LSU | Discover Undergraduate
Research Program

Summer
Undergraduate
Research
Forum

AUGUST 2, 2024

WELCOME TO THE LSU
SUMMER UNDERGRADUATE RESEARCH FORUM 2024

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

Photographer: 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 received a Bachelor of Fine Arts in Photography from LSU in 2024, where she was Co-President of Photo Club, a member of the Gulf Scholars Program, a Distinguished Undergraduate Research awardee, and undergraduate Dean's Medal Recipient for the School of Art. You can find more of her work on her website: brookechouest.com.

SCHEDULE OF EVENTS

All locations in the Patrick F. Taylor Hall

Time	Event	Location
8:00 a.m. - 9:00 a.m.	Check-in & set-up	Cambre Atrium, Patrick F. Taylor Hall
9:00 a.m. - 9:10 a.m.	Welcome Remarks	Cambre Atrium, Patrick F. Taylor Hall
9:10 a.m. - 11:00 a.m.	Poster and Visual Display Session	Cambre Atrium, Patrick F. Taylor Hall
11:30 a.m. - 12:30 p.m.	Presenter Lunch Break	Capstone Gallery, Patrick F. Taylor Hall
12:30 p.m. - 1:30 p.m.	Research Career Panel	Room 1100, Patrick F. Taylor Hall
1:30 p.m. - 2:30 p.m.	Lightning Talks	Room 1100, Patrick F. Taylor Hall
2:30 p.m. - 3:00 p.m.	Keynote Speech *Speaker: Dr. Naohiro Kato*	Room 1100, Patrick F. Taylor Hall
3:00 p.m. - 3:30 p.m.	Poster/display take down	

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

GUEST WIFI

Wi-Fi Name: **lsuguest**
Username: **SURF2024**
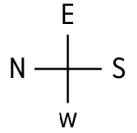Password: **000718**

PROGRAM QR CODE

TO VIEW ABSTRACTS PLEASE VISIT THE QR CODE

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
- Dr. Lattin's NSF Career REU
- Dr. Schneider's Undergraduate Summer Research Group
- LA NASA EPSCoR FFP
- 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 P2O GM103424-21
- Louisiana Materials Design Alliance (LAMDA)
- LSU Gulf Scholars Program
- 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
- MissDelta REU
- Pennington Biomedical Research Center - Summer Undergraduate Research Experience
- 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
- LSU Museum of Art

PATRICK F. TAYLOR HALL
FIRST FLOOR

N E S W (compass)

SYSTEM INTEGRATION CLASSROOM (1360)

HUMAN FACTORS LAB (1354)

CAMPUS COMPUTER LAB (1350)

ELEVATORS

RESTAURANT (1375)

THE COMMONS

STUDENT LEADERSHIP INCUBATOR (1280)

STUDENT LEADERSHIP CONFERENCE (1278)

CIV SURVEYING LAB (1233)

CHEM ENG GRAD COMPUTER LAB (1237)

CLASSROOM (1245)

CAPSTONE DESIGN SPACE (1340)

(1342)

(1344)

CAPSTONE GALLERY

EE MICRO GRID + RELAY (1100)

ROBOTICS LAB (1300)

CENTER FOR ENGINEERING EDUCATION (1269)

(1272) (1259A) **CAPSTONE DESIGN SPACE (1259)**

(1257)

PFT MAIN ENTRANCE

South Quad Dr.

CLASSROOM (1225)

CLASSROOM (1221)

CLASSROOM (1232)

CLASSROOM (1236)

CLASSROOM (1240)

SEMINAR CLASSROOM (1244)

COMPUTER CLASSROOM (1246)

CLASSROOM (1212)

CLASSROOM (1218)

CLASSROOM (1216)

CLASSROOM (1253)

COMPUTER CLASSROOM (1256)

MODULAR CLASSROOM (1258)

MODULAR CLASSROOM (1262)

MODULAR CLASSROOM (1206)

CLASSROOM (1263)

STORAGE (1208)

PETE CLASSROOM (1202)

CLASSROOM (1200)

★ **CAMBRE ATRIUM**

SUSTAINABLE LIVING LAB (1154)

CHEM ENG RESEARCH LAB (1139)

CHEM ENG RESEARCH LAB (1133)

SHARED COMPUTER LAB (1131)

CHEM ENG PROCESSING LAB (1147)

(1145) (1143)

(1137) (1135)

CHEM ENG PROCESSING LAB (1119)

CHEM ENG HIGH BAY (1120)

UNIT OPERATIONS LAB (1114)

CHEM ENG CONTROL ROOM (1112)

(1106) (1104)

SHARED TEACH LAB (1102)

AUDITORIUM (1100)

(1150) (1146) (1144) (1142) (1140) (1138) (1134) (1132) (1130)

(1126)

COMPUTER LAB (1124)

Engineering Ln.

★ <u>Cambre Atrium</u>
9:10 - 11:00 am Poster/Visual Display session

✦ <u>Auditorium room 1100</u>
12:30 - 1:30 pm Research Career Panel
1:30 - 2:30 pm Lightning Talks
2:30 - 3:00 pm Keynote Speech

📍 <u>Capstone Gallery Stairs</u>
11:00 - 11:30 am Group Photo
1:30 am - 12:30 pm Lunch
Presenters & Paid Guests Only

ASPIRE

1 **Camille Meaux,** Layla Deprimo, Sydney Junot, Arline Narez & Dr. Louisiana State University   David McDougal
David McDougal, "The Establishment of a Sprague Dawley Colony for
Laboratory Research Purposes"

Sprague Dawley (SD) rats are commonly used in biomedical research and are readily available for purchase from commercial breeders. Although convenient, acquiring rats from a vender comes at an increased cost. Alternatively, a breeding colony can be established in-house to produce experimental animals more cost-effectively, but proper planning and regulatory approval is required. The purpose of this project was to establish a breeding of SD rats in Dr. David McDougal's laboratory at Pennington Biomedical Research Center (PBRC). The initial phase of the project concerned obtaining regulatory approval from the IACUC (Institutional Animal Care and Use Committee) at PBRC. This required calculating the rate at which pups needed to be produced, and a guide from The Jackson Laboratory was used to determine the number of pups produced per week, number of female and male founders needed, and how often a replacement breeder would be needed. Once approval was gained from the PBRC IACUC, founding breeding rats were acquired from an outside vendor. The second phase of the project involved developing an advanced, theoretical calendar to manage the timing of breeding, weaning, and the movement of pups into experimental protocols. To maximize breeding efficiency, the final phase of the project involved establishing procedures for routine vaginal cytology to determine the timing of each female rats' estrus cycles. Once the females' cycles were established, the male and female could be pair-housed on the optimal day to maximize breeding success. The ability to form a colony of laboratory grade Sprague Dawley rats will aid Dr. McDougal in his research by allowing the funds that would go to animals to now go to other necessities for the lab.

BECKMAN SCHOLARS PROGRAM

2 **Lexi Cheramie**, Nidhi Kulkarni, Xiaozhuo Wang & David J. Vinyard Louisiana State University   David Vinyard
"Confocal Subcellular Localization Study of Deg Proteases in
C*hlamydomonas reinhardtii*"

Photosystem II (PSII) drives the conversion of solar energy to chemical energy in photosynthetic organisms by acting as water plastoquinone oxidoreductase. PSII is subject to frequent photodamage, and proteases are involved in its repair by degrading the photodamaged D1 subunit and allowing for a newly synthesized D1 to be inserted. The molecular identity of proteases, besides FtsH, involved in D1 degradation in algae like *Chlamydomonas reinhardtii* is not known. Deg proteins are a class of ATP-independent proteases important in protein homeostasis and are involved in D1 degradation in plants. There are 14 deg genes in the Chlamydomonas genome, and our goal is to screen for which of these, if any, is potentially involved in D1 degradation. We begin by identifying the subcellular localization, as a protease involved in D1 degradation would be localized to the chloroplast. 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. Our data shows that Deg1A is in the cytosol and so does not play a role in D1 degradation. Work is currently in progress to localize five other Deg proteases. By discovering which Degs are localized to the chloroplast, we can further study them to understand the process of D1 degradation in PSII repair.

BECKMAN SCHOLARS PROGRAM

4   **Sydney Lawson**, Taotao Ling & Fatima Rivas "Bioactive Constituents of   Louisiana State University   Fatima Rivas
    the American Beautyberry"

Of the estimated 2.3 million women globally who will be diagnosed with breast cancer this year, 20% will be diagnosed with the triple negative breast cancer (TNBC) subtype. This subtype disproportionately affects younger women and women of color. The unique lack of certain receptors which defines TNBC makes it resistant to treatment with hormone therapies that are effective against other breast cancers. TNBC leads to approximately 150,000 deaths annually, indicating a need for effective therapeutics. Using bio-guided drug discovery principles, our aim is to identify compounds that could potentially be used to selectively treat TNBC.
Various species of the Lamiaceae plant family have been reported to produce compounds with anti-cancer activities. The American beautyberry, *Callicarpa americana*, is a member of the Lamiaceae family that is widespread across the southeastern United States. We hypothesize that *C. americana* could serve as a source of novel medicinal molecules against TNBC.
Our methodology includes a) collection and isolation of *C. americana* foliage, b) extraction with adequate solvent systems, c) organic compound purification via column chromatography, d) structure elucidation using spectrometric techniques, and e) biological evaluation of fractions and purified compounds. The biological evaluation includes cytotoxicity and cell death modality evaluation using TNBC and non-cancerous cellular models.
It is expected that this investigation will lead to the discovery of novel compounds with selective properties against TNBC cell models. A thorough study of their in vitro mode of action and physicochemical properties will be conducted to advance these compounds to in vivo model efficacy studies.

5   **Dykia Williams**, Brandon P. Russell & David J. Vinyard "Characterizing   Louisiana State University   David Vinyard
    Structure-Function Relationships on the Acceptor Side of Photosystem
    II"

Photosystem II (PSII) is a large protein-pigment complex that splits water and releases O_2 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 was 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 were then 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.

6   **Rhegan Barrett**, Les Butler, Kyungmin Ham & Cecily Lu "3D X-ray   Tulane University   Les Butler
    Imaging and Artificial Intelligence"

3D X-ray tomography allows for in-depth visualization of smaller scale subjects and has many applications in different fields. A ThermoScientific HeliScan MicroCT was used to create 3D images of various samples, and the image/data analysis softwares Avizo and Fiji were used to analyze and create animations of the 3D images. One sample was a heat exchanger with welds created by lasers, in which 3D imaging was combined with deep learning techniques in Mathematica to determine whether welds were faulty. Combination of these analyzation techniques may help the company that makes the heat exchangers pinpoint what constitutes a weld that will leak. Another sample that was imaged were dense wood blocks from the Graphyte company which will be used for carbon sequestration. In Avizo, animations of the block were created to help visualize and analyze different aspects of the block such as its density and composition. This may aid Graphyte in being able to quantify how much carbon dioxide equivalent can be stored in their process.

CENTER FOR COMPUTATION AND TECHNOLOGY - REU

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7   **Nicolas Garcia** & Peter Diener "Building an Initial Data Solver for Black   Columbia University   Peter Diener
Hole-Neutron Star Systems"

This project aims to develop an interface for black hole - neutron star systems between the initial data(ID)solver Frankfurt University/Kadath (FUKA) and the SPHINCS_BSSN numerical relativity code. The FUKA ID solver generates initial data solutions consistent with the eXtended Conformal Thin-Sandwich (XCTS) formulation of Einstein's field equations for various compact object configurations, including extremely compact, asymmetric, and mixed spin binaries. In parallel, SPHINCS_BSSN utilizes numerical methods to evolve spacetimes in full General Relativity through a Lagrangian approach, integrating the BSSN equations on structured meshes with a straightforward dynamic mesh refinement strategy. The fluid dynamics are modeled using freely moving Lagrangian particles and a modern Smooth Particle Hydrodynamics (SPH) formulation. This research focuses on employing a new version of the FUKA exporter within the SPHINCS code, compatible with OPENMP for direct export file transfer. The outcome of this project will be a FORTRAN interface for the SPHINCS BHBS importer code, facilitating interaction with the C++ FUKA importer.

8   **Luke A. LeGoullon**, Md Tanvir Emrose & Georgios Veronis "Memetic   Louisiana State University   George Veronis
Algorithm Parallelization for the Optimization of Multilayer Photonic
Structures"

This research focuses on parallelizing a memetic algorithm for optimizing multilayer photonic structures. Memetic algorithms have shown promising results in optimization problems by combining evolutionary principles with local refinements. However, these algorithms are often computationally intensive, especially in large-scale applications. This study aims to efficiently parallelize a memetic algorithm for photonics applications using the MATLAB Parallelization Toolkit. The parallelized code will be executed utilizing the extensive computational resources at the Center for Computation and Technology (CCT) at LSU.
The scope of this research includes the parallelization of the algorithm, its implementation on the High Performing Computing (HPC) system, as well as comparative analysis of its performance against the sequential approach. By addressing the computational challenges associated with optimizing multilayer photonics structures, this research aims to advance the development of photonic devices.

9   **Diego Ozuna**, Dr. Juana Moreno & Dr. Ka-Ming Tam "Identifying Spin   California State University   Ka-Ming Tam
Glass Systems Utilizing Deep Learning"   - San Bernardino

The combined effects of randomness and frustration lead to the formation of spin glass, where conventional long-range ordering is absent. However, its existence and nature remain important research topics in statistical physics despite decades of intense study. The spin glass problem is directly related to a variety of important optimization problems, and advances in spin glass research contribute to the development of algorithms and approximations for these problems. The machine learning approach provides a new direction for exploring the spin glass system. Building on the success of generative models in identifying the ferromagnetic transition, we explore the feasibility of using generative models, particularly a variational autoencoder, to identify the spin glass transition.

CENTER FOR COMPUTATION AND TECHNOLOGY - REU

10 **Nicholas Schroeder**, **Devin Lopez**, Michael Thomas, Jake Shore, Julia Patel, Dr. Supratik Mukhopadhyay & Dr. Chris Alvin "Hypermath: An AI-Powered Tool for Math Tutoring"

Auburn University, University of California - Santa Cruz

Supratik Mukhopadhyay

Hypermath focuses on reducing the DFW rate (earning a D/F or Withdrawing from the course) of higher-level institutions College Algebra or Calculus I classes. While student struggle in Calculus I at most major universities is not unusual, these problems have accelerated greatly since the global issues of the pandemic in 2020, and a solution is necessary. Fortunately, the rapid growth of Large Language Models (LLMs), such as OpenAI's ChatGPT or Google's Gemini, now allows for meaningful conversation with users as well as access to great amounts of mathematical problems and solutions. However, these LLMs lack a backbone of reasoning that most people use to solve problems mathematically. Without a hypergraph structure in place to bridge the gap, solutions from LLMs often become confusing and overly-complex. The goal of Hypermath is to guide the power of an LLM within a structured inteligent tutoring environment, specifically assisting towards Calculus I. Including a user-interface and "prompt engineering" directing the LLM toward effective responses, the aim is to provide students with a productive, interactive learning tool.

11 **La Precious Shannon**, Murad Nazari, Dr. Celalettin E. Ozdemir & Dr. Mayank Tyagi "Computational Sediment Transport (COMSET-AI)"

University of San Francisco

Mayank Tyagi

This research explores the potential of AI as a predictive tool for computational fluid dynamics. We focus on a two-fluid system where erosion beneath a pipeline causes instability. While current models can show sediment behavior before and after erosion, they struggle with noisy data during the actual erosion process. By using machine learning, we aim to fill in the gaps in this data. We developed a model for the two-fluid problem using OpenFOAM and Physics-Informed Neural Networks. This model can help protect the shoreline of Louisiana and the Gulf Coast from erosion, providing engineers with valuable data to prepare for these events.

12 **Aadi Singh**, Dr. Ka-Ming Tam & Dr. Juana Moreno "Quantum Computing Approach to Materials Science"

Baton Rouge Magnet High School

Ka-Ming Tam

Exploring the properties of novel materials, such as superconductors and magnets, is very important for device applications. The properties of such materials depend on the strong or weak correlations between electrons, which can be analyzed using sophisticated numerical techniques. Traditional methods to solve models of strongly correlated systems are limited by the computational capabilities of conventional computers. However, we can use quantum computing to overcome some of these limits, as quantum computers process quantum-mechanical model calculations at a much faster rate. One important problem we can study is the quantum many-body problem. To do this, we start by finding the ground state energy of the Hubbard Hamiltonian using a variational quantum eigensolver. Using the variational parameters associated with the ground state, we compute the Green's function and obtain the spectrum of energy levels. With the spectral function of the Hubbard model, we then study the metal to insulator transition of materials.

13 **Emma Strickland** & Michal Brylinski "Predicting Antibiotic Susceptibility in Bacteria Strains Using Graph Convolutional Networks"

Washington and Lee University

Michal Brylinski

As an overview, I will develop code using PyTorch that will predict how bacterial strains will respond to antibiotics using graph convolutional networks. This tool will improve our understanding of bacterial resistance mechanisms and foster the development of new antibiotics and treatment strategies, which will aid greatly in the treatment of bacterial infections, thereby improving clinical outcomes and combating the growing threat of antibiotic resistance. Each instance of bacteria data will be represented by its own graph, with nodes denoting proteins, and edges symbolizing protein-protein interactions. Each of these nodes will have features generated from amino acid sequences of the bacterial proteins, and some will have drug association scores that indicate how strongly an antibiotic targets a protein. The 3 convolutional layers and 2 fully connected layers will use the ReLU activation function to capture hierarchical structures in protein interaction networks then later refine the model's features. The global pooling layer will distill node features into a graph representation, and output layer will use the softmax function to predict whether a strain is sensitive or resistant to an antibiotic. I will use the binary cross-entropy loss function and Adam optimizer for training as well as five-fold cross-validation. For evaluating its effectiveness, accuracy, precision, recall, F1-score, and ROC-AUC score will be considered.

DR. CHRISTIE'S RESEARCH GROUP

14   **Gregory Bonvillian** & Kofi Christie "Dissolution Kinetics of Gypsum   Louisiana State University   Kofi Christie
Crystals of Varying Size and Morphology"

Gypsum is a low-solubility mineral scalant that grows on heat exchangers, membrane surfaces, and other industrial equipment. Improved gypsum removal methods are needed to prevent efficiency reductions in a wide range of applications, which can often occur if plant operators apply an excess of costly chemicals like sulfuric acid. The purpose of this study is to test our hypothesis that gypsum crystal size and morphology influence the dissolution kinetics in more environmentally friendly and cost-effective solvents, such as acetic acid (vinegar) and ethylenediaminetetraacetic acid (EDTA). To produce gypsum crystals with varying size and morphology, supersaturated solutions with polymeric additives that carry acidic, basic, or neutral functionality were prepared. Then, 0.5 g of each crystal sample were exposed to varying concentrations of vinegar (1 vol%, 5 vol%, and 15 vol%) and EDTA (10 wt%, 20 wt%, and 30 wt%) in a stirred-batch reactor process. The dissolution kinetics were then monitored electronically by a conductivity probe. It was observed that crystals with a smaller size and rougher morphology dissolved faster than larger and smoother crystals, likely due to an increased number of solvent collision sites during the dissolution reaction. The implications from this work can inform the tailored application of fit-for-purpose dissolution solutions in industrial contexts and potentially reduce wastes from excessive costly solvents.

15   **Caroline Devlin**, Gbenga Daniels & Kofi Christie "Ultrafiltration   Louisiana State University   Kofi Christie
Membrane Design, Performance, and Selectivity"

Ultrafiltration is a pressure-driven membrane separation process with a wide range of applications from the agricultural and pharmaceutical industries to wastewater treatment and potable water production. This research examines the design-performance relationship of polyvinylidene fluoride (PVDF) membranes fabricated using the phase separation method. Specifically, membranes were fabricated using varying design choices, including polymer dope solution composition (15 wt%, 20 wt%, and 25 wt% PVDF) and casting dope thickness (100 μm, 150 μm, and 200 μm). Membrane permeability was characterized under varying applied pressures, and membrane selectivity for salt ions and uncharged organic molecules were quantified using a mass balance approach. It was observed that the design choices were correlated to specific performance outcomes, which will inform future membrane designs for sustainable applications.

16   **Lunden LaBee**, Gbenga Daniels & Kofi Christie "Assessing the   Louisiana State University   Kofi Christie
Efficiency of Open-Graded Friction Course Pavements in Filtering
Hydrocarbons, Total Suspended Solids, and Heavy Metals"

The effectiveness of Open Grade Friction Course (OGFC) pavements in filtering pollutants from runoff was assessed in aims to reduce environmental hazards in aquatic systems and create a more sustainable urban environment. In using an enhanced filtration system with optimized pore size, OGFC can be utilized to better filter hydrocarbons, total suspended solids (TSS), and heavy metals compared to traditional asphalt. Urban runoff with the three pollutants was simulated separately and filtered through the pavement samples using a water pump to maintain a constant flow rate. The filtration efficiency was assessed by measuring the concentration of the pollutants in the inflow and outflow, as well as analyzing the retained solids and volume losses. The results provide insight into the potential of OGFC pavements in mitigating pollutants in runoff.

17   **Gavin Lanka**, Azmain Akash & Kofi Christie "Dynamic Crossflow   Florida Institute of   Kofi Christie
Conditions for Scaling Mitigation in Membrane Separations"   Technology

Membrane separations have become an integral part of the global technological package for drinking water treatment, desalination, and industrial wastewater reuse. In many wastewater sources, high total dissolved solids content leads to the growth of minerals on the membrane surface (i.e., scaling). Although much attention has been given to the chemical pretreatment approaches, few studies have identified chemical-free approaches that leverage operational controls, such as the static or dynamic crossflow rate. In this study, we explore the effects of dynamic crossflow rates on the scaling mitigation capacity for calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$), or gypsum. A programmable flow controller was employed to produce ramped, stepped, and delay-ramped flow conditions with temporal alignment to three regimes of scale formation on a membrane surface: nucleation, growth, and cake formation. It was found that the slope of the ramped flow was highly influential to the overall water recovery percentage. Similarly, the magnitude and duration of the delay executed during the first stage of delay-ramped flow were moderately influential to the overall water recovery percentage. This work informs the chemical-free water treatment train design possibilities for membrane-based water reuse applications.

POSTERS AND VISUAL DISPLAYS

DR. LATTIN'S NSF CAREER REU

18   **Blake Dusang**, Marquise Henry, Melanie Kimball, Ella Cochran &   Louisiana State University   Christine Lattin
Christine Lattin "Investigating the Role of the Hippocampus in
Modulating Neophobia in House Sparrows"

Neophobia, an aversion to novel objects, foods, and environments, is a trait that affects the ability of animals to adapt to the continuous urbanization of landscapes worldwide. However, the proximate causes of neophobia within and across species are poorly understood. While the ventral hippocampus in mammals helps mediate responses to novelty, few studies have investigated whether specific parts of the avian hippocampus are involved in neophobia. In this study, we assessed the role of the caudal and rostral hippocampus in neophobia in wild-caught house sparrows (*Passer domesticus*) using novel object trials. Sparrows were classified as either neophobic or non-neophobic based on their latency to approach and feed in the presence of novel objects. Following five days of novel object trials, sparrows underwent surgery in which they received bilateral electrolytic lesions inactivating either the caudal (n = 17) or rostral regions (n =13) of the hippocampus, two regions proposed to have similar functions to the mammalian ventral and dorsal hippocampus, or a sham surgery (n=32. Two days after surgery, sparrows were exposed to a second round of novel object trials to assess changes in approach and feed latency. These results will help clarify the function of the hippocampus in anxiety-linked behaviors, compare the roles of the hippocampus across different vertebrate taxa, and provide us with information on regions of the brain to target in further neophobia studies to better understand how neurobiological variation contributes to individual variation in behavior.

DR. SCHNEIDER'S UNDERGRADUATE SUMMER RESEARCH

19   **Alyssa Daspit**, Louise N. Perez & Patricia Schneider "Identify Modified   Louisiana State University   Patricia Schneider
or Novel Retinorecipient Regions in the Anableps Brain"

The retina has light-sensitive photoreceptor cells that capture and transmit visual signals into retinal ganglion cells (RGCs), leading to the optic nerve. The optic nerve then extends to certain regions of the brain called arborization fields (AF), each having their own specific functions involving the perception of light and depth as well as the response to light stimuli. AFs convert visual sensory information into motor reactions. Zebrafish (model organism) have ten distinct AFs that can be identified in the zebrafish brain atlas. We aim to create an Anableps brain atlas and compare these regions to understand the neural mechanisms that are responsible for visual perception. We are focusing on AF4 specifically because the removal of AF4 neurons causes the elimination of the vertical migration upwards, which is a characteristic of the normal response to blue light. Also, disruption to the AF4 neuron projections eliminates the phototactic response in zebrafish. A key indicator of the AF4 is a partially overlapping structure called the rostrolateralis nucleus (RL) in the diencephalon, which receives ganglion cell projections of the retina. Anableps, however, have two AF4s in each half of the diencephalon (four total), while zebrafish only have one AF4 in each half (two total). This suggests that in Anableps, each pair of AF4s might obtain projections distinct to the dorsal and ventral retinas. We hope to explore whether the duplicated AF4 structure coevolved with the changes to the Anableps cornea and retina, as to allow for specificity in light perception distinct to the new eye morphology.

20   **Laila Plummer**, Louise N. Perez & Patricia Schneider "Characterize the   Louisiana State University   Patricia Schneider
Dorsal and Ventral Territories in the Retinas of the Zebrafish and the
Anableps (Four-Eyed Fish)"

Every vertebrate eye has two domains, dividing the eye into halves. The top of the eye is labeled the dorsal while the bottom is the ventral. These two domains specialize in processing visual information such as images. They make up a complex interplay of many molecules which help establish these two territories. Among the genes that play an important role in this are tbx5 and vax2. Tbx5 is a transcription factor that is restricted to the ventral domain while vax2 is typically expressed in the ventral field of the optic cup. In this project, immunofluorescence will be performed on both zebrafish and the four eyed fish, Anableps to detect fluorescence of dorsal and ventral boundaries in the retinas of these species. In zebrafish the vax2 gene is active in a ventral area that corresponds to solar downwelling light, while the tbx5 genes limits in the dorsal domain of retina. However, in Anableps the retina is unique as both the dorsal and ventral domains each covers the entire half of the retina. This adaption enables these fish to see a large amount of aerial and aquatic light, unlike many vertebrate species. In theory, this uniqueness shows that overtime in Anabelps the vax2 evolved to take up the entire half of the retina, expressing district photoreceptor genes. Our findings suggests that there are spatial domains of gene expression that are involved in aerial and aquatic visual processing which is effective towards gaining insight in tissue development and progression of diseases in vertebrates.

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

21 **Bridget Adeola**, Anik Boudreau & Jacqueline Stephens "Screening Gall Extracts to Identify Novel Modulators of Adipocyte Development and Adipocyte Function"   Louisiana Tech University   Jacqueline Stephens

Adipocytes, commonly known as fat cells, are essential to mammals, and are important in energy storage, tissue communication and systemic metabolic function. In conditions of metabolic dysfunction, adipose tissue macrophages produce tumor necrosis factor (TNF) that acts on adjacent adipocytes to promote lipolysis and insulin resistance, two pathways that contribute to the pathogenesis of Type 2 diabetes mellitus (T2DM). There are many drugs to treat T2DM and some of these drugs, like rosiglitazone, regulate adipocyte development and function. Yet, rosiglitazone has detrimental effects that outweigh the benefits of the medicine. Alternatively, many drugs are developed from plants. Previous studies have shown that botanical extracts from plants can regulate adipogenesis and decrease TNF induced lipolysis to promote metabolic health. Gall extracts are an unexplored area in botanicals and drug development. The goal of my summer research project was to use different types of gall extracts to determine if they can regulate adipocyte development and function. Adipocyte function was assessed by examining the effects of gall extracts on TNF induced lipolysis. We also studied their effects on adipocyte development, or adipogenesis. The methods used included cell culture of adipocyte, Oil-Red-O staining, glycerol measurements, cell extract preparation, protein quantitation, and Western blot analysis. These novel data demonstrate that some gall extracts inhibited adipogenesis and attenuated TNF induced lipolysis. Collectively, these studies are the first steps in screening gall extracts to identify potential bioactive compounds that might impact metabolic health.

22 **Dahlia Alkadi**, William T. Doerrler & Pradip R. Panta "The Role of Isoprenoid Biosynthesis Pathway in Extreme Colistin Resistance of *Burkholderia thailandensis*"   Southeastern Louisiana University   Pradip Panta

Antimicrobial resistance (AMR) is the cause of an escalating global public health crisis with a significant impact on human health and the economy. Host derived cationic antimicrobial peptides (CAMPs) are promising solutions to tackle emerging antimicrobial resistance. Colistin is one of our last resort antibiotics that belong to a group of CAMPs, known as polymyxin. Our lab has discovered a genetic determinant, a member of DedA superfamily, known as DbcA, that is required for maintaining extreme colistin resistance of *Burkholderia thailandensis*. To better understand the function of DbcA, we screened for colistin resistant mutants of ΔdbcA harboring second site suppressor mutations. We carried out whole genome sequencing (WGS) of six colistin resistant suppressor mutants of ΔdbcA to screen for compensatory mutational changes at the genomic level. Our top suppressor hit was ispB. IspB is an essential gene in isoprenoid biosynthesis pathway that encodes for octaprenyl diphosphate synthase. IspB is required for synthesis of ubiquinone that is an essential factor for aerobic respiration. We propose that modulating the ispB branchpoint of isoprenoid biosynthesis pathway can alter the extreme CAMP resistance of *Burkholderia spp*. We used conditional mutagenesis technique where an inducible rhamnose promoter was inserted into the chromosome to drive the expression of ispB gene in both WT and ΔdbcA backgrounds. We found that modulating ispB expression can indeed regulate extreme colistin resistance of B. thailandensis, supporting our hypothesis. How exactly does reducing ispB expression reduce extreme colistin resistance remains to be investigated.

23 **Jude Cox**, Melena Busse, Owen Traylor & Anat Burger "Conductance Hysteresis in Voltage-Gated K+ Channels"   Loyola University of New Orleans   Anat Burger

Our understanding of the behavior of voltage gated ion channels in eukaryotic would be illuminated by experimental verification of the conductance hysteresis that has been shown in theoretical models. Patch clamping techniques and technology were used to observe and collect data relating to conductance hysteresis. The current and potential data measured from the patch clamp trials can be implemented into statistical models that may be able to reveal the hysteretic properties of the ion channels. An experimental protocol was developed to thoroughly scan through the entire range of conditions predicted to exhibit hysteresis.

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

24 **Sabina Dahal**, Brent A. Stanfield, Emmanuelle Ruiz, Vladimir N. Choulgenko & Konstantin G. Kousoulas "Design, Synthesis, In Vitro and In Silico Evaluation of Novel Pyrazolone Molecular Hybrids as Potential Anticancer Agents"

University of Louisiana Monroe

Siva Murru

Colorectal cancer (CRC) ranks as the third most frequently diagnosed cancer in both men and women across the United States and stands as the second leading cause of cancer-related deaths globally. The American Cancer Society projects approximately 106,590 new cases of colon cancer and 46,220 new cases of rectal cancer in the United States in 2024. Given CRC's limited response to current chemotherapy options, there is a critical need to discover new and effective therapeutic agents. Heterocyclic compounds play a pivotal role in drug design due to their diverse structures and significant biological relevance. Among these, pyrazoles and pyrazolones are particularly noteworthy as pharmacophores in a variety of bioactive molecules. This study is centered on synthesizing molecular hybrids based on pyrazole and pyrazolone through nucleophilic aromatic substitution (SNAr) and Pd-catalyzed Heck cross-coupling reactions. SNAr reactions are recognized for their effectiveness in creating heteroatom-carbon bonds, enabling the incorporation of various nucleophiles into aromatic rings. Additionally, the Heck cross-coupling reaction facilitates the formation of new carbon-carbon bonds by coupling halo-aryl pyrazolones with sp2-hybridized vinyl substrates under Pd-catalysis. Our research involves the synthesis of a series of pyrazolone molecular hybrids and the assessment of their antiproliferative activity against colorectal cancer(CRC) cells. We utilized optimized reaction conditions for synthesis, followed by compound purification and characterization. Furthermore, in-silico docking studies were conducted to evaluate how these hybrids interact with common targets in CRC. This study presents comprehensive experimental procedures and data on antiproliferative activity, highlighting the potential of these novel compounds in CRC therapy.

25 **Brandon David**, Kade Malone & Srinivas Garlapat "Elucidation of *Giardia Lamblia* Transcription Initiation Factors: GleIF3i, GleIF3g, and GleIF4A"

University of Louisiana Monroe

Srinivas Garlapati

Giardia lamblia is a common waterborne human parasite. Giardia is a flagellated protozoan that causes gastrointestinal giardiasis in humans, a waterborne disease that causes diarrhea. New strains of Giardia are resistant to drugs such as Metronidazole and other derivatives. Because of current antibiotic resistant strains of Giardia, new avenues of treatment must be pursued. Giardia lacks detectable homologs eIF4G, 4B, and 4H, has smaller 80S ribosomes, and an unusually short 5' untranslated region (0-6 nucleotides). eIF4G exists as a complex with cap binding protein eIF4E and RNA helicase eIF4A and is responsible for recruiting the PIC to the 5' end of the mRNA. eIF4B, eIF4H, and eIF4G together are responsible for stimulating eIF4A helicase activity. This activity is important for unwinding secondary structures within the untranslated regions. The only detectable homologs of eIF4 in giardia were GleIF4A and GleIF4E2. Without its stimulating partners and with the lack of a 5' untranslated region containing secondary structures, the role of GleIF4A in translation is largely unknown in Giardia. Our lab has identified novel interactions of GleIF4A with two subunits GleIF3i and GleIF3g using its amino terminal and carboxy terminal domains respectively. Both the subunits GleIF3i and GleIF3g exist as a subcomplex with GleIF3b, this subcomplex is involved in nearly every step of translation initiation. This study focused on different ways to determine and understand the interactions GleIF4A may have with this eIF3 subcomplex, and what implications it may have in understanding GleIF4A's function utilizing both in vitro functional assays.

26 **Treiveanna Jenkins**, C. Tims, R. Biswas & A. Kundu "Overcoming Multidrug Resistance in Breast Cancer: Targeting MRP Proteins for Enhanced Therapeutic Efficacy"

Xavier University of Louisiana

Anup Kundu

Chemotherapy remains one of the major treatment options for metastatic breast cancer. Resistance to chemotherapeutic agents is a major reason for cancer treatment failure. We plan to utilize nanotechnology to overcome chemoresistance mechanisms. It's been reported that down-regulating the nuclear expression of MDR proteins (P-gp, MRP, BCRP etc.) by siRNA could increase the delivery of cancer curing drugs (i.e. doxorubicin) to drug resistant breast cancer cells. However, unless those siRNA-encapsulated nanoparticles are targeted specifically to cancer cells, they will have hardly any impact; rather they will create notorious undesired side effects to normal tissues. We plan to overcome these problems by developing a targeted nanocarrier delivery system for siRNA into breast cancer cells. Our hypothesis is that conjugating nanoparticles with a cancer cell specific aptamer should enhance the knockdown of multidrug resistant genes, which will increase the delivery of Dox (i.e. doxorubicin) into breast cancer cells leading to enhanced cellular toxicity and antitumor effect as compared to unconjugated nanoparticles. This study is intended to know whether silencing the expression of P-gp or MRP-1 by aptamer-labeled siRNA nanoparticles could enhance the delivery of doxorubicin into breast cancer cells in culture. For targeted delivery, Aptamer-A6 has been used which can bind to Her-2 receptors on breast cancer cells. The particles were prepared by high pressure homogenization (HPH) using different amount of DOTAP, cholesterol, PLGA or PLGA-PEG and Mal-PEG. After siRNA encapsulation, the particles were incubated with aptamer-A6 for surface labeling. The liposomal particles were characterized for their size, surface charge and cytotoxicity. The delivery of P-gp siRNA or MRP-1 siRNA into 4T1-R cells has been assessed by immunofluorescence, PCR and FACS analysis. The doxorubicin accumulation into the cells has also been observed before and after the knockdown of MDR proteins by immunofluorescence and FACS analysis.

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

27 **Kaila Joseph**, Robert Ellis, Nya Lumar, Victoria A Pugh & Brent A. Stanfield "Utilizing CRISPR Homology Directed Repair to Insert GFP into the GPHLV ORF50 Intron" — Southern University and A&M College — Ojasvi Dutta

Guinea Pig Herpes-Like Virus (GPHLV) is a gamma herpesvirus and was first isolated in 1969 from leukemic guinea pigs. Hsiung and Kaplow were the first to describe the virus, however, until recently research into the biomedical applications of studying GPHLV has not been pursued. We are the first to publish the genomic sequence of the GPHLV strain LK40 and now demonstrate the successful mutagenesis of the GPHLV genome. CRISPR-mediated homology-directed repair (HDR) is a technique employed to insert a foreign DNA repair template containing homology arms surrounding a specific sequence. Here, we utilize CRISPR-mediated HDR to integrate green fluorescent protein (GFP) into the GPHLV ORF50 intron. Sanger sequencing was performed to identify the site of GFP recombination within the GPHLV ORF50 gene, additionally, a comparative analysis was performed using a two-step growth curve to assess differences in viral replication kinetics between the mutant and wild-type viruses. This work demonstrates GPHLV is a genetically tractable gamma herpesvirus with promising biomedical research applications.

28 **Alex Kurtz** Mohamed Hamed & Ahmed Abdelmoneim "Light Dark Preference Assay Using Early Developing Larval Zebrafish: A Tool to Assess Chemical-Induced Risk for Stress-Related Disorders" — University of Louisiana Monroe — Ahmed Abdelmoneim

Stress-related disorders afflict over a quarter of the global population and incur a staggering $1.15 trillion annual toll. Exposure to environmental contaminants can contribute to these disorders, yet a significant gap exists in our understanding of etiologic agents, safe levels of exposure, and underlying mechanisms, impeding mitigation strategies. Zebrafish larvae offer a great model to help bridge this research gap. They are relatively inexpensive to maintain, small in size, have high fecundity, and lack ethical concerns associated with mammalian models. In addition to convenience, they have homologous macro and micro brain anatomy and mediate behavioral stress responses early in life, including innate dark avoidance that is amplified under stress. The degree of dark avoidance can be used to infer the larval level of anxiety following chemical exposures. In this study, we are trying to develop a light/dark preference assay using the zebrafish larval model. We first assessed the behavior of larvae at control conditions and following exposure to acute stressors (heat) at different larval ages and using different well shapes and sizes. Wells were divided into two halves, dark and light, by covering the dark side with infrared (IR) transmitting plexi sheets. The activity of larvae was assessed using a behavioral tracking chamber (based on IR illumination) and associated software. The larval activity was further analyzed to assess light/dark preference (Choice Index) under different holding conditions, both at control conditions and following exposure to acute stressors.

29 **Aimee Martin**, Kayla Grant, Mya Jordan, Sri Hari Galla, Jayalakshmi Sridhar & Stassi DiMaggio "Development of a Smart Dual Acting Drug Delivery System (SDADDS)" — Loyola University New Orleans — Stassi DiMaggio

The present-day challenge of delivering anti-cancer agents selectively to tumor cells to mitigate systemic toxicity has led to greater focus on drug delivery research using nanoscale carriers. Despite progress in pre-clinical studies, the therapeutic effects have not lived up to their expectations in the clinical setting. Though promising, these systems typically exploit passive delivery of a single therapeutic to the target tissue, for example, by the encapsulation of drugs in carrier systems followed by drug release under an external trigger. The current technologies suffer from issues of stability, large scale synthesis, distribution control, drug loading efficiency, and ease of transport across cell membranes. Our current pilot project is addressing this issue through the design and synthesis of the two components of a Smart Dual Acting Drug Delivery System (SDADDS) consisting of bifunctional nanocarriers capable of synergistic targeting of multiple drivers of cancer thereby overcoming current limitations to treating cancers.
The dual components consist of 1) extracellular receptor targeting through polyvalent binding to increase selective binding to cancerous cells (dendron A) and 2) Intracellular targeting by delivering chemotherapeutics selectively through controlled photorelease (dendron B). A fluorescent tagged model system is being synthesized for cellular imaging studies to confirm selective localization of dendron A on the surface of cancer cells. The ability of dendron A to target the AXL receptor will be quantified on TAM (+) or TAM(-) breast cancer cell lines as well as human ex vivo tumor models (tumorspheres), using fluorescent tagged complexes via inverted fluorescent microscopy.

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

30 **Gavin McLemore**, Christella Nelson, Jean Christopher Chamcheu & Konstantin Gus Kousoulas "GSK-3Beta as a Potential Antiviral against HSV-1 Infection"

Southern University and A&M College

Konstantin Kousoulas

Glycogen synthase kinase-3 beta (GSK-3B) is a serine/threonine kinase that plays a crucial role in various cellular processes, including cell differentiation, proliferation, and apoptosis. In the context of herpes simplex virus type 1 (HSV-1) infection, GSK-3B is a significant factor. It has been shown that inhibition of GSK-3B reduces HSV-1 replication, suggesting that the virus exploits GSK-3B's activity for its replication cycle. GSK-3B also influences the host immune response by modulating the activation of immune cells, which are critical in controlling viral infection. During HSV-1 infection, GSK-3B plays a role in apoptosis, allowing the virus to manipulate the host cell's apoptotic pathways to enhance its survival and replication. Moreover, GSK-3B interacts with viral proteins to promote viral replication and inhibit host cell apoptosis. We hypothesize that inhibiting GSK-3B can modulate viral entry, transport, and replication of HSV-1. The effectiveness of GSK-3B inhibitors is being explored as potential antiviral agents using traditional drug assays, with its IC50 (inhibitory concentration) determined through cytotoxicity testing. Initial screening of a library of different kinase inhibitors identified several GSK-3B inhibitors that drastically inhibited HSV-1 virus replication. This replication-inhibition assay utilized a recombinant HSV-1 virus constitutively expressing the green fluorescence protein allowing for the quantitation of fluorescence as a surrogate marker for virus replication. Overall, these investigations aim to enhance our understanding of the molecular and cellular signaling pathways involved in HSV-1 infection and suggest that targeting GSK-3B could be a viable strategy for developing new treatments for HSV-1infections.

31 **Farzeen Nafees**, Md. Wasi Ul Kabir & Md. Tamjidul Hoque "Prediction of Disordered Regions within Proteins via Ensemble Machine Learning Methods"

University of New Orleans

Md. Tamjidul Hoque

Proteins are essential components of organisms; understanding them is key to diagnosing diseases and developing medicines. Proteins comprise of numerous amino acids that interact to form a structure, determining their function. However, proteins are complex molecules; some can exhibit different structures and functions under varying physiological conditions. Sometimes, only specific regions of a protein display this unpredictable nature. These types of proteins or regions are termed disordered. Identifying disordered proteins or regions is highly tedious and challenging for traditional biologists. Consequently, prediction of disordered proteins/regions has become a significant area in bioinformatics.
We aimed to develop a model that accurately identifies disordered amino acids in protein sequences. We first obtained data on intrinsically disordered proteins from DisProt and utilized various tools to extract as many features as possible from this data. We then compared the performance of different machine learning models in their predictions to select the best one. In the future, we aim to optimize the chosen model to enhance its accuracy further.

32 **Heather Parker**, Kelsea Hill, Harikrishnan Mohan, Rhett Stout, Renee Carter, Patrick Hall & Konstantin. G. Kousoulas "Testing the HSV-1(VC2) Live-Attenuated Vaccine Strain for Conferring Protection against Viral Herpes Keratitis in the Rabbit Ocular Model"

Bossier Parish Community College

Harikrishnan Mohan

Herpes keratitis, caused by herpes simplex virus type 1 (HSV-1), is a leading cause of infectious blindness worldwide. The virus remains latent in nerve ganglia but can periodically reactivate, potentially infecting the cornea and leading to irreversible scarring. We have previously demonstrated promising results in preventing ocular pathology from HSV-1 using the attenuated herpes vaccine VC2 in mice. Initially, the virulence of HSV-1(17syn+) and HSV-1 McKrae-GFP (engineered with GFP for tracking), was assessed. Rabbit eyes were infected with approximately 104 plaque-forming units (PFU) of either strain following mild scarification. Rabbits infected with HSV-1(17syn+) exhibited severe ocular and neurological symptoms causing mortality within 7-8 days post-infection. In contrast, those infected with HSV-1 McKrae survived without neurological symptoms and were euthanized after 10 days, showing lower virus shedding. Based on these findings, HSV-1 McKrae was chosen for further studies on a prophylactic vaccine. Eighteen rabbits were divided into three groups: mock-vaccinated, heat-inactivated virus vaccinated, and HSV-1(VC2) vaccinated. Following intraocular HSV-1 McKrae challenge, clinical ocular signs were similar among groups, but virus shedding was significantly reduced in rabbits vaccinated with either live or heat-inactivated HSV-1(VC2) compared to mock-vaccinated rabbits. In ongoing studies, rabbits are being immunized with VC2 using a prime-boost approach and will be challenged with the more virulent HSV-1(17syn+) strain to evaluate morbidity, mortality rates, and ocular symptoms. Further research aims to explore therapeutic applications of the VC2 vaccine to prevent virus reactivation and disease in latently infected rabbits, with potential implications for human clinical trials targeting herpetic ocular disease prevention.

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

33 **Evan Ransom**, & Justin R. Anderson "Virus Hunters: Diversity of Bacteriophages of Soil Bacteria in Louisiana Soil" — Southeastern Louisiana University — Justin Anderson

Bacteriophages are viruses that infect and replicate within bacterial cells. The purpose of this project is to isolate and characterize bacteriophages found in soil to develop a better understanding of the diversity of phages that infect various hosts in particular soil samples.
We attempted to isolate phages through direct isolation and enrichment plating from soil samples against eleven species of bacteria: nine species of Arthrobacter, *Microbacterium foliorum*, and *Citrobacter freundii*. We will assess the diversity of these phages by Random Amplification of Polymorphic DNA (RAPD) PCR and by performing host-preference assays.
We have collected and processed seven soil samples so far and plan to do ten. To date, at least fourteen phages have been isolated from eight hosts. Ultimately we plan to sequence and annotate the genomes of the isolated phages. The more data we collect, the better our comparisons, which could support research in phage therapy.

34 **Devesh Sarda**, **Kaiden Morace** & Subhajit Chakrabarty "Automatic Segmentation of Lumbar Spinal Stenosis" — Louisiana State University - Shreveport, LA Tech — Subhajit Chakrabarty

Lumbar spinal stenosis is a narrowing or constriction in the lumbar spine. MRI is preferred for its diagnosis. Researchers first tried to automate the segmentation of MRI images of the Lumbar Spine in 2014. However, very few papers have been published in this domain that involve Artificial Intelligence / Machine Learning (AI/ML). The objective of this research was to perform comparative evaluation of state-of-the-art AI/ML methods for segmentation of Lumbar Spine Stenosis. Our methods for comparison were U-Net, V-Net, SegNet and GAN. We also used different backbones to enhance the neural nets. We selected a publicly available dataset, named Lumbar Spine MRI Dataset, for reproducibility. We used 1,545 composite T1 and T2 MRI images (combined) in the axial view. The combined images were of 515 patients. We then passed these images through the various AI/ML architectures, for segmentation into four objects: (1) Intervertebral Disk, (2) Posterior Element, (3) Thecal Sac, and (4) the area between Anterior and Posterior vertebrae elements. Our metric was the Dice Score. Our results look promising. We claim that our work is significant, as it compares the state-of-the-art methods on a benchmarked dataset, systematically, in this domain.

35 **Christabel Simon-Alade**, Sunday Negedu & Craig Hart "Investigating Whether BEAF-32 Shows a Preference for Activating Certain Promoter Types in *Drosophila melanogaster*" — McNeese State University — Craig Hart

The common fruit fly, *Drosophila melanogaster*, has an insulator-binding protein called BEAF-32 (Boundary Element-Associated Factor of 32 kilodaltons) that plays a role in gene expression and regulation. BEAF-32 binds in close proximity to promoters, which are DNA sequences that specify where gene expression initiates. Although there are many DNA sequence motifs associated with promoter activity, promoters can be classified into two broad categories: housekeeping and regulated. Genome-wide mapping found that BEAF-32 usually binds near housekeeping promoters. We previously devised an assay to test the ability of BEAF-32 to activate promoters. We found that BEAF-32 generally activates promoters with low basal activity, whether a given promoter has motifs associated with housekeeping or regulated promoters. However, most tested regulated promoters had high basal activity while the opposite was true for most housekeeping promoters. A major subcategory of regulated promoter was not well represented in these data. Here we test promoters from this subcategory and find that they generally have low basal activity and are poorly activated by BEAF-32. This indicates that BEAF-32 has a preference for activating promoters that have housekeeping motifs. This information will guide future efforts to identify proteins that function with BEAF-32 to activate promoters.

36 **Taeyeschanaye Villia**, Christella Nelson, MD Imran Hossain, Jean Christopher Chamcheu & Konstantin Gus Kousoulas "The Efficacy of Kinase Inhibitors in Preventing Viral Entry through EGFR Utilization" — Southern University and A&M College — Konstantin Kousoulas

Herpes simplex virus type 1 (HSV-1) is a prevalent pathogen that causes various human diseases, ranging from minor mucocutaneous lesions to severe encephalitis. However, our understanding of the molecular mechanisms and interactions between HSV-1 and human host factors remains limited. Current therapeutic options primarily rely on nucleoside analogs, which can induce drug resistance over time. Recently, protein kinases have emerged as potential candidates for antiviral treatment. Protein kinases are pivotal in cellular signal transduction and offer promising targets for therapeutic intervention and disease prevention. Both cellular and viral kinases play critical roles in HSV-1 entry into cells and its intracellular transport. This study proposes that cellular kinases are crucial in regulating viral infection. Initial screening of a library of kinase inhibitors revealed several EGFR kinase inhibitors that drastically inhibited virus replication. HSV-1 may utilize EGFR (Epidermal Growth Factor Receptor) to attach and enter the host cells, as well as for potential intracellular signaling. This inhibition of virus replication was observed utilizing a recombinant HSV-1 virus constitutively expressing the green fluorescence protein providing for quantitation of fluorescence as a measure of virus replication in cell culture. The effectiveness of these EGFR (Epidermal Growth Factor Receptor) inhibitors is explored as potential antiviral agents using traditional drug assays, while the IC50 (inhibitory concentration) is determined in conjunction with cytotoxicity testing. These investigations aim to enhance our understanding of the molecular and cellular signaling pathways involved in HSV-1 infection and investigate the role of EGFR in HSV-1 infection.

LA NASA EPSCOR FFP

37 **Brenden Cormier, Owen Thierry** & Congyuan Zeng "Developing a Hot Extrusion Rig for Metallic Materials"   Southern University and A&M College   Congyuan Zeng

A hot extrusion rig for metallic materials is crucial for advancing research capabilities and innovation at Louisiana State University (LSU) and Southern University and A&M College (SUBR). To address this, the project aims to develop a hot extrusion rig, enhancing the ability to deform metallic parts into desired shapes. The project involves two undergraduate students, Mr. Owen Thierry and Mr. Brenden Cormier. Mr. Thierry and Mr. Cormier will work together to focus on designing, constructing, and testing the furnace system to ensure it reaches and maintains necessary temperatures. They will also develop the deformation mechanism, including the hot extrusion mold design, and integrate temperature measurement tools for accurate hot extrusion conditions. This project not only facilitates cutting-edge metallic materials research but also offers significant educational and practical benefits for the students, fostering their interest in the field and providing hands-on experience. Under the guidance of Dr. Congyuan Zeng and Dr. Shengmin Guo, the students will contribute to developing a hot extrusion rig that will support ongoing research and enhance the institutions' overall research capabilities. Engaging in this project has the potential to cultivate a diverse and skilled workforce in mechanical engineering and materials science, driving progress and innovation in the field.

LOUISIANA MATERIALS DESIGN ALLIANCE

38 **Jacob Russell**, Alexandra V. Aucoin & John A. Pojman "Thiol/Vinyl Ether Frontal Polymerization: Applications and Properties"   Louisiana State University   John Pojman

Adipocytes, commonly known as fat cells, are essential to mammals, and are important in energy storage, tissue communication and systemic metabolic function. In conditions of metabolic dysfunction, adipose tissue macrophages produce tumor necrosis factor (TNF) that acts on adjacent adipocytes to promote lipolysis and insulin resistance, two pathways that contribute to the pathogenesis of Type 2 diabetes mellitus (T2DM). There are many drugs to treat T2DM and some of these drugs, like rosiglitazone, regulate adipocyte development and function. Yet, rosiglitazone has detrimental effects that outweigh the benefits of the medicine. Alternatively, many drugs are developed from plants. Previous studies have shown that botanical extracts from plants can regulate adipogenesis and decrease TNF induced lipolysis to promote metabolic health. Gall extracts are an unexplored area in botanicals and drug development. The goal of my summer research project was to use different types of gall extracts to determine if they can regulate adipocyte development and function. Adipocyte function was assessed by examining the effects of gall extracts on TNF induced lipolysis. We also studied their effects on adipocyte development, or adipogenesis. The methods used included cell culture of adipocyte, Oil-Red-O staining, glycerol measurements, cell extract preparation, protein quantitation, and Western blot analysis. These novel data demonstrate that some gall extracts inhibited adipogenesis and attenuated TNF induced lipolysis. Collectively, these studies are the first steps in screening gall extracts to identify potential bioactive compounds that might impact metabolic health.

LSU DISCOVER PROJECT GRANT RECIPIENTS

39 **Daniel Le Lorier**, Saima Nipa, Xuxian He & Semin Lee "Dinaphthofuran-Based Lithium-Ion Receptors"   Louisiana State University   Semin Lee

Due to the growing importance of lithium in technology and the consequent environmental concerns of lithium mining, recycling and separation of lithium-ions from salt mixtures have garnered great interest. Here, we aim at synthesizing lithium-ion receptors based on dinaphthofuran (DNF) to selectively bind and separate lithium-ion against other metal-ions. We hypothesize that the target acyclic receptor will be an optimal receptor for lithium ions. To date, we have successfully synthesized DNF1 and created the reagent needed for DNF3 synthesis. We are planning to continue our effort to prepare DNF3.

LSU DISCOVER PROJECT GRANT RECIPIENTS

40 **Miranda Miller-Soileau** & Fatima Rivas "Data Mining Using Machine Learning to Identify Terpene Solubility Trends" Louisiana State University Fatima Rivas

Kidney disease is the cause of over 57,000 deaths per year, and six million adults have been diagnosed with kidney disease. New medications to manage and treat kidney disease are desired, but the drug development process is long and expensive, complicated by issues such as solubility. Existing guidelines used for solubility prediction were primarily developed for small molecules. We hypothesized that a set of guidelines predicting the solubility of molecules unsuitable to the existing guidelines could be formulated from an analysis of steroids. We performed an in depth-study of currently available steroidal drugs, calculated and compiled a list of their various physicochemical properties from multiple sources with the help of an AI model, sorted these molecules into categories based on size, and formulated a set of rules that would indicate solubility based off the structure of a molecule. Results show that the rules are accurate for steroidal compounds, but further testing is required to determine if they predict the solubility of other types of compounds.

41 **Angelina Nguyen** & Fabio Capra Ribeiro "Integrating Non-human Habitats into Architectural Design: The Case of Bird Nest Facades in Louisiana" Louisiana State University Fabio Capra Ribeiro

The importance of biodiversity within a natural setting has been proven to have a significant effect on everyday life, even within a highly populous area. Despite the reputation of the urban environment being devoid of wildlife, the destruction of animal habitats forces species to take refuge in metropolitan architecture. Human-focused architecture can be hostile to many species, specifically birds, as nearly one billion birds collide into glass every year. The lack of ecological knowledge in architectural education then leads to the negligence of affected species. This negligence significantly threatens many wildlife populations in the growing urban environment.
 Instead of designing urban environments that are hostile to native species for the benefit of the people, this research aims to portray architecture as the harmonic bridge between human, architectural, and environmental interactions. The methodology of this research employs an exploratory, qualitative case study strategy to investigate a research problem in which little is previously known. The aim of this research is to design façade systems that combine building skins with bird habitats in efforts to reestablish resilience to the Louisiana bird populations.
 Promoting biodiversity to recover populations within the urban setting will build resilience against habitat destruction, improve social mental health, and provide education about ecological processes. These aspects position the research as a valuable and original contribution to the discipline with strong potential for further development and application. Therefore, it underscores the importance of sustainable design practices and highlights architecture's potential to conserve urban biodiversity by integrating natural habitats into cities.

42 **Hamood Qureshi**, Khadijatu Nayi Alhassan & Dr. Kevin McPeak "High Entropy Alloy Libraries by Laser Pulsation of Robot-Assisted Microfluidic Droplet Arrays" Louisiana State University Kevin McPeak

Developing methods to efficiently produce and store clean energy is an important step in dealing with climate issues. High entropy alloys are promising candidates for optimizing clean energy processes, as they exhibit excellent catalytic performance. However, few methods exist to rapidly synthesize and experimentally test different compositions of high entropy alloys. Current methods can only test small amounts of high entropy alloys at once. Therefore, a method must be developed that can test large compositions of high entropy alloys to further develop machine learning models that design HEAs. My work involves developing an automated robot that can generate large arrays of HEAs through a microfluidic device and motorized XY stage. The microfluidic device deposits droplets onto a substrate and the XY stage moves the substrate underneath a laser to synthesize HEAs. When designing a microfluidic device, the heights of photoresists are important as they determine the height of the channel. Therefore, extensive testing must be done to determine the optimal conditions for preparing this device. In conjunction, computer software should be developed that can allow for an order method of droplet deposition. This work details the various tests done to spin coat SPR-220-7 and SU-8 3050 onto silicon substrates to control the height of microfluidic channels as well as different coding algorithms that are used to move the XY stage.

LSU GULF SCHOLARS PROGRAM

43 **Frank Bussott**, Hemanth Vundavilli & Matthew Hiatt "The Analysis of Salinity Intrusion in a River-Dominated Delta: An Idealized Numerical Modeling Study"   Louisiana State University   Matthew Hiatt

The formation of deltaic systems is influenced by several factors, including river discharge, sediment deposition, and tidal amplitude. Another factor to consider is saltwater intrusion and its impacts as it travels through a delta which can lead to several complications both directly and indirectly. Additionally, the impacts of saltwater intrusion into a delta plays a crucial role in altering the delta dynamics. In the presence of vegetation, sediment transport and deposition patterns within deltaic environments are controlled by fluctuating salinity gradients caused by tidal amplitudes. As flood tides enter the delta, salinity increases throughout the system and poses a threat to the established vegetation which then leads to coastal land loss. A further effect of saltwater intrusion is found when studying the depletion of freshwater supply due to landward salinity gradients. To understand the patterns of salinity propagation through a coastal deltaic environment, we use numerical simulations of a river-dominated delta formed downstream of a sediment diversion subject to variable river discharge, tidal amplitude, and sediment grain size. The model results provide insight into the processes that control salinities propagation in coastal river deltas, with an emphasis on developing a point of reference of saltwater dynamics for Mississippi River Delta sediment diversions.

44 **William Morales** & Rafael Orozco "A Sociolinguistic Study of Intensificaton in the Spanish of Louisianian Puerto Ricans"   Louisiana State University   Rafael Orozco

Intensifiers are a type of adverb that modifies an adjective in order to make it more emphasized, such as the word "very" in the phrase "very hot." Intensifiers can be studied by measuring the intensification rate – simply how many adjectives are preceded by an intensifier or not. They are of interest because they are affected by many different sociolinguistic variables and have notable similarities with discourse markers. Intensifiers in English have been found in previous studies to correlate to age, gender and even the semantic classification of the following adjective. Whether these sociolinguistic constraints hold the same way for languages other than English remains to be determined.
This study looks at the intensification in the Spanish of Puerto Ricans who have moved to Louisiana. The most common intensifiers in Spanish are muy, tan, bastante, and bien, which roughly mean "very, so, quite, and well." The people who were interviewed contained men of ages 22 to 47 (born 1990 to 1966) and women of ages 22 to 81 (born 1991 to 1932). The data was analyzed in order to find certain patterns across these different sociolinguistic constraints.

45 **Katherine Winchester** & Xiangyu Meng "Autonomous Underwater Vehicle for Gulf South Region Ecosystem Monitoring"   Louisiana State University   Xiangyu Meng

Machine learning is a tool in computer science in which a computer receives a large amount of data then extrapolates to create more data points that appear reasonable based on prior knowledge. Machine learning is used most in image recognition and AI-based chat bots, but its use is expanding to pathfinding and robotics. Along these lines, engineers have theorized that a combination of image recognition and pathfinding might create a fully autonomous target seeking drone. This could be particularly useful on the gulf coast, which contains some elusive species that researchers would like to monitor in their natural habitat. We used Simulink to create a complex digital model of an underwater drone with inertia and density values so it will behave as accurately as possible in a virtual environment. To train the pathfinding function, we placed two digital drones into a virtual environment and instructed them to seek one another, encouraging path generation that avoids obstacles and prioritizes battery life without compromising speed. We can then give the digital drones a set of images of animals that they should identify and place these images in the original maze to create a fully functional virtual model of an autonomous target seeking and target monitoring drone.

LSU MUSEUM OF ART SUMMER INTERN

46 **Sydney Grafals** "Art in Action: Accessibility and Sustainability in Curating Edward Millman's Purpose-Driven Works"   Louisiana State University   Marianna Luquette

This project explores sustainable and accessible methods for curating the works of Edward Millman, renowned for his wartime sketches and WPA work. Conducted under the auspices of the LSU Museum of Art, the study involves digitizing Millman's files and creating virtual exhibits using interactive flipbook software. The primary objectives are to highlight Millman's artistic and advocative legacy, and to compare the environmental costs of traditional physical exhibits versus digital exhibits and assess how virtual exhibits enhance accessibility.
Methodology includes high-resolution scanning of artworks, developing virtual exhibits, and calculating emissions for both physical and digital formats. Predicted* results indicate that physical exhibits generate significant carbon emissions from shipping (4.5 metric tons CO_2) and materials (1 metric ton CO_2), whereas digital exhibits, supported by renewable energy-powered data centers, have a much lower footprint (22.775 kg CO_2/month). Additionally, virtual exhibits enhance accessibility by providing global reach and inclusive features for individuals with disabilities and limitations.
The findings underscore the environmental benefits and accessibility improvements of digital exhibits, suggesting that they offer a sustainable and inclusive alternative to traditional methods. Future research should focus on further quantifying carbon savings and developing strategies to reduce the digital carbon footprint while enhancing accessibility tools. This study serves as a model for future art exhibits aiming to reduce their environmental impact and expand their reach.

MAXIMIZING ACCESS TO RESEARCH CAREERS (MARC)

47 **Samantha Ferrer** & Alyssa Johnson "Investigating Whether Tubular Lysosome Hyperactivation Can Close the Healthspan-Lifespan Disparity in Aging *C. elegans*"   Louisiana State University   Alyssa Johnson

Lysosomes partake in degradative roles in the cell and are critical regulators of cellular homeostasis. Canonically, lysosomes are depicted as vesicular structures, yet recent research from our lab has shown that they can acquire a tubular structure that form networks under stimulating conditions. We have demonstrated previously that tubular lysosome (TL) induction can extend lifespan and healthspan in the model organism *C. elegans* by improving nutrient sensing, metabolism, and degrading and repurposing cellular cargo in the absence of nutrients. Notably, dysfunction of these pathways exacerbates hallmarks of age-related neurodegenerative diseases, such as protein aggregation, mitochondrial dysfunction, and neuronal cell death. Therefore, it is essential to study how the efficiency of lysosomal pathways can be maximized to prevent age-related maladies. Moreover, although many interventions that extend maximum lifespan have been discovered, the healthspan of these long-lived models is not commensurate with their total lifespan. Thus, many interventions that extend lifespan, also extend the period of life in which individuals would be living with an age-related disability. The major goal of this study is to test whether boosting TL function can close the gap between healthspan and lifespan. In previous work, we found that overexpression of human Small VCP-Interacting Protein (SVIP) induces constitutive TL formation in *C. elegans* gut tissues. We have generated several genetic *C. elegans* strains that will overexpress human SVIP in the gut of several canonical long-lived mutants to determine if constitutive TL induction can extend healthspan and/or lifespan of these long-lived mutants. Pathways that will be tested include mutations in insulin signaling (daf-2), germline ablation (glp-1), mitochondrial dysfunction (clk-1), reduced mTOR signaling (rsks-1), and dietary restriction (eat-2). Effects on lifespan and healthspan will be compared through fecundity, mobility, and lifespan assays. Collectively, these studies will provide a basis for whether TL stimulation could be a viable approach to close the gap between healthspan and lifespan.

MAXIMIZING ACCESS TO RESEARCH CAREERS (MARC)

48   **Britney Nguyen**, Stephen M. Boue, Matthew E. Burow, Elizabeth   Louisiana State University   Todd Monroe
C. Martin, W. Todd Monroe, Jorge A. Belgodere "Plant-Derived
Compounds Direct Adipose-Derived Stromal Cell Differentiation
into White or Brown Fat"

Obesity is a complex health condition that affects two out of three adults, reduces quality of life, increasing the risk
of developing serious health conditions, such as hypertension, Type 2 diabetes, heart disease and stroke, and cancer.
White adipose tissue (WAT) primary function is to store excess energy as lipids to be used as fuel sources, while brown
adipose tissue (BAT) uses stored up lipids as fuel resulting in heat release. WAT is most abundant in adults and secretes
mediators that contribute to obesity related complications. Ongoing research on BAT, inspired the idea that the control
over fat formation could combat obesity. Phytoalexins are plant derived compounds that are produced in response
to stress. A few phytoalexins have been reported to exert antioxidant, anticarcinogenic, and cardiovascular protective
activities. Maslinic acid, a phytoalexin, exerts biological activities as an antidiabetic agent. Therefore, research on plant-
derived compounds to counteract obesity is advantageous. Based on this information, the aim of the study was to test
the hypothesis that plant-derived compounds, phytoalexins, will modulate the differentiation of adipose derived stem
cells (ASCs) into either white or brown fat. To test this, adipose media with plant-derived compounds were placed onto
ASCs for three weeks. Oil Red O staining was used to assess the difference in lipid growth. ASCs were collected after
one week to access the differences in gene expression using qRT-PCR. This research has high potential for a natural
way to control fat production and reduce obesity.

49   **Hannah Rigdon**, Ginhyuk Kwon & Neil Johannsen "Tigeraire   Louisiana State University   Neil Johannsen
Zephyr Heat Study"

Physical activity and exercise under heat stress can accelerate heat accumulation and result in decrease physical
performanceand cognitive function, which can result in an increased number of accidents especially in outside workers.
A new device (small portable fan), worn on a cap or hard hat (Tigeraire Zephyr), has been developed to be used for
outdoor workers to alleviate the effects of heat stress. In this study, participants were randomly assigned to 2 trials,
with and without the Zephyr, while exercising on a bike for thirty minutes at 50% heart rate reservein hot and humid
conditions (35C and 60%RH). For both trials,we assessed skin temperature at the neck, chest, thigh, and internal
ear (aural; representing brain temperature) using the BioPak system collecting data at 1 hertz. Cognitive function
wasdetermined before and after exercising using the stroop test which gives data on the cognitive error rate and
response time.Throughout the trial, participants completed questionnaires to evaluate subjective ratings of perceived
heat stress using visual analog scales (VAS) before, during, and after exercise. We will use two-way repeated measures
analysis of variance (RM-ANOVA) to determine the difference in responses (time)between the control and Tigeraire
treatments. We expect the fan to improve cognitive function (reduce errors and increase speed)and decrease skin
temperatures, especially on the face. Nine out of ten participants have been recruited as of July 8, 2024. Data analyses
are ongoing and we anticipate study conclusion by July 20th with full results being available as of August 2nd.

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

50 **Mark Black**, Jacob Searight, Dablieny Souza & Jonathan K. Richards "Effects of Temperature and Genetic Background on Fungal Secondary Metabolism"   Louisiana State University   Jonathan Richards

Fungal plant pathogens cause economically important crop diseases that drastically reduce agricultural production and threaten global food security. Certain fungal pathogens produce mycotoxins which can compromise safe consumption of agricultural products. Additionally, climate change presents enormous challenges to ecosystems, including fungi's metabolic activities, which are essential for nutrient cycling and other ecological processes. The impact of rising temperatures on fungal plant pathogen metabolism is currently unknown and may alter pathogen virulence and mycotixin production. This study will investigate how the genetic background of fungal isolates and environmental temperature fluctuations affect the production of secondary metabolites in the rice pathogen Cercospora janseana. We expect that diverse genetic backgrounds and temperature treatments will produce varied secondary metabolite patterns.
To test this hypothesis, two isolates of the fungus, RL-454 and RL-586, will be cultivated in a liquid medium made using a specific formula that comprises vital nutrients and trace components. The experimental design consists of 12 flasks, each representing two isolates, two temperature treatments, and three replicates per treatment, as well as two non-inoculated standards. Each flask will contain 50 milliliters of medium.
After autoclaving the media, fungal plugs will be injected into the flasks in a sterile atmosphere with sterilized plastic straws and metal wires. The flasks will next be incubated at specified temperatures. The liquid medium will next be analyzed to determine the secondary metabolites produced by the fungus.
The results of this research will unravel the impacts of genetic and environmental variables on fungal metabolism, which will help us understand how climate change may affect fungal-mediated activities in natural and agricultural systems.

51 **Brayden Blackburn**, TaoTao Ling & Fatima Rivas "Analysis of Secondary Metabolites from the Fruiting Bodies of the American Beautyberry"   Louisiana State University   Fatima Rivas

Natural products have been known to contain useful biological properties. The American Beautyberry, or *Callicarpa americana*, is a plant with natural products which are known to affect metabolic diseases including cancer. Its biologically active natural products have been described as generally effective against cancer, but the exact molecular structure and the mode of action (MOA) of these natural products remain understudied. This work aims to isolate biologically active components of *C. americana* and elucidate their molecular structures as well as test them against cancer cell line models. We hypothesize that these natural products will contain a previously undiscovered compound that can be characterized for its effectiveness against certain cancers.
We have performed alcoholic extractions on the fruiting bodies of the *C. americana* and have fractionated the crude extract. We then subjected these fractions to column chromatography for purification. After that, the fractions underwent structural analysis by nuclear magnetic resonance (NMR) and high-resolution mass spectrometry (HRMS). In addition, we tested them against cell line models using the CelTiterGlo assay to evaluate their cytotoxicity and using other biological assays to determine the cell death modality induced by the compounds. In conclusion, our study will produce valuable information on the molecular structure and biological activity of the natural products isolated from the fruit of *C. americana*.

52 **Jennifer Cagnolatti** & Dr. Naohiro Kato "Determining Km and Kcat of Lipase to Optimize Production of Fucoxanthinol"   Louisiana State University   Naohiro Kato

Fucoxanthin, a carotenoid found in algae, plays a crucial role in photosynthesis and offers several health benefits, including anti-obesity, antioxidant, anti-inflammatory, and potential anti-cancer effects. Its active form, fucoxanthinol, is of particular interest for its promising roles in improving human health. This study aims to optimize the production of fucoxanthinol from fucoxanthin by identifying the Michaelis constant (Km) and catalytic constant (kcat) of the enzyme lipase. Identifying the Km and kcat of an enzyme provides vital insights into the enzyme's efficiency and how strongly it binds to the substrate, fucoxanthin. For this experiment, dried algae were extracted using liquid chromatography to obtain purified fucoxanthin. Fucoxanthin was then used as a substrate with lipase to produce fucoxanthinol. The study monitored the interaction between lipase and fucoxanthin over various time intervals. Results indicated that peak fucoxanthinol production occurred between 3 and 6 hours, with the fucoxanthin peak disappearing after the 0-hour mark. These results help determine the Km and kcat of the enzyme lipase, providing numerical values that allow for adjusting parameters to reach maximum fucoxanthinol production. Future research should explore parameters such as taurocholic acid concentration, enzyme concentration, and pH to optimize fucoxanthinol production. Enhancing production efficiency could facilitate advanced studies on fucoxanthinol's health benefits and potential applications in health improvement strategies.

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

53 **Jennifer Luviano** & Abigail Johnson "An Assessment of   Louisiana State University   Abigail Johnson
    Training Procedures for Experimenters Implementing Strategic
    Incremental Rehearsal (SIR)"

Strategic incremental rehearsal (SIR) is an intervention that has been used to introduce words children have never seen before and improve their reading comprehension and fluency after a few short sessions together. SIR uses flashcards to do this with the addition of helpful guidance and teaching if needed. Though, not much has been investigated about how pictures can affect the process of vocabulary acquisition. Therefore, a study was conducted to identify if adding pictures to flashcards can improve how easily children can retain new definitions. However, when undergraduates conducted this study, it was found that due to the complexity of SIR and the addition of pictures it became difficult for the experimenter to accurately implement and keep track of data. Currently, there is no specific training protocol for experimenters to implement SIR with full agreement and accuracy. Thus, the purpose of this study is to investigate the effect an established training protocol for the experimenter can have on their implementation of SIR, to ensure that student's learning of vocabulary is most effective.

54 **Karla Mendez** & John C. Larkin "Genomic and Phenotypic   Louisiana State University   John C. Larkin
    Insights into Leaf Morphology between Standard *Schrenkiella*
    parvula and Turkan Ecotypes"

Leaves occupy most of plants' biomass and are essential photosynthetic organs, thus are crucial to agriculture. Larger leaves can gather more light for photosynthesis, but lose more water in dry or saline environments. *Schrenkiella parvula* is an extremophyte species from the Brassicaceae (mustard) family. In contrast to most plants, it can complete its lifecycle at salt concentrations and is higher than sea water, and it has become a model for studying multi-ion stress. Two varieties of *S. parvula*, the Lake Tuz ecotype and the Turkan ecotype, have different leaf size and shape. Plants from crosses between these two varieties are being studied with the goal of using already available genomic resources to understand what regions of the genome contribute to the difference in leaf shape between these two ecotypes.

55 **Ezra Moore** & Eileen K. Haebig "Exploring Vocabulary   Louisiana State University   Eileen Haebig
    Development in Autistic Children: The Role of Imageability and
    Vocabulary Acquisition"

Language skills and early word learning are typically delayed in autistic children. Previous research has indicated that autistic children may display similar learning biases relative to non-autistic children, but acquire language at a protracted rate, while others suggest autistic children may have different learning biases and processing abilities. Evidence has shown that children are biased to learn words with certain features, including high imageability, which is the ease with which a word evokes a mental image. Though prior research indicates that imageability is associated with vocabulary development in non-autistic and autistic children, imageability data have not been collected for a significant number of early-acquired words, which has restricted previous studies.
Due to the limited research on word learning biases in autistic children, the present study aims to develop an imageability database and to more thoroughly investigate the association between word imageability and vocabulary development in autistic and non-autistic children. Thus, we are developing a task to collect imageability scores for each word that appears on a commonly used parent questionnaire of child vocabulary knowledge (Macarthur-Bates Communicative Development Inventory; MB-CDI).
Thus, college participants will be shown words from the MB-CDI and asked to rate how imageable each word is on a scale from 1 to 7. Following the collection of these imageability scores, we will assess whether word imageability predicts word-level normative data of vocabulary acquisition. Specifically, we will use a newly created vocabulary acquisition normative variable – vocabulary size of acquisition – that has been derived separately for autistic and non-autistic children.

POSTERS AND VISUAL DISPLAYS

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

56   **Marie Vilcin**, Arend W Van Gemmert, Ginhyuk Kwon & Neil Johannsen "The Effects of Exercise, Heat Stress, and Cooling Strategies on Cognitive Function"   Louisiana State University   Arend Van Gemmert

Hot environments has proven to impact performance outcomes negatively when engaged in intense physical activity due to altered cognitive function. Despite extensive research on how rehydration or hypohydration strategies in hot environments ameliorates physical and/or cognitive performance , this study focuses on cooling strategies using a newly developed device called Tigeraire, Zephyr. This device aims to reduce the sensation of heat stress and improve cognitive function during standardized exercise in a hot environment.
Participants were randomly assigned to two separate interventional trials, one with the fan and one without. Participants completed the trials in an environmental chamber set at 30 degrees Celsius and 70% relative humidity [RH]. Physiological assessments were conducted during a 30-minute cycling exercise in normal clothing, including a baseball hat, at a heart rate estimated to be 50% of the heart rate reserve [%HRR].
Both interventions included measurements of heart rate, skin and tympanic temperatures, subjective feedback on exertion and thermal comfort from participants, and a cognitive test [pre- and post-intervention]. If the device provides significant evidence of cooling the forehead and tympanic regions, reducing heat stress, and improving cognitive function, this study could have ecological relevance for military and athlete populations, as well as outdoor workers, potentially preventing heat exhaustion or injury.

MISSDELTA REU

57   **Brooklyn Carter**, Emily Wei & Sam Bentley "Geomorphology and Bathymetric Changes on the Mississippi River Delta Front Using GIS"   Jackson State University   Emily Wei

The Mississippi River Delta, the terminus of the largest river system in the United States, is experiencing a notable retrogradation. The suspended sediment load of the river has reduced significantly by approximately 50% since the 1950s. While previous research has documented the effects of this reduced sediment load on terrestrial environments, its impact on the entire subaqueous delta front's geomorphological features remains underexplored. Two recent studies have investigated bathymetric change in the subaqueous delta during the last century, but did not include the most recent data, had limited spatial coverage, and were focused mainly offshore of Southwest Pass (SWP), the river's highest discharge outlet. To expand our temporal and spatial analysis, this study compared newly-acquired bathymetric data from the USGS and industry data collected in 1973 to 1997 by Enterprise Products Partners, C&C Technologies, BP, and Fugro. Using these datasets, we created depth difference maps to analyze bathymetric changes across the Mississippi River Delta Front [MRDF]. This research enhances understanding of coastal sediment dispersal and seafloor movement, which have critical implications for river management, offshore infrastructure, and hazards on the MRDF.

58   **George Gababa** & Giulio Mariotti "Hydrodynamically-Driven Mud Settling Velocity"   Louisiana State University   Giulio Mariotti

Mud is the dominant sediment class in most deltaic regions. Mud settling velocity is a crucial parameter for delta morphodynamics, as it strongly controls where the mud will deposit and contributes to bed accretion and land building. Mud is composed of silt and clay, which can have a large range of sizes and settling velocities. This research combines laboratory evidence and field investigation in the Mississippi River Delta to quantify its mud-settling velocity.

MISSDELTA REU

59 **Desiree L. James** & Tracy Quirk "Influence of Vegetation Community on Soil Shear Strength across Diverse Deltaic Environments in the Birdsfoot Delta, Louisiana"   Southern University and A&M College   Tracy Quirk

Wetlands in Louisiana represent 41% of the coastal wetland area in the United States, largely due to delta lobe formation processes of the Mississippi River, yet greater than 25% has been lost due to various natural and human-induced causes. In the Birdsfoot Delta, where the main channel of the Mississippi River flows into the Gulf of Mexico, sediment reduction and channelization along with high rates of relative sea level rise is causing an extremely high rate of land loss in this area of high socioeconomic importance. The role of wetland vegetation in influencing the stability of the marshes of this region is relatively unknown. To investigate the role of vegetation type and density on soil strength (e.g., erodibility), we will perform a survey of soil shear strength using a H-4227 Humboldt shear vane in marshes that vary in vegetation type and density across the Birdsfoot Delta. Soil shear strength, plant species, percent cover, height and density will be measured in each plot. Marsh elevation, distance to a channel and soil texture will also be measured and noted as potential related factors. We anticipate wetland vegetation (through the root systems) and sediments positively influence soil shear strength, but will differ among vegetation types leading to management implications for favoring vegetation types that promote lower erodibility. This is particularly important in areas such as the Birdsfoot delta, plagued with subsidence and may provide information to promote greater stability of land in the deltaic region of Louisiana.

60 **Sarah Kennedy**, Faith Walton & Sam Bentley "Analysis of Bioturbation in X-radiographs of Sediment Cores from the Subaqueous Mississippi Delta"   Alcorn State University   Sam Bentley

In recent decades, the lower Mississippi River Delta has undergone significant changes in sediment supply to its offshore regions due to anthropogenic changes to the hydrology. This has led to notable alterations in the underwater landscape and the overall ecosystem of the area, although these changes are sparsely documented. This study is an initial step to explore changes in seabed depositional patterns. An efficient way to identify relative sedimentation patterns of the subaqueous Mississippi River Delta is to use X-radiographs of sediment cores and analyze sedimentary fabric created by sedimentation and bioturbation. We chose 20 cores to analyze which were taken between July 18th-25th, 2023. The seabed depths of each core range from 12.1m to 136.1m. We hypothesize analysis of sedimentary fabric from locations with high sediment discharge will be primarily stratified, and conversely that lower discharge and sedimentation rates will yield sedimentary fabrics that are predominantly bioturbated. Sedimentary fabrics were analyzed using published methods of image analysis (Bentley et al., 2006; Courtois et al., 2024). Bioturbation intensity down each core was generated by visual identification of physical versus biogenic features displayed on each X-radiographs on 1cm grids, then averaged horizontally. We anticipate that this research will provide foundational insights for shaping future field and modeling studies.

90 **Nikolas Lawrence** "Geotechnical Investigations along the MissDelta Front"   Southern University and A&M College   Navid Jafari

In the dynamic and diverse Mississippi River Delta, seabed stability and sediment deposition are essential to the health of the ecosystem and coastal geomorphology. The hypothesis is that the geotechnical properties of sediment, including shear strength, index properties, and grain size distribution, exhibit notable variation among the various morphological facies situated along the Mississippi River Delta Front. It is anticipated that this variance will affect the seafloor's stability, with certain regions being more vulnerable to erosion and instability than others. This project intends to determine how morphological facies and other factors affect sediment properties by evaluating sediment cores from separate places. This can help shed light on issues related to coastal erosion and stability. Sediment cores are obtained from strategically selected places throughout the Mississippi River Delta Front, assuring coverage of distinct morphological facies. Following the collection of cores, I carried out a number of geotechnical tests, including grain size analysis, to ascertain the distribution of particle size using sieving methods. The sediments' shear strength was measured using vane shear analysis, and the overall sediment stability was ascertained by separating the finer particles and evaluating their contribution using wet sieve analysis. In order to determine the usual characteristics of the sediments, bulk density, water content, and liquid limits are also measured utilizing index properties of soil methods on core samples. Significant differences in geotechnical characteristics between various morphological facies are shown by preliminary data. For instance, compared to sediments in shallower regions, those in deeper water facies show more plasticity and lower shear strength. These results provide credence to the theory that seafloor stability is influenced by the differences in sediment characteristics based on morphological facies. The information indicates that to properly handle erosion and stability challenges, coastal management plans should consider these variances. It is essential to comprehend these geotechnical distinctions to anticipate and lessen the effects of anthropogenic activities and environmental changes on delta front.

PENNINGTON BIOMEDICAL RESEARCH CENTER – SUMMER UNDERGRADUATE RESEARCH EXPERIENCE

61 **Suliman Aburahma**, Alyssa Jeansonne, Jaclyn Wiliams & Heike Münzberg "Effects of Temperature Stressors on Immune Cell Density in iWAT"   Louisiana State University   Heike Münzberg

Adipose tissue (fat tissue) is made of adipocytes (fat cells). These cells are classified as white or brown/beige. White adipocytes are mainly used for lipid storage, while brown/beige adipocytes are mainly used for energy expenditure. Also found in adipose tissue are immune cells, including macrophages. This specific immune cell can digest microorganisms and dying cells, and increased adipocyte macrophages are associated with a decline in metabolic health.
The inguinal White Adipose Tissue (iWAT) in mice is mostly made of white adipocytes. After cold exposure, white adipocytes may transform into beige adipocytes, forming a beige island.
The aim of this study is to investigate the distribution and density of immune cells in the iWAT tissue between white and beige adipocytes. Mice were also exposed to cold temperature (7-day 10°C) to increase lipolysis and increase beige island formation compared to mice exposed to warm temperature (7-day 30°C).
Mice were euthanized by perfusions, and the tissues were collected and stained. The IMARIS software was used to count immune cells in iWAT.
Warm exposed mice had very few beige adipocytes, while cold exposed mice had defined beige islands. In cold samples, a significant decrease in macrophage density was observed in beige islands compared to white adipocytes (p<0.005). Comparing white adipocytes of warm and cold samples shows no significant difference in either macrophage density (p=0.937) or immune cell density (p=0.389).
The findings support the claim that cold exposure increases metabolic health, possibly by decreasing macrophage density in beige islands.

62 **Layla DePrimo**, David McDougal, Arline Narez, Sydney Junot & Camille Meaux "Exploring the Impact of a 72-Hour Fasting Period on Hypoglycemic Counter-Regulation in Male Rats"   Louisiana State University   David McDougal

This research project focuses on the significant challenge of treatment-induced hypoglycemia in persons with diabetes. The study specifically investigates the role of leptin, a hormone released by the adipose tissue that regulates energy balance. Our lab has previously reported that leptin is a key regulator of the counterregulatory response to severe hypoglycemia (CRR). The first phase of the current project involves testing whether exposure to a 72-h fast, a potent leptin lower stimuli, leads to impairment of the CRR in rats.
The experimental design involves two groups of Sprague Dawley rats: 72-hour fasted, or ad libitum fed controls. Following treatment, both groups will undergo a hypoglycemic clamp and counterregulatory response hormones, will be assayed at 0-, 30-, 60-, and 90-minute time points of the clamp. We hypothesize that prior exposure to 72 h of fasting will lead to impairment of the CRR, indicated by reduction in hormone levels in the rats exposed to fasting. Future experiments are planned to determine if this impairment can be reversed with physiological leptin replacement during the fasting period.

63 **Alyssa Jeansonne**, Suliman Aburahma, Jaclyn Williams & Heike Münzberg "Macrophage Detection in Adipose Tissue of Cold Exposed Mice"   Louisiana State University   Heike Münzberg

Fat (adipose) tissue secretes hormones that help our body regulate everyday functions like appetite, energy expenditure, and metabolism. Increased adipose tissue causes inflammation and contributes to health issues such as type 2 diabetes.
The two types of fat tissue are brown (BAT) and white (WAT). Brown adipocytes are not used for lipid storage like white adipocytes; they regulate body temperature, release heat energy, and support a healthy metabolism.
In this study we are investigating the distribution and number of macrophages in BAT of mice. We used temperature stressors to induce or suppress BAT thermogenesis, and lipolysis of white adipocytes, respectively.
Mice were exposed to 10° C or 30°C for 7 days and euthanized by perfusions, and the collected tissue samples were stained for further analysis. Using IMARIS spot detection software, we counted the macrophages in the tissues.
In warm exposed mice we found significantly fewer immune cells among the brown adipose tissue areas compared to the surrounding white adipose tissue areas (p<0.02). However, in cold exposed animals, the immune cells present in the BAT increased significantly (p<0.03) and were no longer distinguishable from the surrounding white adipose tissue areas (p=0.08).
This discovery shows that macrophages present in adipose tissue display physiological functions to regulate body temperature and are not always an indication of disease.

PENNINGTON BIOMEDICAL RESEARCH CENTER - SUMMER UNDERGRADUATE RESEARCH EXPERIENCE

64 **Sydney Junot**, Layla DePrimo, Camille Meaux, Arline Narez & David McDougal "Effects of Leptin Replacement on Metabolic Adaptations to Starvation in Sprague-Dawley Rats"

Louisiana State University   David McDougal

Historically, starvation-induced hypoglycemia and insulinopenia have been signaling events considered responsible for fat metabolism. However, recent work in the field has challenged this view by establishing that leptin infusion at the end of a 72-h fast reversed all metabolic adaptations to starvation, including fat/ketone metabolism. We seek to elucidate the role of hypoleptinemia in altering glucose counterregulation during hypoglycemia and starvation. We will test whether physiological leptin replacement during a 72-hour fast in rats is sufficient to reverse the physiological adaptations to starvation. This experiment is designed to isolate the metabolic effects insulinopenia without co-occurrence of hypoleptinemia. Hormone/metabolite levels will be measured non-invasively using an automated blood sampling system at baseline and every 12 hours during the 72-hour fasting period, then assayed for the determination of leptin, glucose, insulin, glucagon, cortisol, and catecholamine levels. These results will help establish leptin's role in the physiological response to starvation.

65 **Joshua Meyer**, Jaclyn Williams, Jenny Bailey, Carrie Elks & Heike Münzberg "Validating a Novel Mouse Model to Target Brown Adipocytes-UCP1-IRES-cre Mice"

Louisiana State University   Heike Münzberg

Uncoupling protein 1 (UCP1) is a mitochondrial protein exclusively located in brown adipose tissue (BAT) and plays a crucial role in thermoregulation and metabolism. BACtransgenic UCP1-cre mice were utilized in numerous studies for conditional genetic targeting of BAT; however, recent discoveries of ectopic expression (including hypothalamic brain areas) jeopardized the validity of these studies. A novel knock-in mouse model, UCP1-ires-cre, was developed by Dr. Randy Mynatt and utilizes the natural UCP1 promoter to drive Cre-expression and should reproduce the natural expression of Cre in BAT. If UCP1-IRES-CRE mice are proven to lack ectopic expression of UCP1 in the brain, it may serve as the superior mouse model for future cre-inducible genetic modifications.
In this study we crossed UCP1-IRES-CRE mice with a reporter mouse (Ai14-Tdtomato) to visualize its expression in the brain and BAT. Immunohistochemistry staining for red fluorescent protein was performed to validate expected RFP expression in BAT and endogenous RFP expression was used to analyze the brain.
In BAT, UCP1 expressing cells were greatly represented by RFP reporter expression. In the brain, endogenous RFP was absent in all control mice (n=3). In cre/experimental animals (n=4) scattered RFP only a few RFP positive neurons in the hypothalamus and endothelial cells in the choroid plexus were seen.
When compared to previous work with BACtransgenic UCP1-cre mice, the novel UCP1-IRES-CRE mouse model showed greatly reduced ectopic reporter expression in the hypothalamus and more accurately displayed the natural expression of UCP1.

PHYSICS & ASTRONOMY - REU

66 **Adriana Baniecki**, Kevin S. Becker, Alexis Mercenne & Kristina D. Launey "Exploring the Fusion of Alpha and Carbon 12"

University of Notre Dame   Kristina Launey

Two linked fusion processes, which occur inside the cores of massive stars, largely determine our universe's carbon-to-oxygen ratio. Three alpha particles first fuse to create Carbon-12, which then captures an additional alpha particle to fuse into Oxygen-16. However, this last nuclear process occurs at an energy level which is difficult to measure in a lab. Additionally, the relatively large number of particles in the Carbon-12 target and the alpha beam make the reaction difficult to simulate exactly. Thus, theorists model the target nucleus and the beam nucleus as point particles, while determining the effective interaction between the two from ab initio (or from first principles) large-scale simulations. This provides ab initio predictions about the relative motion of the fusion fragments, known as the cluster wavefunction, which is in turn used to calculate reaction rates. In this project, we will determine the effective Carbon-alpha potential energy by using a Markov-Chain Monte-Carlo (MCMC) sampling procedure and Bayesian analysis to fit the microscopic cluster wavefunctions for the composite nucleus of Oxygen-16's bound states. The ultimate goal is to use that effective potential energy to fit resonant states in Oxygen-16, which will allow us to estimate the reaction rate and better quantify the carbon-to-oxygen ratio in our universe.

PHYSICS & ASTRONOMY - REU

67 **Nathan Cammarata**, Aaron Ryan, Greg Guzik & Anthony Ficklin   Saint Francis University   Aaron Ryan
"Developing an Automated Sounding Balloon Flight Simulator"

Sounding balloon flights are a cost efficient and highly accessible way to conduct research in atmospheric science and astrophysics. In these flights, latex balloons are launched to altitudes up to approximately 90,000 feet into the sky with tied on payloads that contain devices measuring various quantities. When performing a sounding balloon flight, the launch time and location must be pre-determined in order to ensure a safe flight and to guarantee that the payloads can be recovered for later flights. Prediction softwares for balloon flights already exist but all require manual input, making them highly time consuming. They also are only able to generate predictions for up to a week in advance. The goal of this project is to develop a flight simulation package that automatically pulls wind velocity components from NOAA weather data and runs simulations up to 16 days in advance at various times and locations. This simulation will generate desirable launch times and locations readily available for use, along with establishing a confidence interval for a general area that the flightline can land.

68 **James Chunn**, Ruotong Zhai & Daniel E. Sheehy "Phonon   Harding University   Daniel Sheehy
Dynamics in Analog-Gravity Bose-Einstein Condensates"

The study of quantum fields in curved spacetime is extremely important for the understanding of systems with extreme gravitational effects, such as particle production in expanding spacetimes or in black holes. However, the majority of these systems are not experimentally accessible. So in order to examine these effects in laboratory settings, we need to explore analogous systems that can be mapped onto these curved spacetimes. It is well known that weakly interacting Bose-Einstein condensates can be mapped onto a nonrelativistic scalar field in curved spacetime where the curvature of space is controlled by the local density of the condensate. Indeed recent experiments have achieved both spherical[closed] and hyperbolic[open] 2+1 dimensional curved spacetime geometries. In our research we are studying phonon exitations in these curved spacetime condensates, that follow a curved metric. We also examine quantum phonon production due to expansion in this analogue universe. Finally we hope to quantify the amount of quantum entanglement that is present in phonons that are produced during expansion.

69 **Conner Dooley**, H. Meyer & J. Dey "Using Multiple Harmonics to   Linfield University   Joyoni Dey
Increase the Autocorrelation Length in Grating Interferometry"

X-ray interferometry is a promising medical imaging modality because of its ability to simultaneously produce attenuation, dark-field, and differential-phase images in a single scan. A modulated phase grating is used to create a fringe pattern that is directly resolvable without the need for an analyzer grating. A phase stepping curve is acquired with and without the object in place. Using an established method, we fit sinusoidal parameters to the phase stepping curves on a pixel-by-pixel basis to generate the three images. A key parameter for dark-field images is the autocorrelation length (ACL), which is inversely proportional to the fringe period at the detector and determines the strength of the scattering signal depending on the size and shape of the scatters in the sample. Currently, the first harmonic has been used in making the dark-field images, but the fringe pattern is rarely sinusoidal and has multiple harmonic components. We wish to consider the effect of a second harmonic, which provides an image at double the ACL during the same acquisition. We present qualitative and quantitative comparisons of the first and second harmonic dark-field images of porous carbon and alumina samples, mouse lungs, and PMMA microspheres. The addition of the second harmonic dark-field images allows us to increase the ACL of our imaging applications. This has the potential to increase the quality of patient diagnosis for future clinical applications of X-ray interferometry.

70 **Victoria Fontenot**, H. Meyer & J. Dey "Motion Correction for   Louisiana State University   Joyoni Dey
Artifact Reduction in Interferometry"

X-ray interferometry is used to simultaneously acquire an attenuation, differential-phase, and dark-field image, related to X-ray absorption, refraction, and small angle scattering, respectively. A phase stepping curve is acquired twice, once with the object present and once with it absent. The three images are calculated by comparing the two phase-stepping curves. Errors in grating position result in striped artifacts in the attenuation, differential-phase, and dark-field images due to the grating not being aligned in the reference curve and the curve with the object in place. This research project aims to solve the problem of the sub-pixel shifts due to unintended micro-movement of the grating. We will first interpolate the reference and object images to estimate the movement between them in regions where the object is not present. We will estimate the motion by minimizing the sum-squared error of the region of interest for each phase-step. Then, we will correct the movement, by including this subpixel shift into the estimation method for attenuation, differential-phase, and dark-field images.

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71   **Ashley Hayward** & Jeff Chancellor "Development of Analytical   Ohio Wesleyan University   Jeffrey Chancellor
Methods using the ROOT Framework for Accurate Thick Target
Cross-Section Determination in Space Radiation Research"

This research focuses on the development and application of advanced analytical tools to determine thick target cross-sections from experimental data collected at the NASA Space Radiation Laboratory (NSRL). Accurate cross-section measurements are crucial for understanding the interactions between cosmic rays and various materials, which has significant implications for space exploration. The NSRL provides a unique environment for conducting experiments that replicate the exposure to cosmic radiation encountered in space. However, interactions between high-energy particles and thick targets present a significant challenge for data analysis. To address these challenges, we leverage the ROOT framework, an object-oriented data analysis platform widely used in high-energy physics. ROOT's tools for statistical analysis, histogramming, and data visualization are ideal for analyzing the intricate datasets produced at the NSRL.
Our approach involves developing custom scripts and modules within the ROOT environment to automate the data cleaning, calibration, and cross-section calculation processes. By implementing sophisticated algorithms for peak identification and background subtraction, we enhance the accuracy and reliability of the cross-section measurements. Additionally, the modular nature of ROOT allows for the continuous refinement of our methods. Preliminary results demonstrate that our ROOT-based analytical tools significantly improve the precision of thick target cross-section determinations, offering new insights into the behavior of cosmic rays in various materials. This research not only contributes to a deeper understanding of space radiation interactions but also supports the design of more effective shielding techniques for future space missions, ensuring that we can better protect astronauts and equipment from the hazards of cosmic radiation.

91   **Benjamin Namikas & Michael Shi** "An Analysis of Ansatz   Louisiana State University   Alexis Mercenne &
Parameters for Accuracy and Efficiency of Ansatz Creation"   Kristina Launey

Simulating nuclear physics interactions is crucial to be able to go where experiments are unable to go. A large portion of the systems that are of current interest have large nuclei such as Uranium. The large size means simulating these systems classically is impossible due to an exponential scaling of the computational resources for every additional nucleon. However, quantum computers have recently been able to reduce the computational complexity of the computations. In specific, the Variational Quantum Eigensolver (VQE) is the latest approach that offers a way to access the quantum advantage while solving for the systems. Variational Quantum Eigensolvers depend on mapping of the hamiltonian to the polystings. This process of encoding can be done in many ways. This encoding process is essential to set the system up for a successful score. This process is also affected by a few other parameters such as the number of qubits used and layers of operations used. Our project aims to identify the ideal method and parameters for creating ansatz. In our project we used a Deuteron Deuteron interaction modeled by a Wood-Saxon potential well. In previous experiments it was found that Gray encoding was the best way to model 12C+12C interactions. However, possibly due to our simpler system, we found that One-Hot encoding worked the best. We also find that increasing the number of Qubits decreases the accuracy of the final prediction, and the number of layers has little effect. This additional data supports the idea that when the represented system becomes simpler, a more complex encoding scheme could increase complexity unnecessarily.

72   **Sadman Sobhan Raabith**, Dr. Shania Nichols & Dr Gabriela   Louisiana State University   Gabriela Gonzalez
Gonzalez "Tuning Out the Noise: Unveiling Black Holes and
Binary Neutron Star Mergers"

The Laser Interferometer Gravitational-Wave Observatory(LIGO) detectors are complex instruments that find Gravitational Waves (small perturbations in space-time), caused by Black holes or Binary Neutron Star Mergers for example, using interferometry, and are sensitive to displacements smaller than a proton. However, loud instrumental transients ("glitches") make detecting gravitational waves difficult. I looked at the time series data on the strain in the differential arm for the Livingston Observatory at glitch times, created a power density spectrum for these times, and looked for outlier frequencies possibly responsible for the loud glitches.

PHYSICS & ASTRONOMY - REU

73 **Caroline Redman**, Tyler Stokes, Cullen Domangue, Daniel Carpenter & Thomas Kutter "The Deep Underground Neutrino Experiment (DUNE): From Readout Electronics to Proton Decay in the Vertical Drift (VD) Detector"   Samford University   Tyler Stokes

As the flagship experiment of the Fermi National Accelerator Laboratory, the Deep Underground Neutrino Experiment (DUNE) promises a rich experimental program with one of the largest underground detector masses in the world. DUNE's far detectors utilize liquid argon time projection chamber (LArTPC) technology, which provides 3D imaging of particles as they traverse the detector. When charged particles enter the liquid argon, they ionize the argon nuclei, freeing up electrons that will drift toward the charged readout plane (CRP). Electronics will subsequently read out the collected charge on these planes and produce a usable signal.
A critical component of the detector's functionality is the optimal performance of the readout electronics, particularly the adapter boards in the vertical drift (VD) orientation of the far detectors. This summer, my hardware research focused on quality control testing of these boards. A visual inspection was performed using computer software to analyze the condition of each circuit board. Further functional tests were performed under both warm and cold conditions to simulate the operational environment of the boards. Future work will include refining these studies and conducting more detailed testing.
Maintaining high-quality control standards is essential to maximize the LArTPC capabilities of DUNE's large underground far detectors and allow it to search for phenomena predicted Beyond the Standard Model (BSM), such as proton decay. One decay of interest is p K^+v. A computational aspect of my research has been using Monte Carlo simulations to study this proton decay channel in the DUNE VD detector.

74 **Samuel Reeder**, Jing-Han Chen, Shane Stadler & David P. Young "Efforts in Appling High Entropy Alloys to Sites in Materials of the A15 Structure Type"   Francis Marion University   David Young

High entropy alloys (HEAs) are materials composed of multiple elements in almost equimolar proportions, causing high entropy. These high entropy alloys have been found to have enhanced mechanical properties as compared to traditional alloys, such as hardness, wear resistance, and mechanical strength. Other key features include: corrosion resistance; high temperature stability, making HEAs useful in harsh environments; and tunability, which allows these alloys to be designed with specific properties for different applications. Currently, HEAs are being explored for many applications, such as in aircrafts, turbines, electronics, medical implants, and wear-resistant coatings. However, more recently, some of these materials have also shown supercondivity and surprisingly, their transition temperature is usually greater than that of the individual elements that compose the HEA. Due to this fact, combined with the other enhanced properties and possible uses for high entropy alloys, our research goal is to synthesize and explore the properties of HEAs when applied to different structure types, specifically the A15 structure. This includes the synthesizing the materials and testing their superconductivity as well as comparing their supercondivity to materials in this structure without HEAs on certain sites to test if there are enhancements in supercondivity.

75 **Elijah Richardson**, Tristan Schefke, Saikat Bhattacharjee &Thomas Kutter "Testing Scintillators and Silicon Photomultipliers of the Muon Spectrometer for DUNE"   Penn State University   Tristan Schefke

The Deep Underground Neutrino Experiment (DUNE) is designed to study a neutrino beam generated at Fermilab to deepen our understanding of the fermion's properties. This experiment involves detecting subatomic particles at two locations: first, using a near detector at Fermilab, and then with a far detector located deep underground at Sanford Lab in South Dakota. The near detector is crucial for DUNE as it is essential for characterizing the flavor of neutrinos that are initially present in the produced beam. The Muon Spectrometer (TMS), one of the many subdetectors of the near detector, tracks the trajectory of muons and distinguishes them from other particles. The development phase of the TMS requires testing prototypes of key constituents such as scintillators and silicon photomultipliers (SiPMs) to ensure their functionality before installment. The scintillators react with charged particles to produce light, which the SiPMs detect and measure down to the single-photon level. We tested the SiPMs under controlled conditions and demonstrated that the performance aligned with our expectations. The light yield measurements confirmed the functionality of the detectors, indicating their suitability for future deployment in the DUNE experiment.

PHYSICS & ASTRONOMY - REU

76 **Osvaldo Salas**, Tabata Ferreira, Gabriela Gonzalez "Utilizing   Louisiana State University   Gabriela Gonzalez
Machine Learning to Characterize Transient Noise in Advanced
LIGO "

LIGO searches for gravitational waves in two detectors at Hanford, WA and Livingston, LA. Glitches are transient noises that contaminate data by elevating background noise levels, and some glitches may even mimic real gravitational wave signals. In this study we investigate the behavior of glitches during the first part of the fourth observation run (O4a) at LIGO Hanford. Glitches are categorized based on their morphologies in a time-frequency spectrogram. We analyze glitches during O4a at LIGO Hanford using t-SNE (time-distributed Stochastic Neighbor Embedding), a machine learning technique that reduces the dimensions of a data vector, providing useful visualization by clustering data points according to features present in the data. We look at differences in the clustering over time which helps to identify the origin of transient noises.

77 **Brianna Simon**, Frank McKay & Phillip Sprunger "High-   Louisiana State University   Phillip Sprunger
Temperature Studies of Phase Transitions in Complex
Concentrated Alloys"

The primary objective of this research is to facilitate the integration of the DHS1100 Anton Paar Domed Hot Stage onto the existing Bruker D8 diffractometer at the CAMD facility. The implementation of the Domed Hot Stage allows for temperature-controlled analysis of crystalline materials, ranging from 25°C to 1100°C under 1x10-2 mbar of pressure. This research is particularly interested in studying the high-temperature phase transitions in complex concentrated alloys (CCAs), for use in additive manufacturing (AM) applications. These transitions are observed through Bragg's Law and the diffractometer.
To achieve these phase transitions, we have first sought to characterize the high-temperature stage and calibrate its temperature by comparing the thermal expansion of samples with well-known thermal expansion coefficients. Ultimately, the initial calibration of the temperature stage will allow for future data comparisons to CALPHAD-predicted high-order alloy phase transitions. In addition to presenting the calibration data, this poster presents some preliminary high temperature XRD measurements of CCAs, which are of particular interest for AM applications. These measurements are compared to CALPHAD predictions.

78 **Rebekah Slocum**, Tabata Ferreira & Gabriela González   Louisiana State University   Gabriela González
"Roadblocks to Finding Gravitational Waves near the Frequency
of the Crab Pulsar"

The search for pulsars as continuous sinusoidal waves in LIGO data is disrupted by instrumental periodic disturbances of unknown origin. This noise obscures possible gravitational wave signals, making the search more challenging. We found two separate periodic noise sources around the angular frequency of the Crab pulsar using data from the first part of LIGO's fourth observing run (O4a) and are investigating plausible origins.

79 **Erica Sundermeyer**, Debasmita Nandi & Gabriela González   University of Rochester   Gabriela González
"Mystery Noise in Advanced LIGO Livingston Gravitational Wave
Detector"

LIGO gravitational wave detectors in Livingston, LA and Hanford, WA observe signals coming from mergers of the most dense objects in the universe. Gravitational wave signals are incredibly faint, meaning it is vital to understand and characterize noise that may limit LIGO's sensitivity. Microseismic ground motion is a significant source of noise in the LIGO Livingston observatory (LLO), with high microseismic activity often producing more scattered light within the detector. However, on days with high microseismic ground motion during the fourth observing run, some transient noise cannot be explained with scattered light. We perform bicoherence analysis to investigate these transient noise "glitches," and determine whether they are caused by upconversion of low frequency noise into higher frequencies.

80 **Addison Wilberg**, Chenglong You & Omar Magana-Loaiza   Trinity University   Omar Magana-Loaiza
"Quantum State Engineering of Multiphoton Systems Using
Plasmonic Nano-Antennae"

Surface-plasmon polaritons (SPPs) are charge oscillations that arise from the coupling of photons to the electromagnetic field along the surface of a metal. The propagation and the quantum coherence properties of the SPPs highly depend on the geometry of the metal's surface due to the strong confinement of electromagnetic near-fields. With recent advancements in nanofabrication, plasmonic metasurfaces present a novel opportunity to engineer the quantum properties of SPPs. Here, we investigate the light-matter interactions of plasmonic nano-structures as they change the quantum coherence properties of multi-photon systems in free space propagation. Specifically, we design and fabricate an array of nano-antennae that exploit the metal's surface geometry to effectively control the coherence properties of SPPs. We believe the fine control of SPP coherence properties using a nanostructure source potentially has implications for quantum sensing, imaging, and computing.

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

92   **Matthew Bedell** "An Investigative Framework: J-Integral Calculation for Fracture Resistance of Additively Manufactured Thermoset Shape Memory Polymers"   University of Iowa   Kshitizu Upadhyay

Shape memory polymers (SMPs) are exciting developments in the field of material science. SMPs exhibit the unique property of changing shape following the application of external stimuli. Polymers responsive to thermal heat are known as Thermoset SMPs (TSMPs). TSMPs have applications across numerous fields from biomedical assistive devices to aeronautical constructions. This project seeks to build a framework to evaluate the fracture dynamics and resistance by calculating J-Integral on these TSMPs. Analysis will be conducted utilizing Digital Image Correlation (DIC) of 3-point bending tests. J-integral value at failure (strain energy release rate) will be found from tests investigated in this research. Thie application of this work looks to investigate additive manufacturing parameters' impact on fracture dynamics of 3D-printed TSMP structures. Variables considered during the additive manufacturing process of TSMP structures include layer height, printing angle, printing temperature, and UV-curing intensity, and numerous others. The framework will provide a guideline for future optimization applications of TSMP manufacturing.

81   **Mykhayla Carroll** & Xiaowei Mu "Synthesis of Recyclable Natural Fiber Based Epoxy Resins"   Albany State University   Xiaowei Mu

Recently, studies have tested natural fiber-epoxy reinforced composites' integrity. High energy output is required for synthetically reinforced composites. Using natural fibers as an alternative increases the composite's durability, biodegradability, and recyclability. Fiber hybridization involves combining natural fibers with other fibers (natural or synthetic) that have improved mechanical capabilities. This experiment aims to enhance the standard epoxy composite by implementing natural fibers into the epoxy-based composite.

82   **Kiara Charles**, Dr. Sumaya Kabir & Dr. John A. Pojman "The Oscillation of Ph-Responsive Polymer Gels from Watermelon Seeds"   Louisiana State University   John Pojman

Enzymes contain many acids and bases in their structure, and their activity is highly influenced by pH. Their active behavior is characterized by a bell shape in which they show the maximum activity at a given pH. Thus, enzymes are used to create chemo-mechanical oscillations in polymer gel systems because of their ability to temporarily change in certain pH to control the response of pH-sensitive polymer gels. In this study, we aim to present a pH-responsive polymer gel that shows biochemical and mechanical responses, which is important for drug development. This developed biochemo-mechanical system can transform biochemical energy produced as a result of an enzymatic reaction into mechanical work through the swelling and shrinking of a gel. The pH-responsive polymer gel is prepared using N-isopropylacrylamide with N-vinylimidazole and is loaded with the two antagonistic enzymes urease, from watermelon seed powder, and esterase. The created gel is then cut into a thin cylindrical shape, and the indicator bromothymol blue is used. Urea diffused into the gel, reacted with urease, produced ammonia, and in turn increased the pH. In return, the gel filament changed to a blue color and shrank. That same gel is then placed in ethyl acetate, where acetic acid is produced as ethyl acetate diffuses inside the filament and reacts with esterase. The filament then swelled, and the indicator turned a yellow color. The gel filament can produce a chemical and mechanical response, changing in both size and color when exposed to substrates like urea and ethyl acetate.

83   **Kyle Chastain**, Geornipha Milbin, Md Rigib Hasan, Harry Spencer & David Spivak "The Optimization of Binding and Selectivity of Fentanyl-Selective Imprinted Polymers Using Benzylfentanyl as a Surrogate Template"   The University of Texas at Austin   David Spivak

Fentanyl is an opioid commonly used for pain-management and anesthetics. As the illegal use of fentanyl continues to contribute to a growing number of opioid-related deaths, law enforcement has prioritized methods for the detection of fentanyl. However, most of these methods are inefficient, expensive, and require specific skill sets to operate special instrumentation. An alternative approach using molecularly imprinted polymers (MIPs) as the recognition component of a colored-based assay, testing-strip, or sensor could alleviate the difficulties of past methods. MIPs are advantageous due to their physical robustness, strength, and resistance to elevated temperature and pressure. In prior analysis of fentanyl-selective imprinted polymers, an MIP was built using the functional monomer, methacrylic acid (MAA), the cross-linking monomer, ethyleneglycol dimethacrylate (EGDMA), and the template, benzylfentanyl. By testing various ratios of functional monomer and benzylfentanyl template, an optimum proportion for benzylfentanyl detection has been determined. Current and future studies are underway to optimize crosslinking to functional monomer ratios, and the effects of different functional monomers on the binding and selectivity of fentanyl-selective imprinted polymers.

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

84   **Matthew Conway**, Xiaowei Mu & Guoqiang Li "Smart Polymers: Rowan University   Guoqiang Li
The Search for Electroconductive Two-Way Shape Memory
Polymers"

Shape memory polymers are a class of polymers that, when triggered by external stimuli such as temperature, pH, or electric current, revert to a permanent shape from their "programmed" shape or their current deformed shape. These polymers have a wide range of uses in many fields such as biomedical, aerospace, machinery, textiles, building and self-healing materials. One-way shape memory polymers, once reverted to the permanent shape by stimuli, will not automatically regain the temporary deformed state when the stimulus is removed, while two-way shape memory polymers can transition back to that deformed shape when reverse stimulus has been applied. This study includes the search for elusive new two-way shape memory foam with increased electroconductivity. Different polymer formulations were produced, and the resulting materials were tested for mechanical properties that demonstrated their two-way shape memory capabilities, as well as other mechanical and physical properties. Herein, the results of these investigations and insights into these polymers and future two-way shape memory polymer discovery are described, with recommendations for future work in the area.

85   **Owen Dziedzic**, Titilayo Oluwole, Bhuvensh Barti & Jimmy   University of Wisconsin -   Jimmy Lawrence
Lawrence "Elucidating the Impact of Polymer Architecture on the   Madison
Stability and Performance of Bottlebrush-Based Emulsifiers"

Emulsifiers stabilize oil and water mixtures to enhance product quality and consistency in cosmetics, the food industry, and pharmaceuticals. While traditional small molecule-based surfactants are limited in their chemical functionality, polymer-based surfactants, especially branch polymer-based ones, open up new strategies for designing robust delivery agents and emulsions for biomaterial applications. Within the class of branched polymers, bottlebrush polymers (BBP) have emerged as a promising platform because of their densely grafted side chains. Here, we investigate how topological variations in BBP –random, diblock, and Janus– affect their emulsifying efficacy and stability. To accomplish this, we will synthesize a library of bottlebrush polymer surfactants with different side-chain lengths and side-chain sequences. We hypothesize that polymers with higher grafting densities and longer hydrophobic side chains can significantly improve emulsion stability by lowering interfacial tension and preventing drop coalescence, even under mechanical stress and temperature fluctuations. By studying the performance of BBP-surfactants in stabilizing oil-in-water and water-in-oil emulsions, we will assess emulsion stability, droplet size distribution, and resistance to coalescence. A suite of characterization techniques will be used for material characterization, namely nuclear magnetic resonance, size exclusion chromatography, pendant drop tensiometry, dynamic light scattering, and optical microscopy. To confirm our findings, we will evaluate the performance of BBP-surfactants by studying the encapsulation of dye molecules (drug model). Such a unique ability to adjust emulsion properties dynamically through polymer architecture will revolutionize emulsifier design for industrial and biomedical uses.

86   **Prem Janssen**, Stefanie Klisch &Gerald Schneider "Optimizing   University of Wisconsin -   Gerald Schneider
Lamellarity in DOPC Liposomes through Lipid Concentration: A   Stevens Point
Pathway to Improved Stability"

Liposomes are hollow spherical objects. Their diameters are on the order of 50 to 500 nm. When the lipid is dissolved in water a spontaneous self-assembly process occurs. Lipids self-assemble into bilayers with the hydrophilic heads facing the solvent and the hydrophobic tails facing one-another. The addition of NaCl to the liposome solution causes the liposome diameter to decrease. However, a systematic increase in the NaCl concentration reveals discontinuities, indicated by a substantial increase of the diameter within a variation of less than 0.1 mM. Separate studies revealed the formation of multilayer membranes. Literature discusses the influence of electrostatic interactions and osmotic pressure.
Previous works studied the change of the osmotic pressure of the system by varying the ion concentration while keeping the contribution of the liposomes constant. In this project, the influence of the liposome concentration on the structural discontinuities will be studied. This project makes use of a new dynamic light scattering to measure the diameter.

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

87 **Madeline Krzystowczyk**, Emily Friedman & Felipe Savella   Louisiana Tech University   Genevieve Palardy
"The Ultrasonic Welding and Reassembly Cycle of Dissimilar
Thermoplastic Composites"

As innovations in the automotive and aerospace industries push onward, factors such as weight reduction and reusability become key issues necessitating further research and experimentation. Thermoplastics, composed of a polymer matrix and fiber reinforcement, have been identified as a promising material group for these applications for their strength and rigidity. Furthermore, the method of unification found to be most effective at joining thermoplastics is ultrasonic welding, a process that relies on ultrasonic vibrations applied perpendicular above the interface of a joint. The goal of this research is to create a suitable method of ultrasonic welding of thermoplastics that leads to both high performance (weight bearing) as well as several cycles of reusability. Panels of glass fiber-reinforced polypropylene will be manufactured from layers of film and welded with a pure film of polyethylene as the energy director at the interface of samples. These weld samples will be mechanically tested and analyzed and then undergo several more rounds of reassembly. This research will assist in the development of a synthesis procedure for specific joints and builds and could possibly aid in the identification of limitations of the materials themselves.

88 **Marne' Pierre**, Sulochana Ekanayaka Mudiyanselage & Dr. Amy   Southern University and   Amy Xu
Xu "Dilution-Induced Complex Coacervation as a Novel Surface   A&M College
Modification Strategy"

Complex coacervation is a liquid-liquid phase separation process that occurs due to the associative interactions between charged macromolecules, including polymers, proteins, surfactants. The dense phase enriched in the interacting macromolecules is referred to as the complex coacervate. Traditional triggers for coacervation includes changes in pH, ionic strength, temperature and the total macromolecular concentration (CT). Complex coacervation can be suppressed when CT is above a critical value . However, as CT is decreased to below the critical value upon dilution, complex coacervation can occur. This process is referred to as the dilution-induced complex coacervation (DICC). Motivated by this discovery and the notably low surface tension exhibited by coacervate materials, we anticipate that DICC can be used as an efficient delivery platform for active ingredients onto diverse surfaces. In this study, a system comprising positively charged polymers and negatively charged mixed surfactant micelles was employed as a model coacervation system. By adjusting the mole ratio of the anionic surfactant in the mixed micelles, we could fine-tune the rheological properties of the coacervates. Experimental observations are made by systematically diluting suppressed phase and analyzing the resulting phase behavior and phase boundaries. Interfacial behavior of complex coacervates on different hydrophilic and hydrophobic surfaces are characterized by contact angle measurements, fluorescence studies and quartz crystal microbalance with dissipation monitoring (QCM-D) experiments. Diffusion and macromolecular interactions of suppressed and dense phases are analyzed by fluorescence recovery after photobleaching (FRAP). Collectively, this study aims to investigate the mechanisms of DICC and how well this process works as a delivery platform for modifying various surfaces.

89 **Jackson Smith**, Anuja Thapa & Dr. Donghui Zhang "Thermally   Saint Louis University   Donghui Zhang
Responsive Polymers for Biomimetic Repair of Space Shuttle
Microcracks"

Inspired by the blood clotting process, we envision a biomimetic repair mechanism of microcracks on the surface of space shuttle formed by collision with interstellar debris. This mechanism involves the injection of colloidal nanoparticles from a reservoir to the microcracks followed by in-situ crosslinking of the particles, forming a synthetic "clot". The injection and in-situ crosslinking are intended to be achieved using an external field (magnetic or electric), as the field should cause the nanoparticles to disperse and assemble throughout the crack, followed by cross-linking due to ohmic heating. We intend to synthesize surface-functionalized silica nanoparticles with a binary polymer-grafted system. The first polymer will be poly[[2-[2- methoxyethoxy]ethylmethacrylate]-ran-oligo[ethylene-glycol]methacrylate] random copolymers (i.e., poly[MEO2MA-ran-OEGMA]) via atom transfer radical polymerization. The second grafted polymer will involve poly[ethylene glycol] [PEG] homopolymers bearing reactive diene and dienophile pair chain-ends that can undergo Diels-Alder [DA] reaction to form in-situ crosslinks. The grafted poly[MEO2MA-ran-OEGMA] copolymer will have longer chain lengths relative to the PEG polymers to provide steric shielding of the reactive chain-ends on the PEG chains and thus inhibiting covalent crosslinking of the particles at ambient temperature and low particle concentration. The poly[MEO2MA-ran-OEGMA] copolymers are thermally responsive and known to undergo thermally induced phase transition and lower critical solution temperature [LCST] in the 26-90°C range. Ohmic heating from the external field will bring the temperature above the LCST temperature, the copolymers become increasingly dehydrated, decreasing the hydrodynamic size, and the reactive chain-ends of the PEG polymers will become increasingly accessible, thereby allowing the DA reaction amongst the PEG chain-ends and covalent crosslinking of particles to occur.

CENTER FOR COMPUTATION AND TECHNOLOGY - REU

Rhegan Barrett, Les Butler, Kyungmin Ham & Cecily Lu "3D X-ray Imaging and Artificial Intelligence"

Tulane University   Les Butler

3D X-ray tomography allows for in-depth visualization of smaller scale subjects and has many applications in different fields. A ThermoScientific HeliScan MicroCT was used to create 3D images of various samples, and the image/data analysis softwares Avizo and Fiji were used to analyze and create animations of the 3D images. One sample was a heat exchanger with welds created by lasers, in which 3D imaging was combined with deep learning techniques in Mathematica to determine whether welds were faulty. Combination of these analyzation techniques may help the company that makes the heat exchangers pinpoint what constitutes a weld that will leak. Another sample that was imaged were dense wood blocks from the Graphyte company which will be used for carbon sequestration. In Avizo, animations of the block were created to help visualize and analyze different aspects of the block such as its density and composition. This may aid Graphyte in being able to quantify how much carbon dioxide equivalent can be stored in their process.

Aadi Singh, Dr. Ka-Ming Tam & Dr. Juana Moreno "Quantum Computing Approach to Materials Science"

Baton Rouge Magnet High School   Ka-Ming Tam

Exploring the properties of novel materials, such as superconductors and magnets, is very important for device applications. The properties of such materials depend on the strong or weak correlations between electrons, which can be analyzed using sophisticated numerical techniques. Traditional methods to solve models of strongly correlated systems are limited by the computational capabilities of conventional computers. However, we can use quantum computing to overcome some of these limits, as quantum computers process quantum-mechanical model calculations at a much faster rate. One important problem we can study is the quantum many-body problem. To do this, we start by finding the ground state energy of the Hubbard Hamiltonian using a variational quantum eigensolver. Using the variational parameters associated with the ground state, we compute the Green's function and obtain the spectrum of energy levels. With the spectral function of the Hubbard model, we then study the metal to insulator transition of materials.

LOUISIANA BIOMEDICAL RESEARCH NETWORK - REU

Brandon David, Kade Malone & Srinivas Garlapat "Elucidation of *Giardia lamblia* Transcription Initiation Factors: GleIF3i, GleIF3g, and GleIF4A"

University of Louisiana Monroe

Srinivas Garlapati

Giardia lamblia is a common waterborne human parasite. Giardia is a flagellated protozoan that causes gastrointestinal giardiasis in humans, a waterborne disease that causes diarrhea. New strains of Giardia are resistant to drugs such as Metronidazole and other derivatives. Because of current antibiotic resistant strains of Giardia, new avenues of treatment must be pursued. Giardia lacks detectable homologs eIF4G, 4B, and 4H, has smaller 80S ribosomes, and an unusually short 5' untranslated region (0-6 nucleotides). eIF4G exists as a complex with cap binding protein eIF4E and RNA helicase eIF4A and is responsible for recruiting the PIC to the 5' end of the mRNA. eIF4B, eIF4H, and eIF4G together are responsible for stimulating eIF4A helicase activity. This activity is important for unwinding secondary structures within the untranslated regions. The only detectable homologs of eIF4 in giardia were GleIF4A and GleIF4E2. Without its stimulating partners and with the lack of a 5' untranslated region containing secondary structures, the role of GleIF4A in translation is largely unknown in Giardia. Our lab has identified novel interactions of GleIF4A with two subunits GleIF3i and GleIF3g using its amino terminal and carboxy terminal domains respectively. Both the subunits GleIF3i and GleIF3g exist as a subcomplex with GleIF3b, this subcomplex is involved in nearly every step of translation initiation. This study focused on different ways to determine and understand the interactions GleIF4A may have with this eIF3 subcomplex, and what implications it may have in understanding GleIF4A's function utilizing both in vitro functional assays.

Aimee Martin, Kayla Grant, Mya Jordan, Sri Hari Galla, Jayalakshmi Sridhar & Stassi DiMaggio "Development of a Smart Dual Acting Drug Delivery System (SDADDS)"

Loyola University New Orleans

Stassi DiMaggio

The present-day challenge of delivering anti-cancer agents selectively to tumor cells to mitigate systemic toxicity has led to greater focus on drug delivery research using nanoscale carriers. Despite progress in pre-clinical studies, the therapeutic effects have not lived up to their expectations in the clinical setting. Though promising, these systems typically exploit passive delivery of a single therapeutic to the target tissue, for example, by the encapsulation of drugs in carrier systems followed by drug release under an external trigger. The current technologies suffer from issues of stability, large scale synthesis, distribution control, drug loading efficiency, and ease of transport across cell membranes. Our current pilot project is addressing this issue through the design and synthesis of the two components of a Smart Dual Acting Drug Delivery System (SDADDS) consisting of bifunctional nanocarriers capable of synergistic targeting of multiple drivers of cancer thereby overcoming current limitations to treating cancers.
The dual components consist of 1) extracellular receptor targeting through polyvalent binding to increase selective binding to cancerous cells (dendron A) and 2) Intracellular targeting by delivering chemotherapeutics selectively through controlled photorelease (dendron B). A fluorescent tagged model system is being synthesized for cellular imaging studies to confirm selective localization of dendron A on the surface of cancer cells. The ability of dendron A to target the AXL receptor will be quantified on TAM (+) or TAM(-) breast cancer cell lines as well as human ex vivo tumor models (tumorspheres), using fluorescent tagged complexes via inverted fluorescent microscopy.

Devesh Sarda, **Kaiden Morace** & Subhajit Chakrabarty "Automatic Segmentation of Lumbar Spinal Stenosis"

Louisiana State University - Shreveport, LA Tech

Subhajit Chakrabarty

Lumbar spinal stenosis is a narrowing or constriction in the lumbar spine. MRI is preferred for its diagnosis. Researchers first tried to automate the segmentation of MRI images of the Lumbar Spine in 2014. However, very few papers have been published in this domain that involve Artificial Intelligence / Machine Learning (AI/ML). The objective of this research was to perform comparative evaluation of state-of-the-art AI/ML methods for segmentation of Lumbar Spine Stenosis. Our methods for comparison were U-Net, V-Net, SegNet and GAN. We also used different backbones to enhance the neural nets. We selected a publicly available dataset, named Lumbar Spine MRI Dataset, for reproducibility. We used 1,545 composite T1 and T2 MRI images (combined) in the axial view. The combined images were of 515 patients. We then passed these images through the various AI/ML architectures, for segmentation into four objects: (1) Intervertebral Disk, (2) Posterior Element, (3) Thecal Sac, and (4) the area between Anterior and Posterior vertebrae elements. Our metric was the Dice Score. Our results look promising. We claim that our work is significant, as it compares the state-of-the-art methods on a benchmarked dataset, systematically, in this domain.

LIGHTNING TALKS

LSU DISCOVER PROJECT GRANT RECIPIENTS

Angelina Nguyen & Fabio Capra Ribeiro "Integrating Non-human Habitats into Architectural Design: The Case of Bird Nest Facades in Louisiana"   Louisiana State University   Fabio Capra Ribeiro

The importance of biodiversity within a natural setting has been proven to have a significant effect on everyday life, even within a highly populous area. Despite the reputation of the urban environment being devoid of wildlife, the destruction of animal habitats forces species to take refuge in metropolitan architecture. Human-focused architecture can be hostile to many species, specifically birds, as nearly one billion birds collide into glass every year. The lack of ecological knowledge in architectural education then leads to the negligence of affected species. This negligence significantly threatens many wildlife populations in the growing urban environment.
Instead of designing urban environments that are hostile to native species for the benefit of the people, this research aims to portray architecture as the harmonic bridge between human, architectural, and environmental interactions. The methodology of this research employs an exploratory, qualitative case study strategy to investigate a research problem in which little is previously known. The aim of this research is to design façade systems that combine building skins with bird habitats in efforts to reestablish resilience to the Louisiana bird populations.
Promoting biodiversity to recover populations within the urban setting will build resilience against habitat destruction, improve social mental health, and provide education about ecological processes. These aspects position the research as a valuable and original contribution to the discipline with strong potential for further development and application. Therefore, it underscores the importance of sustainable design practices and highlights architecture's potential to conserve urban biodiversity by integrating natural habitats into cities.

LSU GULF SCHOLARS PROGRAM

William Morales & Rafael Orozco "A Sociolinguistic Study of Intensification in the Spanish of Louisianian Puerto Ricans"   Louisiana State University   Rafael Orozco

Intensifiers are a type of adverb that modifies an adjective in order to make it more emphasized, such as the word "very" in the phrase "very hot." Intensifiers can be studied by measuring the intensification rate – simply how many adjectives are preceded by an intensifier or not. They are of interest because they are affected by many different sociolinguistic variables and have notable similarities with discourse markers. Intensifiers in English have been found in previous studies to correlate to age, gender and even the semantic classification of the following adjective. Whether these sociolinguistic constraints hold the same way for languages other than English remains to be determined.
This study looks at the intensification in the Spanish of Puerto Ricans who have moved to Louisiana. The most common intensifiers in Spanish are muy, tan, bastante, and bien, which roughly mean "very, so, quite, and well." The people who were interviewed contained men of ages 22 to 47 (born 1990 to 1966) and women of ages 22 to 81 (born 1991 to 1932). The data was analyzed in order to find certain patterns across these different sociolinguistic constraints.

LSU SPECIAL COLLECTIONS SUMMER PROJECTS

Charlotte Balart "Archives as a Teaching Tool"   Louisiana State University   Kelly Larson

The purpose of this project is to create supplementary materials for the Nancy Pinson Papers, a manuscript collection from the Louisiana and Lower Mississippi Valley Collection at the LSU Special Collections. The Nancy Pinson Papers detail the life of a female plantation owner in Woodville, Mississippi, with documents spanning from the 1820s to the Reconstruction Era. The collection offers insight into the dynamics of a female-owned plantation, the plantation economy and the effect of the Civil War and Reconstruction on the cotton trade, slave labor and the lingering effects of slavery in sharecropping, and the significance of port cities such as Bayou Sara and New Orleans. This project involves an in-depth examination of the collection coupled with exhaustive background research into the historical context of the primary source. Other preliminary work includes genealogical research and drawing parallels with other manuscript collections in the Louisiana and Lower Mississippi Valley Collection. The goal of this project is to identify different avenues with which this collection can be used as an educational tool and develop supplementary material that will make this collection more accessible to teachers, students, and researchers.

Bryce Edwards & Jennifer Cramer "20 Years in the Middle East: The Veteran's Experience through Oral History"   Louisiana State University   Jennifer Cramer

The United States of America spent over 20 years engaging in counter-terrorism in both Iraq and Afghanistan from the 90s until the 2020s. Veterans participated in both armed conflict and nation building, yet the experiences of these veterans are under documented. So the process of researching the conflicts, recording oral histories, and preserving veterans' stories in both local and national repositories ensures access and discoverability of new primary sources for potential future exploration as well as a fuller appreciation of veteran involvement in the Global War on Terror.

LIGHTNING TALKS

MAXIMIZING ACCESS TO RESEARCH CAREERS

Julia Carroll, Harry C. Spencer & David Spivak "The Design and Synthesis of a Phenyl Ester Mechanophore"   Louisiana State University   David Spivak

Mechanophores are stress responsive molecular units which exploit labile bonds and are activated through mechanical forces such as shear, tensile, and compression. There is growing interest in using mechanical energy to create stress-responsive materials, particularly materials capable of small molecule cargo delivery. Our goal was to design and synthesize a new phenyl ester mechanophore which has been used as proof of concept for mechanochemical cleavage of the ester. This mechanophore will be further modified to equip, store, and release small molecules as cargo. In application, this class of molecules has the potential to be used for drug release or as a protecting group for organic synthesis.

Dillon Harris, Nousha Afshari, Jeffery Chancellor, Basel Abuaita, Linda Heffernan, John Olson, Lukas Carter, Mark Cline & George Schaf "Comparison of In Vivo Irradiated Rhesus Macaque Cardiac Myocytes to Simplified Computational Cell Model for Evaluation of Long-Term Radiation Effects"   Louisiana State University   Nousha Afshari

Historically, irradiated cell survival models more heavily focus on nuclear DNA (nDNA) damage and repair mechanisms in the short-term. While undeniably important, focusing solely on nDNA over short time spans neglects other important subcellular structures as well as impact over longer time spans. Proposed here is an approach to investigating the role mitochondria play in long-term effects following whole-body photon irradiation. The purpose of this project is to evaluate the impairment mitochondria and mitochondrial DNA (mtDNA) undergo after irradiation and how it affects the accuracy of established cell survival models. Blood taken from previously irradiated Rhesus Macaques are run through qPCR to measure the mtDNA concentration present within the samples. These results are compared to simulated data obtained by running a male Rhesus "phantom" and simplified cardiac myocyte "phantom" through PHITS, a particle interaction simulation software. Through validation of computational modeling with experimental measurements, these results will influence how the current mathematical modeling may need to be adjusted. This research is multidisciplinary and impacts radiation-related fields, as it seeks to answer questions about the long-term health impacts from radiation exposure. We plan to improve equations predicting the probability of irradiated cell survival, as well as better identify the importance of other subcellular structures to the cell's overall health and longevity.

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

Isabel Gomez "Teacher Perspective on Policy for English Second Language Programs in Louisiana"   Louisiana State University   Danielle Thomas

Louisiana has one of the most rapidly growing populations of immigrants in the United States, including school aged immigrants. Many of these children are put into English Second Language in their new schools to; however, most of these programs are not equipped to handle the needs of these students. In the United States, there are few policy regulations for these programs nationwide, and Louisiana has a broad description of how these programs should be structured to help these students. The current system is not serving the students in a manner that would allow them to gain a proper education from these programs. Luckily, other states have also experienced an influx of English Language Students in the past and have studied different aspects of these programs that need to be targeted and improved to be successful; most of these studies have found that teachers are at the root of the solution. Based on previous research I plan interview teachers in Louisiana, collecting their experiences and suggestions for English Second Language programs. With these findings, I plan to analyze what policies should be implemented to the current landscape of English Second Language policies in Louisiana to help the programs and improve the education of the students.

RONALD E. MCNAIR RESEARCH SCHOLARS PROGRAM

Ezra Moore & Eileen K. Haebig "Exploring Vocabulary Development in Autistic Children: The Role of Imageability and Vocabulary Acquisition"
Louisiana State University   Eileen Haebig

Language skills and early word learning are typically delayed in autistic children. Previous research has indicated that autistic children may display similar learning biases relative to non-autistic children, but acquire language at a protracted rate, while others suggest autistic children may have different learning biases and processing abilities. Evidence has shown that children are biased to learn words with certain features, including high imageability, which is the ease with which a word evokes a mental image. Though prior research indicates that imageability is associated with vocabulary development in non-autistic and autistic children, imageability data have not been collected for a significant number of early-acquired words, which has restricted previous studies. Due to the limited research on word learning biases in autistic children, the present study aims to develop an imageability database and to more thoroughly investigate the association between word imageability and vocabulary development in autistic and non-autistic children. Thus, we are developing a task to collect imageability scores for each word that appears on a commonly used parent questionnaire of child vocabulary knowledge (Macarthur-Bates Communicative Development Inventory; MB-CDI). Thus, college participants will be shown words from the MB-CDI and asked to rate how imageable each word is on a scale from 1 to 7. Following the collection of these imageability scores, we will assess whether word imageability predicts word-level normative data of vocabulary acquisition. Specifically, we will use a newly created vocabulary acquisition normative variable – vocabulary size of acquisition – that has been derived separately for autistic and non-autistic children.

Balseba Tewelde, Hannah M. Lovato & Matthew Calamia "Investigating the Effect of Sleep on ADHD Symptoms in College-Aged Women"
Louisiana State University   Hannah Lovato

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that significantly impacts various aspects of life, including academic performance and psychological well-being. Emerging research suggests that sleep disturbances, such as insomnia, irregular sleep-wake patterns, and disruptions in circadian rhythms, may exacerbate ADHD symptoms. These students often experience higher levels of inattention, hyperactivity, and impulsivity, with women especially affected, experiencing more inattention symptoms compared to their male counterparts. Sleep can be affected by many factors such as stress and academic workload, and these factors can exhibit downstream effects on ADHD symptoms and may be experienced differently between men and women. This study aims to investigate the relationship between sleep quality and circadian rhythm, on ADHD symptomatology in diverse female college students utilizing a cross-sectional survey design. Sleep quality will be assessed using the Pittsburgh Sleep Quality Index (PSQI), and circadian rhythms will be measured through self-reported sleep diaries and actigraphy. ADHD symptoms will be evaluated using the Conners Adult ADHD Rating Scales (CAARS). We hypothesize that poor sleep quality and misaligned circadian rhythms will be significantly associated with increased ADHD symptom severity. Regression models will be employed to explore different measures of sleep (self-report and objective sleep patterns) predictive ability of ADHD symptoms. The findings of this study will contribute to a deeper understanding of the interplay between sleep, circadian rhythms, and ADHD in female college students, and may inform the development of targeted interventions to improve their academic and psychological outcomes.

PENNINGTON BIOMEDICAL RESEARCH CENTER - SUMMER UNDERGRADUATE RESEARCH EXPERIENCE

Suliman Aburahma, Alyssa Jeansonne, Jaclyn Wiliams & Heike Münzberg "Effects of Temperature Stressors on Immune Cell Density in iWAT"
Louisiana State University   Heike Münzberg

Adipose tissue (fat tissue) is made of adipocytes (fat cells). These cells are classified as white or brown/beige. White adipocytes are mainly used for lipid storage, while brown/beige adipocytes are mainly used for energy expenditure. Also found in adipose tissue are immune cells, including macrophages. This specific immune cell can digest microorganisms and dying cells, and increased adipocyte macrophages are associated with a decline in metabolic health. The inguinal White Adipose Tissue (iWAT) in mice is mostly made of white adipocytes. After cold exposure, white adipocytes may transform into beige adipocytes, forming a beige island. The aim of this study is to investigate the distribution and density of immune cells in the iWAT tissue between white and beige adipocytes. Mice were also exposed to cold temperature (7-day 10°C) to increase lipolysis and increase beige island formation compared to mice exposed to warm temperature (7-day 30°C). Mice were euthanized by perfusions, and the tissues were collected and stained. The IMARIS software was used to count immune cells in iWAT. Warm exposed mice had very few beige adipocytes, while cold exposed mice had defined beige islands. In cold samples, a significant decrease in macrophage density was observed in beige islands compared to white adipocytes (p<0.005). Comparing white adipocytes of warm and cold samples shows no significant difference in either macrophage density (p=0.937) or immune cell density (p=0.389). The findings support the claim that cold exposure increases metabolic health, possibly by decreasing macrophage density in beige islands.

PHYSICS & ASTRONOMY - REU

Adriana Baniecki, Kevin S. Becker, Alexis Mercenne & Kristina D. Launey "Exploring the Fusion of Alpha and Carbon 12"

University of Notre Dame   Kristina Launey

Two linked fusion processes, which occur inside the cores of massive stars, largely determine our universe's carbon-to-oxygen ratio. Three alpha particles first fuse to create Carbon-12, which then captures an additional alpha particle to fuse into Oxygen-16. However, this last nuclear process occurs at an energy level which is difficult to measure in a lab. Additionally, the relatively large number of particles in the Carbon-12 target and the alpha beam make the reaction difficult to simulate exactly. Thus, theorists model the target nucleus and the beam nucleus as point particles, while determining the effective interaction between the two from ab initio (or from first principles) large-scale simulations. This provides ab initio predictions about the relative motion of the fusion fragments, known as the cluster wavefunction, which is in turn used to calculate reaction rates. In this project, we will determine the effective Carbon-alpha potential energy by using a Markov-Chain Monte-Carlo (MCMC) sampling procedure and Bayesian analysis to fit the microscopic cluster wavefunctions for the composite nucleus of Oxygen-16's bound states. The ultimate goal is to use that effective potential energy to fit resonant states in Oxygen-16, which will allow us to estimate the reaction rate and better quantify the carbon-to-oxygen ratio in our universe.

Addison Wilberg, Chenglong You & Omar Magana-Loaiza "Quantum State Engineering of Multiphoton Systems Using Plasmonic Nano-Antennae"

Trinity University   Omar Magana-Loaiza

Surface-plasmon polaritons (SPPs) are charge oscillations that arise from the coupling of photons to the electromagnetic field along the surface of a metal. The propagation and the quantum coherence properties of the SPPs highly depend on the geometry of the metal's surface due to the strong confinement of electromagnetic near-fields. With recent advancements in nanofabrication, plasmonic metasurfaces present a novel opportunity to engineer the quantum properties of SPPs. Here, we investigate the light-matter interactions of plasmonic nano-structures as they change the quantum coherence properties of multi-photon systems in free space propagation. Specifically, we design and fabricate an array of nano-antennae that exploit the metal's surface geometry to effectively control the coherence properties of SPPs. We believe the fine control of SPP coherence properties using a nanostructure source potentially has implications for quantum sensing, imaging, and computing.

SMART POLYMER COMPOSITE MATERIALS AND STRUCTURES REU

Prem Janssen, Stefanie Klisch &Gerald Schneider "Optimizing Lamellarity in DOPC Liposomes through Lipid Concentration: A Pathway to Improved Stability"

University of Wisconsin - Stevens Point   Gerald Schneider

Liposomes are hollow spherical objects. Their diameters are on the order of 50 to 500 nm. When the lipid is dissolved in water a spontaneous self-assembly process occurs. Lipids self-assemble into bilayers with the hydrophilic heads facing the solvent and the hydrophobic tails facing one-another. The addition of NaCl to the liposome solution causes the liposome diameter to decrease. However, a systematic increase in the NaCl concentration reveals discontinuities, indicated by a substantial increase of the diameter within a variation of less than 0.1 mM. Separate studies revealed the formation of multilayer membranes. Literature discusses the influence of electrostatic interactions and osmotic pressure.

Previous works studied the change of the osmotic pressure of the system by varying the ion concentration while keeping the contribution of the liposomes constant. In this project, the influence of the liposome concentration on the structural discontinuities will be studied. This project makes use of a new dynamic light scattering to measure the diameter.

KEYNOTE SPEAKER

Dr. Naohiro Kato

Join us at 2:30 p.m. in Room 1100, Patrick F. Taylor Hall to hear Dr. Kato's keynote speech.

Beyond Biodegradable Mardi Gras Beads

Mardi Gras is important culturally and economically in Louisiana. Throwing and catching beads during the parades is much fun. However, in recent years, environmental problems with plastic-made beads have been a concern.

To solve the problem, we developed technology to produce biodegradable Mardi Gras beads with microalgae, microscopic-size single-cell algae. We grew the microalgae in an open tank on the LSU campus in Baton Rouge and processed them into a powder that can be mixed to create plastic materials. The beads were produced in an industrial molding machine with hemp string. The beads, each with a protruding letter "MADE WITH ALGAE LSU," were thrown in New Orleans in 2022.

People loved the beads, but the cost was the bottleneck to make it available to many. After investigating several paths to reduce production costs, we came up with a new idea: the most effective way to compete with traditional plastics and support our community.

We now grow microalgae to extract and purify compounds that can be used as a medicine for obesity and inflammatory diseases. In Louisiana, nearly one out of four adults are considered obese. To make medicines available to many, we must grow microalgae on a large scale. Louisiana rice farmers in the area of the Gulf of Mexico have suffered from saltwater intrusion. They cannot grow rice on their land anymore because rice is not strong enough for salt water. We isolated microalgae tolerant of salt water from the farmer's land. We are about to test converting the salt-damaged rice field into a large pond to grow the microalgae.

If this project succeeds, the rice farmers could benefit by selling medical ingredients to the biomedical and nutraceutical industries. After extracting the medical ingredients, the by-product biomass can make enough biodegradable Mardi Gras beads to be thrown in New Orleans yearly. Profits from the sale of the medicines could help offset the cost of the beads production.

Undergraduate researchers are the main contributors to this project. In today's talk, I will describe the project in more detail and explain how vital undergraduate researchers are.

About Dr. Naohiro Kato

Naohiro Kato is an LSU associate professor in the Department of Biological Sciences. He received his PhD from Hiroshima University in Japan in 1998, focusing on applied plant molecular biology. His interests in basic sciences include cellular taxis, intracellular trafficking, and systems biology of the cell. His interest in applied sciences is microalgal farming to solve social problems. He is the president of Microalgae LLC, founded to establish the microalgae industry in Louisiana.

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