ARISE

Program

Achievements in Research, Inquiry and Scholarship Exhibition

2023

UNF
UNIVERSITY of NORTH FLORIDA

Welcome

The Achievements in Research, Inquiry and Scholarship Exhibition (ARISE) is a new interdisciplinary conference at the University of North Florida (UNF) at which students showcase their research and creative projects. The symposium, which is sponsored by the UNF Office of Undergraduate Research will be held annually in summer semesters as a venue for students to present their research projects in poster format. We see ARISE as a supportive environment in which students can share their work and hone their presentation skills.

In this inaugural year of ARISE, we welcome students visiting the UNF campus as part of the Research Experiences for Undergraduates (REU) in Coastal Biology on Florida's First Coast, which is hosted by the UNF Department of Biology and funded by the National Science Foundation, as well as UNF students participating in the Summer Undergraduate Research Program (SURP) hosted by the UNF Department of Chemistry and the Summer Opportunity for Learning About Research (SOLAR) program hosted by the UNF Department of Physics. This campus-wide event is an excellent venue for these students to network with other UNF research students and share the knowledge and skills they acquired during the summer term.

We gratefully acknowledge and thank those who contributed to the success of ARISE 2023. Specifically, Kaitlyn Minnicks, the Coordinator of the Office of Undergraduate Research, served as the lead organizer for the event, Kim Roberts, the Faculty Excellence and Academic Engagement office manager coordinated the refreshments, and Rebeca Mata, the Designer for the Office of Undergraduate Research created this program and promotional materials for the event. We also thank Hana Kabil, Maeve Coughlin, and Violet Ochrietor for volunteering their time and helping to make the event a success.

Welcome to ARISE 2023!

Judith D. Ochrietor, Ph.D.

Director of the Office of Undergraduate Research
University of North Florida

Presenting Schedule

The Achievements in Research, Inquiry, and Scholarship Exhibition (ARISE) Symposium is a new interdisciplinary conference at the University of North Florida (UNF) at which undergraduate and graduate students showcase their research and creative projects. The symposium will be held annually in summer semesters as a venue for students to present their research projects in poster format.

Posters will be available to view from **10:30 a.m.** to **1:30 p.m.**
Presenters with **odd** numbers will be presenting at **10:30 a.m.** to **12 p.m.** and presenters with **even** numbers will be presenting at **12 p.m**. to **1:30 p.m.**

Building 4, Room 1705

01 Gulaid Abdo
Observing Model DOM Effects on the UV Degradation of PVC

02 Austin Anderson
Plasmonic MetaMaterials for Non-Linear Optical Applications

03 Austin Anderson
Towards a Prototype Paleo-Detector for Supernova Neutrino and Dark Matter Detection

04 Nathan Bairen
Doped La1-xSrxVO3 Thin Films Grown as Random Alloys and Ordered Superlattices Using MBE

05 David Bosnic
Eclipse Mega Movie

06 Jennifer Britton
Analytical Validation of Reproductive Hormones By Enzyme Immunoassay in Several Elasmobranch Species

07 Sierra Brown
An Evaluation of the Micronucleus Assay for Detecting Genotoxicity in Sharks and Rays.

08 Paul Christenson
Exploring Flux Gradients Within Mbe to Optimize Superconductivity in Yba2cu3o7-X Thin Films

09 Juliet Flores
Variation in Spartina Alterniflora Stomatal Conductance Across Environmental Stress Gradients

10 Elizabeth Gavrilov
Investigating Hindgut Patterning in the Tardigrade Hypsibius Exemplaris

11 Dylan Gore
Condition of Juvenile Scalloped Hammerheads During Nursery Use

12 Hudson Horne
Optimizing the Deposition of Superconducting Niobium Nitride Thin Films

13 Megan M. Howkins
Visualizing Coastal Freshwater Marsh Ecology to Inform Resilience Management

14 Collin Hugo
Characterization of Superconducting Niobium Nitride Thin Films

15 Amanda Jessel
Crystal Structure, Dieletric and Optical Properties of Aurivillius-type: Bi3-xLaxFe0.5Nb1.5O9

16 Hana Kabil
Identifying Natural Products for Use as Potential Antibacterial Drug

17 Skyeler Klinge
Biosynthetic Strategies for Expanding Structural Diversity of Druglike Diketopiperazines

18 Naomi Laird
Student Perceptions of Grading Practices

19 Elizabeth M. Lopez
Relationship Between Florida Crown Conch Density and Biotic and Abiotic Factors within Northern Florida Oyster Reef Ecosystems

Building 4, Room 1706

20 Addison Love
Correlation Between Low Salinity Habitat Use And Skin Lesions in St. Johns River Bottlenose Dolphins (Tursiops Truncatus)

21 Lusiana Martinez
Mercury Biomagnification in the Bonnethead (Sphyrna Tiburo).

22 Rooshka Mathurin
Unraveling the Genetic Diversity of the Asian Green Mussels: Insights into an Invasive Species

23 Tania McCormack
The Role of Tid1 in the Mitochondrial DNA Maintenance

24 Sarah McGinley
Chemoenzymatic Synthesis of Nocardioazine Natural Products

25 Karina Miller
Unmasking Digital Deception: Ethical Implications and Solutions for Combatting Digital Greenwashing

26 Kenzie Murphy
Social Interaction of 5 Atlantic Stingrays in a Touch Pool Setting

27 MuhammadMahdi NabiZadeh
Using a Finite Element Analysis to Simulate the Combined Cold and Hot Flows

28 Cassidy Nguyen
Defect-Induced Self-Activating Photoluminescence of Sr3BxM1-xO4F (M = Al, Ga; $0 \leq x \leq 0.25$)

29 Sarah Nguyen
Examining Student Experience and Agency on Ungraded Quizzes

30 Selma Oregon
Urban Alligator Distribution Across Retention Ponds in Jacksonville, Florida

31 Michael Pedicone
“Why Waste Time Say Lot Word When Few Word Do Trick?”

32 Gustavo Perez
Further Exploration of a Chloroacetamindine Warhead PRMT Inhibitor

33 Haley Peters
Isoleucine Restriction Increases Catabolic Flux of Valine and Leucine in Lubber Grasshoppers

34 Jacary Sapp
(La1-yEuy)1-xSrxMnO3 Thin Films grown as Random Alloys and Superlattices by MBE

35 Fudhial Sayed
Nutrient Availability and Glioblastoma: A Multi-dimensional Analysis within the Tumor Microenvironment.

36 Jordan Tucker
Exclusion of Internal Residues from an H4-16 based Peptide and Warhead Peptoid: PRMT1 Catalytic and Inhibitory Effects

37 Cameron Young
DNAJB1: Sowing the Seeds of Alzheimer’s Disease

38 Shannon Brew
Lateral Migration Space for Coastal Wetlands in Northeast Florida: The Potential of Natural and Created Marsh Islands

Abstracts

Observing Model DOM Effects on the UV Degradation of PVC

Gulaid Abdo, Chloe Perednia, and Dr. Brynna H. Jones

Polymers are remarkable when it comes to the realm of manufacturing due to their durability, flexibility, and exceptional versatility. However, polymers are a known pollutant that directly affects the aquatic environment. In our experiment, we created a model environment to investigate how polyvinyl chloride (PVC) behaves as a pollutant in naturally occurring bodies of water. This model utilized tannic acid in different concentrations to represent naturally occurring dissolved organic matter, known as DOM, along with ultraviolet lamps to represent the sun. Through the application of kinetic analysis on IR spectroscopy data, our objective is to comprehend the direct and indirect impacts of dissolved organic matter (DOM) and UV light on the chemical degradation process of polyvinyl chloride (PVC).

Mentor: Dr. Brynna Jones

Plasmonic MetaMaterials for Non-Linear Optical Applications

Austin Anderson, Dr. Gregory Wurtz, and Pedro Springola

Advancements in the field of optical meta-materials within the past few decades has led to the development of enhanced nonlinear optical functionalities with an increasing level of control over electromagnetic fields in nanostructured systems. The core of meta-material design is in the manipulation of the fields dispersion through careful geometrical nanostructuring. These meta-materials are thought to have potential applications in major fields including energy man agement, medical diagnostics, and military and national defense industry. In this project, we are observing plasmonic forming meta-materials using finite element method (FEM) simulations and identifying the modal contributions to the optical response of these materials.

Mentor: Dr. Gregory Wurtz

Towards a Prototype Paleo-Detector for Supernova Neutrino and Dark Matter Detection

Austin Anderson, Elijah Morter, Jacary Sapp, and Zane Cable

Using ancient minerals as paleo-detectors is a proposed experimental technique expected to transform supernova neutrino and dark matter detection. In this technique, minerals are processed and closely analyzed for nanometer scale damage track remnants from nuclear recoils caused by supernova neutrinos and possibly dark matter. These damage tracks present the opportunity to directly detect and characterize the core-collapse supernova rate of the Milky Way Galaxy as well as the presence of dark matter. Currently, dark matter and supernova neutrino direct detection experiments are based on real-time detection. Ancient minerals as paleo-detectors are

an alternative method, by searching for nuclear recoils preserved in minerals for billions of years. Paleo-detectors can completely revolutionize the way we approach direct detection experiments. Important information about the universe and our galaxy can be revealed with this proposed method. As of now, supernova neutrino and dark matter paleo-detector research is largely theoretical. At UNF, we aim to contribute to the experimental side, testing the sensitivity and feasibility of the paleo-detector technique with ancient minerals.

Mentors: Dr. Gregory Wurtz and Dr. Christopher Kelso

Doped La1-xSrxVO3 Thin Films Grown as Random Alloys and Ordered Superlattices Using MBE

Nathan Bairen and
Dr. Maitri Warusawithana

Using molecular beam epitaxy, we grew samples of strontium-doped lanthanum vanadate, La1-xSrxVO3 (or LSVO) with x ranging from 0 to 1. The samples were grown on (001) oriented SrTiO3 substrates at substrate temperatures around 700 °C and partial oxygen pressures of 5E-8 torr. We found this low oxygen partial pressure to be key to stabilizing the perovskite (ABO3) structure of LSVO. We have explored doping our samples both as random alloys (where La and Sr atoms randomly occupy the A-site) as well as LaVO3/SrVO3 ordered superlattices. We found LSVO to grow in a phase-pure perovskite phase with our growth parameters, although in-situ imaging using reflection high-energy electron diffraction reveals interesting behaviors during the growth of LSVO superlattices. We probe the temperature dependent electronic properties of these films and explore how these properties compare between random alloy and ordered superlattice samples.

Mentor: Dr. Maitri Warusawithana

Eclipse Mega Movie

David Bosnic

People from across the world experience solar eclipses yearly but more than being spectacular to look at they can provide unique information and insight on the effects the sun has on Earth. Astrophotography gives us that opportunity to gain knowledge about the sun, but also allows us to inspire young minds to seek a deeper understanding of the cosmos. This proposal seeks to procure specialized astrophotography equipment for the upcoming solar eclipses in North America in 2023 and 2024. With the equipment we can help the Eclipse Mega Movie team produce data that can help astrophysics, for example solar plasma ejection processes, their journey, and their impact on Earth, including the creation of aurorae. High-quality photographs of the solar corona, accessible during the eclipse, will be obtained using advanced equipment. These images will serve scientific research on coronal mass ejections and magnetic field structures, while providing a valuable educational resource for young scientists. The equipment will also be used for community outreach and astronomy club activities. This project's contribution will be in line with what was expressed in the 2017 Eclipse Mega Movie. With the next solar eclipses in the US only occurring in 2044/2045, this proposal emphasizes

the unique opportunity to create excitement and deepen understanding of this celestial event via astrophotography, benefiting both aspiring astronomers and the wider community.

Mentor: Dr. John Hewitt

Analytical Validation of Reproductive Hormones By Enzyme Immunoassay in Several Elasmobranch Species

Jennifer Britton

Enzyme immunoassay (EIA) is a useful tool for detecting hormone concentrations in blood samples; it is less expensive and safer than chemiluminescent and radioimmunoassays, respectively. Validations of the antibodies used in assays are necessary to ensure accurate detection of the specific hormones for each species. This study sought to validate EIA for elasmobranch species, a group for which endocrine data is lacking: Ginglymostoma cirratum, Carcharhinus acronotus, Carcharhinus plumbeus, Pristis pristis, and Galeocerdo cuvier. Previously banked plasma underwent a double diethyl ether extraction to separate the hormones from blood plasma proteins. Assays used polyclonal antibodies raised against testosterone (T; R156/7), estradiol (E2; R0008), and progesterone (P4; R4859). Serial dilutions of pooled, extracted plasma for each species were tested to determine if dose-response curves were parallel to serially diluted synthetic standards. Parallel displacement curves were obtained for C. plumbeus (T, E2, P4), C. acronotus (T, E2, P4), P. pristis (T, P4), and G. cuvier (T). Sample volume was sufficient to perform an accuracy check for G. cuvier to determine the percent recovery of known concentrations of testosterone (109%) added to pooled plasma ($y=0.996\times-0.001$;$R^2=0.996$). Testosterone concentrations were 66 × higher in male compared to female P. pristis, providing preliminary evidence of physiological relevance for that assay. This project demonstrates the potential utility of EIA for studying reproductive biology of elasmobranchs. Next steps include concentrating pooled plasma to re-test assays where parallelism was not confirmed because measured hormone concentrations were low and examining physiological relevance of these hormones for these species.

Mentors: Kat Mowle and Dr. Lara Metrione

An Evaluation of the Micronucleus Assay for Detecting Genotoxicity in Sharks and Rays

Sierra Brown, Carsen Campbell, Angelo Cantu, Faith Ferguson, Rowen Fleischer, Ethan Fuhrmeister, Keiley Gregory, Amelia Kuel, Kylee Merwin, Briana Traill, and Dr. Jim Gelsleichter

The micronucleus (MN) assay is a commonly employed genotoxicity test that is used for detecting DNA damage resulting from exposure to chemical pollutants and other environmental stressors. MN are small, chromatin containing round bodies visible in the cytoplasm of cells, which can represent chromosomal fragments resulting from un- or misrepaired DNA strand breaks and/or small extrachromosomal bodies formed from genomic instability. The MN assay is routinely used in fish toxicity studies because it can

be easily performed using peripheral blood smears due to the occurrence of nucleated erythrocytes in most non-mammals. However, to date, very few studies have attempted to use the MN assay in elasmobranchs (sharks, skates, and rays) or have examined whether staining procedures influence the sensitivity of this test. Therefore, the purpose of this study was to obtain baseline information on the MN assay in sharks and rays, making use of blood samples non-lethally obtained from individuals from >10 species collected using bottom longline fishing from northeast Florida and southeast Georgia estuaries. In addition to comparing MN prevalence between species and sites of collection, we also compared results from three staining procedures: the DNA-specific Feulgen and Acridine Orange protocols and the non-DNA-specific Giesma protocol. Like earlier studies on teleosts, we found data to support the premise that MN occurrence is overestimated using the Giemsa protocol compared with other procedures. Still, nuclear abnormalities were observed in elasmobranch blood and may prove useful for assessing genotoxicity.

Mentor: Dr. Jim Gelsleichter

Exploring Flux Gradients within MBE to Optimize Superconductivity in YBa2Cu3O7-x Thin Films

Paul Christenson, Dalton Zona, Jacary Sapp, and Dr. Maitri Warusawithana

We utilized the individual source flux gradients within MBE to optimize stoichiometry of c-axis oriented superconducting YBa2Cu3O7-x (YBCO) thin films. The films we studied were grown under ultra-high vacuum (UHV) with distilled ozone as the source of oxygen on (001) oriented strontium titanate (STO) substrates. Each substrate was cleaved into 3mm x 3mm pieces. Seven such pieces from the same substrate were mounted on the same sample holder, spatially separated to form a mosaic, and were grown on at the same time. This ensured that all other conditions including background ozone pressure of 2 × 10^(-6) torr and a constant heating profile of the substrates during film deposition, beginning at approximately 580°C and ending at approximately 650°C were held constant for each film. The only difference between the samples from the same mosaic was small stoichiometry variations due to the flux gradients. In situ reflection high-energy electron diffraction (RHEED) imaging was used to monitor the film surface during growth. RHEED provided real-time feedback on second-phase nucleation due to off-stoichiometry. Ex situ resistance measurements as a function of temperature made using a four-point geometry were used to obtain TC0, the temperature at which the superconducting transition is complete (resistance reaches zero), which was used as an indicator to point to optimum stoichiometry. By iteratively conducting many such mosaic growth experiments, we have been able to optimize stoichiometry and reproducibly synthesize optimally superconducting YBCO thin films.

Mentor: Dr. Maitri Warusawithana

Variation in Spartina Alterniflora Stomatal Conductance Across Environmental Stress Gradients

Juliet Flores and Dr. Scott F. Jones

Smooth cordgrass (Spartina alterniflora) is abundant and flourishes in coastal salt marshes. Due to fluctuation in environmental conditions, such as, increasing salinity and flooding from climate change. These changing conditions affect plant physiology, including the emission of water vapor and other gasses (e.g., soil-generated methane) from the plants leaves. These conditions affect the plants stomata aperture. Our goal is to measure Spartina conductance in different locations along a site to see if Spartina is thriving near the channel or in higher elevation. Here, we measured different distances along the leaf to see where the highest conductance where methane is being released and where carbon is being intake. Future analyses will determine if this variability is predictable based on leaf position, age, and environmental setting. Despite understanding how environmental conditions affect plant physiology, there is lack of information on how plant physiology varies within and across plant morphology. These data enhance a mechanistic understanding of how plants in coastal wetlands mediate the movement of gasses from the soil to the atmosphere, including water vapor, carbon dioxide, and methane, all potent greenhouse gasses. As climate change progresses, this mechanistic understanding will be critical for predicting how plant- mediated carbon sequestration in coastal wetlands might be altered.

Mentor: Dr. Scott F. Jones

Investigating Hindgut Patterning in the Tardigrade Hypsibius Exemplaris

Elizabeth Gavrilov, Dr. Frank Smith, and Mandy Game

Expression patterns of gut patterning genes are conserved across many species, and can be useful mechanisms for understanding the evolution of body plans through comparative studies. Tardigrada is a phylum of eight-legged, microscopic animals that retain ancestral-type gut anatomy for Panarthropoda, the animal clade containing Arthropods, Onychophorans, and Tardigrades. Tardigrades are secondarily miniaturized and simplified, so we are investigating whether the gut patterning mechanism for these animals is conserved in this lineage. In this study, we investigated four different stages of development in the tardigrade H. exemplaris - 24 hours post laying (hpl), 35 hpl, 45 hpl, and hatchling stage. Our study focused on hindgut development. We used Hybridization Chain Reaction in situ (HCR) to visualize mRNA localization. We used confocal microscopy to detect HCR signals. At 24 hpl, the embryo expressed caudal (cad) and Abdominal-B (Abd-B) at the posterior. Forkhead (fkh), a marker of gut cells, was expressed strongly throughout most of the developing gut, and colocalized with cad and Abd-B, but not at the very posterior end. At 35 hpl, Abd-B was expressed in the posterior zone and in the two posterior legs. Cad was also expressed in the posterior zone, but not in the legs. Fkh was expressed throughout the gut including in the posterior zone, and overlapped with cad and Abd-B expression in the posterior zone. At 45 hpl, fkh was expressed throughout the

gut. Both Abd-B and cad were expressed in the hindgut, and overlapped with fkh expression in the hindgut, but were also expressed more posteriorly relative to fkh. At the hatchling stage, ~96 hpl, fkh was expressed stongly in the foregut and hindgut, but not in the midgut, and it appeared to be concentrated where the midgut meets the foregut and hindgut. Abd-B was expressed in the cloaca, the malpighian tubules, and the anterior end of the hindgut. Cad was expressed in the cloaca and the anterior end of the hindgut. Gata456, an endodermal marker, was expressed very broadly and strongly in the midgut. We conclude that the tardigrade hindgut ingresses from an ectodermal posterior zone during development and gives rise to the cloaca, malpighian tubules, and other parts of the hindgut.

Mentor: Dr. Frank Smith

Condition of Juvenile Scalloped Hammerheads During Nursery Use

Dylan Gore and Dr. Jim Gelsleichter

Studies have determined that the Tolomato River, FL is a nursery for young-of-year (YOY) scalloped hammerhead sharks (Sphyrna lewini). It is hypothesized that YOY S. lewini use nurseries for predation release and/or enhanced foraging opportunities. However, there are no studies that have examined the condition of scalloped hammerheads during nursery use in the Tolomato River to see if this nursery is selected for either of these purposes. Thus, this study focused on assessing the condition of YOY S. lewini as they use this nursery habitat. To achieve our goal, we caught scalloped hammerheads in the Tolomato River, using longline and hook-and-line fishing and recorded their length, weight, and girth measurements. We then used these data to assess the condition of the scalloped hammerheads. Our data suggests that scalloped hammerheads residing in this site exhibited good condition. This suggests that the Tolomato River nursery provides enough food for the juvenile scalloped hammerheads during its use. Therefore, this site likely provides multiple benefits to these individuals.

Mentor: Dr. Jim Gelsleichter

Optimizing the Deposition of Superconducting Niobium Nitride Thin Films

Hudson Horne and Collin Hugo

Sputtering is a thin-film deposition technique that uses an energetic plasma to remove material from a source under vacuum, and this material then coats an exposed substrate. In reactive sputtering, the source material reacts with a process gas during the deposition process. Two different types of sputtering are DC sputtering, which uses a DC voltage to excite the plasma, and HiPIMS (high-power impulse magnetron sputtering), which uses a pulsed DC voltage. We use a Lesker magnetron sputtering system to deposit superconducting niobium nitride films via a reactive process in which a high-purity niobium target is sputtered in the presence of nitrogen gas. We measure how the deposition rate varies with nitrogen concentration and determine the optimal nitrogen concentration for both DC and HiPIMS processes. The goal is to produce

ultra-thin films with relatively high superconducting critical temperatures for nanowire device applications.

Mentor: Dr. Daniel Santavicca

Visualizing Coastal Freshwater Marsh Ecology to Inform Resilience Management

Megan M. Howkins, Emily R. Hill, Savanna Mathis, Allix North, and Dr. Scott F. Jones

The continuous impacts of global climate change present new challenges in preserving unique ecosystems, such as coastal freshwater wetlands. Coastal freshwater wetlands contain high biodiversity and provide significant ecological services in northeast Florida. However, these coastal areas and their natural services are threatened by sea-level rise, saltwater intrusion, and severe storms. In order to successfully manage coastal resources susceptible to climate change, conservation and protection agencies need spatial data on the distribution of individual habitats to determine their vulnerability and resilience, something currently lacking. The present study analyzes the foundational conditions of coastal depression wetlands at the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) to provide information for future coastal management strategies and ecosystem vulnerability assessments. We investigated nine distinct wetlands at the GTMNERR along a salt- to freshwater gradient, measuring surface water quality, soil salinity, and plant community diversity. As the vegetative community transitioned, soil salinity, surface water quality, and plant community data were collected. Overall data was compiled in ArcGIS Pro to generate a map comparing salinity and plant species distribution. The surface water and soil salinity varied predictably, increasing as wetlands became closer to the salt marsh ecotones. The plant diversity and dominance were highly variable among the wetlands, which was only partially explained by the soil hydrology. This study provides a visual representation of the spatial distribution and gradation of wetland communities present at the GTMNERR, which will support future research and management strategies that will conserve these habitats. As the impacts of climate change continue to amplify, the need for current data is essential to reduce its threat on the location's ecological stability and overall understanding of wetland resilience.

Mentor: Dr. Scott F. Jones

Characterization of Superconducting Niobium Nitride Thin Films

Collin Hugo, Hudson Horne, and Dr. Daniel Santavicca

Two different types of sputter deposition, DC and HiPIMS (high-power impulse magnetron sputtering), have been shown to produce films with different characteristics. We characterize the physical and electrical properties of superconducting niobium nitride thin films grown using these two techniques. We determine the crystal structure via x-ray diffraction and the surface roughness via atomic force microscopy, and we also compare the resistivities and superconducting critical temperatures via low-temperature electrical characterization. The goal

is to understand how deposition parameters correlate with film properties and to use this understanding to optimize the deposition of ultra-thin superconducting films.

Mentor: Dr. Daniel Santavicca

Crystal Structure, Dieletric and Optical Properties of Aurivillius-type: Bi3-xLaxFe0.5Nb1.5O9

Amanda Jessel and Dr. Michael Lufaso

Bi3-xLaxFe0.5Nb1.5O9 ($0 < x < 1$) was synthesized using conventional solid-state techniques and its crystal structure was refined by the Rietveld method using X-ray powder diffraction data. This mixed-metal oxide presents an Aurivillius-type structure adopting an orthorhombic A21am space group, in which the lattice parameters changed anisotropically with increasing x. Dielectric constant and loss show a tunable increasing trend indicating relaxor ferroelectric behavior. The dielectric constant falls within the range of 20-30 at 1 MHz. Optical properties showed a direct allowed transition of 2.3-2.32 eV band gap energy, increasing with x. Preliminary measurements indicate no photocatalytic activity at low x values, however, further studies will include determination of photocatalytic activity throughout the series.

Mentor: Dr. Michael Lufaso

Identifying Natural Products for Use as Potential Antibacterial Drugs

Hana Kabil and Noah Khosrowzadeh

Antibiotic resistance has become a major public health issue. Bacteria are growing more resistant to medications and microbial infections are increasing globally. To defend against these threats, the bacteria Nocardiopsis has been a source of intrigue due to its diverse applications in antimicrobial related research. Natural products from Nocardiopsis sp. can be the key to potential new antibiotic drugs. Alpha pyrones are an example of natural products in a novel marine strain of Nocardiopsis sp. that potentially exhibit strong antimicrobial activity. In this project, Isolation and determination of three new alpha pyrone structures is in progress to test their potency against different strains of gram-negative and gram-positive bacteria like Methicillin resistant Staphylococcus aureus (MRSA), a common strain that leads to nosocomial infection. Two novel alpha pyrones have been successfully isolated but more natural products are being extracted through Solid phase liquid chromatography (SPE), high performance liquid chromatography (HPLC) and liquid chromatography mass spectrometry (LCMS). The compounds' structure is detected by nuclear magnetic resonance mass spectroscopy (NMR) and tested against other bacterial strains in hopes of garnering new methods to combat the imminent threat of antimicrobial resistance.

Mentor: Dr. Amy Lane

Biosynthetic Strategies for Expanding Structural Diversity of Druglike Diketopiperazines

Skyeler Klinge, Elise Ballash, and Dr. Amy Lane

Living organisms utilize natural products for intercellular communication, making them critical for drug development. Natural products have played a pivotal role in the creation of numerous pharmaceuticals. With the immense diversity of microorganisms, they serve as a rich source for expanding our understanding of natural products. This project aims to create novel natural products that hold potential therapeutic applications and investigate their ecological functions. To achieve this, we employ a biosynthetic approach inspired by nature's toolkit, utilizing bacteria as efficient factories for the production of novel druglike prenylated diketopiperazine (DKP) molecules. We hypothesize that a prenyltransferase enzyme from Streptomyces species ISL100 may be a useful tool for catalyzing prenylation of DKPs to yield druglike molecules. A library of 12 DKPs was screened to assess their potential for prenylation utilizing the ISL100 prenyltransferase. The resulting products were analyzed using LC-MS, providing compelling evidence for the successful generation of prenylated DKP compounds catalyzed by the ISL100 prenyltransferase. Our findings, supported by the LC-MS data, demonstrate the successful prenylation of all 12 DKP molecules. However, a few ambiguous results were observed, suggesting the presence of naturally occurring products within the generated mixture. Future endeavors will entail isolating these novel compounds and focus on determining the structure of these molecules by NMR. Additionally, we aim to assess their biological functions and explore their potential as drug candidates.

Mentor: Dr. Amy Lane

Student Perceptions of Grading Practices

Naomi Laird, Dr. W. Brian Lane, Dr. J. Caleb Speirs, Michael Pedicone, Sarah Nguyen, Josef Van Valkenburgh, and Thanh Lê

Alternatives to traditional grading (such as standards-based grading, contract-based grading, and student self-evaluation) are gaining popularity, but their impact on student learning in the physics context remains largely underexplored. As a first step in understanding these effects, we studied physics students' perspectives on grades in the context of a mid-sized state university. We received qualitative survey responses from N = 94 students in Algebra-Based Physics I & II. We then verified our understanding of the survey responses with focus groups.

Mentors: Dr. Amy Lane and Dr. J. Caleb Speirs

Relationship Between Florida Crown Conch Density and Biotic and Abiotic Factors within Northern Florida Oyster Reef Ecosystems

Elizabeth M. Lopez and Dr. Eric Johnson

Oyster reefs are crucial coastal ecosystems that provide a habitat for other species, improve water quality,

fortify wetlands, prevent shoreline erosion, and provide storm protection. In northeast Florida, oysters are preyed upon by the Florida crown conch. Few studies on the impacts of increases in the abundance and periodic outbreaks of crown conch on oysters in oyster reefs exist, and no studies focused on the relationship between crown conchs and the biotic and abiotic factors within oyster reefs were found. To address these knowledge gaps, we examined the relationship between (1) conch density and the abundance and size of oysters and four other organisms within oyster reefs and (2) conch size and water quality parameters in northeast Florida. Our hypotheses were: (1) conch density will be negatively correlated with abundance, (2) conch density will be negatively correlated with size, and (3) conch size will have no relationship with overall water quality. The study utilized a quadrat sampling method in which quadrats were randomly tossed onto each reef. Within each quadrat, all conchs and live and dead oysters were counted and measured. Approximately 85% of global oyster reefs have been lost, resulting in loss of wetland fortification, shoreline erosion, and declines in marine life. To better understand the potential impacts of crown conch outbreaks on oyster reefs at the ecosystem level, the relationship between this predator's density and the biotic and abiotic factors within oyster reefs must be studied to successfully restore and maintain the health of these vital coastal ecosystems.

Mentor: Dr. Eric Johnson

Correlation Between Low Salinity Habitat Use and Skin Lesions in St. Johns River Bottlenose Dolphins (Tursiops truncatus)

Addison Love and Dr. Quincy Gibson

Photographic analysis of epidermal condition is a non-invasive way to monitor cetacean health. Previous studies found that common bottlenose dolphins (Tursiops truncatus) that were out-of-habitat or experienced flooding developed skin lesions from low salinity; however, lesions may also be caused by pathogens or environmental factors. St. John River (SJR)bottlenose dolphins have elevated prevalence of skin lesions compared to nearby populations. Year-round photo-ID surveys were conducted weekly from the river mouth to 40 km upriver (2016-2018). A sample of resident dolphins were selected based on their number of sightings (>4 sightings) during the warm season (May-Oct.;N=25) and/or (>2 sightings) during the cold season (Nov.-Apr.;N=36). Mean salinity of each dolphin's habitat was calculated from their sightings during each season. Standard Photo-ID methods were used to identify dolphins and high quality photos were used to evaluate lesion prevalence on the dorsal fin and body, and score lesion coverage (background=<5%, low=5-20%, medium=20-50% and high=>50%). Salinity and lesion data will be combined to determine if the two variables are correlated. If residents that spend more time in lower salinity have higher prevalence/coverage of lesions, then salinity may contribute to lesion formation. If there is no correlation, then other environmental or anthropogenic factors should be considered. SJR dolphins are part of a strategic stock

monitored by NOAA, in which few mortalities could put the population at risk. Identifying the source of lesions in this population may lead to changes in the management of the population and/or the environment.

Mentor: Dr. Quincy Gibson

Mercury Biomagnification in the Bonnethead (Sphyrna tiburo).

Lusiana Martinez and Dr. Jim Gelsleichter

Mercury (Hg) is a well-studied, non-essential heavy metal that poses significant health risks to fish and seafood consumers, especially with regards to larger predatory species such as sharks since this toxic metal is believed to biomagnify or increase with trophic position. However, while the ability of Hg to biomagnify in marine food webs is generally accepted, few studies have examined the actual levels of Hg biomagnification in sharks by comparing Hg accumulation in predators with the amounts of Hg in their direct prey. Therefore, the present study examined the biomagnification of Hg in the bonnethead Sphyrna tiburo, a small coastal shark species that is common on the southeast U.S. coast, by measuring total Hg (THg) in muscle samples and blue crabs present within the stomach of 18 individuals from South Carolina estuaries. Concentrations of THg in muscle and prey were used to calculate the biomagnification factor (BMF) of Hg in this species, which ranged from 4.06 to 32.67. The BMF was positively correlated with animal size, indicating that larger sharks receive higher Hg burden than smaller individuals. This may be partly explained by prey size since THg concentrations in blue crabs was significantly correlated with carapace width and larger sharks generally consumed larger prey. Lastly, in four sharks THg concentrations in muscle surpassed the maximum allowable limit for human consumption of 1 mg/kg wet weight as determined by the FDA.

Mentor: Dr. Jim Gelsleichter

Unraveling the Genetic Diversity of the Asian Green Mussels: Insights into an Invasive Species

Rooshka Mathurin and Dr. Matthew Gilg

The introduction of non-native species and their potential impacts on native ecosystems is of major concern due to the ecological and economic damage they can cause. Human activities such as trade, travel, and colonization have all played a role in the introduction of species to non-native ecosystems. The Asian green mussel (Perna viridis) was first discovered in coastal Florida waters in 1999, following earlier observations in Jamaica and Trinidad. Initial studies showed that all of the introduced populations in the Western Hemisphere stemmed from a single introduction, likely from China, that was relatively small in size since genetic variation in introduced populations was low when compared with that of native populations. More than 15 years has passed since the previous genetic assessment and there has been an expansion of shipping from Asia to places like Jacksonville, Florida, suggesting that additional introductions may have occurred. The purpose of this study is to examine whether there have been any subsequent introductions of the Asian green mussel, Perna viridis, to coastal Florida waters. Since previous

studies analyzed samples collected from Jacksonville, Saint Augustine and Tampa Bay, samples were collected from each of these locations in the summer of 2023. The collected samples underwent PCR amplification of the targeted gene, cytochrome oxidase subunit I (COI), which is the same locus utilized in previous studies. A 650 bp sequence of this gene locus was obtained from each sample for subsequent comparisons between individuals. To discover potential new haplotypes, the acquired sequences were evaluated and compared to current databases of Asian green mussels in the Western Hemisphere. Analysis of these sequence data will be provided during the presentation.

Mentor: Dr. Matthew Gilg

The Role of Tid1 in the Mitochondrial DNA Maintenance

Tania McCormack, Dr. Grzegorz Ciesielski, and Dr. Szymon Ciesielski

Protein systems Hsp70/J-domain protein (JDP) are crucial molecular chaperones that regulate the quality control of cellular proteins. The JDP cochaperone assists ATP-bound Hsp70 in folding, moving, and disassembling/assembling proteins by delivering molecules to Hsp70 and stimulating its ATPase activity. Mitochondria, organelles with their own Hsp70 (HSPA9) and JDP (Tid1) systems, are vital for various metabolic and biological activities and possess their own genetic material (mtDNA). Dysfunction of these proteins during mtDNA replication can lead to mutations, deletions, or loss of mtDNA, ultimately resulting in cellular damage and diseases such as cancer. Tid1, which has two isoforms, Tid1-Long (Tid1L) and Tid1-Short (Tid1-s), differing in their C terminus tails due to splicing, plays a critical role in rectifying these dysfunctions and restarting the replication process to ensure accurate mtDNA maintenance. Previous studies on the yeast Tid1 homologue suggest its direct binding to mtDNA for maintenance. Our project aims to investigate the binding ability of JDPs, specifically Tid1, to mtDNA and characterize the underlying mechanisms. We will employ bioinformatics techniques such as multi-sequence alignment and structural data analysis to identify residues involved in Tid1's interaction with mtDNA and compare the binding capabilities of the two spliced forms. Currently, we are establishing an expression system using E. coli bacteria cells to successfully produce Tid1. Comprehending JDP's capability to colocalize with mtDNA is an essential stride to understanding the molecular chaperone's role in preserving the integrity of the mitochondrial genome.

Mentors: Dr. Szymon Ciesielski and Dr. Grzegorz Ciesielski

Chemoenzymatic Synthesis of Nocardioazine Natural Products

Sarah McGinley, Sajan D. Green, and Dr. Amy Lane

Natural products, or secondary metabolites, are molecules produced by living organisms that have various biological functions. Among the natural products are nocardioazines A and B, produced by marine actinomycete Nocardiopsis sp. CMB-M0232. Nocardioazine A is of particular

interest because it is an inhibitor of P-glycoprotein, a protein that can be overproduced by cancer cells and make treatments ineffective. The enzymes involved in the production of nocardioazine B include a cyclodipeptide synthase (CDPS)—which forms the diketopiperazine (DKP), or cyclodipeptide of two amino acids, cyclo-L-Trp-L-Trp—followed by a racemase, prenyltransferase, and a methyltransferase. Nocardioazine B is hypothesized to be a precursor of nocardioazine A, but the remainder of this pathway is yet to be uncovered. This project investigates the specificity of the racemase, prenyltransferase, and methyltransferase towards various analogs of the cyclo-L-Trp-L-Trp precursor, ultimately aiming to produce analogs of nocardioazine B via chemoenzymatic synthesis. Chemical analyses indicate that the enzymes are promiscuous to the cyclo-L-Trp-L-Trp analogs to the degree that some of the nocardioazine B analog is produced, but the efficiency of the enzymes is reduced with the modified substrates. These findings add to our understanding of the nocardioazine B pathway and the activity of marine enzymes. They also demonstrate the potential for a chemoenzymatic method of producing nocardioazine analogs, which may ultimately lead to nocardioazine A analogs. These analogs may, like nocardioazine A, have cancer treatment implications.

Mentor: Dr. Amy Lane

Unmasking Digital Deception: Ethical Implications and Solutions for Combatting Digital Greenwashing

Karina Miller

The phenomenon of digital greenwashing has raised significant ethical concerns. Digital greenwashing can be defined as the act of misleading consumers through deceptive environmental claims in the digital realm. As consumers increasingly prioritize sustainability, companies have seized the opportunity to present their products and services as environmentally friendly. However, this practice misleads consumers, undermines genuine sustainability efforts, and erodes trust. This research delves into the ethical implications of digital greenwashing and proposes solutions to combat its negative effects. The arguments presented emphasize the need for digital transparency, accountability, and empowered consumers. Enhancing digital transparency and accountability is a multifaceted solution that requires the establishment of robust regulations and guidelines, the promotion of transparent reporting and third-party verification, and the introduction of digital tools and platforms to empower consumers. A mobile app/browser extension can be created to scan product barcodes or website content and provide instant feedback on the environmental claims made. These tools can access databases of verified eco-labels, certifications, or sustainability ratings, allowing consumers to evaluate the authenticity of green claims in real-time. This study emphasizes the need for collaboration among companies, regulators, and consumers to promote integrity and

authenticity in environmental marketing, ultimately contributing to a more sustainable future.

Mentor: Dr. Brian Thornton

Social Interaction of 5 Atlantic Stingrays in a Touch Pool Setting

Kenzie Murphy and Dr. Lindsay Mahovertz-Myers

Atlantic stingrays are housed in many managed care facilities in North America but little is understood about their social dynamic. Other elasmobranch species show a dominance hierarchy social structure like smooth stingrays (Pini-Fitzsimmons 2021), while others are solitary like scalloped hammerhead sharks (Jacoby 2011). Data was collected from The Jacksonville Zoo and Gardens' Stingray Bay, an interactive touch pool where guests can feed and pet stingrays from four different species including cownose stingrays, bluntnose stingrays, one Atlantic spotted guitarfish and Atlantic stingrays. The five individuals include one female, age 13 and four males ranging from 1-13 years old. Using Zoomonitor, I recorded any interactions or stereotypic behaviors as all occurrences for ten minutes up to 3 times a day as well as tracking each individual's activity at one minute intervals. Expected results are that individuals with larger disc will be higher in a dominance based hierarchy and therefore have lower aggression behaviors from other individuals whereas the smaller individuals will be the recipients of more aggressive behaviors. Statistical analysis will be done using Excel and PowerBi to create visuals of the data. This research will help keepers make better welfare decisions for Atlantic stingrays within managed care as well as understanding their social needs.

Mentor: Dr. Lindsay Mahovertz-Myers

Using a Finite Element Analysis to Simulate the Combined Cold and Hot Flows

MuhammadMahdi NabiZadeh and Dr. Jutima Simsiriwong

Finite Element Analysis (FEA), a numerical analysis method, has been widely utilized as a computer-based tool for solving mathematical equations that describe engineering problems. Big companies and engineering students use this analysis to better solve those problems cheaper and faster. The structural behavior as a response to the applied forces can be simulated through FEA. This, in turn, supports structural design; And this support, helps engineers to improve engineering designs and their skills of using computer-based tools; The FEA is a step and a tool to achieve the skills of understanding design. Design is a drawing of brainstorming ideas including constraints and other factors that lead engineers to improve and create better quality products. This work provides the first-hand experience of a second-year mechanical engineering student in using FEA to solve a physical engineering problem. This work is a process in which the 2nd year mechanical engineer student used computer-based tools to create a design. In this work, the analysis is performed to obtain the temperature distribution of the fluid in a cylindrical T-duct. Using Siemens NX Advanced Simulation, the finite element model is

created for a given T-duct that contains a mixture of cold and hot flows. The results of the simulation will be presented and discussed.

Mentor: Dr. Jutima Simsiriwong

Defect-Induced Self-Activating Photoluminescence of Sr3BxM1-xO4F (M = Al, Ga; 0 ≤ x ≤ 0.25)

Cassidy Nguyen

Current phosphor-conversion light-emitting diodes (PC-LED) technology focuses on the unique electronic and optical characteristics of rare earth (RE) ions have on their fluctuating prices and availability. The goal is to synthesize and characterize a rare earth-free alternative phosphor material with the potential to absorb blue/near-UV from high-efficiency blue LEDs and emit white light overall. A phosphor with this luminescence would greatly increase lighting efficiency. Previous work done by this research group has confirmed that [BO4]5- can be substituted for [MO4]5- (M = Al, Ga) to form Sr3BxM1-xO4F (M = Al, Ga; 0 ≤ x ≤ 0.25) oxyfluorides with anti-perovskite related structures. By incorporating dopant amounts of RE activator ions into the host lattice and that subtle structural differences in the host lattice from substituting different-sized isovalent A cations for Sr2+ noticeably shifts the wavelength of the excitation and emission wavelengths in these phases. Previous analysis confirmed the I4/mcm tetragonal space group of the phase and incorporation of boron solely on the tetrahedral M lattice site. The synthesized solids demonstrated self-activating photoluminescence without the need for post-synthesis reductive annealing. With further analysis, the tilts and disorder on this structure can be used to describe defect-induced photoluminescence. The samples are scanned with powder x-ray diffraction and neutron powder diffraction for Rietveld analysis. Through Rietveld analysis, lattice parameters, atomic positions, and bond valence sum and global instability index calculations can be determined to investigate the tilts and disorder on this structure. After thorough investigation of the synthesized solids' structure, the sample parameters and characteristics can be discussed with regards to defect-induced photoluminescence. This study characterizes the structural effects of the substitution of boron onto the M site to discuss the defect-induced self-activating luminescence.

Mentor: Dr. Eirin Sullivan

Examining Student Experience and Agency on Ungraded Quizzes

Sarah Nguyen, Dr. J. Caleb Speirs, and Mark Swartz

The term (un)grading used in a physics education setting typically refers to the practice in which instructors reduce the perceived importance of letter grades and in turn, focus on giving students more agency over their learning and providing quality feedback regarding student's learning outcomes. To examine the impact of this method on students' experience of physics, we (un)graded two out of seven total bi-weekly quizzes in an Algebra-based Physics II course by asking the students to reflect on their performance on the quiz and suggest a grade for themselves. On every quiz,

several Likert-style questions were asked assessing motivation, anxiety, confidence, curiosity, etc. Additionally, at the end of these quizzes, students were offered a choice between two bonus questions: a more difficult “life-sciences application” problem and a less difficult “pure physics” problem. On the first quiz, students were able to provide an alternate reasoning for each of the ten questions. Comparisons of student responses between the graded and ungraded quizzes are discussed.

Mentor: Dr. J Caleb Speirs

Urban Alligator Distribution Across Retention Ponds in Jacksonville, Florida

Selma Oregon and Dr. Adam Rosenblatt

Jacksonville is the largest city in Florida and historically supports large numbers of American alligators (Alligator mississippiensis), and very few studies focus on these apex predators within the city. The expansion of urban development has significantly impacted various wildlife habitats, resulting in a limited understanding of how alligators distribute themselves across human-made environments, particularly stormwater retention ponds. This project focused on the assessment of the spatial stability of the alligator population, their distribution patterns in the urbanized area, and identifying the landscape-scale factors that influence their habitat selection. We used a spotlight survey method to examine 70 random retention ponds throughout Jacksonville. Each pond was surveyed three times to ensure a comprehensive assessment of alligator sightings. Out of the 70 ponds surveyed, a total of 16 alligators were observed across 12 retention ponds. Data obtained from these surveys were analyzed using an occupancy model, which recorded the presence or absence of alligator sightings during each site survey. Results indicate significant factors that influence the distribution of urban alligators, such as the presence of fences, pond size, hardened walls along the pond perimeters, and a protected reserve, Guana Lake. Just south of Jacksonville, this source of population is known to support 700 alligators and we predicted how unlikely it is for alligators to disperse far from this location across dense urban development. Understanding these factors is crucial for comprehending how alligators navigate and adapt to urban environments and highlights their preferences for specific living habitats.

Mentor: Dr. Adam Rosenblatt

“Why Waste Time Say Lot Word When Few Word Do Trick?”

Michael Pedicone and Dr. J. Caleb Speirs

The cognitive processes involved in forming an explanation to a qualitative physics problem draw largely on past experiences and knowledge. Instructors and students have drastically different past experiences with evaluating others’ explanations. Typically, physics instructors have spent years training in the logic of physics reasoning and interacting with students explaining their reasoning. Students, on the other hand, largely have only their experience in answering the questions themselves and talking with their peers. We sought to investigate how students in an algebra-

based physics course evaluated the explanations given by other students. We utilized reasoning chain construction tasks during an in-class questionnaire with a class discussion afterwards. Our analysis of the questionnaire revealed that students appear to have an ideal sweet spot between completeness and conciseness that is based more on gut-feeling than logical rules when discerning the necessary elements of an explanation.

Mentor: Dr. J. Caleb Speirs

Further Exploration of a Chloroacetamindine Warhead PRMT Inhibitor

Gustavo Perez and Dr. Corey Causey

Enzymes allow regulatory biological processes to take place by lowering the activation energy required for reactions. Specific substrates are needed to activate these enzymes, allowing certain processes to occur in an intricate system. Without the specificity of the enzyme, anything may occur, leading to debilitating effects for the organism. Enzymes are categorized according to their function, such as oxidoreductases, ligases, phosphatases, isomerases, kinases, and transferases. Specifically, we are examining a mammalian group within the methyltransferases; the protein arginine methyltransferases (PRMTs) transfer a methyl group from the cosubstrate S-adenosylmethionine (SAM) onto an arginine residue in histone tails. PRMTs aid in mRNA splicing, gene transcription, and DNA repair. There are 11 isozymes of PRMTS divided into three types due to differences in product formation. Type I PRMTs form asymmetric dimethylarginine (ADMA), type II form symmetric dimethylarginine (SDMA), and type III form monomethylated arginine (MMA). However, the overabundance of these products leads to the expression of cancer-related genes. Therefore, the synthesis of novel peptoid inhibitors has been introduced due to their low chances of proteolysis, high activity, and versatility. We have developed a first-generation H416 low micromolar inhibitor based on histone H4. To develop more potent and selective versions of this compound, we varied the length of the warhead carbon chain. Furthermore, optimized the compound to streamline developmental synthesis by replacing time-consuming monomer additions. Our results demonstrated that varying the carbon chain did not increase potency, otherwise led to an exciting discovery of a possible novel substrate.

Mentor: Dr. Bryan Knuckley

Isoleucine Restriction Increases Catabolic Flux of Valine and Leucine in Lubber Grasshoppers

Haley Peters, Kerri Conklin, Connor Clark, and Dr. John Hatle

Reduced dietary protein has shown to be the most effective macronutrient restriction in prevention of age-related disease. Restriction of specific amino acids, such as isoleucine, a branch chain amino acid (BCAA), results in pronounced metabolic benefits. To better understand the benefits of isoleucine restriction, we studied the catabolism of BCAAs upon isoleucine restriction in lubber grasshoppers. Catabolism is the fate of an amino acid which cannot be stored or used for protein synthesis, and defects are

associated with obesity related insulin resistance. Utilizing carbon-13 labeled BCAAs allowed for the quantification of catabolism upon isoleucine restriction. Grasshoppers were assigned to one of four dietary treatments: vg-bal 100%, 33% isoleucine, 0% isoleucine, or 1.5g lettuce. “Vg-bal 100%” matches the amino acid composition of the vitellogenin protein, this optimal composition should not catabolize BCAAs abundantly. 33% isoleucine and 0% isoleucine diets were made with a similar composition to vitellogenin; however, grams of isoleucine were restricted to the respective degree, and non-essential amino acids were increased to keep all diets isonitrogenous. Grasshoppers given 1.5g lettuce daily served as a positive control, where starved organisms should catabolize most additional BCAAs. Upon 0% isoleucine restriction, valine ($p=0.0015$) and leucine ($p=2.38x10-5$) catabolism were significantly increased when compared to those on the optimal diet. When restricting isoleucine by 33%, only leucine catabolism significantly increased ($p=0.048$). This confirms that a low isoleucine diet, specifically 0%, increases the catabolism of valine and leucine. Future analysis should elucidate whether increased catabolism contributes to the metabolic benefits of a low isoleucine diet.

Mentor: Dr. John Hatle

(La1-yEuy)1-xSrxMnO3 Thin Films Grown as Random Alloys and Superlattices by MBE

Jacary Sapp, James Payne, Dakota Brown, and Dr. Maitri Warusawithana

Using molecular beam epitaxy (MBE), we grow single-crystalline thin films of mixed-valent manganites. Specifically, we study (La1-yEuy)1-xSrxMnO3 thin films where x was set to 1/3 and the europium substitution for lanthanum, y, was shifted from 0 to ½. The starting compound with no europium (y=0), La1-xSrxMnO3, is well studied, and it is understood that lanthanum and strontium are mostly ionic in the crystal forming La3+ and Sr2+ ions. At x=1/3 this material is well known for its colossal magnetoresistive properties and highly spin-polarized ferromagnetic ground state. The addition of europium into this crystal can impact its electronic properties in three respects. Firstly, the valence state of europium, which is unknown, can influence the doping. The ionic radii of europium can also trigger additional lattice distortions that couple to the electronic structure. Lastly, the f-electrons in europium can influence the spin state of the hybridized t2g and eg electrons that mediate the double exchange interaction and the resulting ferromagnetic metallic ground state. Here we study this influence of adding europium in both random alloy samples and ordered superlattice thin films. Specifically, we carry out a comparison of the electronic properties due to the addition of europium, y=0 vs y=1/2 as well as between the random vs ordered arrangement of europium in the lattice. In both comparisons, we find the influence of europium leads to distinct changes in the electronic properties.

Mentor: Dr. Maitri Warusawithana

Nutrient Availability and Glioblastoma: A Multi-dimensional Analysis within the Tumor Microenvironment.

Fudhial Sayed, Dr. Beatriz I. Fernandez-Gil, Raegan Weil, Dr. Juan-Pablo Navarro Garcia de Llano, and Dr. Alfredo-Quinones-Hinojosa

Cancer cells rely on efficient nutrient utilization to drive energetic and biosynthetic pathways which facilitate disease progression and proliferation. However, the interplay between nutrients and these pathways, specifically the Hexosamine Biosynthetic Pathway (HBP) remains poorly understood. The HBP pathway functions as a nutrient-sensing pathway activated by glucose and glutamine, leading to increased O-linked-N-acetylglucosaminylation (O-GlcNAc). In this study, we sought to investigate the impact of nutrient availability on O-GlcNAcylation in Glioblastoma (GBM). Using six experimental groups, including high levels of glucose, glutamine, lipids, 3-hydroxybutyrate (3-HB), O-GlcNAc and a control group, as well as six additional groups with nutrient depletion by removing glucose and glutamine, we employed glycolytic rate assays, q-PCR, Western Blot, and proliferation assays in two cell lines. Our results demonstrated a significant increase in the expression of glucose transporter GLUT1 across all higher-concentration groups. Moreover, we observed a decrease in proliferation in the groups supplemented with O-GlcNAc. Additionally, the groups provided with higher levels of glutamine and 3-HB were also highly energetic with the highest levels of glycolysis. These findings emphasize the critical role that distinct nutrients play in modulating cellular metabolism. Furthermore, they offer valuable insights into potential therapeutic targets for GBM, presenting promising avenues for future treatment strategies.

Mentors: Dr. Beatriz I. Fernandez-Gil and Dr. Alfredo Quinones-Hinojosa

Exclusion of Internal Residues from an H4-16 based Peptide and Warhead Peptoid: PRMT1 Catalytic and Inhibitory Effects

Jordan Tucker and Dr. Bryan Knuckley

Methylation is a common form of protein post-translational modification (PTM). This modification can be installed by methyltransferases, which are a class of enzymes that transfer a methyl group from a methyl donor to their substrate. Protein arginine methyltransferases (PRMTs) constitute a mammalian family of nine enzymes that catalyze the post-translational methylation of arginine residues in certain peptide substrates. These substrates include the N-terminal tails of various histone proteins. PRMTs are overexpressed in several different cancers, and their activities contribute to oncogenesis and metastasis. High PRMT1 expression is implicated in causing breast, pancreatic, and colorectal cancers, among others. Therefore, inhibitors of PRMT1 have drawn much interest as potential cancer therapeutics. Previous work has revealed peptoids (poly-N-substituted glycines), a type of peptide mimetic, to be PRMT inhibitors. A histone H4-based peptoid inhibitor of PRMT1 was shown to induce autophagy and apoptosis of cancer cells. Optimization of this inhibitor requires further investigation of the relationship between inhibitor length and potency. A decreased molecular

weight could be advantageous for future drug delivery. Here we attempt to answer whether a shorter, condensed version of the previously tested H4-16 warhead peptoid will show similar, improved, or reduced potency as an inhibitor of PRMT1. Purification and kinetic assaying are currently in progress. The results of an IC50 assay will be used to inform the structure and synthesis of any new peptoid inhibitors of PRMT1. Depending on the potency of this particular inhibitor, future work may include treatment of human cancer cell lines.

Mentor: Dr. Bryan Knuckley

DNAJB1: Sowing the Seeds of Alzheimer's Disease

Cameron Young and Dr. Szymon Ciesielski

Alzheimer's Disease (AD) is the 6th leading cause of death in American adults and is forecast to cost the public over 1 trillion dollars by 2060. AD, along with other neurodegenerative diseases such as Parkinson's and Huntington's, is characterized by the presence of highly structured protein aggregate fibrils. Misfolded proteins lack proper biological function and interact with other proteins in a process known as aggregation. Numerous protein chaperones such as the DNAJB1/HSP70 system work together to assist in folding and restructuring protein aggregates. AD fibrils are comprised of two distinct misfolded proteins - Amyloid-β (Aβ) in extracellular 'plaques' and Tau in neuron-specific 'tangles' - of which Tau has been shown to be the more neurotoxic species. The DNAJB1/HSP70 chaperone machinery is known to disassemble Tau fibrils, leading to the formation of 'seeds' capable of spreading converting healthy Tau to its fibrillar form. However, the precise structural features allowing DNAJB1 special authority to recruit HSP70 for fibril disaggregation remain elusive. Herein we investigate the relevance of the J-Domain and GF rich region of DNAJB1 in AD propagation, regions our previous yeast experiments in vivo found to be crucial for B-class essential housekeeping function. Through in vitro expression of DNAJB1 homologue Sis1 we confirm a prokaryotic expression system capable of creating eukaryotic chaperone proteins. Additionally, we demonstrate that E50A, ED-AA, G68N, and F115A mutations do not trigger dismantling by the proteasome, suggesting homologous mutations can be made in human DNAJB1 without compromising its stability.

Mentor: Dr. Szymon Ciesielski

Lateral Migration Space for Coastal Wetlands in Northeast Florida: The Potential of Natural and Created Marsh Islands

Shannon Brew and Dr. Scott F. Jones

Sea-level rise from human-caused climate change is threatening to drown coastal wetlands. Efforts are underway to preserve natural migration corridors for wetlands and to restore impacted wetlands using approaches such as thin-layer placement of dredge material. Despite the pressing need for coastal wetland conservation and management, there is scant information quantifying how wetlands in northeast Florida may adapt to sea-level rise using both natural and created habitats. Here, we leverage

University of North Florida's unique access to natural and impacted coastal wetlands at the William C. Webb Coastal Research Station. We quantified soil and plant community composition across elevation gradients from natural marsh islands and impacted marsh islands created from dredge spoil deposits. Preliminary results suggest that both created spoil islands and natural islands provide lateral migration corridors for coastal wetlands, as long as habitats are occasionally flooded by tides. However, soil composition and carbon density may differ along the elevation gradient between created and natural features. These data will shed light on the potential for coastal wetlands in northeast Florida to adapt to short and long-term sea-level rise, and specifically inform the efficacy of thin layer placement and other marsh restoration practices in enhancing marsh resilience to climate impacts.

Mentor: Dr. Scott F. Jones