OURI Annual Summer Student Showcase
August 17th, 2023, 9am – 10:15am
Center for Teaching and Learning, General Classroom South (GS2)

Optimization of lead compounds targeting RNA CUG repeats causing myotonic dystrophy
Authors: Adam **Burjan** and Ilyas Yildirim
Faculty Mentor: *Ilyas Yildirim, Charles E. Schmidt College of Science*

Current screening methods in drug discovery have inherent limitations that we seek to overcome. Optimizing a lead compound using traditional experimental techniques is excessively expensive and time-consuming. Synthesizing a modified version of a lead compound can take anywhere from a week to a month depending on the complexity of the modification. Therefore, we have developed an in-silico drug discovery pipeline to optimize lead compounds and have applied it to a lead compound known as I27, previously identified for its targeting of RNA CUG repeats (1). A combinatorial approach was employed to generate approximately 2.8 million derivatives, which were subsequently filtered based on the pharmacokinetic and toxicological parameters we established. After conducting MM/PBSA calculations, we predicted the binding free energies of each theoretical derivative to RNA CUG repeats. Initial results reveal 2463 derivatives with lower binding free energies, suggesting that they are better binders compared to the lead compound.

"Y Marien por nombre": Una reconstrucción del ritual de las fadas de las mujeres moriscas.
Author: Florinda **Cano**
Faculty Mentor: *Yolanda Gamboa, Dorothy F. Schmidt College of Arts and Letters*

The crusade of *Reconquista* fought within the Iberian Peninsula resulted in the forced 'conversion' or expulsion of the peninsula's Muslim population. However, many within this group continued to practice their Islam covertly, including the crypto-Muslim women known as *Moriscas* living in the late medieval and early modern periods. This research studies *las fadas,* a Morisca post-birth ritual. Centering on the Moriscas as protagonists of this ritual process, the author constructs a comprehensive account of *las fadas* through ritual analysis and religious, cultural, and theoretical contextualization of historical sources. This analysis allows *las fadas* to be read in the manner of a 'text' which documents the Moriscas' cultural-religious agency and interior states. This ritual functioned simultaneously as a rite of passage, an initiation ceremony, a naming ritual, and a reclamatory ritual whose function was to counteract the forcible baptism of Morisco children by the Catholic Spanish state.

The Influence of Working Memory, Grit, and Personality on Resident In-Training Exam Performance
Author: Alexis **Crowder**
Faculty Mentor: *Michael DeDonno, College of Education*

A better understanding of factors associated with academic performance is of value to institutions of higher education. By understanding these factors, mentors and advisors can better prepare students to achieve desired academic goals. Working memory is one of the executive functions of the brain which processes short-term storage of information. The influence of working memory on academic performance is of interest to cognitive psychologists and human performance researchers. Grit which can be defined as one's passion and perseverance towards long term goals, is also a predictor of academic performance. The factors of personality as offered by the big-five factors of personality have also been aligned with academic performance. A question arises as to how these factors collectively influence medical residents' performance on in-training exams. Our goal is to offer a model to medical resident programs that will enhance the training of physicians.

The Effects of Targeted Memory Reactivation on the Consolidation of Episodic Memories (*)
Authors: Paige **DeForest**, Annie da Costa Souza, and Carmen Varela
Faculty Mentor: *Carmen Varela, Charles E. Schmidt College of Science*

Target memory reactivation (TMR) is an experimental technique researchers can use to alter memory consolidation. It has been shown to significantly improve memory consolidation, the process in which short-term memory is converted to long-term memory. Episodic memories are a type of memory that stores events and experiences. In this experiment, we use a small burst of white noise to try to stimulate the cortico-hippocampal-cortical loop that has been previously correlated with memory consolidation. This loop involves two oscillatory patterns of interest: slow oscillations (SOs) and sharp-wave ripples (SWRs). Using Long-Evans rats as a model, we examined the effects of targeting auditory stimulation to specific periods of SOs to examine its effects on long-term episodic memory consolidation. Our results could pave the way for a better understanding of the exact mechanisms of memory consolidation and serve as a technique to improve the symptoms of memory disorders.

Local field potentials as a predictor for optimal DBS contact for Essential Tremor and tremor-dominant Parkinson's disease
Authors: Shelby Sabourin, Maria P. Merlano **Gomez**, Ilknur Telkes, and Julie G. Pilitsis
Faculty Mentor: *Julie G. Pilitsis, Charles E. Schmidt College of Medicine*

The efficacy of deep brain stimulation (DBS) with segmented electrodes in the subthalamic nucleus (STN) for Parkinson's disease (PD) and ventral intermediate nucleus of the thalamus (VIM) for essential tremor (ET) was explored. While phase-amplitude coupling (PAC) between oscillations is well-studied, functional directional Local field potentials (LFPs) using PAC remain underexplored. Based on existing literature and previous studies, the objective was to investigate whether PAC can delineate basal ganglia sub-territories and guide stimulation direction for device programming. Participants with tremor-dominant PD or ET scheduled for DBS surgery were recruited. LFPs were recorded using segmented DBS leads during surgery, and time-frequency analysis with a Modulation Index (MI) approach was employed. Strong PAC was found in optimal stimulation contacts for ET, indicating potential programming guidance. Previous findings localized PAC to dorsal STN in PD subjects with dominant tremor, aligning with DBS contact selection. Notably, PAC patterns varied between VIM-LFP in ET and STN-LFP in PD, suggesting distinct modulation factors. Preliminary data revealed beta-HFO in LFP recordings from directional leads in ET, hinting at its utility for optimal contact selection and improved DBS programming efficiency. Further investigation with a larger cohort is planned.

Type 1 Receptor (IL-1R1) is Implicated in Emergence and Severity of Seizures in a Transgenic Mouse Model of Progressive, Generalized Tonic/Clonic Epilepsy.
Authors: Arthi **Khan**, Tashi Dillon, and Adrianna Tran
Faculty Mentor: *Ceylan Isgor, Charles E. Schmidt College of Medicine*

The inflammatory cytokine Interleukin-1 (IL-1) is recognized for its neuromodulatory actions within the central nervous system (CNS). Its increased expression has been observed in epilepsy patients, while its application has proconvulsive effects. This study aimed to explore the impact of inhibiting IL-1 signaling via its type 1 receptor (IL-1R1) on epileptogenesis and seizure severity in a transgenic mouse model of adult-onset spontaneous epilepsy. The study uses transgenic mice (TgBDNF) with overexpressed brain-derived neurotrophic factor (BDNF), which develop progressive generalized tonic/clonic seizures (GTCSs). By manipulating IL-1R1 expression, TgBDNF mice lacking IL-1R1 exhibited delayed GTCS onset and reduced postictal generalized EEG suppression (PGES) associated with loss of posture/consciousness, suggesting IL-

1R1's involvement in seizure severity progression. These findings propose IL-1R1 modulation as a potential therapeutic avenue to mitigate epileptogenesis and enhance seizure control in epilepsy patients. This research holds implications for managing seizure-related risks, including sudden unexpected death in epilepsy (SUDEP).

How Sure Are You? Investigating the Mechanisms of Confidence in Memory Decision-Making (*)
Author: Isabella **Klopukh**
Faculty Mentor: *Kevin Darby, Charles E. Schmidt College of Science*

How do we determine confidence in our memories? The purpose of this project is to better understand how confidence and memory processes unfold over time. Undergraduate adults (n = 34) studied pairs of images and were later tested on their memory to discriminate between intact and recombined image pairs. Participants rated their confidence either before, after, or at the same time as the memory decision. Preliminary analyses of the results suggest that (1) while the timing of confidence judgements did not significantly impact memory accuracy, it did impact the metacognitive accuracy of confidence judgements; (2) confidence was lower for recombined compared to intact memory pair decisions; and (3) reaction times were comparable for memory decisions made before or at the same time as confidence judgments. The implications of these results and plans to implement mechanistic models of confidence and memory decision-making will be discussed.

Mesoscale Organization of Aragonite Nanocrystals in Stony Coral Tissue Loss Disease Lesions. (*)
Authors: Diannelle **Lacambra** and Alejandra Coronel-Zegarra
Faculty Mentor: *Vivian Merk, Charles E. Schmidt College of Science*

This project investigates the impact of Stony Coral Tissue Loss Disease (SCTLD) on coral skeletal mineralization and crystal orientation at the micro- and nanoscale. Employing a multi-step approach using advanced imaging techniques such as Raman Spectroscopy, Scanning Electron Microscopy, Atomic Force Microscopy, and X-ray Crystallography, we analyze SCTLD-affected coral samples from the local species *Montastraea cavernosa* as well as healthy controls. Preliminary results reveal alterations in crystal lattice orientation, hierarchical organization, degree of calcium carbonate mineralization, and nano-scale crystal properties. Raman spectroscopic datasets reflect chemical changes in the organic matrix of diseased corals. Findings will help us draw parallels to other pathogenic demineralization processes such as osteoporosis and dental decay. This study broadens our comprehension of pathogenic demineralization across biological systems, contributing to coral reef preservation and advancing related medical research.

Developing better fluorescent cholesterol probes (*)
Author: Nicholas **McInchak**
Faculty Mentor: *Maciej J. Stawikowski, Charles E. Schmidt College of Science*

Cholesterol is an essential mammalian lipid. A deeper understanding of its subcellular localization and trafficking mechanisms will lead to a better understanding of cholesterol-related diseases, along with potential treatments. Using fluorescent cholesterol analogs has proven to be a promising method to elucidate information about cholesterol's subcellular localization and transport. Recently, our lab has developed a library of novel naphthalimide-based fluorescent cholesterol probes. Previously we developed fluorescent cholesterol probes making use of the 1,8-naphthalimide fluorophore substituted at the C4 position and utilized amino acids as linkers to cholesterol esterified at the hydroxyl group of cholesterol. To gain a better understanding of the structure-activity relationship of our probes, based on molecular simulation studies, we have developed,

synthesized, and characterized a set of four other than ester linker analogs. The new compounds were characterized by a set of physicochemical methods and, in the future, will be used in live cell imaging studies.

Investigation of melatonin's role in plant response to environmental stresses (*)
Author: Mia **Michnik** and Xing-Hai Zhang
Faculty Mentor: *Xing-Hai Zhang, Charles E. Schmidt College of Science*

Plant melatonin has been shown to play crucial functions stress responses and developmental processes. In this study, it was found that melatonin plays an important role in defense against environmental stressors in tobacco Nicotiana tabacum. Environmental stresses including radiation, sodium chloride and potassium chloride concentrations aggregated the CRISPR enabled melatonin-knockout plants as compared to the wild type control plants. Tobacco samples exposed to UV radiation exhibited visual signs of stunted growth and damage to plant tissue. We propose that due to the absence of melatonin biosynthesis, these knockout plants were unable to regulate the expression of various stress-response pathways. Lacking melatonin also leads to the impairment of photosynthetic process, such as biosynthesis of chlorophyll a/b. Under stress, these samples were subjected to manage stresses imposed upon them by spending more energy in either tissue generation or in root generation. The study provides insight into the role melatonin undertakes in alleviating damage caused by environmental stressors that plants face constantly during their life cycle of growth and development.

Deciphering the role of APP *O*-glycosylation in the pathogenesis of Alzheimer's disease (*)
Authors: Gustavo **Mundim**, Nancy Vela, YashoNandini Singh, Valentina Sopo, Maria Eduarda Vezzi, Ramya Ayyalasomayajula, Ivet Boneva, Dmitriy Minond, and Maré Cudic
Faculty Mentor: *Mare Cudic, Charles E. Schmidt College of Science*

Alzheimer's disease (AD) is one of the most common neurodegenerative disorders linked to aging. Evidence continues to emerge supporting the idea that deficiencies in amyloid-β precursor protein (APP) trafficking and clearance of Aβ peptides are the initiating events of AD pathogenic processes. Efforts to understand the role of APP proteolytic cleavage by α-, β-, and γ-secretases into the toxic amyloidogenic pathway have sparked interest in the role of MUC-type *O*glycosylation in the production and clearance of Aβ peptides. With this goal in mind, we have synthesized native and Swedish-mutated (Lys670Asn/Met671Leu) (glyco)peptides with *O*-GalNAc moiety on Tyr681, Ser667, and Thr663 to explore the role of glycosylation on conformation and secretase activity. The sequences incorporate the β-secretase (BACE-1) (M671~D672 or L671~D672) and α-secretase (ADAM-10) (K687~L688) cleavage sites, located near and within the Aβ40 domain, respectively. CD analysis was conducted in three solvent systems to evaluate the peptide environment and *O*-glycosylation-induced conformational changes.

Developing Materials for Direct Carbon Dioxide Capture from Ambient Air
Author: Laura **Rojas**
Faculty Mentor: *Masoud Jahandar Lashaki, College of Engineering and Computer Science*

Concentrations of carbon dioxide, a prominent anthropogenic greenhouse gas responsible for global warming and the current climate crisis, have experienced a rapid increase since the industrial revolution, primarily caused by human-generated emissions. Due to the excessive release of CO_2, heat becomes trapped in the atmosphere, resulting in increasing global temperatures and severe consequences like sea levels rise and extreme weather events. To address this problem, CO_2 capture technologies have gained significant attention as potential strategies for climate change mitigation. The primary objective of this project is the development

of materials suitable for direct carbon dioxide capture applications. To achieve this goal, 12 amine-grafted silica samples were synthesized, employing varying quantities of water and triamine. These samples were analyzed using thermogravimetric analysis (TGA) in order to obtain CO_2 uptake and amine efficiency. From this initial set, the four best samples exhibiting the highest CO_2 uptake were subjected to further analysis to study their CO_2 adsorption kinetics.

How Breaking Symmetry by Vision Influences the Stability of Coordination (*)
Authors: Carter **Sale,** Aliza Sloan, and J.A.S. Kelso
Faculty Mentors: *Aliza Sloan and Scott Kelso, Charles E. Schmidt College of Science*

Symmetry plays a crucial role in science and nature. In Coordination Dynamics, symmetry operations are used to categorize behavioral patterns and neural circuitry. For instance, in-phase and anti-phase rhythmic patterns between body parts are symmetric, but symmetry breaking occurs when the less stable anti-phase pattern spontaneously switches to in phase as movements speed up. Preliminary experiments reveal a remarkable discovery. Placing a mirror between participants' hands during antiphase coordination leads to earlier switching at a much lower movement rate. This is because the mirror image of one hand is seen as visually in-phase with the other, conflicting with participants' felt finger movements and intended goal. While stabilizing in-phase motion, vision destabilizes the naturally less stable anti-phase pattern. This symmetry breaking phenomenon proves robust against various manipulations like handedness, posture, and movement rate, indicating that visual perception exerts a powerful influence on the stability of coordinated movements.

Antecedents and Outcomes of Health Equity Orientation in U.S Hospitals
Authors: Emily **Seigelman** and Neeraj Puro
Faculty Mentor: *Neeraj Puro, College of Business*

One of the classic questions in publicness literature is whether public and private organizations operate differently, and what implications they have for organizational outcomes. This study seeks to identify mechanisms through which publicness influences organizational outcomes that have a public value. Focusing on US acute care hospitals, we use realized publicness framework and investigate how regulative, normative, and cultural-cognitive publicness affect the organizational strategies to improve health equity orientation. Furthermore, we examine the effect of health equity orientation on realized public value outcomes related to cost, quality, and access.

Osteobiography of Skeleton Found in Sicily
Author: August **Stone**
Faculty Mentor: *Dr. Meredith Ellis, Dorothy F. Schmidt College of Arts and Letters*

This project aims to learn about life in ancient Sicily through the skeletal remains of an adult male found in Palike de Mineo, Sicily. The remains were excavated from the field in Palike and a skeletal analysis was completed. The analysis aimed see evidence of determining factors in the individual's life which impacted the bones and can be seen thousands of years later. Analysis of the remains showed that the individual was an adult male between the ages of 50-59 based off of the auricular surface of the pelvis. The individual also showed extensive bone modification from active use, including osteophytes and wear on the joint surfaces, as well as degenerative joint disease likely linked to heavy labor. The cervical spine showed a likely fracture, causing the fusion of C3+C4 and C5+C6. Through further research the living conditions of individuals living in ancient Sicily can be more clearly understood.

Analyzing the Effects of Stress on the Gut Microbiome, Cognition, and Sexual Ornamentation of Songbirds (*)
Author: Joseph **Swaress**, Morgan Slevin, and Rindy Anderson
Faculty Mentor: *Rindy Anderson, Charles E. Schmidt College of Science*

Our project examines how stress impacts the gut microbiome, which may lead to health and fitness variation among animals of the same species. Specifically, we will test the hypothesis that stress negatively affects the gut microbiome, which consequently negatively affects a variety of physical and physiological traits in songbirds. Zebra finches are gregarious and social isolation is a moderately stressful stimulus for them. We used social isolation to induce mild but chronic stress in captive zebra finches and quantified gut microbiome qualities, beak ornamentation, cognitive performance, and body mass before and after treatments for both cohorts of isolated and socially housed birds. I will present preliminary results on the variations in beak ornamentation, cognitive performance, and body masses and discuss our predictions for the other aforementioned elements. These results are important as they may be applied to occasions when social species are isolated in wildlife hospitals or captive breeding programs.

The relationship between breastfeeding exclusivity and postpartum anxiety in women who gave birth during COVID-19
Author: Theodora **Tertus**
Faculty Mentor: *Christine Toledo, Christine E. Lynn College of Nursing*

Postpartum anxiety is one of the most common mental health disorders following the delivery of a baby and it can have major impacts on the breastfeeding experience of a mother, including whether or not she will exclusively breastfeed. Research has shown that exclusively breastfeeding is linked to lower risks of children becoming obese, developing asthma, and dying from sudden infant death syndrome (SIDS). The COVID-19 pandemic brought on a new set of challenges to postpartum mothers due to the increasing anxiety and isolation surrounding the illness. Postpartum anxiety, though common, has a lack of literature surrounding it, and the topic remained neglected during the global pandemic. This study examines the correlation between anxiety scores and breastfeeding exclusivity in postpartum women during COVID. We hypothesized that women with low anxiety scores were more likely to exclusively breastfeed compared to those who had high scores. Research about breastfeeding patterns in this demographic will give healthcare professionals deeper insight into how to best promote the safest practices for the health of the mother and her baby.

Exploring Nesting Behaviors of the Gopher Tortoise at the FAU Preserve
Author: Martha **Torres**
Faculty Mentor: *Evelyn Frazier, Charles E. Schmidt College of Science*

The gopher tortoise, also known as *Gopherus polyphemus,* is a keystone species that provides shelter and resources for over 350 species. In Florida, gopher tortoises are state designated as threatened. It has been observed in previous literature that gopher tortoises breed during the spring. Due to the subtropical climate at the Florida Atlantic University Preserve, gopher tortoises may be breeding all year round. The absence of literature regarding the natural breeding season is crucial to the conservation of this species. We studied the gopher tortoise population at the Florida Atlantic Preserve to determine if the breeding season in South Florida extends in that of previously reported literature. Cameras were placed in front of burrows that were identified

of housing female tortoises. Video was captured, and this data was then analyzed. The information obtained in this study will serve to improve the current Florida gopher tortoise conservation management plan.

Analysis of Carbon Capture and Storage Using Seawater-Based Waste Concrete Solvent in Lab-Scale Reactor
Authors: Sofia **Wiskoff** and Abhishek Ratanpara
Faculty Mentor: *Myeongsub (Mike) Kim, College of Engineering and Computer Science*

Anthropogenic CO2 emissions have reached a record of over 36.8Gt as of 2022, highly contributing to the severe effects of climate change. To mitigate global warming, carbon capture and storage technologies like amine scrubbing and geological storage of CO2 have been implemented. Despite their effectiveness, they present drawbacks of high energy demands, toxic CO2 solvents, and potential leaks. We propose an environmentally benign method of carbon capture and storage utilizing the abundant resources of seawater and waste concrete. Their performance in CO2 capture and storage in the form of carbonate minerals was tested on the microscale. For the large-scale implementation, a lab-scale model was developed with reactor-simulating conditions. The reaction of seawater and DI water with concrete-mixed counterparts was analyzed in different pressure and mixing conditions. While CO2 dissolution was obtained from continuous pH measurements, CO2 storage in the form of alkaline minerals was analyzed with X-ray powder diffraction.

Dynamics of compact infinite dimensional delay maps (*)
Author: Adam **Zaidan**
Faculty Mentor: *Jason Mireles-James, Charles E. Schmidt College of Science*

Proposal is to search and quantify period-doubling cascades in a class of compact infinite dimensional delay maps. Computers and rigorous numerics will be used to quantify and study the periodic orbits of these maps. Specifically, these orbits will be projected onto a finite dimensional linear splines space. Then they will be parameterized via a Fourier series and represented as vectors in a tensor product of the splines and Fourier spaces. To ensure accuracy, a Newton-Kantorivich method will be implemented on this tensor space. After successful implementation, we hope to utilize the tools of Feigenbaum renormalization and derive Feigenbaum-like constants pertaining to the infinite dimensional class. We aim to replicate behavior similar to that of the logistic map in the infinite dimensional setting.

GLP-1 Genetic Engineering and Insertion into the Chloroplast Genome of Nicotiana Tabacum for Treatment of Type 2 Diabetes
Authors: Alysa **Suissa** and Marcos **Klingler** (UG Research Grant awardees)
Faculty Mentor: *Dr. Xing-Hai Zhang, Charles E. Schmidt College of Science*

Glucagon-like peptide-1 (GLP-1) is a peptide hormone produced by animals/humans following nutritional intake, primarily functioning in stimulating insulin biosynthesis and secretion. GLP-1 lowers glucose through inhibition of glucagon secretion, which is very desirable for type 2 diabetes patients. However, current GLP-1 analogs, such as Ozempic, are costly and limited by patent restrictions. Using plants as a biofactory for pharmaceutical production presents a platform with better economic and environmental outcomes. By introducing the human GLP-1 gene into the chloroplast genome of *Nicotiana tabacum* plants through particle bombardment, a low-cost and scalable production of GLP-1 can be achieved. GLP-1-producing chloroplasts offer protection of antigens through bioencapsulation, oral delivery potential, and a reduced need for costly cold storage. Type 2 diabetes is the costliest chronic condition in the U.S, making insulin increasingly

unaffordable for many. By making GLP-1 more accessible and affordable, this plant-based treatment could be an insulin alternative treatment for type 2 diabetes, potentially transforming diabetes care in the future.

(*): *SURF award supported by the Charles E. Schmidt College of Science.*

Not Presenting:

Faculty Mentor: Andia Chaves Fonnegra, Harriet L. Wilkes Honors College
Student Fellow: Camila Rimoldi Ibanez
Project: Sound Emission and Perception in Corals

Faculty Mentor: Robert Stackman, Jr, Charles E. Schmidt College of Science
Student Fellow: Marli Knox
Project: MPP2 as a target for improving long-term memory in aging and Alzheimer's disease (*)