confocal Subcellular Localization Study of Deg Proteases in *Chlamydomonas reinhardtii*" **Louisiana State University**

Photosystem II (PSII) drives solar energy conversion into storable chemical energy in photosynthetic organisms by acting as water plastoquinone oxidoreductase. PSII is subject to frequent photodamage, and proteases are involved in the repair process by degrading the photodamaged D1 subunit and allowing for a newly synthesized D1 to be inserted to reassemble a functional PSII. However, the molecular identity of proteases, besides FtSH, involved in D1 degradation in algae like *Chlamydomonas reinhardtii* is not known. Therefore, I will study a class of ATP-independent proteases known as Deg proteins, which are important in protein homeostasis and are known to be involved in D1 degradation in plants. There are 14 deg genes in the *Chlamydomonas* genome that code for 12 Deg proteases, and our goal is to screen for which of these is potentially involved in D1 degradation. To do this, each of the Deg gene products in *Chlamydomonas* will be fused with a fluorescent protein, and the localization patterns will be visualized using confocal microscopy, as a Deg protease involved in PSII degradation must be localized to the chloroplast. By discovering which degs are localized to the chloroplast, we can further study them to understand the process of D1 degradation in PSII repair.

- 3 **Dykia Williams** "Characterizing Structure-Function Relationships on the Acceptor Side of Photosystem II" **Louisiana State University**

Photosystem II (PSII) is a large protein-pigment complex that splits water and releases O₂ during photosynthesis. Purification of PSII is complicated by being a membrane protein with low solubility in water, and not being able to be expressed recombinantly in *E. coli*. One common method for isolating PSII from cyanobacteria is through the introduction of poly-histidine tags on core polypeptides. Though this purification method is widely adopted, there is little analysis of the structural implications introduced by the poly-histidine tag. Structural modeling suggests that the most common addition of a poly-histidine tag on the CP47 subunit will extend the C-terminus within the range of an essential quinone cofactor binding site. I hypothesize that introducing a poly-histidine tag on CP47 will produce a local charge density and shift the quinone reduction potential. A shift in reduction potential would alter the kinetics of electron transfer. To study the effect (if any) that poly-histidine tags have on the kinetics of electron transfer, site-directed mutagenesis will then be carried out to introduce poly-histidine tags of varying lengths (0, 2, 4, or 6 histidine residues) at the C-terminus of CP47. These plasmids will then be introduced into cultures of *Synechocystis* sp. PCC 6803, a naturally transformable cyanobacteria. Each strain will then be assayed to assess the kinetics of electron transfer from the quinone as a function of histidine residues.

POSTERS AND VISUAL DISPLAYS

CENTER FOR COMPUTATION AND TECHNOLOGY - REU

- 4 **Luke Atkins** & Ka Ming Tam "Correlating Self-Similarity With Time-Series Performance on Data Sets From Fat-Tailed Distributions" **Indiana University - Bloomington**

In this paper, we examine the accuracy of existing time-series machine learning models and investigate their ability to predict rare events. We explore the relationship between their predictive performance and the multi-fractal dimension analysis, which serves as a measure of volatility in the training datasets. Specifically, we focus on the exchange rates of the top ten non-stable cryptocurrencies.

To make predictions on the distribution of price fluctuations, we employ recursive neural networks and long short-term memory models. Through comprehensive evaluation, we assess the effectiveness of these models in capturing rare events. Moreover, we draw insights on the risk associated with such models by considering their multi-fractal analysis and robustness in predicting rare events.

By analyzing the multi-fractal dimension and the predictive performance of these models, we aim to enhance our understanding of their volatility estimation capabilities and their ability to identify infrequent, yet impactful, events in cryptocurrency markets. The findings of this study contribute to the ongoing research in time-series modeling and provide valuable insights for risk assessment of deploying these models in domains known to exhibit frequent rare events.

- 5 **Kendall Bearden**, Md Tanvir Emrose, Georgios Veronis "Multilayer Switchable Absorbers Based on Phase-Change Materials " **Samford University**

We present multilayer switchable absorbers designed with a fixed set of materials, two of which are phase-change materials germanium-antimony-tellurium (GST), and vanadium dioxide. We use a memetic algorithm to optimize both the material composition of the structures and the thickness of each layer, involving a periodic local optimization. Previous use of this algorithm allowed for the presence of only one phase-change material in the optimization; specifically, the amorphous and crystalline phases of GST were represented. We show that the modification of this algorithm to allow for the presence of the metal and insulator phases of vanadium dioxide with the crystalline and amorphous phases of GST, respectively, produces structures with better performance in the 1-1.2 μm wavelength range compared to those produced by the version of the algorithm suited for GST alone. Given a fixed list of materials and their refractive indices in the wavelength range of interest, this version of the memetic algorithm generates a population of individuals with random material compositions and thicknesses. It evaluates the relative fitness of each individual by comparing the absorption of the metal vanadium dioxide and crystalline GST phase with the insulator vanadium dioxide and amorphous GST phase. Using this memetic algorithm with both GST and vanadium dioxide, we produce multilayer structures with improved performance in the 1-1.2 μm wavelength range when compared with those produced by the algorithm when GST alone is present.

- 6 **Allison Chevis**, Matthew Penny & Jonas Klüter "Microlensing Masses in the Milky Way Galaxy: Bayesian Estimation Using Synthetic Stellar Populations" **Michigan State University**

Gravitational microlensing is a phenomenon predicted by Einstein's theory of general relativity that describes the curvature of light's trajectory around massive objects. The light from a distant source star is warped in a distinct way when a less distant, "lens" star passes in front of it from our line of sight. Any massive bodies orbiting the lens star, i.e. exoplanets, will also affect the warped light we see from a source star. Microlensing observations provide an avenue of exoplanet detection that allows us to study relatively uncharted planet demographics. Using Bayesian inference, we can connect what information we are able to infer from a microlensing observation with a model of how stars are distributed throughout the Milky Way galaxy, allowing us to determine what the masses of these distant objects could be. This model is evaluated using SynthPop, an object-oriented Python software that generates synthetic stellar populations along a specified line of sight through our galaxy. The properties of the microlensing "events" that are simulated by this population serve as the prior distributions of the Bayesian analysis. The aim of this project was to expand on the functionality of SynthPop and establish tools to easily assess the differences in these mass estimates produced by varying the assumed galactic model. The advantages of such a tool include, for example, a means to compare the accuracy with which various galactic models are able to describe our galaxy.

POSTERS AND VISUAL DISPLAYS

CENTER FOR COMPUTATION AND TECHNOLOGY - REU

- 7 **Kimberly Heard**, Noah Rahman, Andrew Allocca, William Shelton & Justin Wilson "LatticeHamiltonians.jl: A Comprehensive Software Package for Matrix-less Tight-binding Models" **Georgia Institute of Technology**
- We present "LatticeHamiltonians.jl", an efficient software package designed for matrix-less Hamiltonians on lattice systems. This package has applications within condensed matter physics, mathematical physics, and material science; it aims to provide a powerful tool for analyzing quantum materials. Our approach leverages metaprogramming features in Julia to construct the Hamiltonian matrix as a linear operator. By optimizing matrix-vector multiplication in a matrix-less manner, we enable calculations that do not require explicit matrix storage. The package provides functions for generating expressions that capture the onsite and hopping components of the Hamiltonian, which are crucial for modeling the behavior of quantum materials. Additionally, there are functions for calculating the site index in the 1D unwrapped lattice and generating optimized loops for iterating over lattice sites in periodic systems.
- The structure of the "LatticeHamiltonians.jl" package includes dimensions, number of orbitals, system size, and parameter configurations of the Hamiltonian. To complete the package, we have introduced a macro called `@lattice_hamiltonian`, which automates the construction of the Hamiltonian and generates a function for its application. The package is well-suited for modeling tight-binding approximation models in 1D and 2D systems in particular. These models are widely used in condensed matter physics, describing how particles are transported through condensed matter systems. Our research project aims to provide a versatile and user-friendly tool for researchers working with lattice Hamiltonians. We aim to accelerate scientific discoveries, deepen the understanding of quantum materials, and foster collaboration within the research community.
- 8 **Pride Jia**, Ka Ming Tam & Juana Moreno "Stability of Suppliers Network with Finite Substitutability" **Colby College**
- Does input substitutability significantly impact the stability of a supplier network? We investigate this effect by utilizing results from Random Matrix Theory to construct an economic network that emulates real-world supply chains. Using the constant elasticity of the substitution function with varying levels of substitutability on a network model, we assess the impact on system stability by calculating the eigenvalues of the matrix representing the directed graph of the supplier network. The simulation results indicate that higher levels of substitutability in the system lead to an overall improvement in system stability, as the eigenvalues in the matrix tend to approach a perfectly stable condition. These findings suggest the importance of diversifying supply chain management for firms to ensure the stability of their own supply and the broader economy.
- 9 **Trinity Mata**, Andrew M. Webb & Hye Yeon Nam "Living Sound" **Millikin University**
- Living Sound examines the interactions between humans, plants, and technology. In the modern world, humans do not interact with plants as closely as they used to before the rise of urbanization. Urbanization has caused a disconnect between humans and plants as fewer people are interacting with plants in day-to-day life. This decline in human-plant connection and humanity's care for plants has contributed to environmental issues such as climate change, and social issues like the mental health crisis. Wilson's biophilia hypothesis is the idea that humans have a tendency to want to form connections with plants. Humans innately want to interact with plants but because of urbanization, it is harder for them to do so as there are fewer plants in more urban places. Living Sound looked into how to strengthen the human-plant connection with the use of technology. The project used sound recordings and data visualization to create planting patterns for participants to grow their plants. The participants took care of their plants and shared their progress with each other using an interactive website. Living Sound demonstrates that technology can help improve the connection between humans and plants even with the rise of urbanization.
- 10 **Kyle Palermo**, Dylan Wichman & Supratik Mukhopadhyay **Texas A&M University**
- "Demystifying Mechanisms of Permafrost Degradation Through Deep Learning: A High-Resolution, Localized, Mechanistic Approach to Permafrost Degradation Prediction"
- Permafrost degradation, exacerbated by climate change, can cause infrastructural damage, alter hydrological patterns, and potentially unlock dormant pathogens. Existing studies often neglect localized nuances due to their broad scale, leaving key mechanistic factors underexplored. Our research seeks to fill this void by deploying a two-tiered deep learning framework that illuminates the local, mechanistic factors driving permafrost degradation. We first utilize a variety of spatio-temporal and static spatial data to generate heat maps of permafrost degradation over Alaska. These maps inform the selection of sample collection sites, from which we obtain chemical and microbial data through soil core and pore water samples. This information then feeds into the second component of our system. This component utilizes causal inference to delineate the causal relationships among factors, mechanisms, and degradation. Subsequently, it leverages these relationships to identify 'mechanistic embeddings'-unique signatures of degradation mechanisms. The second component then uses these relationships to identify 'mechanistic embeddings'-unique signatures of degradation mechanisms. Ultimately, our framework provides a high-resolution, localized, mechanistic model for predicting permafrost degradation. This project is poised to significantly enhance our understanding of permafrost degradation mechanisms and improve the precision and accuracy of predictive models. Such advancements will be instrumental in anticipating and managing consequences such as land subsidence and potential pathogen release, as well as aid informed decision-making in climate change response strategies and mitigation efforts.

POSTERS AND VISUAL DISPLAYS

CENTER FOR COMPUTATION AND TECHNOLOGY - REU

- 11 **Emily Ramos**, Anthony Ives & Daijiang Li "Exploring the Sensitivity of Phylogenetic Regression Models to Different Phylogenetic Hypotheses" **Fordham University**
- Our aim is to expand upon the research Dr. Li and his colleagues have conducted to investigate the sensitivity of phylogenetic regression models to phylogenies through simulations
This will hopefully give more general insight into:
- When it is appropriate to use a certain method of construction for phylogenetic models
 - How to make phylogenetic models more approachable to researchers
 - What steps can be taken to minimize sources of error in phylogenetic research
- Our methodology is as follows:
- Get phylogenies
 - Convert phylogenies as matrices through R (assuming Brownian motion evolution)
 - Simulate data with and without phylogenies
 - Fit the data with regression models
 - Compare results to see how different phylogenies affect model estimations
- 12 **Natalie Tabb**, Patrick Diehl, Noujoud Nader & Serge Prudomme **Louisiana State University**
"Coupling Approach for Classical Linear Elasticity and Bond-Based Peridynamic Model in 2D"
- Local-nonlocal coupling approaches provide a means to combine the computational efficiency of local models and the accuracy of nonlocal models. We studied the continuous and discrete formulations of three existing approaches, focusing on the vertical horizon method for the coupling of classical linear elasticity and bond-based peridynamic models. The results are then displayed through a matrix that shows where and how likely a material is to be affected from the studied outside influence. This study focus on the study in affects to the two-dimensional planes expanding upon past one dimensional work.
- 13 **Raygan Taylor**, Paige DeNiro, Edem Mensah & Mayank Tyagi **Dillard University**
"Exploring the Analysis of Thermal Productivity in Geothermal Systems"
- Geothermal energy is a great, clean energy source, however, better understanding of heat extraction from the subsurface environment is needed for economically developing this energy source further. The GeoThermal Cloud packages in Julia use non-negative matrix factorization with k-means clustering (NMFk) to group well sites based on characteristics such as heat flow and ion concentration. The GeoThermal Cloud results can not only help with the geothermal resources exploration, but also predict the longevity of geothermal sites through optimized operations. In this research project, we are using a web application that predicts the thermal productivity of closed-loop geothermal systems by measuring output fluid temperature over time to help researchers interpret what conditions are ideal for the selected geothermal systems. The application of a 1-D pipe flow model and transient heat transfer model is implemented to predict the overall thermal productivity of the closed-loop geothermal systems.
- 14 **Kirah Van Horn**, Anshumitra Baul, Juana Moreno & Ka Ming Tam **Sonoma State University**
"Accuracy of Unitary Coupled Cluster Wavefunctions for Various Quantum Spin Models"
- Quantum computing is a relatively new and promising field of computation that has potential applications in a variety of disciplines. This project utilizes the application of quantum computing within condensed matter physics. We focus on using the Variational Quantum Eigensolver (VQE), a hybrid algorithm that uses the variational principle to compute the ground state energy of a Hamiltonian for quantum spin models. The accuracy of the VQE depends crucially on the choice of the variational wavefunctions. We performed various tests to assess the accuracy of the unitary coupled cluster wave functions with different types of quantum lattice models. By finding the accuracy of this wavefunction among a variety of models, we can conclude if the unitary coupled cluster wave function is a computationally efficient and accurate ansatz for the VQE on solving the strongly correlated many body quantum problems.

POSTERS AND VISUAL DISPLAYS

DR. CHRISTIE'S RESEARCH GROUP

- 15 **Gregory Bonvillian** & Kofi Christie "Kinetics of Gypsum Within Polar Protic Solvents" **Louisiana State University**

The purpose of this project is to find the difference in dissolution time between the different polar solvents that are used for gypsum experiments. The methods that will be used to find these results are to first prepare the gypsum crystals, then prepare the solvent of the predetermined composition, prepare the experimental setup (such as stir plate and conductivity meter), then add the crystal to the solvents and record the conductivity over time and keep the experiment going until the conductivity levels are off. Clean the equipment and prepare for the next experiment. The scope of this project should take a few weeks to truly get a good sense of the conductivity and the dissolution time.

- 16 **Gavin Lanka**, Azmain Akash & Kofi Christie "Effects of Antiscalants on Membrane Distillation" **Florida Institute of Technology**

Membrane Distillation (MD) is an emerging technology that can cheaply and efficiently handle a variety of wastewater and desalination compositions. While MD has promising applications, scaling and fouling still remain as problems not allowing a more widespread use. Antiscalants have potential to effectively mitigate these scaling and fouling issues while enhancing membrane performance. This study will look into the effects on antiscalants on membrane distillation and the optimization of certain antiscalants in MD systems.

- 17 **Aidan O'Neal** & Kofi Christie "The Effect of Flowrate on Gypsum Crystallization in Membrane Distillation" **Louisiana State University**

Gypsum crystallization is a widespread issue that is hindering the industry implementation of membrane distillation. It occurs when the concentration of the feed water that is being distilled reaches a concentration where crystals begin forming on the face of the membrane. This can lead to a drop in flux through the membrane and can even compromise the distilled side by allowing feed water to permeate through. While changes in the operating conditions of membrane distillation have been shown to have huge effects on the time it takes for gypsum crystals to form, the effect of flowrate has not been studied exclusively. The purpose of this project is to determine the effect of flowrate on the time it takes for gypsum crystals to begin forming on the face of the membrane. If a relationship can be determined between flowrates and the induction times of gypsum crystals, the process can be optimized to delay crystallization as much as possible.

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

- 18 **Pranup Adhikari**, Patrik Rollefson, Demetrius McAtee, Mohamed Ateia & Ahmed Abdelmoneim "A Safer Alternative? Evaluating the Effects of PFAS-containing Aqueous Film Forming Foam and a PFAS-free Alternative [Angus JetFoam 3%] on the Development and Behavior of Larval Zebrafish" **Southeastern Louisiana University**

Recent reports have highlighted the ubiquitous presence of polyfluoralkyl substances, also known as PFAS, in the environment and their negative impacts on human health, particularly developing children. These chemicals are broadly used in industrial and agricultural applications as well as fire suppressants. Growing health concerns have prompted federal initiatives that support the development of fluorine-free alternatives to PFAS-containing aqueous film-forming foam (AFFF). The objective of this study is to evaluate the effects of developmental exposure to a PFAS-containing AFFF [Buckeye] and its fluorine-free alternative [Angus JetFoam 3%] on the development and behavior of organisms using the zebrafish model. Enzymatically dechorionated wild-type zebrafish embryos were individually plated in 96-well plates and exposed to concentrations corresponding to 0.1% of the working concentrations of these AFFFs and folds lower [0.02%, 0.004%, 0.0008%, 0.00016%]. The exposures extended between 6- and 120 hours post-fertilization. Daily media changes [50%] were performed using a robotic liquid handling system to maintain appropriate water quality and exposure concentrations. At the end of the exposure period, a battery of endpoints was assessed, including mortality, the prevalence of morphological developmental defects, overall development, and behavioral alterations to the acute stress response. This research sheds light on the effects these chemicals have on developing organisms and lays the foundation for the development of safer PFAS-free alternatives.

- 19 **Christina Aseyomi**, Krishna Dahal, Mingli Xia & Rui Lu "Function Study of C. Brissgae RSD-6 in the Context of Antiviral Immunity" **McNeese State University**

Tudor domain is found in many proteins involved in DNA and RNA regulation in diverse biological pathways. RSD-6, a tudor domain protein, is required for robust antiviral RNAi in *Caenorhabditis elegans* against Orsay virus. Currently, whether RSD-6 homologs also confer antiviral function in other nematode species, such as in *Caenorhabditis briggsae*, remains largely unknown. To address this question, the expression of *rsd-6* was downregulated in wild type *C. briggsae* strain [JU1085] using feeding RNAi and the affected worms were then challenged with Santeuil virus which naturally infects *C. briggsae*. Comparing the levels of virus replication, as detected through northern blot and/or qPCR, in knockdown strain and wild type strain would show to what extent *C. briggsae* RSD-6 is required for antiviral RNAi against Santeuil virus. Results of this research would be useful in further exploring the role of tudor domain proteins in antiviral RNAi pathway.

POSTERS AND VISUAL DISPLAYS

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

- 20 **Sabina Dahal**, Brent A. Stanfield, Emmanuelle Ruiz, Vladimir N. Choulgenko, & Konstantin G. Kousoulas "Guinea Pig Herpes Like Virus is a Novel Oncogenic Gammaherpesvirus" **University of Louisiana Monroe**
- In 1969, Hsiung and Kaplow made a significant discovery by isolating a virus called Guinea Pig Herpes Like Virus (GPHLV) from tissue cultures derived from guinea pigs. These guinea pigs were known for their high susceptibility to acute lymphoblastoid leukemia. Further investigations revealed that GPHLV had the ability to transform embryonic cells from Syrian hamsters and rats, and later these transformed cells demonstrated tumorigenic properties in adult animals. One notable characteristic of GPHLV is its broad host tropism, allowing it to infect and replicate efficiently in various animal models. Our primary goal was to explore the cancer-causing abilities of GPHLV and create a novel animal model to study how gammaherpesviruses cause disease in alternative hosts. This model will enhance our understanding of gammaherpesvirus latent infection and facilitate the advancement of preventative and therapeutic approaches. To achieve this, we introduced a GPHLV GFP+ clone into murine NIH/3T3 cells in a laboratory setting and examined the infection through the use of fluorescent microscopy. The primary focus of the current project is to investigate the factors that restricts the infection of NIH/3T3 cells [a fibroblast cell line derived from a mouse NIH/Swiss embryo] in comparison to guinea pig 104c1 cells. The latter cells are derived from a female fetal carcass of a strain 2 guinea pig and are productively infectable with GPHLV. . Understanding the barriers to infection between these cell lines derived from different hosts is of particular interest. This research aims to shed light on the host restriction factors GPHLV combats in guinea pig but is susceptible to in murine cells. The findings could provide valuable insights into the viral tropism and pathogenesis of GPHLV and aid in the development of a novel small animal model of gammaherpesvirus pathogenesis.
- 21 **Kaleigh Howard**, Iván Martínez-Espinoza & Antonieta Guerrero-Plata "Characterization of THP1 Monocyte Differentiation into Macrophages: A Model for Studying Virus Interactions with the Respiratory Epithelium" **Grambling State University**
- Rationale: Alveolar macrophages, specialized white blood cells derived from differentiated monocytes, play a pivotal role in eliminating infected cells and defending the respiratory epithelium from bacteria and virus. Gaining a comprehensive understanding of the mechanisms by which macrophages contribute to this defense is of immense significance. Cells derived from primary cultures have a limited lifespan, but alternative cell lines are promising, therefore, the development of a reliable and accurate model of macrophages is crucial for studying respiratory virus infections. Such a model enables in-depth exploration of the intricate interactions between the immune system and viruses, thereby providing valuable insights into disease mechanisms and potential therapeutic interventions. In this study, we sought to characterize the differentiation process of the THP-1 monocytic cell line into macrophages.
- Method: THP-1 monocytes were exposed to Phorbol 12-myristate-13-acetate [PMA] for 48 hours to induce differentiation and different times of rest. Following differentiation, macrophages were characterized by evaluating the expression of the CD11b marker using flow cytometry and fluorescent microscopy. Appropriate controls were implemented to validate the differentiation process. Statistical analysis was used to validate our findings.
- Results and conclusion: Our findings indicate that treatment of THP-1 monocytes with PMA successfully induces their differentiation into macrophages, as evidenced by the expression of the differentiation marker CD11b.
- Significance: Establishing a reliable macrophage model is of vital importance for studying the role of these cells in the respiratory tract. Such a model allows for more precise investigations into the functions and interactions of macrophages during respiratory virus infections, ultimately contributing to a deeper understanding of disease pathogenesis and the development of targeted therapeutic strategies.
- 22 **Damilola Iguwe**, Amit Sharma, Linda Heffernan & Basel Abuaita **Louisiana State University**
- "Genetic Ablation or Pharmacologic Inhibition of the ER Stress Sensor IRE1 α Counteract Melanoma Pathogenesis."
- The endoplasmic reticulum [ER] stress regulator, IRE1 α , has been linked to cancer cell proliferation, metastasis, and immune evasion. During cancer development, a high rate of cell proliferation imposes stress on the ER. To overcome this, cells must activate IRE1 α to increase the functionality of the ER and aid it in keeping up with the constant cell division. IRE1 α has two enzymatic domains: endonuclease and kinase which derive two distinct signaling pathways via activation of the transcription factor, XBP1 by cleaving cytosolic mRNAs and phosphorylation of JNK, respectively. However, it remains unclear whether activation or inhibition of these pathways would be beneficial or detrimental to the replication of cancer cells. To tackle this question, we make use of B16F10, a murine melanoma model, and a range of experimental procedures. We found out that silencing IRE1 α in this model reduced the ability of melanoma cells to develop tumors. We also found that a selective IRE1 α kinase inhibitor [Kira8] inhibits cell migration and causes apoptosis. On the other hand, a selective endonuclease inhibitor [4 μ 8C] did not do this; instead, inhibition of the endonuclease seemed to increase cell migration and survival. The results of our experiments, hence, lead us to believe that targeting specific signaling cascades of IRE1 α , especially the kinase domain, might be promising in learning how to treat cancer while utilizing chemotherapeutic interventions.

POSTERS AND VISUAL DISPLAYS

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

- 23 **Jesslyn James** & Naohiro Kato "Biological Function of Cortex Microtubules in *Chlamydomonas reinhardtii*" **Xavier University of Louisiana**
- 24 **Aria Jenkins**, Linda Heffernan & Basel Abuaita "Heterogeneity of Salmonella Enterica Lipopolysaccharide Determines Susceptibility to Colistin and Human Antimicrobial Peptide LL-37" **Xavier University of Louisiana**
- Salmonella enterica serovars Typhimurium [STM] and Enteritidis [SE] are two highly prevalent non-typhoidal serovars [NTS] that cause an extensive spectrum of disease ranging from self-limiting diarrhea to severe gastroenteritis depending on the effectiveness of host defenses. A major difference between Salmonella serovars is the O-antigen of their lipopolysaccharide [LPS]. Previous work from our lab showed that transposon inactivation of rfaI, a gene required for LPS biosynthesis in SE, interferes with LPS composition, and the LPS mutant strain is taken up by macrophages at a higher rate than the wild-type parental SE strain. Nonetheless, it is not clear whether interfering with LPS biosynthesis renders STM or SE more susceptible to other parts of immune responses like antimicrobial peptides. Here, we showed that STM and SE have differential susceptibility to LL-37, an antimicrobial peptide found in the human body, and Colistin, a last resort antibiotic for multi-drug resistant bacteria. Inhibition of normal LPS formation through inactivation of rfaI, increased STM and SE susceptibility to both LL-37 and Colistin. Our findings suggest a model where some Salmonella enterica serovars modify their LPS composition resulting increases antimicrobial resistance to host defenses and antibiotics. These observations highlight that interfering with LPS biosynthesis can serve as a therapeutic strategy to restrict microbial efforts to exploit host defenses.
- 25 **Alex Kurtz**, Udeni B. R. Balasuriya, Wellesley Dittmar, Ganwu Li, Come J. Thieulent & Mariano Carossino "Genetic Variation of Equine Arteritis Virus During In Vitro Persistent Infection of Primary Accessory Sex Gland Cells" **University of Louisiana Monroe**
- Equine Arteritis Virus [EAV] is a single stranded, positive-sense RNA virus and the causative agent of equine viral arteritis, a respiratory and reproductive disease of horses. EAV is transmitted through either the respiratory or venereal routes (infected semen), and outbreaks of disease have more recently been associated with the increased use of artificial insemination and shuttle stallions. EAV has the unique ability of establishing persistent infection in the reproductive tract of 10-70% of infected stallions in an androgen-dependent manner, being shed in the semen for variable periods of time ranging from several weeks to life-long. Persistently infected stallions play a central role in maintenance and evolution of EAV. Persistent infection is a source of genetic and phenotypic divergence, leading to mutations likely associated with the establishment and maintenance of persistent infection and emergence of novel viral variants with different neutralization phenotypes. Recognizing viral factors associated with persistence is critical to understand the pathogenesis of EAV persistent infection. The objective of this project was to analyze genomic changes in EAV following establishment of an in vitro persistent infection model system using primary accessory sex gland cells from the equine reproductive tract in order to identify evolutionary patterns associated with persistence.
- 26 **Kaleb Macklin**, Sonni Tavern, Kwon Choi & Olalekan M. Ogundele "Conditioned Place Preference Test for Probing Reward-Oriented Learning" **Xavier University of Louisiana**
- The ventral tegmental area (VTA) is a key part of the mesocorticolimbic pathway that governs reward and aversion learning. Neurons in the VTA, and their associated projections, guides the animal to obtain a reward and avoid punishing contexts. The goal of this summer project is to enumerate a modified form of the conditioned place preference [CPP] test that can be used to assess the propensity to learn rewarding contexts. For this project, n=10 female mice were allowed to become acquainted with the box for three days. In the preconditioning phase animals explored the chamber freely to show preference for one of two sides [A and B] side based on the wall marking [visual cue], floor pattern [tactile cue], and whether vinegar is present or not [olfactory cue]. Once the preference is established, in the conditioning phase, a reward [16% sucrose] was presented in the non-preferred side and the propensity to explore the non-preferred rewarded side was determined in a behavioral tracking software equipped with machine learning features [Ethovision XT 17]. This software generated heat maps and statistics about how many times a mouse has entered a side, and how long they stayed on each side. Our results showed that CPP test is a useful tool for assessing VTA-linked reward learning and can be applied for other forms of learning which include discrimination between the weight of rewards, or the probability of receiving a reward.

POSTERS AND VISUAL DISPLAYS

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

- 27 **Cassidy Magnon**, Craig Hart & Sunday Negedu "Investigating the Physical Interaction between *Drosophila* Boundary Element Associated Factor (BEAF) and the FACT Complex Subunit, Dre4" **McNeese State University**

Boundary element-associated factor (BEAF) is a sequence-specific DNA-binding protein that binds to chromatin domain insulators found in *Drosophila melanogaster*. BEAF was found to be associated with transcription start site of house-keeping genes. BEAF interacts with transcription factors Serendipity δ (Sry- δ) and Relative of WOC (ROW). The mechanism of BEAF's role in transcription is unclear. Here, we explore BEAF's ability to interact with Dre4 using bacterially expressed proteins in pull-down experiments, and bimolecular fluorescence complementation (BiFC) assays in cultured *Drosophila* S2 cells. Dre4 is one of two FACT (Facilitates Chromatin Transcription) complex subunits. FACT destabilizes nucleosomes and removes histones from genes during transcription. Dre4 was 5-fold enriched over the control in our coimmunoprecipitation, tandem mass spectrometry proteomic analysis, compared to 2.5-fold for Sry- δ and 2-fold for ROW. Hence, it is anticipated that our experiments will detect a physical interaction between Dre4 and BEAF.

- 28 **Adriana Marshall**, Sebastian Oloo & Graca Vicente "Synthesis and Characterization of Tetrabenzoporphyrin Dye" **Xavier University of Louisiana**

Porphyryns are macrocycles composed of four pyrrole rings linked by four methine bridges. Tetrabenzoporphyrins are porphyrin derivatives that can be synthesized from isoindoles. In this work I synthesized a tetrafluoro-isoindole that will be used to prepare a fluorinated tetrabenzoporphyrin. Tetrabenzoporphyrins are highly fluorescent molecules that absorb in the visible region of the optical spectrum, between 400-700 nm. They can be used as photosensitizers in photodynamic therapy (PDT) of cancers. PDT uses a drug that absorbs light and converts it into singlet oxygen and other oxygenated species that destroy cancer cells. The synthesis of tetrafluoro-isoindole started with commercially available tetrafluoro phthalonitrile. The tetrafluoro-isoindole was formylated with dimethyl formamide and phosphorus oxychloride. My work involved setting up reactions, work-up reactions, and purification of organic compounds using extraction, column chromatography, and thin-layer chromatography. The resulting products were analyzed by nuclear magnetic resonance (NMR) spectroscopy. The tetrabenzoporphyrin can also be characterized by UV-Vis spectroscopy.

- 29 **Ibrahim Ogunleti**, Juan Martinez & Lucy Barre "Analysis of Growth Dynamics of SFG *Rickettsia* Species In Mammalian Cells" **Louisiana State University**

The Spotted Fever Group (SFG) rickettsiosis are diseases caused by a group of closely related bacteria species spread to people through bites from ticks and mites. Tidewater spotted fever caused by *Rickettsia parkeri* is one of the two most usually reported SFG *Rickettsia* related diseases in the United States. Due to the complexity of these bacteria species, the exploration of their pathogenicity and adaptive mechanisms is important. This research focuses on the analysis of growth dynamics of SFG *Rickettsia* species in Mammalian cells, specifically instituting *Rickettsia parkeri* as a case study. Specified *Rickettsia parkeri* mutants with distinct rickettsial loss-of-function were isolated using an improved mariner-based transposon mutagenesis scheme provided by preliminary research. These mutants were then introduced to lab cultured mammalian host cell lines including immortalized bone marrow derived macrophages from a mouse, endothelial cells derived from a human umbilical vein and epithelial cells derived from the kidney of an African green monkey. The wild type *R. parkeri* is known to be highly adaptive in all of these cells. The growth analysis of the mutants in these cell lines was investigated and analyzed using a couple of methods including- qPcr, flow cytometry and microscopy- results were then interpreted and evaluated to obtain a conclusion based on each mutant's growth pattern in the cells. Small plague (SP)64, one of the mutants with Ankyrin repeat- containing protein [RARP-1] gene knocked out, a gene that supports *Rickettsia parkeri* growth and host cell invasion, showed a slow onset of growth in the host cells. The efficient study of SP64 and why this defect occurs in these cells may be a breakthrough model to explain the growth pattern and adaptive mechanism of *Rickettsia* in host cells.

- 30 **Ashlyn Parrott** & Patrick DiMario "Developing Co-relative Light and Transmission Electron Microscopy for *Drosophila Nucleoli*" **McNeese State University**

Co-relative light and transmission electron microscopy (TEM) is a potentially powerful method to distinguish sub-cellular components. Initially, samples are observed at the light microscopic level where best maximum resolutions reach ~200 nm, and thereafter at the TEM level where best resolutions reach 1-10 nm.

The objective for this project is to establish co-relative microscopy for the nucleoli in the fruit fly, *Drosophila melanogaster*. The nucleolus is a region within the nucleus responsible for ribosome biogenesis. Many ribosome biogenesis factors reside in the nucleolus to facilitate the assembly of ribosomes. However, these factors do not themselves form ribosomes such as Nopp140 [Nucleolar phosphoprotein of 140 kDa].

To facilitate the localization of Nopp140, it was tagged with the Green Fluorescent Protein (GFP). This permitted the visualization of the protein within the nucleoli of transgenic fruit flies and larvae via light microscopy. A primary antibody directed against GFP was detected using a secondary antibody. The secondary antibody and peroxidase are both tagged with biotin and linked together by avidin. Diaminobenzidine (DAB) was used to detect the avidin-bound peroxidase, resulting in the formation of a brown precipitate that can also be visualized by light microscopy. For TEM visualization, selective osmium tetroxide precipitation on the DAB should be appear as electron-dense material in TEM images. Thus far, visualization of nucleoli using light microscopy has been successful but further development is required for visualization under TEM.

POSTERS AND VISUAL DISPLAYS

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

- 30 **Ashlyn Parrott** & Patrick DiMario "Developing Co-relative Light and Transmission Electron Microscopy for *Drosophila Nucleoli*" **McNeese State University**
- Co-relative light and transmission electron microscopy (TEM) is a potentially powerful method to distinguish sub-cellular components. Initially, samples are observed at the light microscopic level where best maximum resolutions reach ~200 nm, and thereafter at the TEM level where best resolutions reach 1-10 nm.
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- To facilitate the localization of Nopp140, it was tagged with the Green Fluorescent Protein (GFP). This permitted the visualization of the protein within the nucleoli of transgenic fruit flies and larvae via light microscopy. A primary antibody directed against GFP was detected using a secondary antibody. The secondary antibody and peroxidase are both tagged with biotin and linked together by avidin. Diaminobenzidine (DAB) was used to detect the avidin-bound peroxidase, resulting in the formation of a brown precipitate that can also be visualized by light microscopy. For TEM visualization, selective osmium tetroxide precipitation on the DAB should appear as electron-dense material in TEM images. Thus far, visualization of nucleoli using light microscopy has been successful but further development is required for visualization under TEM.
- 31 **Kya Perry** & Gianluca Veggiani "Development of a Platform for the Swift Production of Nanobodies" **Xavier University of Louisiana**
- Monoclonal antibodies (mAbs) have revolutionized biomedical research and the treatment of many diseases, including infections, neurodegeneration, and cancer. However, producing mAbs at population scale is technically and financially challenging, as they suffer from limited stability and cannot fold correctly in the bacterial cytoplasm. To address these limitations, nanobodies have emerged as alternatives to mAbs. Nanobodies are recombinant single variable domains of heavy-chain-only (VHH) antibodies characterized by affinity and specificity equivalent to that of mAbs. Nanobodies are stable at extreme pH and temperatures and can be expressed cheaply, quickly and at population-scale levels in bacterial cultures, making them ideal molecules for the rapid development of novel therapeutic antibodies. Here we present a modular strategy for rapid cloning, expression, and on-demand modification of nanobodies, using molecular superglues. Our method allowed us to develop a platform for efficient and rapid nanobody engineering, expression, purification, and decoration. Our results highlight the unique features of nanobodies and provide a development towards their successful clinical use.
- 32 **Adeyinka Sanusi**, Mingli Xia, Krishna Dahal & Rui Lu "The Tudor Domain of *C. briggsae* RSD-6 Functionally Replaces the Corresponding Domain of *C. elegans* RSD-6" **McNeese State University**
- Tudor domain protein RSD-6 plays an important role in antiviral immunity mediated by RNAi in *Caenorhabditis elegans*. Currently, whether RSD-6 homologue also mediates antiviral RNAi in *Caenorhabditis briggsae* remains unclear. Both *C. elegans* RSD-6 and *C. briggsae* RSD-6 contain a tudor domain and 3 degenerative nuclease domains. However, these function domains exhibit distinct layout in these two proteins. Accordingly, overexpression of *C. briggsae* RSD-6 does not restore antiviral RNAi in *C. elegans* containing *rsd-6* null allele. To find out whether the tudor domain in both RSD-6 proteins confers the same or similar function we tested the antiviral function of a recombined *C. elegans* RSD-6 in which the tudor domain is derived from *C. briggsae* RSD-6. We found that the recombined protein restored antiviral RNAi in *C. elegans* mutants containing *rsd-6* null allele. This finding suggests that the tudor domains in *C. elegans* RSD-6 and *C. briggsae* RSD-6 are functionally interchangeable.
- 33 **Christabel Simon-Alade**, Krishna Dahal, Mingli Xia & Rui Lu "Probe FHV Replication Dynamics in *C. elegans* Using a Pathogen Infection Inducible Reporter" **McNeese State University**
- Although an insect virus, Flock house virus (FHV) is able to replicate efficiently in *Caenorhabditis elegans*, making the FHV and *C. elegans* combination a powerful model system for the study of virus-host interactions. Previously it has been shown that a GFP-tagged FHV replicon, termed FR1gfp, replicates to high levels to produce bright green fluorescence in RNAi defective mutants upon heat induction, which drives the production of FR1gfp primary transcript. No green fluorescence was observed in non-induced worms although FR1gfp primary transcript was shown to be produced at low level in an RNAseq assay. Currently, it remains unclear whether FR1gfp is able to replicate at low level in non-induced worm mutants defective in RNAi. To address this question a pathogen infection inducible reporter transgene was co-delivered into RNAi mutants that harboring the FR1gfp replicon transgene. This reporter transgene produces bright green fluorescence in intestine in response to low-level viral replication, making it a robust reporter of viral replication dynamics. In this study we observed a green spot at the vicinity of vulvar in worms mutants corresponding to *rde-1*, *rde-4*, *rde-10*, *rde-11* and *rff-1* when these mutants were maintained at 25°C. Those green spots remains unchanged in term of size or localization, suggesting that the corresponding intestine cells may have weaker antiviral response and serve as the primary replication site for FR1gfp. Interestingly, low level green fluorescence was observed across the entire intestine in *rsd-2* mutants when maintained at 25°C. Since FR1gfp production in non-induced worms is very low, this finding suggests that RSD-2 may mediate an early antiviral response at the beginning of viral infection.

POSTERS AND VISUAL DISPLAYS

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

- 34 **Alexis Smith**, Rita Aoun, Catherine Takawira, Mandi Lopez, Anais Musso & Takashi Taguchi "Kinetic Analysis of the Equine Stance Cycle with Distinct Shoe Configurations " **Xavier University of Louisiana**

This research covers the study of using Equine Gait analyzes in order to determine how the hoof joints react when loading and unloading in a stance cycle using the motion software, Codamotion. In the motion software, Codamotion shows the markers placed on the horse hoof and the recording of its step as it goes across the force platform. Four of the best trials that resembled a two-peak graph were used from the set of trials given. All data captured were organized into Microsoft Excel, and each trial was labeled as the horse ID, side performed, and the direction of the stance duration. Using the Codamotion graph, the peak or the highest point of force was first measured. Then, to find the rest of the forces, the time durations of the first and last points of force were taken and calculated into periods according to the seconds of the hoof movement. From then, each time between the start and end was used to determine the force, and a protractor hand-measured an angle.

- 35 **Kennedy Willis**, Simran Dhingra & Grace Vicente "Synthesis and Characterization of Methyl Pheophorbide a - a Potent PDT Agent" **Xavier University of Louisiana**

For several decades, porphyrin-based photosensitizers are being used as PDT agents for various cancer types due to low dark toxicity and sharp absorbance peaks within the "therapeutic window" of 600-800nm. The research focus involves the synthesis and characterization of methyl-pheophorbide a, which is a chlorophyll a derivative and has the potential to be used as a photosensitizer for cancer treatment via photodynamic therapy (PDT) where the photosensitizer after absorbing the light, produces singlet oxygen and reactive oxygen species that damage the cells containing the photosensitizer, thus, reducing the harm on the normal cells or surroundings making it more selective than the conventional treatment using chemotherapy, radiotherapy or surgery.

LSU DISCOVER PROJECT GRANT RECIPIENTS

- 36 **Kayla Dearman & Reagan Power** "Integrating Chemistry & Physics with Animation: Aquatic Polymeric Suspension in Stop Motion Animation" **Louisiana State University**

Stop motion animation has long been a driving force for novel innovations - which often marvel the world for their unique ability to meld together seemingly disparate disciplines. One environment that has yet to be successfully emulated by stop motion without considerable digital manipulation is that of the sea. Few modern productions have attempted to tackle this feat; those that have are unable to capture the complex movement of the sea-life and aquatic environment because of the unpredictability of the water surrounding them. Animators are forced to painstakingly move each animated item how they intuitively feel it would move underwater. This process requires costly motion rigging devices that give the illusion of weightlessness to objects being animated and a considerable amount of post-production digital manipulation. The effort and cost put into this process doesn't often yield the desired results, which has discouraged many stop motion animators from attempting underwater animation. However, by using a simple solution of super-absorbent polymer beads and water in a transparent vessel, an artificial aquatic environment with imperceptible suspension is created. This study examines the efficacy of this medium for use in animation to evaluate how this method compares to other attempts at emulating aquatic environments. Various materials, sealants, and puppet prototypes were tested to identify the uses and limits of the medium. Though this project focuses on portraying an aqueous environment, the methods investigated here have further implications for making stop motion animation more cost-effective and accessible in a way that is environmentally friendly.

- 37 **Will Decker & Julie Schneider** "Is EEG Really Better Left Alone for Developmental Datasets?" **Louisiana State University**

Event-related potentials (ERP) are common evaluations of EEG data as they evoke robust neural responses with simple experimental designs. However, within ERP data exists intrinsic noise that can moderately affect, or significantly occlude the true EEG signal. Fortunately, there are many signal processing operations to reduce such noise in EEG data, yet, there remains little consensus as to which preprocessing standards are most effective. In an effort to standardize EEG preprocessing and promote reproducibility, Delorme [2023] evaluated the effectiveness of each preprocessing method. This evaluation indicated that "EEG data is better left alone"-or better left to automated pipelines. However, it remains unknown whether the same findings apply to developmental EEG data. Therefore, a distinct evaluation of the optimal preprocessing operations must be made given the numerous differences in EEG data quality that exist among younger populations. We directly address this issue by asking what preprocessing methods are most optimal for developmental EEG data. Using open-source developmental datasets, we tested the EEG preprocessing parameters implemented by Delorme [2023], evaluating their optimization using both the tmax statistical test and the standard measurement error (SME). We found that a conservative bandpass filter, line noise removal and moderate artifact removal were optimal for analyzing developmental EEG. Our findings suggest the need for different preprocessing parameters for analyzing developmental data.

POSTERS AND VISUAL DISPLAYS

LSU DISCOVER PROJECT GRANT RECIPIENTS

- 38 **Victoria Delacruz**, Taotao Ling & Fatima Rivas "Studies of Natural Products Against Cancer Cellular Models" **Louisiana State University**
- Acute lymphatic leukemia [ALL] is a rapidly growing cancer of immature lymphatic cells from the bone marrow. Currently, as the first line of treatment, ALL is treated with a mixture of therapeutics including glucocorticoids [GCs] from the steroid hormone family. Extended duration of treatment, especially for pediatric ALL patients, can lead to GC resistance which is an adverse prognosis. Natural products [NPs] have a strong track record of inducing selective cell death and are used in 60% of clinical anti-tumor treatments. The objective of this study is to identify new chemical entities from monoterpene NP derivatives by investigating their anti-tumoric abilities in pre-B ALL cell models [Nalm-06, KOPN-8]. A therapeutic index [TI] will be determined by also evaluating non-cancerous cell models. Complementary cellular assays using fluorescence and luminescence [Propidium iodide, CellTiter-Glo, TMRM] will be carried out to rank capable compounds. Once hit compounds have been identified they will undergo chemical modifications to improve their efficacy as well as secondary mechanistic studies. This project aims at closing a gap of knowledge in the field of drug resistance in ALL patients while also eventually identifying lead compounds that have the potential to effectively treat GC resistance in the clinic.
- 39 **Mary Hutson**, Chen Yang, Laura Beaubrun & Chen Chen **Louisiana State University**
- "Purification of Superantigen-Like Proteins from *Staphylococcus aureus*"
- Staphylococcus aureus* produces superantigen-like [SSL] proteins which are virulence factors for the bacteria. Some, including SSL4, SSL5, and SSL6, contain a conserved carbohydrate-binding site that allows for improved infiltration of host cells. This is achieved through mimicking the carbohydrate coating found on all human cells used for cell interactions. Although many members of the SSL family share this carbohydrate-binding site, information of its purpose in each protein is incomplete. Therefore, it is important to research these SSL proteins, allowing for further understanding of SSL mechanisms.
- Protein purification involves the growth and selection of recombinant *Escherichia coli* vector stocks containing a specific SSL gene. By choosing the SSL strain that produces the most protein, further research is made easier due to larger protein availability. Purification of previously polyhistidine [His] and 3XFLAG tagged SSL4, SSL5, and SSL6 proteins will be achieved using recombinant *Escherichia coli* with aforementioned SSL genes inserted. Three stocks of each *E. coli* vector will be cultured and then induced with IPTG for protein expression. SDS-PAGE analysis and Coomassie staining will be performed on the products of the induced *E. coli* to determine the stock with the highest protein expression for large scale protein purification.
- 40 **Gregory Juge**, Pritika Pandey & Alyssa Johnson "Ups and Downs: Underlying Genetic Mechanisms of a Short Sleep Model in *Drosophila*" **Louisiana State University**
- The short sleep mutant, Dec2-P384R, allows humans to sleep only 6 hours seemingly without negative consequence. This mutation has been studied by creating a transgenic model in *Drosophila melanogaster*, and the phenotype produced by this mutation in humans is phenocopied in *Drosophila*. This allows the flies to return to their circadian cycle more quickly after disturbance and resist many forms of stress related to poor sleep and aging. While many of these observations have been thoroughly cataloged, the underlying mechanisms of these phenotypes are unknown. Therefore, we have been studying other genes that are either upregulated or downregulated in the Dec2-P384R *Drosophila* model that might be contributing to these phenotypes. The hope is to learn which of these genes contribute to the phenotype and in what ways.
- 41 **Sophie LeBlanc**, Iebu Devkota, Zachary L. Bonomo & Constantine A. Simintiras "Extending Ungulate Embryo Development in vitro" **Louisiana State University**
- Mammalian reproduction involves a complex dialogue between the developing conceptus [embryo and extra-embryonic tissues] and the maternal uterus. In several agriculturally relevant ungulate species [e.g., cattle, sheep, and pigs] the conceptus undergoes an extended period of pre-implantation development known as conceptus elongation. If the conceptus does not elongate enough, the estrous cycle will resume, and the pregnancy will be lost. The conceptus elongation window coincides with a period of high pregnancy losses. To date, conceptus elongation has not been recapitulated in the lab [in vitro]. However, many studies show that select metabolites are present in uterine fluid and are likely important to elongation. Our hypothesis is that supplementing these metabolites to in vitro embryo culture medium will extend embryo development in the lab. We have produced porcine embryos by in vitro fertilization, using slaughterhouse-derived oocytes, and semen from a single boar of proven fertility. We are currently in the process of metabolite supplementation to culture. If successful, this work could improve ungulate reproductive efficiency, which is the main driver of farm profitability.

POSTERS AND VISUAL DISPLAYS

LSU DISCOVER PROJECT GRANT RECIPIENTS

- 42 **Peyton Meares**, Raju S. Thombal, Estefania Armendariz, Edward Mureka & Rendy Kartika "Regioselective Alpha Di-functionalization of Cyclopentanones with Indoles" **Louisiana State University**

A new synthetic reaction for alpha di-functionalization of cyclopentanones has been identified. Indole is among the most important heteroaromatic rings in molecules of biological and pharmaceutical significance. Given the vast medicinal applications of indole, the development of organic synthetic reactions that incorporate indole to complex molecular scaffolds is on the continuous rise. Recently, the focus has shifted from single alpha addition of indoles to alpha di-functionalization of cyclopentanones with indoles. The new regioselective methodology results in products that have several hallmarks of medicinal compounds such as quaternary centers and the indole moiety. The findings highlight the optimization of the reaction conditions, as well as the exploration into the impacts of a variety of substrates and indoles on the overall yield of the reaction.

- 43 **Emma Tsai**, Melanie Wilson, Mohamed Ateia & Ahmed Abdelmoneim "Impacts of Leachates from Real Microplastics on the Development and Behavior of Larval Zebrafish [*Danio rerio*]" **Louisiana State University**

Real microplastics (MPs) contain various additives and are now ubiquitously present in aquatic environments. These additives include heavy metals, bisphenols, and disinfection byproducts that are desorbed from the plastics into the surrounding environment. This poses a risk to aquatic organisms that inadvertently ingest or absorb these contaminants. However, there has been a lack of research on how the desorption capabilities of real microplastics may affect the early development and behavior of aquatic organisms. This project aims to investigate the impacts of early developmental exposure to leachates from real MPs on the development and behavior of larval fish using the zebrafish model. Different forms of plastics were sourced from a plastic recycling facility, washed, dried, frozen in liquid nitrogen, and crushed to diameters below 500 μm to form MPs. Leachates were then obtained by exposing MPs suspended in water to UV-C light and agitation for 24 hours to simulate environmental weathering. The MPs were subsequently removed and zebrafish embryos were exposed to the leachates between 6 and 120 hours post-fertilization. At the end of the exposure period, effects on larval survival, overall development, prevalence of developmental defects, and behavioral responses to acute stressors were evaluated. Understanding the effects of the MPs additives desorption on developing aquatic organisms can help expose potential long-term negative effects MPs may have on the aquatic environment.

- 44 **Juan Martin Velez Diaz**, Alireza Rahnama, Ted J. Gauthier & Adam T. Melvin "Investigation on the Role of Cannabinoids on the Enzymatic Activity of Members of the Ubiquitin Proteasome System" **Louisiana State University**

The Ubiquitin-Proteasome (UPS) is an enzymatic pathway in charge of intracellular degradation of proteins. Upregulation of the Ubiquitin Proteasome system has been linked to various diseases, such as cancer. The two main enzymes in control of protein degradation and regulation within the UPS are Deubiquitinating enzymes (DUBs) and Proteasome. Currently, two UPS inhibitor drugs approved by the FDA, Carfilzomib, and Bortezomib are successful in treating Upregulated Proteasome activity. However, some individuals show resistance to this medication, and this has been linked to high DUB activity. Therapeutic treatments derived from Cannabinoids have been more popular in recent years for treatments of relief and pain related to various diseases linked to high UPS activity, but there is little information known about the effects of cannabinoids on Intracellular pathways. The goal of this research is to determine the effects of Cannabinoids on DUB and Proteasome activity in Cancerigenous Cell lines. Using Cellular Lysates treated with varying concentrations of CBD, and commercially- available Peptide-based biosensors, DUB and Proteasome activity was quantified using Fluorometry. Further research will be aimed at using live intact cells to expand understanding of the effects of Cannabinoids on active cancer cells.

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

- 45 **Dimitrius Allen**, Zeyu Deng & Chen Wang "Teleoperation of Robotics with Advances in XR Technology" **Louisiana State University**

This project aimed to investigate the different uses for teleoperation between a user and a robot using technology such as VR, AR, and MR. This technology has opened the door for more benefits with the use of robotics to do hazardous jobs that would be difficult for normal users to do on their own, it also allows for users with less training with exclusive and complex machinery to control these robots to their peak performance. In this project, we work with a simple pan-tilt camera connected to a raspberry pi that will be operated via a Meta Quest 2 headset to allow for a live feed from the robot to the user with the position of the users head moving the camera almost mimicking the user's movement to gain a better visual of the surrounding area of the robot. The reading of the previous advancements in the field added to experiments done with this technology will help gain a better grasp on what can and will be achievable in the present as well as the future as we keep advancing. While also looking more applications of this specific teleoperations technique to allow for more efficient work flow and a safer work environment.

POSTERS AND VISUAL DISPLAYS

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

- 46 **Andrea Bickley** & Rebecca Brossoit "The Impact of Nature on Worker Job Satisfaction, Stress, and Productivity" **Louisiana State University**
- Many workers spend most of their time in office spaces with little to no contact with the outside world. According to theories like Attentional Restoration Theory (ART) and the Biophilia Theory, interacting with nature should significantly increase employee productivity and well-being, and decrease stress levels. This research's purpose is to bring awareness that humans need to interact with nature, especially after taking part in mentally demanding tasks at work, to restore their energy. This field of research is gaining popularity amongst business, management, and organizational psychology professionals. It is through the combined interest across these interdisciplinary fields that light has begun to be shed on how interacting with nature can positively affect employee productivity, well-being, and stress. Methods used in environmental psychology research can advance research and practice in the organizational sciences. Through these methods, Attentional Restoration Theory (ART), and Biophilia Theory; Researchers have come to explain the extent and scale that nature plays on employee productivity, well-being, and stress levels. Overall, this paper will provide a review of ART, Biophilia Theory, and research findings from environmental psychology and other disciplines, and apply it to the organizational sciences to examine the role of nature at work on employee performance, well-being, and stress-related outcomes. In my future work, I plan to look at the role bringing nature into the workplace specifically plays in increasing mood, stress levels, and job satisfaction amongst workers.
- 48 **Xavier Clute**, Alec J. Sheehy, Shannon Cruz, Brandon Ballengée & Prosanta Chakrabarty "Ten Years Later: An Update on the Status of Collections of Endemic Gulf of Mexico Fishes Put at Risk by the 2010 Oil Spill" **Louisiana State University**
- The Deepwater spill was the largest spill recorded in human history during a 12-week period; however little is known about the long-term impact on the development and distribution of endemic fish species within the region of the spill. We explore how endemic fish of the Gulf of Mexico were affected by the Deep Water Horizon spill back in 2010. We do this by examining data of known collection events occurring over the last 20 years (ten years prior to the spill, ten years post-spill). By noting their past and present distributions within oil spills, with can further understand the oil spill effects on endemic fish and their current population statuses.
- 47 **Liam Lopez** & Li-Hsiang Lin "Optimizing Local Regression with Conformal Prediction" **Louisiana State University**
- Local regression estimates the true function for a set of data by observing a region around one data point and finding the best fit line for that region. Several regions around different points will be tested in order to create a single estimated function. If the size of each region, or the bandwidth, is too large or too small, then the estimated function will give inaccurate predictions for new data points. The purpose of the project is to use conformal prediction to find the bandwidth that will produce the best predictions. We will be using RStudio for all tests and calculations.
- 49 **Kayla Melerine** & Janet McDonald "Impacts of Implicit and Explicit Instruction with Blocked and Interleaved Organization" **Louisiana State University**
- The benefits of interleaved practice and implicit instruction are well supported, but little research has been conducted on how their integration would impact second language learning and the resulting long-term retention of that information. The topics of interest for this study are pronoun and aspect conjugation of a fake language based on Spanish. Participants will be randomly assigned to either the implicit or explicit group and be further subdivided into four separate categories: totally interleaved, only interleaved aspect conjugation, only interleaved pronoun conjugation, and nothing interleaved. As a result, there will be eight groups where every participant is taught the same vocabulary and conjugation rules. They will do differently structured learning tasks followed by an immediate test and will return after a week for a delayed test. Although this study only focuses on two specific grammatical devices, it's findings can be generalized and further built upon for other linguistic devices.
- 50 **Isabella Thomas**, Christopher Reed & Mathew Calami "The Effects of a Single Session Virtual Reality Reminiscence Intervention on Mood in Older Adults" **Louisiana State University**
- Previous research has shown that residents in senior living facilities have lower levels of well-being and higher rates of depression. One intervention previously shown to improve positive mood in older adults is reminiscence (e.g., recalling positive periods in one's life). Most past reminiscence studies have used photographs or objects associated with the past. Some studies have used non-immersive virtual reality (e.g., viewing scenes on a laptop). With immersive virtual reality (VR) becoming more widely available with commercial headsets for the public, it is now easier than ever to simulate visiting locations more fully from one's past. However, little is known about how well immersive VR can induce reminiscence or increase positive mood states. The present study will use an immersive VR headset to let participants explore a location associated with a positive memory, such as a childhood home or previous honeymoon destination. Participants are 65+ years old and currently live in senior living facilities. To measure mood changes associated with the intervention, the Visual Analogue Mood Scale (VAMS) was used before and after the intervention. The VAMS measures positive and negative aspects of mood states, including happiness, sadness, anger, and confusion. The study hopes to find a general increase in positive mood after the immersive VR experience.

POSTERS AND VISUAL DISPLAYS

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

- 51 **Tyra Washington**, Tyler Butsch & Adam Bohnert "Organelle-Specific Autophagy: A Look at Pexophagy in *Caenorhabditis elegans* and its Possible Implications in Aging Research" **Louisiana State University**

Aging is a natural process that is somewhat of an enigma. While it is clear that aging is subject to regulation like other biological process, the mechanisms that drive age-related deterioration and diseases are still incompletely understood. This study focuses on the analysis of peroxisome autophagy [pexophagy] - an understudied process involving the degradation of peroxisomes at digestive lysosomes. Peroxisomes play an important role in cellular homeostasis, but peroxisome function becomes imbalanced as something ages. By studying the regulation of pexophagy in live *Caenorhabditis elegans*, there is the prospect of learning the ties between this and aging; to somehow manipulate the mechanism to combat age-related diseases. We are testing how altering the rate of pexophagy with age may alter other cellular hallmarks of aging, and we are also investigating how this process governs animal lifespan.

- 52 **James Yu** & Shyam Menon "Characterization of Swirl Combustor Velocity Field Using Hot Wire Anemometry" **Louisiana State University**

Understanding the characteristics of a swirl combustor velocity field can help optimize the combustion process leading to a more efficient combustion and reduced emissions. Finding regions where turbulence is highest also allows for engineers to design the combustor so that the swirl direction and intensity achieves better flame stability. The first step to measuring the velocity flow field is to calibrate the hot wire anemometer to ensure accurate measurements. The next step would be to stick the probe into the swirl combustor and take velocity measurements. After retrieving data, process the data to find the turbulence intensity and plot the data on a graph.

PHYSICS & ASTRONOMY - REU

- 54 **Daniel Carpenter** & Thomas Kutter "Testing Cryogenically Cooled Components of the Signal Readout Chain for Implementation in the Deep Neutrino Experiment Vertical Drift Liquid Argon Detector" **Louisiana State University**

The Deep Underground Neutrino Experiment [DUNE] is a new flagship particle physics experiment currently in development that aims to investigate and measure neutrino oscillations parameters, in particular it will constrain Charge-Parity violation in neutrinos and resolve the neutrino mass hierarchy, amongst others. The experiment consists of a neutrino beam generated by Fermilab National Laboratory, a near detector, and a far detector at a baseline distance of 1300 km and 1.5 km underground in the Sanford Underground Research facility [SURF]. The far detector will utilize Liquid Argon Time Projection Chamber [LAr-TPC] modules to detect and reconstruct the trajectories of charged particles resulting from incident neutrinos. The scope of this project is to develop procedures and an apparatus for testing signal readout electronics assemblies that will be subjected to the cryogenic conditions of the LAr-TPC modules in the far detector. The electronics assemblies will need to be tested at warm, intermediate, and cryogenic temperatures. A cryostat with liquid nitrogen [LN₂] will be used to achieve cryogenic conditions during testing. To date a prototype testing apparatus has been designed and constructed, and warm testing is expected to begin shortly. During testing, the PCBs will be subjected to electrical input signals simulating the detection of charged particles resulting from neutrino interactions in the LAr detector. System responses from the signal readout assembly will be analyzed to ensure requirements at each temperature are met and undesired effects such as crosstalk or signal reflections are negligible.

- 53 **Ella Chevalier**, Alison Crisp, Jonas Klüter & Matthew Penny "Detailed Vetting of Transiting Planet Candidates Toward the Galactic Bulge" **University of Wisconsin - Madison**

The MISHAPS exoplanet survey is searching for hot Jupiters in the metal-rich and alpha-rich Galactic bulge, with the goal of comparing the planet occurrence rate in the bulge to the occurrence rates in other parts of the galaxy. Hot Jupiters are readily detected when they transit in front of their star, which causes an observable dip in the lightcurve. However, there are other astronomical events such as eclipsing binaries that can mimic transiting planets. I have developed a semi-automatable program that can vet the planet candidates found by the MISHAPS survey in order to analyze whether the candidate is a planet or an eclipsing binary. I compare the transit depths between different wavelength bands and between odd and even transits. I also estimate the density of the host star using the fit parameters from my models and compare it to the density found via spectral energy distribution [SED] fitting. By applying my program to a selection of planet candidates, I will make progress towards classifying the candidates as either planets or eclipsing binaries.

POSTERS AND VISUAL DISPLAYS

PHYSICS & ASTRONOMY - REU

- 57 **Caroline Davis** & Francois Mauger "Modeling and Analysis of Absorption Spectroscopy Using Self-Amplified Spontaneous-Emission Light Pulses " **Louisiana State University**
- Self-amplified spontaneous-emission (SASE) free-electron lasers (FEL) can generate light pulses with unmatched intensities and lasting a few femtoseconds (10^{-15} s) and shorter. These ultra-bright, ultra-short pulses offer new perspectives for time-resolved spectroscopies in atoms and molecules. But the spontaneous emission process leads to random pulses with limited temporal and spectral coherence and varying from shot to shot which makes the analysis of the measured spectra challenging. In this poster we numerically investigate linear and nonlinear absorption spectroscopy using extreme ultraviolet (XUV) SASE pulses to extract meaningful information from the interaction between these pulses and molecules. We compare our simulated SASE-FEL spectra average with what coherent XUV lasers with similar intensities would yield.
- 56 **David Duong** & Kenneth Matthews "Image Quality Assessment of SPECT/CT" **Nebraska Wesleyan University**
- Preclinical research is a mandatory stage in developing and evaluating the safety and efficacy of new pharmaceuticals and treatments for human diseases. Preclinical research uses animal models of disease; these models can also be used to study underlying disease mechanisms. Imaging techniques are invaluable tools for preclinical research, allowing researchers to noninvasively monitor and analyze the impact of investigational drugs or new techniques on an animal's anatomy and physiology. Imaging tools include computed tomography (CT), ultrasound, magnetic resonance imaging (MRI), and radiotracer imaging. The use of radiotracers in single-photon emission computed tomography (SPECT) imaging gives physiological information, which is invaluable for assessing the effect of new treatments or drugs but has relatively poor spatial resolution and high noise compared to anatomical imaging with CT and MRI. Frequently, SPECT and other radiotracer imaging techniques are combined with CT to enhance the overall visualization of anatomy and physiology.
- A crucial issue for the best use of preclinical imaging is quality assurance. One must be confident that the quality of the image data is high, and that the integration of multiple imaging modalities is accurate. Metrics for image quality include spatial resolution, contrast, noise, image registration, radiation dose and artifacts. My project implemented testing protocols to assess image quality for a SPECT-CT preclinical imaging system, with particular focus on radiotracer imaging quality.
- 55 **Zoë Hardnett**, Khang Pham & Catherine Deibel "Studying $^{32}\text{S}(t,^{6}\text{Li})^{35}\text{Ar}$ Reactions: Mimicking Nuclear Reactions in Classical Novae" **Mercer University**
- Thermonuclear reactions drive stellar explosions including classical novae. Ashes from these reactions are found in presolar grains that are encapsulated in meteorites and then found on Earth. One reaction that affects the composition of these ashes is the $^{34}\text{Cl}(p, \gamma)^{35}\text{Ar}$. However, studying this reaction is very difficult because of ^{34}Cl 's radioactive properties. Instead, we measured the $^{32}\text{S}(^{6}\text{Li}, t)^{35}\text{Ar}^*(p)^{34}\text{Cl}$ reaction in order to mimic the $^{34}\text{Cl}(p, \gamma)^{35}\text{Ar}$ reaction. In collaboration with Florida State University, we studied proton-decay emissions of excited states in ^{35}Ar populated by the $^{32}\text{S}(^{6}\text{Li}, t)^{35}\text{Ar}$ reaction using the Super Enge Split-Pole Spectrograph (SE-SPS) with the Silicon Array for Branching Ratio Experiments (SABRE) and a focal plane detector. SABRE measures the proton decays from excited states in coincidence with the tritons from the $^{32}\text{S}(^{6}\text{Li}, t)^{35}\text{Ar}$ reaction measured by a focal plane detector. Analysis of these data and results will be presented.
- 58 **Ashley Harrington**, Kenneth Matthews, Daniel Neck & Connel Chu "Enhanced Head Immobilization for GammaKnife Radiosurgery" **University of Northern Iowa**
- Elekta Icon GammaKnife is a radiotherapy treatment system that delivers very precise doses of radiation to brain tumors, arteriovenous malformations (AVMs), and other neurological conditions. It has 192 sources of Cobalt-60 which are pinpointed in "shots" to target bad tissue while minimizing dose to surrounding healthy tissue. To perform these shots, the patient's head has to remain still and cannot move more than 1.5mm. Currently, high precision is achieved by using a patient-specific thermoplastic immobilization mask on a rigid frame, in conjunction with video tracking of reflective markers placed on the frame and tip of the patient's nose. The GammaKnife system's computer watches for movement of the markers; head movements that exceed 1.5mm automatically stop delivery so the patient can be repositioned. Experience over the past several years with GammaKnife at Mary Bird Perkins Cancer Center has shown that the immobilization mask adequately limits side-to-side head motion, but head pronation is not as well controlled. In order to combat this, an add-on brace was created in CAD software and 3D printed using resin. The brace mounts to the rigid frame of the machine and is adjustable to all patients. It presses against the upper lip and teeth of the patient to restrict head pronation and thus allow for controlled and uninterrupted treatment. Following the development of the brace, head movement will be tracked with and without the brace, and eventually the performance of the brace will be evaluated during GammaKnife treatments.

POSTERS AND VISUAL DISPLAYS

PHYSICS & ASTRONOMY - REU

- 59 **Eliot Hiegel** & Tabettha S. Boyajian "Fundamental Properties of Three Metal-Poor Stars with Optical/NIR Interferometry" **Denison University**
- Angular diameters of three metal-poor and one solar metallicity star-HD 184499, HD 22879, and HD 76932 and HD 108510-were directly measured using the CHARA Array interferometer. Limb-darkened angular diameters of $\theta_{LD} = 0.403 \pm 0.004$, 0.397 ± 0.006 , 0.570 ± 0.005 , and 0.360 ± 0.006 mas were found for HD 184499, HD 22879, HD 76932, and HD 108510, respectively. Using these diameters combined with Hipparcos parallaxes and average literature values for bolometric flux, linear radii of $R = 1.38 \pm 0.02$, 1.09 ± 0.02 , 1.29 ± 0.01 , and $1.16 \pm 0.03 R_{\odot}$; effective temperatures of $T_{\text{eff}} = 5824 \pm 47$, 5856 ± 50 , 5913 ± 47 , and 5950 ± 84 K; and luminosities of $L = 1.97 \pm 0.07$, 1.26 ± 0.04 , 1.82 ± 0.05 , and $1.50 \pm 0.09 L_{\odot}$ were calculated. Given these effective temperatures and luminosities along with average literature values for metallicity, the Python package *Kiauhökü* was used to compute an age and mass for each star from four different stellar model grids: YREC, MIST, DSEP, and GARSTEC. For the metal-poor stars HD 184499, HD 22879, and HD 76932, the resulting ages were systematically higher than literature values and the masses systematically lower. For the solar metallicity star HD 108510, the resulting ages were marginally higher than literature values while the masses were in agreement. To investigate these discrepancies in age, all four stars were fitted to DSEP isochrones, this time accounting for alpha-enhancement in the three metal-poor stars. The resulting fits indicated significantly lower ages than those computed by the model grids for HD 184499, HD 22879, and HD 76932, and an age for HD 108510 which agreed with the model grids.
- 60 **Emily Joy Jones**, Shania Nichols & Gabriela Gonzalez "Solving the Mystery of Loud Glitch Sources in LIGO" **Cardiff University**
- I made use of the Hierarchical veto analysis tool, an algorithm that analyses the auxiliary channels at LIGO to determine which ones have the highest statistical significance in relation to coincident triggers in the main strain channel, to attempt to locate the sources of Koi Fish glitches, which are very loud triggers that affects the detector's ability to pick up on gravitational wave transients. After multiple runs of the algorithm, removing channels that were concluded to be simply witnesses of the glitches rather than the cause, the channels which need further investigation at the LIGO Livingston site as they are showing unusual correlations to the main channel are associated with the internal seismic isolation system, a system which serves the purpose of keeping the detector insensitive to external vibrations that would be picked up by the main strain channel.
- 61 **Aidan Kelly**, Kevin Becker, Alexis Mercenne & Kristina Launey **The Pennsylvania State University - University Park**
"Bayesian Uncertainty Quantification in Nuclear Reaction Theory for Astrophysical Applications"
- There are certain short-lived nuclei that play a role in astrophysical events but do not exist outside of those events. Due to their elusive nature, these exotic nuclei are difficult to perform experiments with, hence the need for theoretical models. As much as physicists yearn for perfect, analytical solutions, we must employ numerical methods to best approximate and gain insight into nuclear properties. These computational models come with a certain degree of uncertainty, and there has been a recent outcry in the nuclear theory community for quantification of these model-uncertainties. In this project, we will be employing Bayesian methods using a Markov-Chain Monte-Carlo (MCMC) sampling procedure to quantify the uncertainty on nuclear model parameters and the cross-sections of various nuclear reactions, such as proton scattering off oxygen-14 to describe fluorine-15. These results will aid astrophysicists in studying breakout processes in the Carbon-Nitrogen-Oxygen (CNO) Cycle that lead to thermonuclear events such as supernovae.
- 62 **Bernadette Lesieur** & Krystal Kirby "Evaluation of MR Image Quality on a Diagnostic Versus RTP Tabletop" **Saint Michael's College**
- In radiotherapy treatment planning (RTP), many cancer patients receive an MRI scan of their tumor site to create a radiation therapy treatment plan. Medical physicists and dosimetrists must be very precise in creating these treatment plans which are designed to direct radiation at the cancerous cells inside the patient, at the same time avoiding healthy tissue to minimize negative side effects. Because of this necessary precision, the patient should be lying in the exact position during the MRI scan as they will be during treatment. Modern MRI diagnostic tables are curved, compromising the reproducibility of patient positioning, so a flat tabletop is placed over the curved bed during MRI RTP scans, which also allows the immobilization devices to be used. However, the receiver coils for an MRI machine are underneath the table, so placing a flat tabletop on the diagnostic table pushes the patient farther from the receiver coils, lowering the signal received by the coils and hence lowering overall image quality. This study evaluated the differences in phantom image quality between the diagnostic and RTP tabletops for a variety of MR protocol parameters, including shimming methods and k-space acquisition schemes. All MR images were then analyzed and compared by calculating the signal to noise ratio (SNR) in specific regions of interest (ROIs).

POSTERS AND VISUAL DISPLAYS

PHYSICS & ASTRONOMY - REU

- 63 **Jed McPike**, Fox Foley & Phillip Sprunger "Formation and Photodegradation of Environmentally Persistent Free Radicals [EPFRs] on ZnO Nanoparticles" **Austin College**
- Environmentally persistent free radicals [EPFRs] form when hazardous wastes are burned. Inhalation of these pollutants can cause adverse effects to cardiovascular health. In this study, phenol, an aromatic compound, was absorbed onto the surface of 18 nm ZnO nanoparticles. The two are commonly found in industrial product manufacturing and previous studies have shown this combination creates long-lasting EPFRs. This enables the existence of numerous industrial waste sites capable of generating large amounts of harmful EPFRs. In order to understand the intricacies of EPFR formation, x-ray photoelectron spectroscopy [XPS] and x-ray absorption spectroscopy [XAS] were used to study the electronic processes with respect to formation and degradation of EPFRs. Samples were also exposed to UV light to simulate sunlight as a possible means of remediation.
- 66 **Sadman Sobhan Raabith**, Shania Nichols & Gabriela Gonzalez **Louisiana State University**
- "Understanding the Causes of Mysterious Loud Instrumental Glitches in LIGO"
- The LIGO detectors are complex instruments that find gravitational waves [stretching of space-time] using interferometry and are sensitive to displacements smaller than a proton. However, there are also very loud instrumental transients ["glitches"] that make the detection of gravitational waves more difficult. I have looked at data in the many signals from feedback control loops at times near and far from the glitches. We fit the ratios of spectral densities of the signals to look for outliers that provide clues for the causes of the glitches. The search for such outliers has yielded no clear occurrences but there are many other channels to look at.
- 65 **Anish Suresh** & Parampreet Singh "Towards a Modified Generalized Friedmann's Equation of an Anisotropic Universe" **Rutgers University - New Brunswick**
- General Relativity solved many of the issues of gravity in the Newtonian regime. However, it brought forth its own problem: singularities, points of spacetime where all geodesics end. Their existence strongly implies the incompleteness of General Relativity, which Loop Quantum Gravity aims to resolve. This addition of Quantum Mechanics to General Relativity, in a setting in which the universe expands/contracts, has produced a 'quantum bounce' instead of the infamous Big Bang, which is mathematically encrypted in the modified Friedmann's equation. This result assumes a universe that is homogeneous and isotropic [i.e., same in all positions and directions]. However, if the universe's size changes differently in each direction, the behavior of the universe is much harder to model with an equation. To solve this highly complex problem we worked with a slightly simplified model of Bianchi-I LRS spacetime in which two of the directional scale factors and their time evolutions are identical. We find an analytical form of the modified generalized Friedmann equation in this setting which is found to capture the numerical evolution to a high accuracy. Our results fill a long-standing gap in understanding of anisotropic models in loop quantum cosmology and lay the foundation of finding similar governing equations in more general settings.
- 64 **Abby Tejera**, Jane Glanzer & Gabriela González "From O3 to O4: The Evidence of Reduced Noise Transients in the LIGO Livingston Gravitational Waves Detector Interferometer " **Oberlin College**
- This research consists of a comparison between data from the LIGO Observing run 3 [O3], and the observing run 4 [O4]. There are many noise transients in LIGO detectors that are classified in different groups. We compared the rate of these transients in different classes with different days in O3 and found that there's a much lower rate. For some categories, like fast scattering, we expected this, for others we did not. To do this analysis, I used a machine learning algorithm called Gravity Spy, which classifies Omicron triggers into different glitch classes. During the time of this study, Gravity Spy had data available for 10 days of O4, therefore, in order to do a fair comparison, 10 days in O3 similar to those in O4 were chosen. The criteria to choose similar days was their seismic noise in different seismic bands [microseismic, anthropogenic, earthquake]. Besides, the days chosen are in May and June of 2019 and 2023 for each observing run, accounting for any seasonal conditions. Comparing these days in O3 and O4 allows us to determine what glitch types were more common in O3 in these months and which ones are more common in O4. It also lets us have a better understanding of how Gravity Spy is improving in its classification of glitches, and see if there's evidence of an improvement in the data quality offered by the interferometer.
- 67 **Andrew Valentini**, Zach Yarbrough & Andre Guimaraes **Carthage College**
- "Analyzing Causes of Gravitational Wave False Alarms"
- The prompt discovery of gravitational wave events is performed by a variety of matched-filtering search pipelines. Due to the non-Gaussian nature of the Advanced LIGO detector, these pipelines often react to transient noise sources, commonly referred to as glitches, and mistake them for gravitational wave events. Analyzing the properties of these glitches and a pipeline's reaction to them is thus crucial to improve pipeline efficiency and event validation accuracy. In this study, we perform such an analysis on one of these pipelines, GstLAL, with the intent of providing a battery of tests and models by which a given gravitational wave candidate may be evaluated against to provide a higher degree of confidence in the identification of the event origin in addition to offering a valuable perspective on the responsiveness of this pipeline to instrumental noise.

POSTERS AND VISUAL DISPLAYS

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

- 68 **Ian Army** & Ope Owoyele "Machine Learning Algorithm for Determining Fiber Orientation"

Miami University

Manufacturing composite materials often requires incorporating multiple layers with specific fiber orientations to achieve desired mechanical properties. However, visually determining these angles during the manufacturing process alone can be challenging. This project aims to address this issue by developing a machine learning algorithm capable of automatically detecting fiber orientation angles using images. The objective was to create a computer program that accurately determines the angles of glass fibers within polypropylene composite layers. To accomplish this, a convolutional neural network (CNN), a machine learning approach is designed to analyze data organized on a grid, such as images and videos. The CNN utilizes filters that slide along the image to extract relevant features. To train the CNN, a dataset comprising images and their corresponding measured angles was compiled. Initially, the machine learning model exhibited significant errors, but its performance improved over time through modifications to the filters, learning rates, and overall architecture. In future studies, this process will be implemented in an augmented reality headset, enabling manufacturers to receive training and assistance when working with various fiber-reinforced polymers. If successful, this innovation has the potential to greatly enhance productivity in manufacturing industries both nationally and worldwide.

- 69 **John Campbell** & Brendan Harmon "Using Biopolymers to Improve Plant and Soil Resilience"

Mississippi State University

Biopolymers, or polymers that are produced from cells of living organisms, have been receiving more notice in recent years. Biopolymers can be found almost everywhere, and so finding uses for them could prove extremely rewarding. Working with Dr. Brendan Harmon, I hope to use biopolymers to take the place of clay in aiding in soil adhesion to complex environments, and 3D print-ability. Clay is very successful at accomplishing these; however, it does so with the drawback of damaging the plant's overall health. With the large amount of clay that is necessary to allow soil to adhere, the seeds that are planted in the soil cannot draw as many nutrients from them. We will be testing the biopolymers Kappa Carrageenan, Sodium Alginate, Agar, and Nanocellulose. At first the tests will measure the effects of these biopolymers mixed with some clay, but eventually we aim to create a formula that will not require any clay. We hope that with the use of biopolymers in soil we will see increased adhesion, better overall plant health, and 3D print-ability.

- 70 **Daniela Castro**, Yogesh C. Chandrashekar & Kshitiz Upadhyay "Effect of Cryopreservation on the Mechanical Properties of Liver Tissue"

Laredo College

Cryopreservation is the process of preserving biological cells and tissues via low-temperature freezing. Freezing at low temperatures allows for the structural and metabolic conservation of biosamples for an extended period. As a result, cryopreservation has found wide-ranging applications in biomedicine, from organ transplantation to regenerative medicine and drug delivery. Recent advances in this area have led to new cryopreservation techniques that employ cryoprotective agents (CPA) and controlled freezing rates to minimize cell death and damage at low temperatures. However, the effect of freezing on the mechanical behavior of cryopreserved tissues remains largely unknown. The biomechanics of cryopreserved tissues play a critical role in organ functioning and affects cellular processes such as growth, degeneration, and repair. Thus, an in-depth understanding of the effect of cryopreservation on the mechanical behavior of tissues is much needed. The objective of this study is to investigate this effect on the bovine liver tissue, which is chosen as a model tissue due to its homogeneous cellular composition. To this end, uniaxial tension tests are conducted on fresh and frozen-thawed tissue samples to obtain stress versus strain responses. Samples will be frozen using the controller rate freezing method at fixed cooling rates of $-5\text{ }^{\circ}\text{C}/\text{min}$, $-10\text{ }^{\circ}\text{C}/\text{min}$, and $-15\text{ }^{\circ}\text{C}/\text{min}$. Digital Image correlation (DIC) is used for strain measurement during mechanical tests. The stress-strain responses are post-processed to calculate elastic modulus, tensile strength, and strain to failure. These results will be compared for the three cooling rates to shed light on the effect of cryopreservation on the mechanical behavior of tissues.

- 71 **Hailee Griffin** & Amir Teimouri "Inverse Machine Learning Framework for Optimizing Thin-Walled Structures "

Loyola University New Orleans

Lightweight plate-lattice cell structures are shown to have significantly better results when it comes to their mechanical properties. These higher standards allow for polymers to be used in everyday applications such as submarines and aeroplanes. This is because the cell structures are able to maintain higher level of force while also maintaining structural integrity. Using the machine learning algorithm Generative Adversarial Networks (GANs), structural optimization of these designs are able to be utilized with 3D printed models. With the GANs model unique plate-lattice structures are simulated with the highest yield in stress recovery.

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

- 72 **Taylor LeFlore** & Chengbin Yu "The Ultimate Guide to 2 Way Shape Memory Polymers" **Alcorn State University**

This report summarizes my recent findings on the constant structural changes that have occurred during the two-way shaped polymers. Two-way shape memory polymers or 2W-SMP are actuating materials due to their ability to actuate autonomously as well as reversibility with large amplitude in both a wet and a dry environment. The two-way shape memory effect is associated with forward and backwards transformations. This type of phenomenon affects the resolvable shape, creating a change during different elements such as heating, and cooling without external stress. Thus far in the experiment, multiple samples have been conducted resulting in five separate sucrose measurements. These results will produce a valid and sound sample that can withstand the stretching process without breaking.

During the initial phase the stress is moderately low, due to the lack of elasticity in the PCL and sucrose combination. Throughout the second phase, the mixture undergoes the drying-out process, with removing all the chloroform. This process takes 24 hours to complete. After all the chloroform is removed, the mixture undergoes immense pressure for another 24-hour process. The third phase in this process, is placing the polymer into the curing process at 140°C for 20 and 28 minutes. This phase is fairly tricky as we must not over cure. Finally, we carefully rinse the polymer and if the curing process is valid, testing can occur. The process is completed using the DMA machine to determine the strain, temperature, and stress of the sample.

- 73 **Jenea Owens**, Genevieve Palardy & Patrick Raley "Establishing Relationships Between UV Lights, Temperature, and Degree of Cure" **Mississippi State University**

3D printing is now commonly used in a wide range of applications and industries, including aerospace, automotive, energy, and biomedical (implants, 3D printed organs, etc.). Moreover, it shows promise for large-scale automation through robotic systems and if printed sample quality can be evaluated and corrected in real time. Current 3D printing methods, such as fused deposition modeling (FDM), are primarily limited to planar, layer-by-layer approaches, necessitating additional support material for overhanging structures. Free-standing printing is a 3D printing approach enabled by the use of materials that can solidify as they are deposited. It can therefore eliminate the need for support material and further reduce costs while enabling structural complexity. Some examples of promising approaches to free-standing printing involve ultraviolet (UV)-curable resins. Photopolymers are solidified by "shining" a UV light on them, typically in a matter of seconds. However, to incorporate them into an automated 3D printing system a better understanding of their solidification behavior concerning polymer type and UV light parameters is required. In this project, we propose to investigate methods allowing real-time quality monitoring of printed photopolymer composites. This can be done through the use of cameras to observe defects or temperature changes. In particular, when the polymer solidifies, it undergoes an exothermic chemical reaction during which temperature increases. We expect that higher temperatures will lead to more "solid" samples. Therefore, this project aims to assess the effect of UV light parameters on the solidification of different photopolymers (acrylic or epoxy-based). To measure temp, under various UV light parameters, we will use an infrared camera which records in real-time as the resins cure showing the variations in temperature as the resins go from liquids to solids. So far, we have tested the variation in temps of three UV curable resins' solidity.

- 74 **Regina Raemsch**, Anuja Thapa & Donghui Zhang "Synthesis and Aggregation of Hydrophobically Modified Poly-Epsilon-Lysine" **University of Illinois Urbana-Champaign**

Poly-epsilon-lysine (PEL) is an antimicrobial biopolymer that is biodegradable and nontoxic to humans. The goal is to create an efficient procedure using reductive amination to create sidechain functionalization with the purpose of creating a hydrophobically modified poly-epsilon-lysine. Since RNA is water soluble, it is difficult to transport or analyze samples. Hydrophobically modified poly-epsilon-lysine will be able to interact with double stranded RNA (dsRNA) to encapsulate and transfer it in different medias. PEL can eventually be used as a drug carrier to transport RNA and treat diseases in plants. To achieve hydrophobic modification, different ratios of PEL and decyl aldehyde are reacted in a solution of methanol and later reduced using sodium cyanoborohydride. The samples are then concentrated, and aliquots are taken in between each step to track the process and determine the chemical structure using both FT-IR and NMR spectroscopy. The hydrophobically modified samples are expected to form a micelle aggregate, and dynamic light scattering (DLS) will be used to characterize the polymer. The poly-epsilon-lysine was found to be modified based on the ratio of aldehyde added.

POSTERS AND VISUAL DISPLAYS

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

- 75 **Devin Schwaibold**, Taotao Ling & Fatima Rivas "Synthesis and Evaluation of Redox Active Molecules as Drug Delivery Tools Against Cancer Cells" **Southeastern Louisiana University**

Triple negative breast cancer (TNBC) is one of the most dangerous subtypes of cancer currently facing our society. TNBC represents about 15% of all breast cancer reports and supports only a 12% survival rate once the cancer has spread. Over 60% of anti-cancer drugs in use today can be traced to the origin of a natural product. However, many natural products suffer from poor physicochemical properties, mainly their solubility in water. To overcome this challenge, our project aims to design prodrug strategies using smart polymers to assist in improving the properties of these natural products, as we hypothesize that these prodrugs may hold exceptional potential for fighting triple negative breast cancer.

Our prodrugs have been synthesized by a series of organic reactions, including many known organic techniques, such as column chromatography, as well as characterization of the created compounds through NMR. Through these reactions, we were able to attach several different functional groups to prodrug that provide great biological advantages, including water solubility and redox capabilities. The last step of our synthesis includes a carbonate linker, which can be easily broken down in the body, allowing quick release of the 'warhead' of the prodrug. Once the drug is synthesized, we plan to evaluate their cytotoxicity in order to test its effectiveness against TNBC. Pending the success of this project, we hope to test these prodrugs on other types of cancer cells, eventually designing a prodrug that exhibits nearly universal adverse effects on cancer cells.

- 76 **Lacy Severn**, Stefanie L. Klisch & Gerald J. Schneider "Influence of Temperature on the Size and Polydispersity of PEG-PDMS Polymersomes" **Tarleton State University**

Polymersomes are synthetic polymer vesicles that self-assemble due to the polymer's amphiphilic nature. These molecules are of interest because they have been shown to act as artificial liposomes. An irreversible size change was observed in the polymersomes as a result of increasing the temperature. Therefore, this study focuses on the polymersomes' properties during and after the temperature-dependent change in diameter. To observe a size and polydispersity (PDI) change, the polymersomes were heated and their hydrodynamic diameter (DH) was measured using Dynamic Light Scattering (DLS) throughout the heating process. The DH and PDI were then tracked over the subsequent days. After reaching a certain temperature threshold, the polymersomes continued to grow in size before being measured again the next day. For this particular system, heat also results in a decrease in polydispersity. Over time the polydispersity increases again, but it does not return to its original value. These results will have a positive impact on future sample preparations and scientific studies by creating a more defined system, which is therefore easier to manipulate and understand.

- 77 **Claire Wingfield**, Alexandra Aucoin, Brecklyn Groce & John Pojman "Study of the Front Velocity and Mechanical Properties of Frontally Cured Epoxy and Vinyl Ether Resins" **The University of Dallas**

Epoxy resins and divinyl ether resins can be cured by propagating reactions in a process called frontal polymerization. These monomers are highly reactive through a process known as radical-induced cationic frontal polymerization and are typically seen in applications such as coatings. We will study how the front velocity is affected by the concentrations of a peroxide (Luperox 231) and a cationic initiator (IOC-8) in resin formulations containing milled carbon fiber and fumed silica. The modulus and material strength of the samples will be characterized by 3-point bending. We will also test these formulations via 3D printing.

SOUTHERN UNIVERSITY/LOUISIANA STATE UNIVERSITY SUMMER RESEARCH EXCHANGE

- 78 **Fahja Bonnett**, Alejandra Ham, Josie Ostrowe, Blake Nassar, Elizabeth Martin & Adam T. Melvin "The Effect of Fluid Shear Stress on the Migration of Cancer Cells During Extravasation Through Single Cell Analysis" **Southern University and A&M College**

The scope of this research is to interpret the impact of fluid shear stress (FSS) on the migratory behavior of breast cancer cells at the metastatic site using single cell analytics. Microfluidic devices containing two parallel channels, connected by an array of 7 μm wide x 210 μm long channels, are utilized to induce one-dimensional (1D) migration of sheared cancer cells.

POSTERS AND VISUAL DISPLAYS

SOUTHERN UNIVERSITY/LOUISIANA STATE UNIVERSITY SUMMER RESEARCH EXCHANGE

- 79 **Talajha Hunter**, Daniel Yeboah, Fareed Dawan & Patrick Mensah **Louisiana State University**
"Water-Soluble, Carbonated Polymers Made by Additive Manufacturing"

Polymers are an important class of materials for diverse applications in engineering. This is because they are light weight, can be easily manufactured, affordable and have high strength to weight ratio. This research project aims to explore the potential of utilizing additive manufacturing techniques in conjunction with laboratory-made polymers that are water-soluble to develop a novel class of printable polymers. Investigation to be conducted will include selecting appropriate water-soluble monomers based on literature, identification of photo activators to be used and determining appropriate mixing ratios that favor flowability and printing. Also curing time for the polymer, when exposed to a source of light, will be monitored. This will provide an idea of a starting exposure time to use during print trials. Formulated photo-polymers will be printed using a digital light processing (DLP) printer and immersed into varying water quantities to assess its dissolution. As a further step, synthesized polymers will be infused with carbon dioxide gas and printed. Varying quantities of carbon dioxide gas will be infused. Commercially available water-soluble printable resins will also be used and compared to those synthesized. To prove the presence of carbon dioxide in the printed parts, they will be immersed in water to observe the release of gas bubbles out of the water. This work has prospective application in sustainable extraction of essential oils from plants. In recent times, as additive manufacturing [AM] [commonly known as 3D printing] has gained much attention when it comes to rapid prototyping, polymeric products have been widely printed via the same technology for various purposes. Additive manufacturing offers unprecedented design flexibility and enables the fabrication of complex polymer structures with ease. Yet, resins for printing polymeric objects are usually commercial and hence may not adapt well for certain specialized (i.e., water-soluble) application

- 80 **Samantha Staggs**, Ivana Barley, Stephen Akwaboa & Patrick Mensah **Louisiana State University**
"Investigating Cloud Aerosol Production in the Planetary Cloud Aerosols Research Facility through Rayleigh-Bénard Convection"

On Earth, numerous research on aerosol cloud formation has been conducted to understand the effect it has on climate and health. For other planetary bodies however, there has been little research towards understanding the complex formation of these clouds. Thus, the Planetary Cloud Aerosols Research Facility [PCARF], a research funded by the National Aeronautics and Space Administration [NASA], is dedicated to investigating the generation of cloud aerosols within a controlled chamber, emulating atmospheric conditions found on various planets and moons. A subset of the project aims to find the relationship between key parameters, such as aspect ratio and thermal boundary conditions, and their impact on Rayleigh Bénard convection. This research starts with the observation that Rayleigh-Bénard cells, which are crucial for cloud formation, evolve during laminar flow but disintegrate once turbulent flow commences. This observation forms the hypothesis that specific conditions need to be met to produce clouds effectively and can be tested through numerical analysis. With known properties of nitrogen gas at ambient temperature and atmospheric pressure, two distinct Rayleigh numbers, Ra , are considered: laminar flow when $Ra = 104$ and turbulent flow when $Ra = 109$. For both flow types, a diameter of 2 m will be maintained while the length of the chamber will be altered for three different cases: 1 m, 2 m and 3 m. By varying the lengths, the effect of aspect ratio on Rayleigh Bénard cell formation are examined. To validate and provide a comprehensive understanding of the heat transfer phenomenon occurring within the chamber, simulations will be performed using the ANSYS Fluent Software. These simulations will yield visual and numerical representations towards insights into the behavior of the fluid. The parameters for evaluation for the different case studies are the magnitude and direction of the velocity vectors, vorticity magnitude and heat flux reports.

LIGHTNING TALKS

ASPIRE

Gabrielle Mellor, Colette Mouton & Don Zhang, "Are Risk Takers Happier?"

Louisiana State University

Despite recent research supporting the notion that risk propensity is correlated with both happy [e.g., high extraversion] and unhappy [e.g., low conscientiousness] personality traits, the role of risk propensity as a personality predictor of happiness has been often overlooked in psychological research [Anglim et al., 2020; Joseph & Zhang, 2020]. Relatedly, risk propensity has been found to individually predict both adaptive and maladaptive real-world outcomes separate from the Big Five personality traits (Highhouse et al., 2022). Extending this research, the present study examines the relationship between scores on multiple measures of wellbeing [e.g., Subjective Wellbeing, Psychological Wellbeing, Life Satisfaction] and measures of risk propensity. The study sample consisted of 465 participants from the LSU SONA participant pool who were tasked with completing a 20-minute Qualtrics survey. This research intends to generate crucial insights into the ways risk propensity uniquely contributes to the happiness and wellbeing of individuals and uncover whether risk takers are happier than their non-risk-taking peers.

CENTER FOR COMPUTATION AND TECHNOLOGY - REU

Kimberly Heard, Noah Rahman, Andrew Allocca, William Shelton & Justin Wilson "LatticeHamiltonians.jl: A Comprehensive Software Package for Matrix-less Tight-binding Models"

Georgia Institute of Technology

We present "LatticeHamiltonians.jl", an efficient software package designed for matrix-less Hamiltonians on lattice systems. This package has applications within condensed matter physics, mathematical physics, and material science; it aims to provide a powerful tool for analyzing quantum materials. Our approach leverages metaprogramming features in Julia to construct the Hamiltonian matrix as a linear operator. By optimizing matrix-vector multiplication in a matrix-less manner, we enable calculations that do not require explicit matrix storage. The package provides functions for generating expressions that capture the onsite and hopping components of the Hamiltonian, which are crucial for modeling the behavior of quantum materials. Additionally, there are functions for calculating the site index in the 1D unwrapped lattice and generating optimized loops for iterating over lattice sites in periodic systems.

The structure of the "LatticeHamiltonians.jl" package includes dimensions, number of orbitals, system size, and parameter configurations of the Hamiltonian. To complete the package, we have introduced a macro called `@lattice_hamiltonian`, which automates the construction of the Hamiltonian and generates a function for its application. The package is well-suited for modeling tight-binding approximation models in 1D and 2D systems in particular. These models are widely used in condensed matter physics, describing how particles are transported through condensed matter systems. Our research project aims to provide a versatile and user-friendly tool for researchers working with lattice Hamiltonians. We aim to accelerate scientific discoveries, deepen the understanding of quantum materials, and foster collaboration within the research community.

LSU DISCOVER PROJECT GRANT RECIPIENTS

Kayla Dearman & Reagan Power "Integrating Chemistry & Physics with Animation: Aquatic Polymeric Suspension in Stop Motion Animation"

Louisiana State University

Stop motion animation has long been a driving force for novel innovations - which often marvel the world for their unique ability to meld together seemingly disparate disciplines. One environment that has yet to be successfully emulated by stop motion without considerable digital manipulation is that of the sea. Few modern productions have attempted to tackle this feat; those that have are unable to capture the complex movement of the sea-life and aquatic environment because of the unpredictability of the water surrounding them. Animators are forced to painstakingly move each animated item how they intuitively feel it would move underwater. This process requires costly motion rigging devices that give the illusion of weightlessness to objects being animated and a considerable amount of post-production digital manipulation. The effort and cost put into this process doesn't often yield the desired results, which has discouraged many stop motion animators from attempting underwater animation. However, by using a simple solution of super-absorbent polymer beads and water in a transparent vessel, an artificial aquatic environment with imperceptible suspension is created. This study examines the efficacy of this medium for use in animation to evaluate how this method compares to other attempts at emulating aquatic environments. Various materials, sealants, and puppet prototypes were tested to identify the uses and limits of the medium. Though this project focuses on portraying an aqueous environment, the methods investigated here have further implications for making stop motion animation more cost-effective and accessible in a way that is environmentally friendly.

LIGHTNING TALKS

LSU DISCOVER PROJECT GRANT RECIPIENTS

Will Decker & Julie Schneider "Is EEG Really Better Left Alone for Developmental Datasets?"

Louisiana State University

Event-related potentials (ERP) are common evaluations of EEG data as they evoke robust neural responses with simple experimental designs. However, within ERP data exists intrinsic noise that can moderately affect, or significantly occlude the true EEG signal. Fortunately, there are many signal processing operations to reduce such noise in EEG data, yet, there remains little consensus as to which preprocessing standards are most effective. In an effort to standardize EEG preprocessing and promote reproducibility, Delorme [2023] evaluated the effectiveness of each preprocessing method. This evaluation indicated that "EEG data is better left alone"-or better left to automated pipelines. However, it remains unknown whether the same findings apply to developmental EEG data. Therefore, a distinct evaluation of the optimal preprocessing operations must be made given the numerous differences in EEG data quality that exist among younger populations. We directly address this issue by asking what preprocessing methods are most optimal for developmental EEG data. Using open-source developmental datasets, we tested the EEG preprocessing parameters implemented by Delorme [2023], evaluating their optimization using both the tmax statistical test and the standard measurement error (SME). We found that a conservative bandpass filter, line noise removal and moderate artifact removal were optimal for analyzing developmental EEG. Our findings suggest the need for different preprocessing parameters for analyzing developmental data.

Benjamin Klein, Armita Govar & Ryoichi Teruyama "Involvement of MPOA-Oxytocin Receptor Neurons in the Parental Behavior of Male Mice"

Louisiana State University

When mouse pups are displaced from their nest, mothering mice commonly find and return them in a behavior termed pup retrieval. Oxytocin receptor (OXTR) expressing neurons in the anteroventral periventricular nucleus within the medial preoptic area of the hypothalamus are necessary for maternal pup retrieval. Fathering mice can also exhibit pup retrieval after a learning period following parturition. However, much is unknown about the neurons necessary for this behavior in male mice. Therefore, brain sections of fathering mice will be analyzed after the completion of a pup retrieval test. Immunocytochemistry will be performed to visualize OXTR-expressing neurons and oxytocin-producing neurons. The presence of the protein c-Fos will also be visualized to serve as an indicator for neuronal activity. The number and localization of the neurons expressing these target proteins will be compared between male mice that retrieved pups and those that did not retrieve pups as well as virgin male mice. The results of this project will be further compared to a similar project assessing postpartum female mice to determine if there is a sexual dimorphism in the neural circuitry underlying pup retrieval in male and female mice.

MAXIMIZING ACCESS TO RESEARCH CAREERS

Christian Foti, Wayne Newhauser & Maxwell Cole "Development of a Novel Computer Simulation Approach to Replace Small-Animal Experiments for Radiation Cancer Therapy"

Louisiana State University

Radiation therapy is a safe, effective and non-invasive treatment for many forms of cancer. High doses of radiation eradicate tumors but can also lead to side effects in surrounding healthy tissues. Radiation injury to the vasculature plays key roles in both. Research on novel radiotherapy treatments typically requires preclinical studies involving experiments involving small animals in order to test hypotheses, safety, and efficacy. However, recent studies suggest that it may soon become possible to supplement or replace some animal experiments with computer simulations. In this project, we report on an experimental approach to validate simulations. Simulations will include blood flow in an organ-on-a-chip system and corresponding measurements in a radiation therapy beam. The quantities validated will include blood flow rate and radiation dose. Preliminary calculations revealed good agreement of the simulations of blood flow rate. Preliminary design work is underway on an experimental apparatus that will precisely position animals during irradiation.

LIGHTNING TALKS

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

Aqsa Khan & David Chicoine "Climate Change Effects on the Harappan Civilization, and Its Relevance Today"

Louisiana State University

The Harappan civilization was an ancient advanced civilization that, at its peak, spanned the majority of Pakistan and part of India, and prospered from 3300 BCE to 1300 BCE. The purpose of this research is to enlighten people of the dangers climate change can pose on societies if action is not taken by using the Harappan civilization as an example. This civilization is an excellent model on how climate change can negatively affect societies because it has a plethora of similarities to modern day societies, both before the effects took place and after. The method utilized for this research is secondary research. The research uses a multitude of scholarly articles regarding the Harappan civilization and other civilizations within the Indus River Valley region. These articles are used to create a rough timeline of the civilization's history and include the different political and environmental states each phase experienced. The research will focus primarily on the Mature Harappan phase [2600-1900 BCE] and Late Harappan phase [1900-1300 BCE] of the Harappan civilization. It will also focus on the changes and events that were caused by climate change that resulted in the ancient civilizations' disintegration.

Madison O'Neal, Caroline Scherzer & Julia D. Buckner "Social Anxiety and Sexual Assault Protective Behavior Strategies Among College Women: The Role of Alcohol-Related Behaviors"

Louisiana State University

This research project aims to explore the predictors of sexual victimization among college women in several ways. Understanding the barriers faced by college women with anxiety symptoms when utilizing sexual assault protective behavior strategies (PBS) will enable the development of more tailored and effective interventions to promote their safety and well-being.

A mixed-methods approach will be utilized, consisting of a baseline survey and a 14-day daily diary assessment. The baseline survey will collect data on demographics, levels of depression and anxiety, utilization of sexual and drinking PBS, history of sexual assault, drinking and sexual motives, alcohol consumption, and sexual assertiveness. The daily diary assessment will provide information on participants' drinking behaviors, utilization of drinking and sexual PBS, sexual experiences, nature of sexual victimization, sexual and drinking motives, and the timing of alcohol consumption and sexual encounter.

Through this research project, we aim to address the gaps in previous literature and provide implications for mental health care providers, prevention programs, and college campuses. By understanding the factors influencing the utilization of protective strategies, this study will contribute to promoting a safer environment and supporting the well-being of college women, especially those experiencing social anxiety symptoms and sexual victimization.

Darlina Tran, Julie Nguyen & Danbi Choe "Asian Parental Ethnic-Racial Socialization"

Louisiana State University

The purpose of this research is to explore Parental Ethnic-Racial Socialization among Asian Americans and their perspective of identity and ethnicity. Ethnic-Racial Socialization involves four basic dimensions: preparation for bias, promotion of mistrust, cultural socialization, and pluralism. Each of these dimensions affects how Asian American youth relate to ethnic and racial issues. We are doing three phases for this project. The first stage involves collecting data through surveys. Then, applicants who stated interest in a compensated interview are interviewed one by one virtually. The participants who have expressed interest in participating in a development team are assigned to group(s) dedicated to developing an intervention aimed at enhancing their ethnic identity. I will present a literature review about ethnic-racial socialization among Asian American youth and share my initial impressions while conducting the interviews.

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

Lacy Severn, Stefanie L. Klisch & Gerald J. Schneider "Influence of Temperature on the Size and Polydispersity of PEG-PDMS Polymersomes"

Tarleton State University

Polymersomes are synthetic polymer vesicles that self-assemble due to the polymer's amphiphilic nature. These molecules are of interest because they have been shown to act as artificial liposomes. An irreversible size change was observed in the polymersomes as a result of increasing the temperature. Therefore, this study focuses on the polymersomes' properties during and after the temperature-dependent change in diameter. To observe a size and polydispersity (PDI) change, the polymersomes were heated and their hydrodynamic diameter (DH) was measured using Dynamic Light Scattering (DLS) throughout the heating process. The DH and PDI were then tracked over the subsequent days. After reaching a certain temperature threshold, the polymersomes continued to grow in size before being measured again the next day. For this particular system, heat also results in a decrease in polydispersity. Over time the polydispersity increases again, but it does not return to its original value. These results will have a positive impact on future sample preparations and scientific studies by creating a more defined system, which is therefore easier to manipulate and understand.

LIGHTNING TALKS

LSU SPECIAL COLLECTIONS SUMMER PROJECTS

Nathaniel Dela Pena "Creating a Historical Tour of our Greater University"

Louisiana State University

LSU's campus and our university have a rich history. The grounds of today's campus used to be part of several plantations and our campus has one of the oldest man-made structures in the Western Hemisphere. And there are many stories of our campus and university that many people have covered that demonstrate that rich history. But there are often overlooked stories that can contribute to the well-being and overall knowledge of our university, particularly the stories of our underrepresented communities.

Therefore, I want to create a walking tour, displayed on a website, that allows anyone to enjoy the rich history of our campus and university. I have used the deep, rich archives of Special Collections to create narratives of these locations and reveal the magnificent stories that can contribute to a better overall knowledge of our university and our campus.

Madison Saucier "Confronting the History of LSU's Land: Arlington Plantation"

Louisiana State University

Louisiana State University [LSU] was built on the grounds of former plantations, such as the Arlington Plantation. Arlington Plantation is now the site of the LSU Veterinary and Animal Science School. However, little is documented about the enslaved people that worked and lived on Arlington Plantation, which provided valuable resources and acreage for the University. The enslaved peoples' history on this land is mostly ignored in the general narrative of the University's history. Documenting these enslaved people challenges the status quo in the University's history and placement within the U.S. South's historical narrative. The documentation of these formerly enslaved people contributes to an enrichment of the University's history, and the overall historical narrative of universities in the U.S. South. Addressing the history of the land and labor that built these impressive universities is one step towards creating a more accurate and inclusive historical narrative.

This research guide holds important information regarding the enslaved people who previously resided and worked on Arlington Plantation. It places the plantation and enslaved people within the historical narrative. Erasing enslaved people-their stories, locations, and names-supports harmful ideas, such as white supremacy and the whitewashing of American history through the absence of African American voices in the historical record. Furthermore, it is easier to establish a historical narrative that supports white supremacy when enslaved peoples' biographical information is lost or ignored. Creating this research guide that includes names, locations, and other biographical information humanizes those who were-and continue to be-dehumanized.

KEYNOTE SPEAKER

Dr. John Pojman

Join us at 11:00 a.m. in the Atchafalaya, Room 339 to hear Dr. Pojman's keynote speech.

Cure-On-Demand Polymeric Materials for Art and Wood Repair using Frontal Polymerization



The goal of cure-on-demand polymerization is to create one-pot systems that have a long shelf life but will react rapidly when curing is desired. We use two approaches: coupling polymerizations with clock reactions and an approach called frontal polymerization in which a localized reaction zone propagates from the coupling of thermal transport and the Arrhenius dependence of the reaction rate of an exothermic polymerization. We demonstrate that frontal polymerization can be used to create a cure-on-demand wood filler. The filler has a months-to-years shelf life, is a one-pot formulation, can be applied leisurely and then cured rapidly with a flat heat source. We will explore the commercialization of “Quick-Cure Clay” for the arts and crafts market and consider how frontal polymerization can be used for additive manufacturing and coatings.

Dr. John A. Pojman, a native of North Royalton, Ohio, received his B.S. in Chemistry (with a minor in Classics) from Georgetown University in 1984. He earned his doctorate in Chemical Physics in 1988 at the University of Texas at Austin. Pojman then worked for two years at Brandeis University with Irving Epstein. In 1990 he joined the Chemistry & Biochemistry department at The University of Southern Mississippi, where he taught for 18 years. Dr. Pojman joined the Department of Chemistry at Louisiana State University in August 2008, where he is the Patricia Senn and William Senn, Jr., Distinguished Professor & Chair.

Pojman co-authored one monograph, "An Introduction to Nonlinear Chemical Dynamics," and co-edited two others. He has served four times as a guest editor for the journal Chaos and authored 181 peer-reviewed publications and ten book chapters. Over his academic career, he made 315 presentations and received three patents. Since 1990 he supervised 185 undergraduates. His research expertise is in nonlinear dynamics in polymer systems and materials of art. Additionally, he is an avid bass fisherman, trout fisher and amateur herpetologist with a special interest in the aquatic salamanders of Louisiana (<http://amphiumas.org>). He also boasts the world largest collection of pocket protectors. www.pocketprotectors.info. John is the President and CEO of Pojman Polymer Products, LLC (3pllc.com).

He lives in Baton Rouge with his wife, Dionne Rousseau.

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