Welcome to the

GRADUATE + POSTDOCTORAL

RESEARCH SYMPOSIUM

UNIVERSITY OF MIAMI

GRADUATE + POSTDOCTORAL

RESEARCH SYMPOSIUM

EVENT OVERVIEW

12:00 - 1:00 P.M.	Registration + Lunch *Third Floor Mezzanine*
1:00 - 2:00 P.M.	Keynote Address: Dr. Sara M. St.George *Ballroom East*
2:00 - 3:30 P.M.	Poster Session *Ballroom Center*
3:30 - 5:00 P.M.	Oral Presentation Sessions *Ballroom West* *Ballroom East* *Activities Room South* *Activities Room North* *Senate Room* *Vista Room* *Iron Arrow Room*
5:00 - 6:00 P.M.	TED-like Talk Session *Ballroom East*
6:00 - 6:30 P.M.	Awards Ceremony + Reception *Ballrooms East + Third Floor Mezzanine*

UNIVERSITY OF MIAMI

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RESEARCH SYMPOSIUM

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UNIVERSITY OF MIAMI

Keynote Speaker
Dr. Sara M. St. George

Dr. Sara M. St. George will provide the keynote address titled: “Leveraging Technology to Build a Legacy of Health in Hispanic Families.”

Dr. St. George is a behavioral scientist and licensed psychologist trained in clinical-community psychology, health psychology, behavioral medicine, prevention science, and public health. She directs the Health eLifestyles Lab, which is dedicated to promoting health, preventing chronic disease, and fostering positive relationships among Hispanic/Latino families by developing, evaluating, and disseminating evidence-based multigenerational digital lifestyle interventions. Aside from research, Dr. St. George contributes to the University’s mission of training the next generation of prevention scientists through the teaching and mentoring of students. She directs the Masters of Prevention Science and Community Health program, teaches two courses in the Department of Public Health Sciences (Qualitative Methods, Obesity and Public Health), and mentors undergraduate and graduate students.

Poster Presenters

Nicolle Acuna

Master's Student in Public Health

Stakeholder Perceptions on PCB Health Risks and Awareness Interventions in Guánica, Puerto Rico

Guánica, Puerto Rico, is home to the second-highest levels of polychlorinated biphenyls (PCBs) ever recorded globally. This contamination poses serious health risks, including cancer and neurological disorders, mainly through eating contaminated fish and exposure to polluted sediments. Despite community outreach efforts, including school campaigns, many residents remain unaware of health risks associated with PCBs. This study explored how community stakeholders, specifically residents and fishermen, perceive the health risks associated with PCB contamination. Three focus groups were conducted: one with eight fishermen, one with eight residents, and one with ten residents. Sessions lasted 60 minutes and were recorded on Zoom before being transcribed from Spanish to English. Thematic analysis was performed using NVivo to identify shared concerns, knowledge gaps, and barriers to behavioral changes. Participants expressed widespread fear of cancer and frustration over the lack of visible improvements in their community. Fishermen often prioritized economic concerns, while residents voiced concerns about health risks. Across all focus groups, there was a mistrust of government agencies and a lack of access to reliable information. This study highlights gaps in awareness and the need for projects that address both health and economic concerns. Public health interventions should focus on culturally appropriate education and community engagement to build trust and ensure widespread understanding of PCB risks. These are essential to reduce PCB exposure and empower Guánica stakeholders to advocate for meaningful environmental and health changes within their community.

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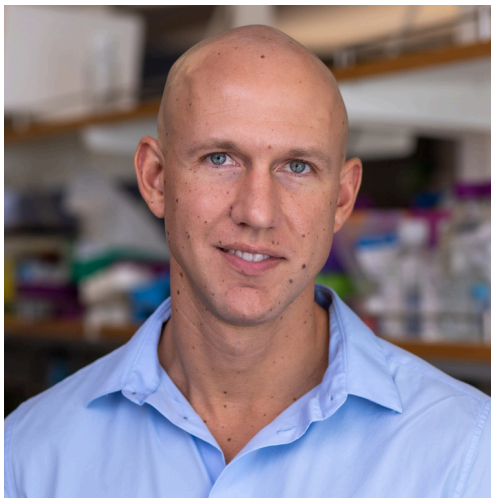

Andrew Adams

Ph.D. Student in Cancer Biology

MDSC-Derived Transmembrane TNF is a Central Regulator of Stromal Inflammation and T-Cell Dysfunction in Pancreatic Cancer

Pancreatic ductal adenocarcinoma (PDAC) is a lethal malignancy characterized by stromal inflammation and T-cell dysfunction. Neutrophilic/granulocytic myeloid-derived suppressor cells (gMDSC) infiltrate early in PDAC development and contribute to a highly immunosuppressive tumor microenvironment (TME). We have previously shown that gMDSC-derived tumor necrosis factor (TNF) is a novel regulator of therapeutic resistance in the PDAC TME, and pharmacological targeting of transmembrane (tm)TNF-TNFR2 signaling can reprogram the TME to improve chemosensitivity. Here we dissect the precise functional consequences of gMDSC-derived tmTnf on cancer-associated fibroblast (CAF) skewness and CD8+ T-cell function. To assess global effects of tmTNF in orthotopically and subcutaneously injected KPC models of PDAC, we compared T-cell/CAF phenotypes in littermate vs transgenic mice overexpressing exclusively tmTnf (tmTnfOE) in which site-directed mutagenesis of Tnf cleavage sites renders tmTnf uncleavable, resulting in systemically overexpressed tmTnf signaling. To investigate effects of gMDSC-derived tmTnf in vitro, J774M cells that phenocopy gMDSCs were engineered to overexpress exclusively tmTnf (J-tmTnfOE) or wild-type Tnf (J-TnfWT) following CRISPR/cas9 silencing of endogenous Tnf (J-TnfKO). These cells were co-cultured with dual reporter CAFs (Il6GFP=inflammatory iCAF; Acta2dsRed=myofibroblastic myCAF) and CD8+ T-cells followed by cell trace violet proliferation assay, flow cytometry phenotyping, and IFNγ ELISA. Compared to littermate controls, flank and orthotopic KPC tumor-bearing tmTnfOE mice displayed accelerated tumor kinetics and volume, respectively, as well as striking increase in stromal fibrosis and collagen deposition (Trichrome/Sirius Red). Flow cytometric phenotyping revealed increased proportion of iCAF (PDPN+Ly6C+) vs myCAF (PDPN+Ly6C-) in tmTNFOE vs littermate mice. CD8+ T-cell phenotyping revealed higher proportions of CD39+Ly108- dysfunctional and KLRG1+CD127- short-lived effector T-cells (SLEC), with concurrent reduction in CD127+KLRG1- memory progenitor effector T-cells (MPEC), in tmTnfOE compared with littermate tumors. Using confocal microscopy in vitro, we confirmed that transmembrane sequestration of Tnf was more pronounced in J-tmTNFOE vs J-TnfWT, with complete loss of subcellular Tnf in J-TnfKO cells. To define the precise contribution of gMDSC-tmTNF on CAF/T-cell skewness, co-culture of J-tmTnfOE with dual-reporter CAFs resulted in striking induction in CAF-Il6GFP compared with J-TnfKO-CAF co-cultures. Moreover, J-tmTnfOE significantly restrained CD8+ T-cell proliferation, MPEC differentiation, and IFN-γ release relative to J-TnfKO. gMDSC-tmTnf is a central regulator of inflammatory CAF polarization and CD8+ T-cell dysfunction in PDAC. Selective pharmacologic or genetic strategies to disrupt gMDSC-tmTNF derived signaling in the TME may improve chemoimmunotherapy sensitivity in PDAC.

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Gustavo Aguilar

Postdoctoral Associate

Experimental Quantification of Hurricane-Induced Loads - Winds, Waves and Storm Surge - On a Residential Building Model

Tropical storms and hurricanes have caused significant damage to coastal structures, as evidenced by the devastation wrought by Hurricanes Helene and Milton in Florida. While wind and flood loads are considered in construction standards, the combined effects of wind, storm surge, and waves are not fully understood and are often modeled using a simplified load combination. To address this knowledge gap, this study investigates the Alfred C. Glassell, Jr. SUSTAIN Laboratory, where scaled physical testing is conducted to quantify hurricane-induced wind, wave, and surge loads on a residential building model. By analyzing the mean wind speed (MWS) profile and wave height (HS) development in the flume, an appropriate scale for the model was determined. The study examines the combined action of wind and waves under various surge conditions to evaluate and refine existing load models on residential structures. This research aims to provide valuable insights into scaling combined wind, wave, and surge forces, ultimately enhancing the resistance and resilience of coastal structures to tropical storms and hurricanes.

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Abelardo Aguilar Camara

Ph.D. Student in Biology

New Uncultured Viral Entities Redraw the Origin of Viruses and Cellular Compartments

The HK97-fold is a conserved three-dimensional protein structure specialized in forming protein shells intimately related to the origin of cellular life. It is the primary building block of capsids that contain the genome of Duplodnaviria, a realm of viruses found in all domains of life. It also forms encapsulins, compartments that confine biochemical reactions in prokaryotes. Prior studies hypothesized that HK97-fold proteins share a common ancestor and encapsulins derived from HK97-fold viruses. However, HK97-fold viral capsids are larger and more complex than encapsulins. We solved this paradox by discovering smaller and simpler HK97-fold viral entities in metagenomes across ecosystems. Well-defined groups within these simpler HK97-fold viral entities displayed molecular similarities with encapsulins. The extended structural phylogenetic analysis of HK97-fold entities revealed a bidirectional evolutionary relationship between encapsulins and HK97-fold viral lineages. The structural and molecular parallels between encapsulins and the immature state of viral capsids (procapsid) suggest that procapsids are akin to the common HK97-fold protein shell ancestor and may still facilitate transitions between viruses and encapsulins. If procapsids retain any ability to carry biochemical reactions, the role of viral capsids should be revised, and, given the abundance of viral-like particles, even a small fraction of biochemically active procapsids may impact biogeochemical processes at a planetary scale.

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Arya Ajith

Ph.D. Student in Chemistry

Metformin-Based Carbon Dots: Revolutionizing Gemcitabine Delivery for Pancreatic Ductal Adeocarcinoma Therapy

Pancreatic Ductal Adenocarcinoma (PDAC) is one of the most lethal malignancies with occurrences increasing at an alarming rate and survival not improved substantially during the past three decades. Gemcitabine (GEM) has been the established first-line therapy for PDAC treatment but has a short half-life due to rapid metabolism and clearance, requiring continuous dosing, which causes severe side effects like renal and hematological toxicities.

This study proposes the utilization of carbon dots derived from metformin (MetCDs) as a nanocarrier for GEM in PDAC therapy. Our inspiration stems from metformin's ability to overcome the tumor's desmoplastic stroma and the selective uptake of MetCDs by cancer cells, due to their structural similarity to glutamine. Positively charged MetCDs enhance interaction with cell membranes, allowing efficient GEM delivery through endocytosis. Their fluorescence also enables real-time tracking of drug delivery.

The MetCD-GEM conjugate is synthesized using carbodiimide coupling, allowing controlled drug release in the acidic tumor environment. Since GEM in its conjugated form cannot be tracked using UV-Vis or fluorescence spectroscopy, a novel approach leveraging Circular Dichroism spectroscopy is employed for drug quantification.

In vitro cytotoxicity studies reveal that the conjugate significantly enhances GEM's toxicity toward cancer cells while reducing harm to normal cells. This research offers a potential breakthrough in PDAC treatment, highlighting the promise of carbon-dot-based drug delivery systems.

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Talia Arcieri

Postdoctoral Associate

ECMO as Salvage Therapy in Burn-Related ARDS

Introduction: Extracorporeal membrane oxygenation (ECMO) is an effective therapy for severe acute respiratory distress syndrome (ARDS), but its use in burn patients is uniquely challenging due to bleeding risk associated with frequent operations. We aimed to characterize a case series of burn patients with the hypothesis that ECMO use is feasible in appropriately selected patients.
Methods: All burn patients treated with ECMO from November 2021 to August 2024 at one burn center were retrospectively reviewed. Revised-Baux scores (r-BS) and Respiratory ECMO Survival Prediction (RESP) classes were calculated.
Results: Six patients (mean burn total body surface area (TBSA) 52.1%, mean r-BS 102.8, RESP class range II to V) received veno-venous ECMO. Three patients had non-surgical bleeding complications (Patients 1, 3, 4; Table 1). Three patients (Patients 3, 4, 5) had operations while on ECMO. Patient 3 underwent bedside burn excision and tracheostomy with anticoagulation (AC) held 3 hours pre-operatively (pre-op), and required 2 units (U) of blood products in the 24-hour post-operative period. Patient 4 underwent two bedside burn excisions with AC held 1 hour pre-op, and OR tracheostomy with AC held 13 hours pre-op, and required a sum of 4U of blood products in the 24 hours following all operations. Patient 5 did not receive AC due to coagulopathy, but had two bedside burn excisions and one OR burn excision with lower extremity amputation, requiring a sum of 23U of blood products in the 24 hours following all operations. Three patients had AC held at any time with no thrombotic complications. Four patients survived (three discharged to acute inpatient rehabilitation, one home). Two patients died of severe sepsis.
Conclusions: ECMO is a feasible salvage therapy in appropriately selected burn patients with ARDS. Bleeding is a concern, but this case series suggests that operative intervention and AC can be safe with close monitoring. Further studies in larger patient populations are needed to identify which phenotypes benefit most from ECMO.

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Afshin Asadi

Ph.D. Student in Industrial Engineering

Uncovering Latent Patterns for Predictive Energy Management in Industrial Systems using Transfer Learning

Identifying factors that influence the consumption behavior of industrial equipment, such as compressors and chillers, is a significant challenge that requires a comprehensive understanding of both the dynamic behavior of the equipment and hidden variables like efficiency and degradation status. Leveraging the capabilities of Variational Recurrent Neural Networks (VRNNs), our model uncovers latent patterns, contributing to a more accurate estimation of power consumption. By feeding real-time measurements into a Seq2Seq framework, enhanced with the power of Long Short-Term Memory (LSTM) networks, the model dynamically predicts power consumption over time. This VRNN architecture effectively encodes sequences into a compact representation and then decodes them to forecast future states, offering a comprehensive view of equipment performance.
Our approach stands out by combining the advanced capabilities of VRNNs with the sequential processing strengths of the Seq2Seq architecture, while incorporating transfer learning to further generalize predictions and reduce the amount of data needed for accurate forecasting. This implementation not only enhances model adaptability across different datasets but also improves prediction accuracy, even with limited data, by transferring learned features from similar tasks. This integrated framework captures immediate operational data while identifying underlying trends and patterns, providing insights into proactive energy management. As a result, the model becomes a robust tool that goes beyond traditional monitoring, offering predictive analytics and optimization strategies for complex industrial environments.

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Ph.D. Student in Biomedical Engineering

Human Marrow-Isolated Adult Multilineage Inducible (MIAMI) Cell Derived Extracellular Vesicles Possess Immunomodulatory and Anabolic miRNAs Cargo that Modulate Pro-Inflammatory Macrophage Polarization

INTRODUCTION: Recent studies highlight the role of proinflammatory pathways in the synovium and infrapatellar fat pad (IFP) in osteoarthritis (OA). Mesenchymal stem/stromal cell-derived extracellular vesicles (MSC-EVs) exhibit anti-inflammatory, anti-fibrotic, and regenerative properties. This study examines EVs from Marrow-Isolated Adult Multilineage Inducible cells (MIA-EVs). MIAMI cells exhibit a distinct ability to release anti-inflammatory cytokines, enhance cell survival, and recruit progenitor cells. Our previous work has demonstrated that MSC-EVs contain miRNAs and proteins with strong immunomodulatory and anabolic effects favoring joint homeostasis in vivo. Herein, we investigate MIA-EVs' miRNA cargo and its role in modulating macrophage polarization from M1 pro-inflammatory to M2 anti-inflammatory phenotypes, hypothesizing that MIA-EVs carry stronger immunomodulatory and anabolic properties than MSC-EVs.
METHODS: MIAMI cells were cultured under low oxygen tension, specific substrata, and growth factors to mimic physiological conditions. MIAMI cell gene profiling was done using a 90-gene qPCR array from STEMCELL Technologies, and miRNA profiling of MIA-EVs used a 166-miRNA qPCR array from GeneCopoeia. Interactomes were generated via miRNet. THP-1 monocytes were differentiated into macrophages with PMA/IO and polarized to M1 using PromoCell's generation medium. For functional assessment, PMA/IO-stimulated THP-1 macrophages were incubated with MIA-EVs for 2 days, followed by qPCR array analysis for macrophage polarization from ScienCell.
RESULTS: MIAMI cells expressed high levels of TERT, PROM1, and COL1A1, with low expression in adipogenic and chondrogenic genes (LEPR, ACAN, SOX9). These conditions favor upregulation of stemness and osteogenic pathways. Nineteen miRNAs were detected in MIA-EVs, with high levels of hsa-miR-4466, hsa-miR-7975, and hsa-miR-4454. Pathway analysis revealed roles in immune response, BCR signaling, Toll-like receptor cascades, and Wnt, MAPK, and mTOR signaling. MIA-EVs promoted M2 macrophage polarization, suggesting a therapeutic approach for inflammatory conditions like OA.
SUMMARY/CONCLUSIONS: Our study indicates that MIAMI cells significantly express and enhance genes related to stemness and osteogenesis. The miRNA profile of MIA-EVs, including the high levels of hsa-miR-4466, hsa-miR-7975, and hsa-miR-4454, suggests their potential involvement in key immunomodulatory and anabolic pathways. These findings indicate that MIA-EVs can influence both immune and anti-inflammatory responses, highlighting their potential use in therapeutic applications.
ACKNOWLEDGEMENTS: Study supported by NIH/NIAMS grant number 5R21AR080388-02, by the University of Miami Provost's Research Award, and Sylvester Comprehensive Cancer Center.

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Ethan Carmichael

Postdoctoral Associate

E-Selectin/AAV2/2 Gene Therapy Upregulates HIF-1a Expression in Ischemic Hindlimb Mouse Model

Chronic limb-threatening ischemia (CLTI) is the most severe form of peripheral arterial disease (PAD) affecting 25 million people worldwide. CLTI carries a risk of major amputation of 22% at one year in the U.S. While endovascular or surgical revascularization is the gold standard treatment for CLTI, approximately 20% of patients with CLTI are not candidates for these invasive interventions. Therefore, these patients with “no-option CLTI” require improved medical therapies to increase neovascularization and distal arterial perfusion. Previously, we have shown that E-selectin/AAV2/2 gene therapy administered intramuscularly increased neovascularization and angiogenesis, preserved myofiber integrity, and improved functional outcomes in a murine ischemic hindlimb model. PCR array at post-operative day 21 (POD21) counterintuitively demonstrated increased mRNA expression of hypoxia inducible factor-1 (HIF-1α) in mice treated with E-selectin/AAV2/2 gene therapy versus controls. HIF-1α is a heterodimeric transcription factor upregulated in response to acute hypoxia and is responsible for upregulation of pro-angiogenic and cell survival responses. In this study, we aim to determine how E-selectin/AAV2/2 increases HIF-1α expression in the presence of improved arterial perfusion and oxygen tension relative to control mice. Here we demonstrate via immunofluorescent (IF) tissue staining that HIF-1α protein expression, but not HIF-2α, is significantly increased in E-selectin/AAV2/2-treated mice at POD21, specifically in endothelial cells (ECs) and not in inflammatory cells.Our ongoing experiments seek to investigate whether E-selectin/AAV2/2 increases HIF-1α protein expression in a hypoxia-independent manner using cultured ECs transfected with E-selectin/AAV2/2 in vitro. We will determine if E-selectin overexpression in ECs can upregulate HIF-1α expression directly or indirectly. Future experiments will seek to understand the significance of upregulated HIF-1α in the ischemic tissues with improved arterial perfusion and oxygen tension.

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Jessica Delamater

Postdoctoral Associate

PICC Lines Increase Risk of Venous Thromboembolism in Trauma Patients

Objectives: Venous thromboembolism (VTE) is a leading cause of morbidity in critically injured patients. We aimed to determine if the presence of a peripherally inserted central catheter (PICC) is a risk factor for VTE in trauma intensive care unit (TICU) patients.
Methods: This was a retrospective review at a single level 1 trauma center from October 2021 to November 2023. All TICU patients were screened, and those at high-risk for having a VTE, defined as risk assessment profile (RAP) >10 on admission, were included. Patients with VTE on admission were excluded. Logistic regression was performed to evaluate effect of PICC line on VTE risk.
Results: Out of 1,362 TICU patients screened, 499 (137 PICC and 362 No PICC) met inclusion criteria. The rates of VTE (33.6% vs 10.8%), lower extremity DVT (16.1% vs 7.7%), upper extremity DVT (13.9% vs 2.2%), and pulmonary embolism (13.9% vs 2.2%) differed by 2-5-fold (all $p<0.01$) for patients with vs without PICCs. The groups differed in age (49 vs 58 years), gender (80% vs 64% male), injury mechanism (78% blunt vs 92%), length of stay (35 vs 11 days), injury severity score (27 vs 21), RAP score (15 vs 13), and days to thromboprophylaxis (TPX) initiation (2.4 vs 1.6 days) (all $p<0.001$). We controlled for the variables in Table 1 in the regression to attempt to isolate the effect of PICC line presence. After controlling for these confounders with logistic regression, PICC lines were independently associated with VTE with an odds ratio of 3.14 [95% CI 1.810-5.457]. After excluding patients with an upper extremity DVT, PICCs were still associated with VTE [OR 2.167, 95% CI 1.136-4.135], suggesting the prothrombotic effects of PICCs may not be localized to the catheter and may cause a systemic coagulopathy.
Conclusion: Risk stratified TICU patients who receive a PICC have an increased risk of VTE compared to those without PICCs. Future prospective work should be done to verify these findings and determine the mechanism of this effect.

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Claudia Deveaux

Ph.D. Student in Civil and Architectural Engineering

Harnessing the Power of Mangroves: Evaluating Wave Attenuation and Community-Driven Restoration

Nature-based solutions (NbS) offer a sustainable solution to coastal protection. As climate change intensifies, coastal communities become more vulnerable to erosion, rising sea levels, and storm surges. This highlights the need for innovative, eco-friendly approaches to shoreline defense. Mangroves are particularly effective at dissipating wave energy, reducing erosion, and providing ecological benefits. This study investigates the wave attenuation properties of the Rhizophora mangle (red mangroves) by analyzing models that simulate different growth stages.

Through scaled laboratory testing and water-level measurements before and after the mangrove models, we evaluate how mangroves at various growth stages respond to regular wave conditions and simulated storm surges. The research will assess key structural characteristics, including root height, tree spatial arrangement and diameter, to determine their influence on wave energy reduction over time. As they age, their spacing and arrangement becomes more complex, forming an expanded root network that enhances wave dissipation by increasing drag and reducing water flow. Focusing on structural attributes and their evolution, it addresses a crucial question for NbS: at what point do mangrove ecosystems achieve the desired level of performance in shoreline defense?

Additionally, this study includes ongoing co-design workshops with local communities to integrate local knowledge and restoration practices. These workshops foster dialogue between researchers and stakeholders, ensuring that scientific findings are grounded in the local context and address community needs. By actively involving community members during the research phase, the study enhances the relevance and applicability of mangrove-based solutions while building trust and ownership among stakeholders. This collaborative process ensures that restoration strategies are not only ecologically effective but also socially and culturally appropriate.

The findings highlight mangroves as a dynamic, adaptable solution that can be used to complement and, in some cases, replace conventional coastal defenses. Unlike static solutions, mangroves grow and evolve, enhancing their protective functions while providing additional benefits like carbon sequestration and biodiversity support. Moreover, integrating scientific insights with ongoing community collaboration highlights the importance of inclusive, locally driven approaches. These efforts demonstrate how the mangroves can promote coastal resilience, empower vulnerable communities, and support sustainable development in an era of climate uncertainty.

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Maria Di Bello

Postdoctoral Associate

Heart Rate Variability Moderates the Relationship between Monocyte-to-Lymphocyte Ratio and Liver Fibrosis in Women Living With and At Risk for HIV

Background. Liver disease is a major cause of morbidity and mortality among people living with HIV (PWH), with advancing age being the greatest predictor. The autonomic nervous system plays a crucial role in moderating systemic disease processes, including those affecting the liver. Autonomic derangement, as indexed by heart rate variability (HRV), has greater incidence in PWH and is a known risk factor for metabolic dysfunction-associated fatty liver disease. Since chronic monocyte activation significantly mediates hepatic inflammatory processes in PWH and higher HRV has been associated with lower monocyte activation in women with and without HIV, it suggests that HRV may moderate the age-related risk of liver fibrosis.

Aims. This study examined two HRV metrics to determine their moderating effects on the direct and indirect effect of age on metabolic dysfunction-associated fatty liver disease, assessed by FIB-4 index, through the values of the monocyte to lymphocyte ratio (MLR).

Methods. Sociodemographic, FIB-4 and MLR data were analyzed in a sample of 1,269 female PWH (n=1031) and without HIV (n=235) from the WIHS Cohort. HRV measures were derived from 10 s electrocardiogram recording.

Results. Multiple regression analysis showed a significant indirect effect of age on FIB-4 through MLR at low levels (β = .003, SE = .001, 95%-CI [.0006 .0063]) and at the mean of HRV (β = .0008, SE = .0003, 95%-CI [.0001 .0020]). After accounting for relevant risk factors,the conditional effects remained significant.

Conclusions. The findings suggest that higher HRV mitigates the age-related impact of expanded monocyte-to-lymphocyte ratio on liver fibrosis risk in women living with and without HIV, highlighting the potential therapeutic value of methods to boost vagal-mediated HRV as a treatment approach for end-organ targets.

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Anna Golikova

Ph.D. Student in Biology

New Bacteriophage Isolates Infecting Coral Commensals and Opportunistic Pathogens

In the coral holobiont, disruption of interactions between mutually dependent organisms may result in dysbiosis and declines in health. Bacteria of the genus Vibrio are abundant opportunistic pathogens known to be involved in the emergence of several coral diseases including bleaching as well as diseases of other marine organisms. Bacteriophages (viruses of bacteria) can directly regulate microbial communities via lysis contributing to coral's defense against pathogenic bacteria. Conversely, upon infection phages can introduce novel genes to their hosts converting coral-associated bacteria into pathogens in the process called lysogenic conversion. In this project, I aim to investigate how marine bacteriophages can modulate bacterial-coral interactions and affect coral holobiont. I developed a spectrophotometer-based method to screen 83 bacteria isolated from healthy mucus and tissues of two important reef-building stony corals, Pseudodiploria strigosa and Montastraea cavernosa, for susceptibility to infection by viruses concentrated from seawater. Using plaque assays and a double-layer agar method I isolated five putative phages infecting Vibrio coralliilyticus, Vibrio owensii, or Vibrio tetraodonis, which have certain strains identified as common marine pathogens. Upon sequencing DNA extracted separately from bacteria and their associated viruses, I am conducting genomic analyses on isolated host-phage pairs. Preliminary annotations of assembled draft genomes of Vibrio spp. identified metabolic genes from pathways involved in pathogenicity and drug resistance highlighting genomic potential of these bacteria to negatively affect coral welfare. Subsequent analyses of genes encoded by viruses integrated in bacterial genomes (prophages) as well as by viruses isolated from seawater will uncover viral potential to introduce metabolic changes in the coral holobiont. The study proposed here facilitates a better understanding of bacteriophage contributions to tripartite phage-bacteria-coral interactions through the genomic investigation of seawater bacteriophages infecting coral microbiome.

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Maydelis Gutierrez

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Humanities Instructors' Perceptions and Attitudes on Integrating Virtual Reality (VR) in Higher Education

Ogbonna (2021) highlights the lack of empirical evidence and research to help educators choose effective methods for integrating virtual reality (VR) into classrooms, particularly in the humanities. Moreover, Beams and Crofton-Sleigh (2024) state in the summary of their book that extended reality (XR)[1], which encompasses VR, has been widely used and studied in STEM education; however, its application in the arts and humanities has received significantly less attention.

At Utah Valley University (UVU), the Smith College of Engineering & Technology (CET) created, in 2021, a Virtual Reality (VR) Experience, allowing UVU Digital Media instructors to develop an in-class experience using VR equipment (Hendrick et al., 2022). But nothing has been done in the Humanities field at UVU. Thus, the study "Humanities Instructors' Perceptions and Attitudes on Integrating Virtual Reality (VR) in Higher Education" examined the perceptions, attitudes, and readiness of UVU humanities instructors to incorporate VR into their teaching. It also proposed a professional development (PD) program inspired by UVU's AI Academy to train instructors in VR-based teaching.

OBJECTIVES

The study answered the following questions:

1.What are the humanities instructors' perceptions of VR in education?

2.What are the attitudes/techniques of instructors already using VR in the classroom?

3.What is the overall readiness of the humanities faculty to integrate VR into their educational practices?

Furthermore, it provided valuable insights and practical solutions for incorporating VR into humanities education at UVU.

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Taylor Henry

Ph.D. Student in Molecular and Cellular Pharmacology

Novel Synthetic Ligands Reveal the Role of the Ectopically Expressed Olfactory GPCR OR51E1 in Prostate Cancer Progression

G-protein coupled receptors (GPCRs) are a large and diverse family of membrane receptors that regulate essential physiological processes. In cancer, GPCR signaling plays a pivotal role in driving critical tumorigenic processes such as cell proliferation, apoptosis resistance, angiogenesis, and metastasis. GPCRs are highly druggable, and as such around 35% of FDA-approved drugs target these receptors. However, there are only few approved therapies targeting GPCRs for cancer treatment. Nearly two decades ago, a significant correlation emerged between the expression of olfactory receptors (ORs) and poor clinical outcomes in prostate cancer. The OR family consists of nearly 400 genes, representing about half of all GPCRs. However, their functions remain underexplored due to limited research tools, such as specific antibodies or effective agonists and antagonists. Among these, OR51E1 is particularly notable: it is highly conserved across mammals (95% homology in humans), has been deorphanized, and is upregulated in approximately 60% of malignant prostate cancers.

To investigate OR51E1's role in prostate cancer, we developed a novel high-throughput screening (HTS) platform using the LNCaP human prostate cancer cell line. We identified small molecules that activate OR51E1 and enhance cAMP release. These compounds demonstrated greater potency and selectivity than the endogenous ligand, butyrate. Functional assays, including colony formation and migration studies, showed that OR51E1 activation significantly enhanced LNCaP colony formation in soft agar, a hallmark of tumorigenic potential. This effect was blocked by OR51E1 knockdown or our novel antagonist, confirming its role in promoting cancer aggressiveness. Additionally, we linked elevated levels of isocaproic acid, a byproduct of testosterone synthesis and OR51E1 agonist, to prostate cancer progression.

In summary, while previous studies established a correlation between OR51E1 expression and cancer prognosis, our studies provide a direct link between OR51E1 activity and prostate cancer cell behavior. This work lays a foundation for future GPCR-targeted therapeutic interventions in prostate cancer.

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Opeyemi Isaac

Ph.D. Student in Chemistry

Investigating Heme and Disulfide-Mediated Dimerization of PGRMC1 in a Biomimetic Membrane Model

Progesterone Receptor Membrane Component 1 (PGRMC1) is a heme-binding protein that is expressed in heme-rich organs like the breast, liver, and ovaries, indicating its involvement in various biological functions, drug metabolism, cytochrome P450 activity, and cancer cell proliferation. Previous reports have shown that heme-dependent PGRMC1 dimers interact with cytochrome P450 enzymes (CYPs) and epidermal growth factor receptors (EGFRs), exhibiting promising functional activity compared to the monomeric form. In a recent study from our lab on the cytosolic domain of PGRMC1, we identified two routes to form the dimer: heme-mediated and disulfide-bond-mediated pathways. Despite these advancements, significant knowledge gaps remain regarding the physiological role of cytosolic PGRMC1 and its dimer, as well as the functional dynamics of the full-length, membrane-bound PGRMC1. Therefore, investigating full-length PGRMC1 in a membrane-like system is crucial to understanding its behavior and interactions with respect to oligomerization. Such insights could pave the way for novel therapeutic approaches that leverage PGRMC1's role in cellular signaling and cancer proliferation, ultimately improving treatment options for various malignancies. Full length PGRMC1 consists of three domains: a lumenal N-terminal domain, a cytosolic domain, and a single-pass hydrophobic transmembrane domain responsible for insolubility in an aqueous environment. We designed and expressed a recombinant construct of PGRMC1 containing the transmembrane and cytosolic domains in Escherichia coli, purified and incorporated it into a biomimetic membrane model. This model mimics the native environment of PGRMC1. So far in this work, we have utilized various spectroscopic techniques, such as size exclusion chromatography to evaluate the oligomeric state of the protein and circular dichroism in the far UV region for secondary structural analysis of full length PGRMC1. Our goal is to explore full-length PGRMC1 homodimerization dynamics in the presence of nanodiscs via biophysical approaches, investigating the nuanced effects of heme binding and comprehensively characterizing its enigmatic interactions with cytochrome P450 enzymes and EGFR to unravel its multifaceted functional relevance in drug metabolism and cancer treatment.

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Annu Joji

Ph.D. Student in Chemistry

The Road Less Travelled: Embracing Skepticism in Research

Exosomes, once considered mere cellular waste, are now recognized for their critical role in cellular communication. They transport valuable information between cells and show great promise in nano drug delivery systems due to their biocompatibility and low toxicity. However, challenges like limited tracking capabilities and low loading capacities remain. Addressing these challenges with the help of another versatile nanoparticle called carbon dots will be a promising strategy. These small, spherical nanoparticles are valued for their safety, adaptability, and water solubility, making them superior to many traditional nanocarriers. The adaptability of carbon dots reassures us about the versatility of our approach. Harnessing the ability of exosomes to get past barriers unnoticed to smuggle in therapeutic cargo along with a built-in GPS to track drug delivery, we create a novel nanocarrier. This dual platform thereby leverages the inherent fluorescent properties of carbon dots for labeling vesicles without dyes, while exosomes, with their lipid bilayers, ensure the safe transport of therapeutic molecules across biological barriers while evading immune detection. Nanoparticles of biological origin offer many possibilities, from targeted cancer treatments to crossing barriers like the blood-brain barrier. By combining exosomes with carbon dots renowned for their photoluminescence and biocompatibility, we aim to enhance our novel nanocarriers' loading efficiency and functionality. This approach could revolutionize early detection and treatment strategies for diseases like tumors and Alzheimer’s soon.

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Patrick Kiel

Ph.D. Student in Marine Biology and Ecology

Electrochemically Induced Alkalinity Enhancement Increases Massive Coral Growth Rates

Inherent to the concept of reef restoration, is the production of coral tissue for outplanting. Slow growth rates, however, hinder nursery output and thereby represent a bottleneck for large-scale restoration efforts. Therefore, innovative technologies to accelerate growth rates are needed, especially for slow-growing and critically endangered species. Alkalinity enhancement (AE) creates favorable seawater conditions that can boost coral growth. This study explores electrochemically induced alkalinity enhancement (eAE) as a passive propagation system for lab or field use. First, we built a lab-based eAE system with a platinized anode and steel cathode, operating at carefully controlled current densities, and assessed it using geochemical and microsensor techniques. Next, we evaluated the impact of eAE on bulk calcification and planar areal growth rates of two species of corals commonly used for restoration in the Caribbean (Acropora cervicornis and Pseudodiploria strigosa) in replicated eAE and control aquaria. We found a centimeter-thick enhanced microenvironment with pH increases of 0.1 to 0.5 units, representing a 20% to 100% rise in the aragonite saturation state. However, A. cervicornis fragments were taller than the microenvironment and showed no growth rate increase, and P. strigosa microfragments taller than 1.5 cm also did not exhibit growth enhancements. Notably, P. strigosa microfragments approximately 0.5 cm in height, thereby situated within the elevated microenvironment, experienced a 48% increase in bulk calcification rates and a 63% increase in planar tissue growth rates. Furthermore, all corals, whether grown on eAE or control substrates, maintained their health and photochemical efficiency throughout the experiment. These results help constrain the limitations of eAE technologies and highlight the potential to significantly boost growth rates, particularly for early life-stage and microfragmented corals. If applied in carefully controlled lab-based coral production facilities, these approaches may increase output and ultimately facilitate restoration at scale.

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Indigo Knecht

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The Chanting of Coral Reefs: Bringing Awareness to the Endangerment of Coral Reefs Through the Sonification of Settling Larvae

How do we persuade humankind to care about our ecosystem? How do we compel society to take an interest in preserving and restoring our environment? I seek to answer these questions through sonification—the process of converting data into sound—and using music to raise awareness about ecological crises and engage the community in environmentalism, specifically coral reef endangerment. Building on the work of Lindborg (2023) and Majhour (2023), I will consider the various possibilities for translating scientific data into sound such as how to convey numerical data through musical parameters such as pitch, timbre, and form in both abstract and concrete methods. I extend Lindborg and Majhour's discussions by exploring
strategies for enhancing the accessibility of sonified data to a broader audience beyond the scientific community. Specifically, I focus on how music, when paired with interactive technologies, can transform complex ecological data into an experience that invites deeper engagement and understanding while remaining approachable to those outside the scientific community. As a case study, I will reflect upon my own The Chanting of Coral Reefs. This interactive installation sonifies the data of coordinates of coral reef larvae in Miami, translating such data into several musical parameters, including pitch, timbre, dynamics, and form. It combines a fixed media composition that sonifies the data with a physical installation where participants can manipulate the sound by interacting with coral reef “stations” that include buttons and infrared proximity sensors to represent humans’ effects on the environment. By analyzing how participants interact with The Chanting of Coral Reefs, I will discuss the challenges and opportunities that sonification presents in fostering an interest in environmentalism within the community while offering insights from my experience in this area.

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Sumit Kumar

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Analyzing the Cellular Architecture of Tensegrity Structures

Tensegrity structures are lightweight, efficient systems that employ tension and compression to form stable structures. Composed of interconnected cables (tension elements) and struts (compression elements), they rely on the equilibrium of forces to maintain their form. This prestressed equilibrium state ensures stability and adaptability under varying loads. Tensegrity structures are often designed using form-finding methods. In this work, a novel method that enables the generation of tensegrity structures using elementary tensegrity units, called tensegrity cells, is explored. It is hypothesized that tuning the composition of tensegrity structures along with their structural parameters can lead to desired shapes and optimized mechanical performance. Research has highlighted several advantages of tensegrity, such as its high strength-to-weight ratio, structural robustness, adjustable parameters, and morphing capabilities. These characteristics make tensegrity suitable for a diverse range of applications, including civil and aerospace structures, metamaterials, soft robotics, and as a model for cellular mechanics.

Parametric analyses are conducted to investigate the structural and mechanical behavior of tensegrity cells and their assemblies. By employing fundamental mechanics, analyzing the stiffness matrices of relevant structures, and utilizing advanced numerical methods, we aim to understand the behavior of these structures at the cellular level. The Dynamic Relaxation (DR) method is explored for both static analysis and form-finding, a process by which the initial geometry of the tensegrity structure, prior to loading, is determined. The DR method iteratively adjusts nodal positions to achieve a state of force equilibrium. Numerical simulations are performed to investigate the effect of critical parameters, specifically prestress levels and the axial stiffness of constituent members, on the structural response of tensegrity cells subjected to diverse loading scenarios. The investigation encompasses an analysis of how varying initial internal forces (prestresses) affect the cell's behavior, as well as an assessment of the impact of modifying member cross-sectional area and/or material elastic modulus (axial stiffness). Furthermore, the study evaluates the cell’s strength by analyzing internal force distributions under load and assesses their compliance by quantifying member deformation.

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Sandesh Lamsal

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Study of Wave Energy Attenuation in Perforated Submerged Breakwater Structures by Disrupting Wave Dynamics: An Experimental Study with Modular Hexagonal SEAHIVE® Configurations

Wave energy dissipation plays a pivotal role in the effectiveness of coastal protection systems. This study explores wave-structure interactions and energy dissipation through experimental investigations of solid and perforated breakwater structures, with a focus on hexagonal prismatic units known as SEAHIVE®. These units also hold potential as substrates for hybrid coral reef ecosystems. The performance of various breakwater designs was assessed using scaled physical model tests conducted at the University of Miami's Alfred C. Glassell, Jr. SUSTAIN Laboratory (SUrge-STructure-Atmosphere INteraction).

Initial experiments focused on solid wave-breaking structures, followed by perforated variants in its 6 units. The findings reveal that perforated or porous structures exhibit significantly higher wave energy dissipation compared to their solid counterparts. The study tested porous designs with configurations of 6, 9, and 12 SEAHIVE units arranged in different layouts to optimize their performance in wave energy dissipation and coastal protection.

A parametric analysis of hydrodynamic variables, including water depth and wave height, was conducted using 1:8 scaled model tests. By systematically varying these parameters in controlled laboratory conditions, the study aimed to identify optimal configurations for maximizing wave energy dissipation.

Understanding the dynamics of wave interactions with structures, particularly in terms of energy attenuation, is critical for addressing coastal challenges and designing efficient, sustainable coastal protection systems. This research provides valuable insights into the performance of modular, porous structures like SEAHIVE units, offering a promising approach to enhancing coastal resilience.

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Christopher Laurie

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Front-of-Package Nutrition Labeling: An Opportunity for the U.S. to Address Diet-Related Chronic Diseases

Mandatory Front-of-Package Nutrition Label (FOPNL) policies have been implemented in over a dozen countries, with the United States (US) yet to adopt a FOPNL standard. FOPNLs are designed to complement existing Nutrition Facts Labels (NFLs) and are placed at the front of packages where consumers can readily view and make easy, quick and informed decisions on the nutritional quality of food and beverage products.

Fundamentally, FOPNLs empower consumers with concise nutrition knowledge which can lower their risk for diet-related chronic diseases. These conditions are some of the most common and preventable, driven by excess consumption of salt, sugar and fats. This paper reviews the literature on FOPNLs, synthesizing global trends in FOPNL implementation, industry responses, the history of US food labelling and the current US policy landscape which presents a timely opportunity for FOPNL implementation.

FOPNLs have been shown to positively influence consumer behavior towards more nutritious food options. We identified 5 meta-analyses that demonstrated interpretive, nutrient-specific labels led to improved perceived healthfulness of products ($r = .051$, $p < .001$) and increased purchase intent for more nutritious products ($r = .026$, $p < .05$), while warning labels for unhealthy options decreased purchase intent of the labelled products ($r = .140$, $p < .001$).

Globally, mandatory FOPNLs have been adopted by 17 countries, including Mexico, Chile and Brazil. Though several FOPNL models exist, data from a six-country experimental study showed that “High-In” Octagonal labels had the greatest impact on perceived healthfulness of foods. In a systematic review of industry responses, it was also found that FOPNL implementation influenced the reformulation of products to meet recommended nutrition standards, with greater and more consistent effects occurring with mandatory policies.

On January 14, 2025, the US Food and Drug Administration (FDA) proposed the mandatory adoption of FOPNLs on most packaged foods. While the FDA has the authority and principal responsibility to implement FOPNL, this is likely to be met with challenges from the food and beverage industry. Strong political will, a supportive legislative framework and robust education campaigns on the benefits of FOPNL are crucial to realize this public health intervention in the US.

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Nga Le

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Arteriovenous Malformation Mouse Model Induced by Activation of Endothelial Notch 1 Signaling

The Notch signaling pathway is a highly conserved intracellular pathway critical for various developmental processes in multicellular organisms. Among its roles, Notch signaling plays a crucial role in regulating angiogenesis and vascular development. Dysregulation of the Notch pathway has been implicated in aberrant angiogenesis, particularly in arteriovenous malformation (AVM), characterized by abnormal direct connections between arteries and veins. However, the mechanisms underlying dysregulated Notch signaling during adulthood remain poorly understood. This study aims to elucidate the role of Notch signaling in adult cardiovascular diseases, specifically focusing on endothelial cells by utilizing murine models with inducible gene activation/inactivation techniques. For this purpose, an inducible EC-specific gain-of-function of Notch1 mouse model were generated: ROSAN1IC F/F; Cdh5(PAC)-CreERT2. All ROSAN1IC +/+; Cdh5(PAC)-CreERT2 mice died after 6-8 weeks post tamoxifen injection due to heart failure, whereas control ROSAN1IC F/F; Cdh5(PAC)-CreERT2 mice remained phenotypically normal. Tamoxifen induced overexpression of N1IC mimics constitutive activation of Notch1 pathway in EC and results in a progressive increase in cardiac output and in the left ventricle diastolic and systolic diameters which was confirmed by weekly echocardiographs and validated histologically. The precise molecular and cellular mechanisms of endothelial Notch1 signaling in dilated cardiovascular diseases is under investigation. Additionally, this mouse model will provide insight into the role of endothelial Notch1 signaling in the pathogenesis of postnatal cardiovascular diseases and offer a dependable animal model for the development of cardiovascular therapeutics.

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Jack Lee

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Concrete 3D Printing for Coastal Protection: The SEAHIVE® Solution

Coastal communities worldwide have faced repeated devastation from catastrophic storms and hurricanes, resulting in billions of dollars in damages. To safeguard against future threats and the impacts of climate change, innovative green engineering solutions are urgently needed. SEAHIVE® is a shoreline protection system composed of hexagonal concrete tubes. Perforations on the sides of the concrete units allow water to flow through the system, dissipating wave energy while increasing structural complexity. This enhanced complexity, combined with sustainable concrete mixtures and non-corrosive reinforcement, promotes biocompatibility with local ecosystems. Concrete 3D printing offers unparalleled design flexibility, enabling precise and customized construction. It also facilitates clustering—combining SEAHIVE units into a single monolithic structure—which improves stability, simplifies transport, and streamlines on-site assembly. This project explores the application of concrete 3D printing for SEAHIVE through comprehensive material and structural testing of concrete 3D printing units. Structural tests include both unreinforced and reinforced units, evaluating variations in printing path, reinforcement type, and grouting time to optimize the system's structural performance. The experimental plan includes testing at least three specimens in compression and three specimens in bending, with variations in printing path (hexagonal, dodecagonal, and circular inner geometries), reinforcement (unreinforced or vertically reinforced), and grouting timelines (immediately after printing vs. 72-hour delay). Digital Image Correlation (DIC) is used to evaluate deformation, as well as to monitor each specimen's mode of failure, providing critical insights into crack propagation and structural behavior. Combined with auxiliary material tests, these tests advance the concrete 3D-printed SEAHIVE technology and promotes a more resilient and sustainable infrastructure.

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Jasmine Looi

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Retrospective Cohort Study of CAA and AD Case Series with Pathology Confirmed

Purpose: Stereotactic radiosurgery is a cornerstone in the management of brain metastasis, offering targeted, high-dose radiation with minimal impact on the surrounding healthy brain tissue. Patients with large, symptomatic brain metastasis benefit from surgical resection of brain metastases, which is commonly followed by fractionated SRS (fSRS) to reduce the risk of local disease recurrence. Resection cavity volumes shrink gradually over time after surgical resection of brain metastases. Therefore, we sought to use 0.35 T MRI-guided fSRS to quantify post-surgical cavity changes during the fSRS course, as these cavities are typically not visualized during cone-beam CT.
Methods: A retrospective analysis was conducted on five patients treated with MRI-guided fSRS at three centers. Each patient underwent 3–5 treatment fractions. Pre-treatment and fractional MRIs were analyzed on the balanced Steady State Free Precession (bSSFP: TR=3.84 ms, TE=1.92 ms, Voxel size = 1x1x1 mm or 1.5x1.5x1.5 mm) images to assess relative planning target volume change (PTV index), PTV Hausdorff distances, and brain migration volume (the brain volume pulled into the PTV by shrinking cavity). Comparisons were made between initial and each fraction MRIs, focusing on changes in target coverage and healthy brain tissue sparing.
Results: Four of five patients exhibited resection cavity shrinkage during treatment. The PTV index ranged from 0.59 to 1.13, with a median value of 0.85 ± 0.14. Brain migration volume varied between -1.57 and 16.53 ml, with a median of 2.59±4.78 ml. PTV Hausdorff distances (maximum linear change) ranged from 2.34 to 9.84 mm, with a median value of 4.30±1.96 mm.
Conclusion: Per-fraction MRI imaging with a 0.35T MRI-Linac during fSRS identifies shrinking cavities in most post-operative brain metastasis patients. As cavities shrink, normal appearing brain moves into the high dose PTV. Since fSRS is correlated with the volume of brain receiving high dose radiation, this study identifies possible benefit of real-time adaptive PTV reduction to reduce treatment toxicity.

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Harper Marsh

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Defining Interleukin-1 Receptor Accessory Protein (IL1RACP) as a Critical Determinant of Neutrophil Trafficking in Pancreatic Cancer

Interleukin 1 receptor accessory protein (IL1RAcP) serves as a critical co-receptor for the IL-1 superfamily cytokines which are implicated in potent inflammatory signaling, a hallmark of pancreatic ductal adenocarcinoma (PDAC). Our data reveal that IL1RAcP is primarily found in a subset of early innate immune sentinels—polymorphonuclear/granulocytic myeloid-derived suppressor cells (gMDSCs)–that infiltrate PDAC earliest during its initiation and contribute to chemoimmunotherapy resistance. We sought to determine if IL1RAcP is a critical determinant of gMDSC trafficking to the tumor microenvironment (TME) in PDAC.

Single-cell RNA sequencing (scRNAseq) and computational analysis of tumors and spleens derived from Ptf1aCre/+; KrasLSL-G12D/+;Tgfbr2flox/flox (PKT) genetically engineered mouse model (GEMM) at early and late time-points was performed. CRISPR/Cas9-based genome editing was used to silence Il1rap in J774M gMDSC-like cells (J774M-Il1rapKO). To induce Il1rap-downstream signaling for further in vitro studies, pre-treatment with IL-33 was performed in J774M gCTL and J774M-Il1rapKO cells. In vitro cell migration assays were performed to measure chemotaxis of J774M cells, where IL1RAcP was either genetically silenced or pharmacologically inhibited using neutralizing antibody nadunolimab (Cantargia AB), towards tumor cell-secreted stimuli. Flow cytometry analysis was conducted to evaluate trafficking or tissue-resident markers expression of PMN-MDSCs after stimuli with recombinant cytokines and tumor condition media.

scRNAseq of PKT tumors/spleens revealed striking temporal and phenotypic heterogeneity in neutrophil subclusters with PDAC tumorigenesis. RNA velocity analysis identified distinct terminal-state (TS) populations in tumors and circulation. The intratumoral-TS fate of PMNs resembled gMDSC-like specialization. Conversely, spleen-TS neutrophils showed imprinting of trafficking programs. Interestingly, Il1rap was the strongest trajectory-defining gene expressed in the trafficking spleen-TS cluster. Genetic ablation of Il1rap in J774M cells significantly impeded trans-well migration in response to tumor-derived stimuli in vitro. Due to the known role of CXCR2 in myeloid trafficking, we sought to evaluate if ablation of Il1rap was regulating its expression. Indeed, RT-qPCR revealed that IL-33 ligation of IL1RacP in J774M cells induced Cxcr2 expression, which was significantly abrogated in J774M-Il1rapKO vs. gCTL. Next, we investigated if Cxcr2 cognate ligands–namely Cxcl1–are responsible for gMDSC trafficking in response to the tumor conditioned media. Recombinant IL-33 pre-treated J774M gCTL cells showed enhanced trafficking toward a Cxcl1 stimulus, which was completely disrupted in J774M-Il1rapKO. Moreover, neutralization of Cxcl1 in tumor cell condition media abolished the previously increased migration of J774M gCTL, while migration of J774M-Il1rapKO remained unchanged due to negligible baseline expression of Cxcr2.

IL1RAcP is a critical determinant of CXCR2 mediated gMDSC trafficking toward tumor-derived chemotactic gradients, suggesting IL1RAcP as a novel target to mitigate pathogenic gMDSC recruitment in PDAC patients that promotes chemoimmunotherapy resistance.

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Sabrina Mas

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Investigating the Role of PTEN Inhibitor Combinations in Enhancing mTOR Pathway Activity and Promoting Axon Regeneration

Background: Axon regeneration in retinal ganglion cells (RGCs) is limited by the intrinsic low regenerative capacity of adult central nervous system (CNS) neurons. The mechanistic target of rapamycin (mTOR) pathway is a critical regulator of neuronal growth and axon regeneration. However, its activity is often downregulated following optic nerve injury, preventing successful axon regrowth. Recent studies suggest that PTEN inhibition or knockout can enhance mTOR pathway activity and promote axonal regeneration. This study aims to investigate how PTEN inhibitor combination treatments influence mTOR signaling and promote axon regeneration after optic nerve injury.

Methods: We are using a murine optic nerve crush (ONC) model to evaluate the effects of PTEN inhibitor treatments on RGC axon regeneration. Mice will receive intravitreal injections of PTEN inhibitors, with control groups receiving vehicle injections. To trace regenerating axons, cholera toxin B (CTB) will be used. Retinal and optic nerve tissues will be collected at predefined time points for analysis. Axon regeneration will be assessed by histological examination using CTB and DAPI staining. Functional outcomes will be assessed using pattern electroretinography (PERG), and retinal integrity will be evaluated using optical coherence tomography (OCT).

Expected Outcomes: We hypothesize that PTEN inhibitor combination treatments will enhance mTOR pathway activity, resulting in improved axon regeneration. We expect to observe enhanced axonal outgrowth and improved functional recovery in PTEN inhibitor-treated groups compared to controls. These findings may provide insights into the role of PTEN inhibitors in modulating neuronal regeneration and uncover potential therapeutic strategies for optic neuropathies and other CNS injuries.

Conclusions: This study will contribute to understanding the impact of PTEN inhibitors on mTOR signaling in RGCs. If successful, it may lead to the development of PTEN inhibitor-based therapies for promoting CNS repair, offering a promising approach for treating optic neuropathies and other neurodegenerative disorders.

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Age Amplifies Immune Response Following Optic Nerve Injury

Purpose: Optic nerve injury, a prevalent cause of blindness, triggers an inflammatory response in both the nerve and retina. Chronic systemic inflammation associated with aging underlies many age-related diseases and enhances susceptibility to illness. This study investigates how aging impacts the inflammatory response following optic nerve injury and its role in optic nerve degeneration and retinal ganglion cell (RGC) death

Methods: Young adult BL6/J mice (3-5 months old) and aged mice (12-15 months old) were divided into two experimental groups and sacrificed at two time points: two weeks and six months following a crush injury. Optic nerves and retinas were immunostained with various molecular markers and visualized with confocal microscopy to assess optic nerve scar formation and to characterize immune cell infiltration. Longitudinal tracking of nerve fiber layer thickness was conducted using optical coherence tomography to compare the rate of degeneration between aged and young mice. RNA sequencing (RNA-Seq) was employed to identify age-associated biological processes and molecular markers enriched among differentially expressed genes.

Results: In addition to the crush site, aged mice displayed significant secondary degeneration throughout the optic nerve at six months post-injury. These GFAP negative regions were infiltrated by CD-68 monocytes and Oil Red O-positive foamy macrophages, resembling the characteristic immune response and scar formation at the crush site. This was not observed in young mice or aged mice two-weeks post-crush. Additionally, macrophage quantification revealed a greater number of immune cell infiltration in aged mice compared to young mice. Differences in the rate of RGC death and optic nerve degeneration between young and aged mice were also observed.

Conclusion: The findings indicate that following optic nerve injury, aged mice experience an amplified immune response characterized by heightened macrophage activation, increased RGC death rate and secondary degeneration. Understanding the implications of aging in optic nerve injury is crucial for the development of therapies for age-related eye diseases such as glaucoma.

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Power to the People: A Guide to Community-Based Initiatives

The term "community-based" has become a buzzword with organizations and individuals using the phrase as a self-proclaimed badge. Oftentimes, initiatives that have the intention of assisting a vulnerable population with a social problem further subject the community to being victims of the 'system'. Communities posed with social injustices are led to believe that institutions are outside of their influence. The powerlessness induced by this belief promotes the notion that individuals are destined by chance, removing self agency and initiative from the people. Communities have been alienated from institutions and self-action, causing a lapse in communication in discussing social issues with the affected community. In combination with not properly engaging and discussing the issue with the population, organizations assume the needs, methods, and solutions required of a community, leaving out the most vital component of community-based work: the community. Not only do these self-styled 'community-based' initiatives lack the consideration of the community, but they lack any philosophical thought or theoretical ground. This is to no fault of the organizations, but an overall deficiency in accessible guidelines and criteria that address what community-based work really entails. Thus, the need for establishing a theoretical framework that embodies a community-based philosophy is evident. In this thesis, through the exploration of community-based supportive theories, power is found in the people. In order to adapt a community-based philosophy, initiatives must allow organizational operations to be fully guided by the community. Local knowledge and local control are paramount to community-based work. This begins with communities defining themselves and utilizing individual and community realities to inform the direction of the initiative. Organizations are required to facilitate dialogue that interprets community members in the manner in which they wish to be understood. Dialogue serves as the foundation to understanding the needs and lived experiences of a community. Community-based instruments are explored and a critique of non-governmental organizations (NGOs) addresses the cardinal flaws of NGOs and the fundamental traits of community-based initiatives. This thesis concludes with an action-oriented handbook to being community-based.

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Exploring the Impact of Noise Exposure and Cochlear Implantation on Hearing Preservation Outcomes

Background: In our increasingly noisy world, the general population experiences damaging environmental noise exposures that contribute to noise-induced hearing loss (NIHL). Acoustic trauma leads to auditory dysfunction known as NIHL and eventually manifests into permanent sensorineural hearing loss (SNHL). While those with mild SNHL may be treated with hearing aids, those with more severe hearing loss profiles may only qualify for cochlear implants (CIs). CIs are one of the most successful neuroprotheses and have benefitted a vast number of patients, including those with normal low frequency hearing (dual stimulation CI qualification). However, CI outcomes are complicated and confounded by numerous factors, often resulting in post-implantation loss of low frequency residual hearing. Therefore, this study aims to ascertain how combined noise and electrode insertion trauma (EIT) contributes to poor residual hearing outcomes in a controlled preclinical environment.
Methods: Awake Male Brown Norway rats (n=16) were exposed to broadband noise (4-16 kHz) for 1 hour at 110 dB SPL to induce SNHL. After 3-months post-noise exposure, unilateral electrode insertion trauma (EIT) was performed. Auditory brainstem response (ABR) was performed at multiple frequencies (2, 4, 8, 16, 24, and 32 kHz) after noise exposure and after EIT to be compared to an EIT-only (no-noise) control group (n=16) for up to 3-months following EIT (total of 6-months).
Results: Following 3-months noise exposure, significant elevation in ABR thresholds were detected at all frequencies tested except low frequency 2 kHz, as compared to nonexposed control thresholds. This loss was permanent, with increased damage towards higher frequencies mimicking human CI candidacy. ABR thresholds were collected following EIT, showing that the double-insult group had significantly elevated thresholds at 2, 4, and 8 kHz at 1-month post-EIT compared to (no noise) EIT-only implanted ears. No statistical significance was found at this timepoint in higher frequency regions – 16, 24, and 32 kHz. This trend persisted only at 2 kHz frequency by 3-months post-EIT, suggesting that prior noise exposure has an effect on post-operative lower frequency hearing.
Conclusion: Our results demonstrate that underlying electrophysiological mechanism are at play following noise-induced SNHL with CI-driven post-operative residual hearing loss.

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Mechanisms of Promiscuous (Oxidase and Hydrolase) Activities of Asymmetric Binuclear Cu(II) Complexes

The design of small metal complexes that can efficiently mimic the activities of natural metalloenzymes has been one of the holy grails in chemistry. The existing metal complexes exhibit much slower activities and lower turnover numbers in comparison to natural enzymes. Therefore, there is an intense interest in the development of the next generation of molecules with improved activities. In general, each catalytic system is optimized to catalyze a specific reaction due to its unique structural, chemical and electronic properties. Catalytic promiscuity occurs when a system catalyzes two or more distinct reactions. Currently, the information regarding the roles of metals in natural systems is gained through comparative studies on metalloenzymes and their synthetic analogs.

We have investigated uncommon oxidase and hydrolase activities of two dinuclear copper(II) complexes, using the unsymmetrical ligands N′,N′,N-tris(2-pyridylmethyl)-N-(2-hydroxy-3,5-di-tert-butylbenzyl)-1,3-propanediamin-2-ol (L1) and N′,N′-bis(2-pyridylmethyl)-N,N-(2-hydroxybenzyl)(2-hydroxy-3,5-di-tert-butylbenzyl)-1,3-propanediamin-2-ol (L2). Their activity towards hydrolysis was investigated using model substrate 2,4-bis(dinitrophenyl)phosphate and oxidation using model substrate 3,5-di-tert-butylcatechol. Multiple possible binding modes of substrates were optimized, and the mechanism of ideal reactants were further investigated. For hydrolysis, according to the enthalpies, L1 prefers a stepwise mechanism with a bridging-substrate reactant and L2 prefers a stepwise mechanism with terminal-substrate reactant. For oxidation, two electrons are transferred from the catechol to the catalyst, making both coppers Cu(I). We found that the first electron is transferred via an electron-coupled proton transfer and the second electron is transferred via a no-bond electron transfer for both L1 and L2 complexes. The electronic structures of the molecules were investigated to validate the mechanistic pathways and the catalytic promiscuity. The major factor influencing the electron transfer was found to be the coordination number of each copper and the change in coordination number from five to four mediates the electron to transfer from the catechol to the catalyst. Catalyst regeneration using oxygen was also investigated where oxygen is converted into hydrogen peroxide and Cu(I)s becomes Cu(II)s.

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Ph.D. Student in Sociology

Institutionalization, Job Satisfaction, and Depression

Depression is one of the most common mental illnesses amongst adults in the United States. This study aims to identify factors that cause and alleviate symptoms of depression. I expect to find that socio-demographic factors, educational factors, institutionalization, job satisfaction, physical health and mental health will be associated with depression in adulthood. The variables used to analyze impact on adulthood depression are father's formal schooling, mother's formal schooling, race, dropped out of junior high, dropped out of high school, formal schooling, depression in junior high, prison status, psychiatric hospital treatment, good pay, job security, interesting work, ADL index, health worries, health compared to five years ago, expected health, health compared to peers, no one for help, felt alone, not enough money, learn everything again, anxiety, and adulthood depression. This research is important because it shows how factors at play in everyday life impact depression. It also demonstrates the importance of obtaining a personally perceived "good" job, especially after being institutionalized, these jobs must be made available for people to obtain them. The data is from an approx. two hour face to face surveys conducted over a five year period in the mid eighties in Texas and narrowed down to only include men who are Black, white, or Hispanic in this analysis. The results overall show that socio-demographic factors did not have an effect on depression, but some educational variables, all variables that describe institutionalization, all job satisfaction variables, some physical health variables, and some mental health variables predict depression.

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Abdul-Manaf Mutaru

Ph.D. Student in Nursing Science

Exploring the Role of Discrimination in Prenatal Care Utilization to Understand Health Disparities: Application of the Social-Ecological Model

Objective: Early, consistent, and quality prenatal care is essential for preventing low birth weight, preterm birth, and maternal complications or mortality during pregnancy. Ethnic and racial minorities in the United States exhibit lower prenatal care utilization, experience high levels of discrimination prenatally, and often prefer racially concordant care. Addressing these concerns is crucial to enhancing their prenatal care utilization. However, evidence of the association between the experience of discrimination and prenatal care utilization in the U.S. remains limited and sporadic. This study applies the social-ecological model to evaluate and synthesize existing evidence on this relationship among ethnic and racial minority populations.

Methods: A scoping review was performed using three major databases: Web of Science, PubMed, and CINAHL. Peer-reviewed articles, focused on the United States population, were screened from an initial retrieval of three hundred and thirty-six peer-reviewed articles published between 2010 and 2024. Eleven studies met the eligibility criteria. Five from full-text reviews and an additional six studies were identified through ancestry searches.

Results: The review highlights limited studies addressing this critical topic. Among the available evidence, internalized discrimination including perceived discrimination emerged as the most prevalent form of discrimination studied, and it influenced prenatal care utilization. Additionally, language barriers were highlighted as significant contributors to disparities in prenatal care utilization.

Conclusions: The findings highlight the significant impact of discrimination on prenatal care utilization among ethnic and racial minority populations. Future research should investigate the moderating roles of individual and interpersonal factors, such as resilience and social support, to identify strategies for mitigating the adverse effects of discrimination. Additionally, addressing negative patient-provider relationships and structural barriers, including language differences, is crucial to ensuring equitable access to prenatal care.

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Imran Noor

Ph.D. Student in Biology

The Genomic Features Associated with the Diversity and Evolution of Capsid Architectures Assembled from Proteins Adopting the Jelly-Roll Fold

Viral capsids are assembled from a limited number of structurally conserved protein folds. One of the most ancient and versatile folds is the jelly roll, an eight-stranded antiparallel β-barrel fold found in viruses infecting organisms across all domains of life. A unique feature of this fold is its ability to form capsids for viruses storing their genomes in different chemical forms, including single-stranded RNA viruses, single-stranded DNA viruses, and double-stranded DNA viruses. Here, we developed a comparative structural and genomic analysis of the sequences, protein structures, capsid architectures, and assembly pathways of 10 cellular and more than 40 viral viruses organisms encoding the jelly roll fold. This approach aimed to trace the evolutionary trajectory of JR proteins, from their potential cellular precursors to their emergence as key structural components of viral capsids. The analysis identified several capsid architecture gaps in different groups. We employed a bioinformatic framework to analyze the sequence and structural variations of the jelly roll systematically. This included resolving orthologous relationships and identifying conserved structural features associated with functional shifts in capsid assembly. By integrating protein structure prediction models with isolated genomes, we explored the assembly mechanisms of jelly roll-based capsids, including their genetic determinants, structural constraints, and evolutionary pressures. This research elucidated the structural and genomic evolution of jelly roll fold and identified molecular features that can be used to search for the missing capsid candidates among the uncultured viruses through bioinformatics approaches.

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Max O'Malley

Ph.D. Student in Physical Therapy

Prognostic and Diagnostic Utility of Heart Rate Variability to Predict and Understand Change in Cancer and Chemotherapy Related Fatigue, Pain, and Neuropathic Symptoms: A Systematic Review

Advances in early cancer detection and treatment have significantly improved survival rates, resulting in over 18.1 million cancer survivors in the United States. Many of these survivors experience chronic pain, fatigue, and neuropathic symptoms related to cancer or its treatments. Emerging evidence suggests that autonomic nervous system dysfunction plays a crucial role in these symptoms. Heart rate variability (HRV), a measure of autonomic function, has shown potential in predicting the onset of somatic symptoms in cancer patients. This systematic review aimed to assess the association of HRV with pain, fatigue, and neuropathy in cancer patients and survivors. A comprehensive search was conducted across multiple databases, yielding 19 studies that met inclusion criteria. These studies varied in cancer types, stages, and HRV measurement methods. Most studies focused on breast cancer and reported a predominant female population. Fatigue was the most commonly studied symptom, followed by pain. HRV measures included both time and frequency domain variables, with significant variability in measurement duration and control for confounding factors. Findings suggest that decreased HRV is associated with increased fatigue and pain, providing potential support for a bidirectional relationship between autonomic dysfunction and these symptoms. However, the heterogeneity in HRV measurement methods and the high risk of bias in many studies highlight the need for standardized HRV protocols in cancer research. Further large-scale studies with low risk of bias are necessary to validate HRV as a reliable tool for phenotyping and managing cancer-related symptoms.

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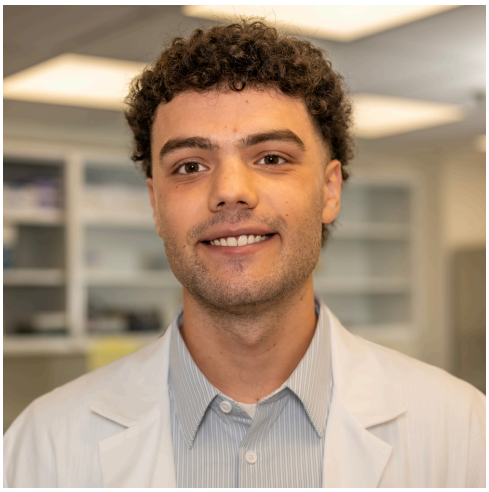

Arthur Perez

Master's Student in Biochemistry and Molecular Biology

Design and Validation of Quantitative Live-Cell Sensors for Specific Phosphoinositide Species

Background: Phosphoinositols metabolism revolves around the phosphorylation of the inositol ring at various positions. This modification of the inositol ring creates chemically and functionally distinct phosphoinositide species (PIXPs), including different isomers of equal phosphorylation state. distinct enables the formation of several distinct isomers. These different PIXPs are crucial for the regulation of various cellular processes like proliferation, differentiation or mobility. Dysregulation of phosphoinositol converting enzymes, such as PTEN and PI3K, have been linked to cancer. Further, a retrospective analysis of gene expression data of breast cancer patients in the TCGA database shows pronounced deregulation of several inositol kinases in its branched metabolic network. Specifically, gene expression changes associated with PIXPs, such as PI4P and PI(3,4)P2, far surpass that of PI(4,5)P2 or PIP3 (incl. PTEN). However, beyond the heavily studied PI(4,5)P2 and PIP3, the remaining PI derivatives have proven difficult to evaluate, in large partly due to an inability to quantify their levels selectively in live cells and by the lack of methods that are readily accessible to most cancer research labs. Methods: The sensor is designed around the use of Split Green Fluorescent Protein (sGFP) coupled to PIXP species specific PH domains. High local concentrations of the selected PIXP species drive sGFP complementation and signal creation. The current studies utilize PH domains that are expected to be selective for PI(4,5)P2, PI4P and PI(3,4)P2 to create and validate the respective sensors in a cellular setting. Parameters to be evaluated are specificity, proportionality of signal to PIXP species levels, and the response kinetics. Results: Using the sGFP sensor, we were able to evaluate the synthesis of the PI(4,5)P2 precursor, PI4P. Direct evaluation of PI4P synthesis by a sGFP reporter can assess sensitivity to kinase inhibitors with varying specificity for alternative PI4-kinases and assess their contribution across different cell lines. Conclusion: This work is part of an effort to provide a set of urgently needed sensors for the dissection of PIXP metabolism as a therapeutic target. Using these sensors, we will primarily target PI(4,5)P2 and the PI4P metabolic branchpoint to assess the genes involved in PI4P synthesis and utilization in representative cell lines.

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Ana Reyes

Postdoctoral Associate

Injury Patterns and Outcomes of Frail vs. Non-Frail Elderly Motorcycle Riders

Objective: Older adults experience greater morbidity and mortality after traumatic injury, but less is known about injury patterns in specific mechanisms. This study's aim was to examine injury patterns and outcomes of elderly patients injured in motorcycle crashes (MCCs) using a national trauma registry. We hypothesized that elderly patients with frailty would have more severe injuries and greater mortality than non-frail patients.
Methods: The Trauma Quality Improvement Program (TQIP) registry was queried from 2017-2021 for patients ≥65 years injured in an MCC. We calculated the modified 5-item frailty index (mFI) and categorized patients into frail (mFI ≥2) and non-frail (mFI<2). Chi-square and Mann-Whitney U tests were used to compare groups. Multivariable logistic regression was used to test for association of frailty with in-hospital mortality.
Results: Of 202,270 MCC patients, 15,202 (7.5%) were elderly. Of these, 3,206 (21%) were frail and 11,989 (79%) non-frail. Patient and injury characteristics stratified by frailty are reported in Table 1. Frail patients were more often older, male, non-helmeted, on anticoagulation, and had a higher average GCS than non-frail patients. There was no significant difference in ISS. Frail patients had fewer severe neck and lower extremity injuries, and more severe chest injuries. Frail patients had a lower mortality rate (6.3% vs. 7.8%, p=0.004) but higher none-home discharge rate (60.4% vs. 52.1%, p=<0.001) than non-frail patients. On regression controlling for age, heart rate, systolic blood pressure, GCS, ISS, helmet use, and anticoagulation, frailty was associated with 1.33 (1.08-1.65) times increased odds of mortality.
Conclusion: Though frailty was associated with mortality, frail patients in this study overall had a lower mortality rate and similarly severe injuries as non-frail patients. This suggests that older adults with multiple comorbidities may be involved in less severe motorcycle crashes or transported to trauma centers for less severe injuries, but further research is needed to demonstrate this.

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Farzad Rezaeicherati

Ph.D. Student in Civil Engineering

The Effect of Amine Solution on Carbonation Curing of Cement Paste

Carbonation curing offers a promising solution for improving the physical and mechanical properties of cement-based materials while reducing their carbon footprint. However, challenges such as limited CO_2 diffusion within cement matrices hinder the full potential of this method. To overcome these limitations, this study introduced a novel approach using carbonated amine solutions as both mixing and curing agents. Monoethanolamine (MEA), diethanolamine (DEA), and piperazine (PZ) were evaluated at concentrations of 0.5%, 5%, and 15% as mixing agents and at 30% as curing agents. The study assessed CO_2 sequestration potential and mechanical properties using thermogravimetric analysis (TGA), Fourier-transform infrared spectroscopy (FTIR), and compressive strength tests. The results demonstrated that carbonated solutions as mixing agents significantly enhanced carbonation, with MEA and DEA outperforming PZ. Incorporating 5% and 15% concentrations of MEA and DEA solutions led to improved carbonation due to internal carbonation curing. In terms of mechanical properties, amine solutions at concentrations below 5% as mixing agents maintained compressive strength, while higher concentrations caused strength reduction due to the retardation effects of amines. Conversely, the use of amine solutions as curing agents was ineffective, as the precipitation of a carbonate layer on the sample surface hindered CO_2 diffusion and reduced performance. This study identified carbonated MEA and DEA solutions at 5% concentration as optimal mixing agents, achieving significant CO_2 sequestration and enhanced mechanical properties. In contrast, amine solutions as curing agents showed limited potential for both carbonation and strength improvement. These findings provide a pathway for developing more efficient carbonation curing methods.

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Drew Rich

Ph.D. Student in Civil Engineering

Development of an International Design Framework to Optimize and Size Premise Plumbing Systems

In recent decades, population growth and threats to natural water resources have highlighted the necessity for efficient water use practices. Low-flow fixtures were introduced in 1992 as a solution that can reduce water withdrawals and associated energy consumption. Because of its success, reducing flow has become an approach implemented by regulators to better manage water supplies more effectively; however, this approach does not come without drawbacks. Sizing methods for distribution pipes that are used in development today were created well before the introduction of efficient fixtures, resulting in modern supply systems being grossly oversized. Oversized plumbing systems are associated with increased energy consumption, inflated construction costs, degradation of systems that undermine their lifespan and integrity, and elevated levels of pathogen development when compared to properly sized piping systems. To avoid these issues reducing pipe diameters is ideal, however, reducing diameters too much can lead to undersized pipes can display inadequate water pressure and operating conditions that can cause system stress and/or failure. Additionally, clogging becomes an issue with undersized wastewater pipes such as high velocities in supply pipes and clogging in drainage pipes. Currently, there is no pipe-sizing methodology that addresses both supply and drainage systems (including venting) on a global scale. The goal of this research is to develop an inclusive next-generation pipe-sizing method with accompanying standard(s) that can adapt to the specific water use practices of a community. Parameters that are expected to have an influence on pipe size will be transformed into adjustment factors to help tailor plumbing systems. Testing and experimentation will validate and verify the proposed pipe sizing approach for residential occupancies. Findings will encourage further research to explore the benefits of this method including parameters such as water usage, energy savings, operational conditions, and system lifespan across different building occupancies and water/sewer/energy infrastructure utilities

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Kassidy Rodriguez

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Defining Factors that Influence the Stability and Reactivity of EgtB from Chloracidobacterium thermophilum

Ergothioneine (EGT) is a vital antioxidant synthesized exclusively by microorganisms and is associated with various oxidative stress-related diseases in humans. EGT biosynthesis is catalyzed by a gene cluster containing the enzyme EgtB, a sulfoxide synthase. While multiple EgtB enzymes have been characterized, EgtB from Chloracidobacterium thermophilum (Cth) uniquely forms a homo-tetrameric structure, in contrast to the monomeric forms of its homologues. Despite being the only tetrameric EgtB identified, most studies published to date have focused on kinetics and computational analyses to infer reaction mechanisms. In this study, we applied biophysical and biochemical techniques to examine the secondary and quaternary structures of CthEgtB, focusing on how pH modulation and thermodynamic factors influence its stability and oligomerization. Our findings identify key factors such as pH, temperature, and the presence of a 6xHistidine (6xHis) tag that impact the enzyme's structural integrity and thermal stability. This work underscores the importance of considering structural and environmental factors of sulfoxide synthases, such as pH and 6xHis-tags, as these factors are shown here to significantly alter the structural stability and may the influence reaction mechanism.

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Natalie Ruiz-Ocana

Ph.D. Student in Microbiology and Immunology

Elucidating the Role of Rac1 in Kaposi's Sarcoma Herpesvirus Replication

Kaposi's Sarcoma Herpesvirus (KSHV) is a human double stranded DNA oncogenic virus and the etiological agent of several diseases, including the AIDS-associated malignancy, Kaposi Sarcoma (KS). Despite the availability of antiretroviral therapies for patients living with HIV, there is currently no cure for KS. Herpesviruses like KSHV establish a latent infection in host cells to evade immune surveillance. Cellular stress can trigger reactivation of the virus and lead to the lytic phase of the KSHV's infectious cycle. During infection, KSHV relies on the host cellular machinery for replication, however, it is unclear which host molecules and mechanisms are most important for KSHV reactivation and replication. The lack of understanding of these interactions with host machinery prevents the development of novel curative medicines for patients suffering from KS.

Small GTPases, such as Rac1, are important in host cell signaling, proliferation, and protein translation. Since KSHV depends on host cell machinery, the aim of this study was to further elucidate the mechanistic role of Rac1 during KSHV replication. To do this, we used a Doxycycline-inducible KSHV cell line (iSLK.219.KSHV) which contains a recombinant KSHV virus. During latency, these cells constitutively express green fluorescent protein (GFP) and following reactivation they express red fluorescent protein (RFP). In this study, we silenced Rac1 in KSHV-infected 219 cells, and then following the addition of Doxycycline, we measured infectious virus production over 72 hours. Our results demonstrated that silencing Rac1 silencing significantly increases the production of infectious virions, suggesting a regulatory role in lytic reactivation. This study enhances our understanding of the pathophysiology of KSHV and identifies Rac1 as a potential target for orchestrating KSHV-associated malignancies.

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Ariana Samuel

Ph.D. Student in Counseling Psychology

Exploring the Intersection of Mental Health, Relationships, and Financial Well-being Among Black and Hispanic/Latino Males in South Florida

Objective. Black and Hispanic/Latino men are more likely to experience financial insecurity, mental health issues, and a lower quality of life partly due to systemic discrimination (Campbell & Allen, 2019; Bazargan et al., 2023). Thus making it important to explore this population's experiences with mental health, financial well-being, and relationship quality. This study examined potential associations between mental health, financial well-being, and relationship quality in non-Hispanic/Latino Black and white Hispanic/Latino males in South Florida.

Methods. Participants were drawn from a larger study of Black and Hispanic/Latino fathers recruited from cities in South Florida. This study focused on 691 adults ages 21-71 (Mage=38.25) who identified as male and Black or Hispanic/Latino and had completed relevant measures. Participants reported their mental health (PHQ-9 & GAD-7), financial well-being (Financial Well-being Scale), relationship quality (CSI), and other demographic information. A Multivariate Analysis of Covariance was run in SPSS to explain mental health, financial well-being, and relationship quality based on age, race, marital status, education, and employment status.

Results. There was a significant relationship between Mental Health and Healthy Relationships, r = -0.653. The overall model explains a 5.0%, 3.2%, and 17.4% variation for mental health (R2 = 0.050), financial well-being (R2 = 0.032), and relationship quality (R2 = 0.174), respectively. Mental health scores were lower for non-Hispanic/Latino Black men compared to white Hispanic/Latino men. The difference was statistically significant, t(395.99)= - 3.179, p = 0.001, Cohen's d = 0.90. There was no significant difference in financial well-being and relationship quality. These results may inform future research and interventions in mental health, financial literacy, and healthy relationships for this population. Additionally, positive ratings in these sectors may provide positive implications for child-rearing, sustaining encouraging ratings of mental health, financial literacy, and health relationships throughout generations.

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Chloe Spina

Master's Student in Athletic Training

Rapid Return to Play in an AC Joint Sprain

The patient is a male, D1 football player who sustained a Grade 2 Acromioclavicular (AC) Joint Sprain to his right shoulder during a football game. He has a previous medical history of AC joint injury, for which he received a Cortisone injection to alleviate pain. The patient reported soreness in the muscles surrounding the right AC joint and rated his pain 3/10 with no popping or clicking in the right shoulder. The patient was tender to palpation over the right AC joint, had weakness in flexion and abduction movements, and presented with 3.5/5 of strength in all ranges. The patient experienced significant pain and strength deficit when assessing the middle deltoid with 2-2.5/5. AROM in flexion was limited to 90 degrees, secondary to pain. The patient experienced discomfort while trying to sleep and was given a sling. The doctor prescribed Celebrex for 6 days to reduce the pain. The patient had no signs of neuromuscular weakness or sharp pain with movement. His activities of daily were barely affected. Treatment began with modalities to reduce inflammation and therapeutic exercises, including isotonic exercises with resistance adjusted based on the patient's pain. By day 3, the patient showed improved ROM, discontinued wearing his sling, and reported no pain during activities of daily living. By week two, he had improved strength and was introduced overhead press exercises. The patient returned home for a week and completed a home exercise program. When the patient returned, he participated in team activities without restrictions or complaints. After week 6, patient reported feeling 100%, no tenderness to palpation, and was stable in his right AC joint. Following AC Joint Sprain protocols, progressing through each stage of rehabilitation and treatment, the patient made a successful recovery in 6 weeks compared to the average of 12 weeks. The patient fully returned to lifting and football, regaining full ROM and strength. The patient continues to play football at Miami and has not reported any issues. The patient still has a deformity over the right AC joint and has not reported any reoccurrence of symptoms throughout the 2024 season.

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Stacey Swanson

Ph.D. Student in Music Education

From Policy to Practice: Examining AI Integration in Music Education Institutions

As AI develops, so does the premise of progressive education in all spheres, including music. It continues to be a challenge for music institutions to formulate and put in place feasible AI policies. This cross-sectional research looks into policies of different categories of higher education music institutions: how AI policies are developed and how they are transformed into practice in personal and professional settings. The study focuses on multi-year colleges, four-year universities, and conservatories or community colleges, and how these institutional structures are put into operational classroom practice within the context of attitudes and perceptions of the relevant actors.

The study utilizes a multi-phase technique: detailed cross-sections of documents describing policies at the institutional level and course syllabi, surveys to faculty on how they implement AI and their perception of AI, followed by qualitative interviews. Keeping in mind the intricate matrix that exists between policy formulation and practice, this method enables us to evaluate the approach of various institutions in AI implementation. The examination will consist of five questions posed, such as the correlation existing between the amounts of policies an institution has and its size, whether attitudes of faculty have any influence on adherence to policies, and if there is any concern towards the freedom of academics versus the implementation of policies.

This study will bring new insights into the integration of AI in higher education in the context of curriculum music education. It is anticipated that this research will result in an intelligent approach to policy formulation and, as a result, serve the different needs of the stakeholders in music education, which are normally not met by unrelated general policies. These insights will come in handy to the many administrators and instructors charged with the development of AI policy frameworks in the context of higher education devoid of these schools of thought and discipline obstruction.

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Emily Sweet

Master's Student in Athletic Training

Undiagnosed Grade 4 Spondylolisthesis in a Semi-Professional Hockey Player: A Case Study

A 19-year-old male semi-professional hockey player initially presented with a right groin injury and was later diagnosed with a grade four spondylolisthesis at L5-S1. This case study is important to provide insights into treating young athletes with high-grade spondylolisthesis and the importance of conducting thorough evaluations along the kinetic chain. While assessing the groin injury, a bump was noticed in his lumbar spine, and he was sent for an x-ray and MRI which confirmed a grade 4 spondylolisthesis. Upon physical exam he presented with daily back pain, intact dermatomes and myotomes, Trendelenburg gait and leg girth discrepancy. After examination, he was cleared to play. His treatment plan focused on pain management including daily soft tissue treatment, strengthening, and a steroid nerve block injection of 80mg Depo Medrol to control pain. The patient avoided therapeutic exercises in lumbar extension, rotation and side bending. After the first injection in preseason, he was able to continue to play for 23 games until he lost sensation in his right leg through the L5 nerve pattern. A second injection provided no pain relief. He attempted to play one more game but had severe nerve pain and was unable to lift his leg. It has been found in the literature that, over time, non-operable cases typically experience adverse effects on quality of life, pain or neurologic deficits and may require surgical intervention.1 He underwent spinal surgery, fusing L5 on S1. Damage to peroneal nerve during surgery affected his ability to skate and postponed his timeline for return to hockey. Within 3 hours post-op he stood 2 inches taller and was able to walk. The patient currently reports improved quality of life with pain free activities of daily living. Currently, he is working to recover sensation and strength to the lateral aspect of his lower leg from the peroneal nerve damage which has shown improvement over the past 10 months. This patient's exceptional core and back strength is suspected to have aided his ability to perform at a semi-professional level for a significant amount of time with an undiagnosed grade 4 spondylolisthesis.

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Theodora Tertus

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Self-Silencing Among Black Women in South Florida

Background: In the United States, Black women (BW) are disproportionately affected by psychosocial factors that impact their emotional well-being. These factors contribute to a phenomenon known as self-silencing, where women suppress their emotions, thoughts, behaviors, personal needs, and self-care. This suppression significantly hinders their ability to advocate for themselves to attain optimal health outcomes and well-being.
Purpose: This study aims to investigate the association between self-silencing and key psychosocial factors, including depression, self-esteem, and discrimination, among BW residing in Miami-Dade County, South Florida.
Methods: A cross-sectional design was used to enroll 100 Black women. A self-reported survey was administered to assess demographics, self-silencing, depression, self-esteem, and discrimination. The analysis included descriptive statistics and Pearson's correlation analyses.
Results: A total of 100 BW with a mean age of 34 years (SD=9.0) participated in this study. The majority identified as African American (88%), followed by Haitian American (6%) and other Caribbean islanders (6%). Many participants were single (55%) and unemployed (58%). Additionally, most reported completing high school (56%). Regarding discrimination, the mean score was 41.45 (SD=11.4; range= 9-54), and the mean score for self-esteem was 20.1 (SD=5.6; range= 5-30). Most of the participants (88%) experienced mild to severe depression, and 100% of them experienced self-silencing. Pearson's correlation analyses indicated that self-silencing is significantly correlated (P<.001) with daily discrimination, self-esteem, and depression.
Conclusions: The results of this study indicate that self-silencing is significantly associated with experiences of discrimination, depression, and self-esteem among Black women. Although further research is needed to explore these relationships, these initial findings underscore the importance of developing targeted interventions that foster self-advocacy and address the psychosocial needs of this population. Such interventions could be crucial in encouraging healthier decision-making and improving well-being among Black women.

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Praga Vipulanandan

Ph.D. Student in Electrical and Computer Engineering

Uncertainty Quantification in Large Language Models and Sensitive Weight Identification

The increasing deployment of large and powerful deep learning (DL) models, such as large language models (LLMs) and vision transformers (ViTs), is transforming various fields by leveraging billions of parameters and datasets spanning exabytes. However, the training of these models demands enormous computational resources, leading to energy expenditures in the millions of dollars. In response, state-of-the-art AI chips have adopted strategies such as pruning model layers and quantizing model parameters to reduce computational requirements. Despite their efficiency, these techniques often introduce significant model uncertainties, which can degrade prediction accuracy. Consequently, a key concern arises: how reliable are the decisions made by these DL models? Additionally, which layers can be pruned, and which parameters can be quantized with minimal impact on predictive performance? Traditional methods, such as Monte Carlo analysis, are often impractical for models of such scale, particularly when applied to edge cases that are critical in mission-sensitive domains, including healthcare, defense, and autonomous driving. The lack of transparency and accountability in these models has sparked skepticism, particularly in high-stakes areas like criminal justice, public health, finance, and real estate, where the consequences of inaccurate predictions can be profound. These challenges highlight the need for more reliable, interpretable, and accountable methods to ensure the safe and effective deployment of DL models in critical applications. To mitigate these issues, we propose an uncertainty quantification mechanism that is rooted in quantum physics, providing explainability and interpretability easily. We showcase the utility of this methodology in sensitive weight identification in LLM models such as Llama and OLSMo.

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Gianni Walker

M.D. Student

Dilated Cardiomyopathy Mouse Model Induced by Activation of Endothelial Notch1 Signaling

The Notch signaling pathway is a highly conserved cellular signaling pathway that is crucial for a diversity of developmental processes in multicellular organisms. The role of the Notch signaling pathway in cardiovascular development is well-known, however how Notch signaling regulates the adult cardiovascular system, specifically its involvement in postnatal cardiovascular diseases, is poorly understood. The goal of this study is to investigate the role of Notch signaling in adult cardiovascular diseases using murine inducible gene expression approaches, specifically in endothelial cells (EC), through the usage of mouse genetics, imaging, cell, and molecular biology techniques. For this purpose, an inducible EC-specific gain-of-function of Notch1 mouse model were generated: ROSAN1IC F/F; Cdh5(PAC)-CreERT2. All ROSAN1IC +/+; Cdh5(PAC)-CreERT2 mice died after 6-8 weeks post tamoxifen injection due to heart failure, whereas control ROSAN1IC F/F; Cdh5(PAC)-CreERT2 mice remained phenotypically normal. Tamoxifen induced overexpression of N1IC mimics constitutive activation of Notch1 pathway in EC and results in a progressive increase in cardiac output and in the left ventricle diastolic and systolic diameters which was confirmed by weekly echocardiographs and validated histologically. Therefore, constitutive activation of endothelial Notch1 signaling pathway induces dilated cardiomyopathy in adult mice. The precise molecular and cellular mechanisms of endothelial Notch1 signaling in dilated cardiomyopathy is under investigation. This mouse model will provide insight into the role of endothelial Notch1 signaling in the pathogenesis of postnatal cardiovascular diseases and offer a dependable animal model for the development of cardiovascular therapeutics.

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Akeitha Walton

Ph.D. Student in Counseling Psychology

Bridging the Cognitive Gap: Examining the Relationship between Patient Education and Cognitive Impairment

Cognitive impairment has been exhibited across myriad cancer patients undergoing chemotherapeutic treatment. As a result of increases in inflammatory proteins in the prefrontal cortex and hippocampus, specific deficits have been noted in verbal and prospective memory, attention, and learning. Patient education is a critical component of patient care that can assist in the mitigation of cancer-related symptoms. Verbal and written materials provided by health care professionals, as well as patient obtained information, are sources of education that may influence how patients manage their care and subsequent outcomes. Hence, it is possible that cognitive impairment may influence the educational health material patients obtain. To investigate this association, participants of an ongoing randomized clinical trial examining serious gaming to reduce the impact of chemotherapy induced nausea and vomiting were examined. Baseline data was collected and included variables for cancer and treatment related symptoms, memory, concentration, sources of information, and cognitive status.
We observed an inverse relationship between the quantity of sources of information obtained and some cancer/treatment related symptoms and cognitive impairment. No significant relationship was found between the quantity of sources of information obtained by the participant and memory problems ($p=.47$, 95% CI [.86, 1.39]) or memory difficulties ($p=.99$; 95% CI [.83, 1.19]). Though, having received information from more sources, was found to increase the likelihood of experiencing concentration difficulties by 29% ($p= .03$ (95% CI [1.012, 1.64]). Further, when controlling for age and sex, there was a positive relationship between cognitive status and receiving information more resources. Thus, more cognitively intact patients received information from more sources. Significant differences were observed in the number of sources of information received between Hispanic and non-Hispanic participants ($t(138)=2.98$; $p < .05$). Participants who identified as White indicated significantly more (about 1.5) sources of information than Blacks/African Americans. There was no observed difference between number of sources of information received by males and females. Our findings indicate a novel potential area of intervention to remediate cancer treatment-related symptoms and compensate for impairment experienced by cancer patients prior to undergoing chemotherapy.

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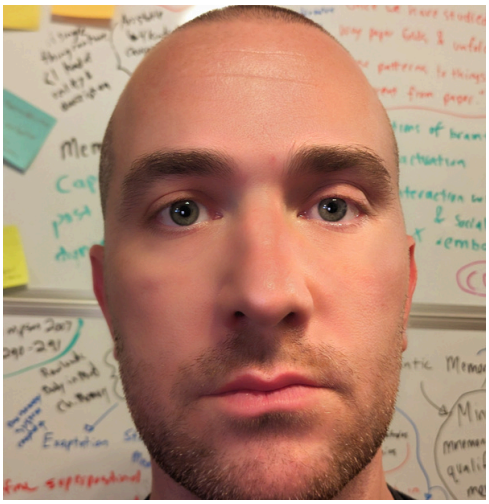

Matthew Watts

Ph.D. Student in Philosophy

A Constructive Account of Semantic Memory

Philosophy of memory has primarily focused on episodic memory (memory of past events), often neglecting semantic memory (memory of facts), despite its central role in cognitive endeavors like future-oriented thought and imagination. This neglect may stem from the widespread yet insufficiently examined view of semantic memory as a dedicated storage of factual knowledge. However, recent developments in philosophy and cognitive science challenge this orthodox perspective.

I argue that the traditional view of semantic memory as a factual storage system conflates the ability to use facts with the need to store them explicitly. My constructive account shifts focus to the (re)constructive processes of memory, treating procedural skills as foundational to semantic memory and analyzing memory in terms of the activities involved in its construction. This framework provides a novel articulation of how we use factual knowledge and integrates other memory types, such as episodic memory.

Unlike accounts that classify memory based on predefined knowledge types, my framework types memory by the actions and skills used in its (re)construction. As such, I identify two modes of constructing semantic memory — mnemonic efforts and mnemonic habits. Mnemonic efforts are activities attributable to operations occurring at the time of semantic knowledge construction through conscious use of prior experience and often, take the form of the determination of similarities among multiple episodic memory traces activated in parallel. Mnemonic habits form as a result of fluency of constructive memory processes that can be broadly understood as embodied, or enacted, and are attributable to embodied processes that become causally connected to the constructive processes of mnemonic efforts. On this view semantic memory is the dynamical emergence of semantic knowledge attributable to constructive processes. This account adopts the procedural causal theory, and a contentless conception of memory traces, as well as incorporating aspects of multi-trace memory frameworks, and burgeoning enactive memory approaches into a view of semantic memory that is non-transmissionist (no content is transmitted from the initial experience to retrieval), and generationist in the sense that the content of memory can often (though not always) exceed the content of the initial experiences of the event.

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Oral Presenters

Activities Room North

Benjamin Minch

Ph.D. Student in Marine Biology and Ecology

Uncoupling Abundance and Activity: Insights into Giant Virus Dynamics during an Algal Bloom

Viruses are the most abundant biological entities in the ocean, playing large roles in bacterial and eukaryotic population dynamics, nutrient cycling, and gene transfer. Giant viruses are a subset of these viruses infecting eukaryotes and have gained interest due to their large capsid and genome sizes as well as their armory of cellular genes not previously found in viruses. Despite recent research interest, many questions remain regarding the ecology and temporal dynamics of Giant virus communities. In this study, we leverage a 40-day, daily metagenomic (abundance) and metatranscriptomic (activity) time series during a Dinoflagellate bloom in Monterey Bay, CA to elucidate the ecological dynamics of the giant virus community during the bloom. By analyzing the temporal dynamics of both Giant virus phylotypes (capsid genes) and genomes we discovered that most phylotypes had a high correlation between abundance and activity, but around 10% had discordant patterns of abundance and activity, possibly indicating different ecological strategies to the normal boom and bust dynamics of lytic viruses. When investigating these trends within the context of 96 giant virus genomes, we found similar patterns and clusters of genes within the genomes that were not correlated with that virus's abundance. Using a random forest model with genomic information, we found that GC % was the most explanatory variable for predicting the proportion of coordinated genes, with genomes having low GC % having uncorrelated gene expression. Our findings suggest that some giant viruses have evolved alternative ecological strategies, maintaining low GC content in genes to achieve reduced gene stability, therefore decoupling the expression of these genes from genome replication and abundance. This could allow these viruses to elongate the virocell period and persist for longer times in environments where their host is scarce.

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Alicia Sneij

Postdoctoral Associate

Improved Nutrition Knowledge in People with Chronic Spinal Cord Injury After Nutrition Education Program

Background: Diet-related complications, such as cardiometabolic disease, are common in people with chronic spinal cord injury (SCI). We created the NeuroNutrition Program (NNP) as a pilot initiative designed to enhance nutrition education and promote healthier dietary habits among individuals with chronic SCI in our community.
Objective: We aimed to evaluate whether the NNP effectively improved nutrition knowledge in a small sample of individuals with chronic SCI. We hypothesized that both short-term and long-term nutrition knowledge would improve after the NNP.
Design: Single-arm prospective
Methods: Twelve nutrition education sessions covered major food groups, macronutrients, and healthy dietary patterns. Changes in short-term knowledge were assessed with pre- and post-session content-specific questions, and changes in long-term knowledge were assessed via the Revised General Nutrition Knowledge Questionnaire administered before and after the 12-month NNP.1 Lipids, insulin resistance, blood pressure, and body mass were assessed before and after the NNP. Changes in outcome variables were assessed with the Wilcoxon Signed-Rank Test with an alpha of 0.05.
Results: The sample (n=10) primarily consisted of males (70%) and those with tetraplegia (80%), with an average age of 41.2±13.1 years and time since injury of 20.7±12.7 years. Improvements in the short-term ($p=0.007$) and long-term ($p=0.008$) nutrition knowledge were observed. No changes were observed for lipids ($p\geq0.44$), insulin resistance ($p=0.09$), blood pressure ($p\geq0.77$), and body mass ($p=0.17$).
Conclusion: The NNP project enhanced short- and long-term nutrition knowledge in individuals with chronic SCI; however, these improvements did not lead to measurable physiological changes, highlighting the need for behavioral modifications to accompany enhanced knowledge.

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Mariana Viso

Ph.D. Student in Biomedical Engineering

Recapitulating Immune-Driven Stromal Remodeling in Pancreatic Cancer within a Microfluidic Platform

Pancreatic cancer adenocarcinoma (PDAC) is one of the deadliest types of cancer, with 90% of its patients succumbing to this illness within five years after diagnosis. Chemotherapy is the primary method of treatment for most cases of PDAC, but its effectiveness is limited by the development of chemoresistance. This motivates the need for tools to study chemoresistance development and novel therapeutic treatments.

Previous research suggested that chemoresistance arises from the polarization of cancer-associated fibroblast (CAF) into a pro-inflammatory state (iCAFs) within the PDAC microenvironment. This polarization is driven by CAF interaction with myeloid-derived suppressor cells (MDSCs). However, not much is understood about the mechanisms that govern immune-driven iCAF polarization, nor the full effect it has on tumor progression.

We set to uncover these gaps in PDAC by developing a microfluidic platform capable of recapitulating the complex tumor-stromal interactions that occur in-vivo, as well as allowing for the real-time observation of the influence that MDSCs have on this interaction.

To mimic PDAC tumor, dual reporter CAFs were engineered to fluoresce green when they adopt an inflammatory phenotype and combined with pancreatic tumor cells to form spheroids. These spheroids were seeded on the platform and allowed to interact with MDSCs that are fluidically introduced at physiologically relevant dosages. Positive and negative controls were conducted by flowing in cytokines that stimulate an inflammatory (TNF-α) or non-inflammatory (TGF-β) phenotype.

Confocal imaging was used to measure iCAF fluorescence. MDSC and TNF-α groups had the highest levels of CAF polarization compared to the media control and TGF-β groups, further demonstrating the role of MDSCs in inducing an inflammatory microenvironment. CAF polarization results will further be validated by using ELISA assays to measure the difference in iCAF-secreted IL-6. To study the role of MDSCs in tumor progression, RT-qPCR will be used to analyze the tumor cells and understand to what degree the MDSCs promote their induction into a basal configuration, which is associated with tumor metastasis. Understanding the role of MDSC in tumor progression and the development of an inflammatory microenvironment will provide novel insight into the mechanisms that govern chemoresistance development, and possible targets for attenuation.

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Javi Rodriguez Casariego

Postdoctoral Associate

Acquisition and Transgenerational Inheritance of Hypoxia Resistance in Aplysia californica

Preconditioning to mild levels of hypoxia has been linked with ameliorated symptoms during ischemia and other neurodegenerative disorders in human models, but the mechanisms behind the acquisition of this hypoxia resistance are obscure. While our understanding the mechanisms leading to neuroprotection under hypoxic treatment can benefit from hypoxia-resistant models, this is not a common feature in model organisms like rats and mice. Our previous work showed how remarkably resistant to hypoxia the California sea hare, Aplysia californica, can be and hinted some of the transcriptional signatures of such resistance in the CNS. Here we tested the hypothesis of environmental exposure being the main driver of the establishment and maintenance of hypoxia resistance, hinting to an epigenetically regulated process. hypoxia resistance is induced by exposure and that experience is transferred to the offspring. To test such hypothesis, we developed a transgenerational experiment differentially exposing a sea hare family to chronic hypoxia before sexual maturity and developing different crosses after maturity. The offspring of control lab reared animals (naïve to hypoxia for two generations) showed impairment of Time to Right (TTR) and Tail Withdrawal Reflex (TWR) after 7 days of repetitive hypoxia (6h, DO <20%), while individuals derived from hypoxia pre-exposed parents (pre-exposed) maintained resistance. Interestingly, exposing only one of the parents could rescue resistance in the offspring when the male-acting individual in the cross is exposed to hypoxia. F1 animals were dissected after 2h, 6h, 6 days, and 7 days of exposure, as well as right after reoxygenation and 12h recovery, and CNS ganglia were sampled for gene expression analysis. Preliminary results showed clear divergence of the transcriptional profiles between the offspring groups, evidencing potential signatures of hypoxia resistance. Overall, here we show that hypoxia resistance is environmentally driven in Aplysia and can be inherited transgenerationally, producing distinctive transcriptional profiles.

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Deema Abayawardena

Ph.D. Student in Biology

Specification of the Primary Embryonic Axis in Metazoan Embryos: Insights from Sea Star Development

In many metazoans, a critical early event in embryonic development is the specification of the primary embryonic axis, the anterior-posterior (AP) axis in early bilaterian embryos. The localized activation of Wnt/β-catenin (cWnt) signaling in posterior blastomeres plays a role in forming the AP axis in bilaterians. Studies in echinoderms have demonstrated that Dishevelled (Dvl), a central cWnt regulator, is required to activate this pathway in posterior blastomeres. Live imaging of oocytes from the seastar Patiria miniata revealed that a Dvl-GFP fusion protein localizes to puncta throughout the cortex. During maturation, these puncta vanish, and new puncta form at the vegetal pole. The maternal mechanisms that regulate Dvl enrichment and activation at the vegetal pole remain unknown, but understanding these processes is crucial for understanding how cWnt signaling is selectively activated in vegetal blastomeres to initiate AP axis patterning. To identify the maternal factors that regulate Dvl and cWnt activation in vegetal blastomeres, I conducted RNA-seq and mass spectrometry on Patiria oocyte animal and vegetal halves. This analysis identified several mRNAs, long non-coding RNAs (lncRNAs), and proteins that are differentially enriched at the animal and vegetal poles. After validating the asymmetric enrichment of these factors to either the vegetal or animal pole, I will experimentally test the hypothesis that these factors specify the animal-vegetal (AV) axis by establishing cytoarchitectural polarity in the oocyte and/or activating cWnt signaling at the vegetal pole. This work will provide valuable insights into the maternal mechanisms that specify the AV axis in echinoderms and into the evolution of this fundamental polarity in animal eggs.

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Marlene Redlich

Ph.D. Student in Microbiology and Immunology

Aptamer- Decorated Lipid Nanoparticles for Targeted Delivery to Pancreatic Beta-Cells

In many metazoans, a critical early event in embryonic development is the specification of the primary embryonic axis, the anterior-posterior (AP) axis in early bilaterian embryos. The localized activation of Wnt/β-catenin (cWnt) signaling in posterior blastomeres plays a role in forming the AP axis in bilaterians. Studies in echinoderms have demonstrated that Dishevelled (Dvl), a central cWnt regulator, is required to activate this pathway in posterior blastomeres. Live imaging of oocytes from the seastar Patiria miniata revealed that a Dvl-GFP fusion protein localizes to puncta throughout the cortex. During maturation, these puncta vanish, and new puncta form at the vegetal pole. The maternal mechanisms that regulate Dvl enrichment and activation at the vegetal pole remain unknown, but understanding these processes is crucial for understanding how cWnt signaling is selectively activated in vegetal blastomeres to initiate AP axis patterning. To identify the maternal factors that regulate Dvl and cWnt activation in vegetal blastomeres, I conducted RNA-seq and mass spectrometry on Patiria oocyte animal and vegetal halves. This analysis identified several mRNAs, long non-coding RNAs (lncRNAs), and proteins that are differentially enriched at the animal and vegetal poles. After validating the asymmetric enrichment of these factors to either the vegetal or animal pole, I will experimentally test the hypothesis that these factors specify the animal-vegetal (AV) axis by establishing cytoarchitectural polarity in the oocyte and/or activating cWnt signaling at the vegetal pole. This work will provide valuable insights into the maternal mechanisms that specify the AV axis in echinoderms and into the evolution of this fundamental polarity in animal eggs.

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Lizeth Camacho Lopez

Ph.D. Student in Biochemistry and Molecular Biology

Understanding the Biogenesis of the Respiratory Supercomplexes in Saccharomyces cerevisiae

The mitochondrial respiratory chain (MRC) plays an important role in cellular bioenergetics, mainly in the respiratory pathway generating most of the ATP molecules in the cell. The MRC is composed of multimeric enzymatic complexes that transfer electrons from reducing equivalents to molecular oxygen generating an electrochemical gradient across the mitochondrial inner membrane used by complex V to catalyze ATP. MRC biogenesis and activity involve the dynamic organization of the single MRC complexes in ordered structures known as supercomplexes (SCs). SCs have been found in a variety of organisms in various configurations based on the cellular metabolic state and/or tissue type. The MRC complex assembly is a highly regulated process due to its dual genetic origin requiring expression of subunits encoded in both nuclear and mitochondrial genome. The MRC organization model postulates the existence of individual complexes with SCs in a dynamic equilibrium to allow a fast adaptation to change in cellular energetic requirements. Moreover, individual assembly pathways for MRC complexes have shown there is no interdependence in their biogenesis. However, scattered data in the literature revealed the presence of assembly intermediates composed of different complexes. These observations suggest a crosstalk between complexes that may play an important role in SCs biogenesis. In the yeast Saccharomyces cerevisiae, the MRC lacks the canonical complex I which function is partially replaced by three NAD dehydrogenases. Yeast SCs are composed of complexes III and IV (CIII, CIV) into two different configurations; obligatory homodimer CIII flanked by either one or two CIV monomers. Here to better understand the biogenesis of yeast SCs, we generated a knock-out library of individual nuclear encoded subunits for each complex, and analyzed SC formation by sucrose gradient ultracentrifugation, and Tandem-Tag Mass Spectroscopy of each knock-out. We were able to classify each knock-out strain into two categories: one where their absence prevents any interaction between both complexes and another one where there is an interaction. Additionally, we detected potential SC intermediates that contain subunits of both CIII and CIV. We are proposing a respiratory SC biogenesis that follows a coordinated facultative pathway where CIII and CIV biogenesis is not fully independent.

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Joseph-Michael Schulz

Ph.D. Student in Molecular Cell and Developmental Biology

Advancing Antiviral Therapeutics: Leveraging Targeted Protein Degradation to Overcome Resistance and Expand Drug Discovery Horizons

Targeted Protein Degradation (TPD) is a transformative therapeutic strategy that leverages the cell's ubiquitin-proteasome system to eliminate disease-causing proteins. Unlike traditional inhibitors, which rely on continuous occupancy of active sites to suppress protein activity, TPD employs event-based degradation to irreversibly remove proteins from the cellular environment. Proteolysis Targeting Chimeras (PROTACs), a prominent tool in TPD, induce ternary complex formation between a target protein and an E3 ubiquitin ligase, facilitating targeted ubiquitination and subsequent proteasomal degradation.

This project advances antiviral drug discovery by addressing the limitations of traditional therapies, including resistance development, limited target range, and partial inhibition. TPD enables the degradation of "undruggable" targets, mitigates resistance by eliminating entire proteins, and provides durable therapeutic effects. Our innovative approach integrates a comprehensive database of viral protein structures and solvent-exposed ligands, predictive computational tools, and machine learning algorithms to optimize degrader design. This platform accelerates therapeutic development by streamlining target prioritization and facilitating rational design of PROTACs tailored to viral and host-pathogen interactions.

Key to our strategy is the creation of a publicly accessible, enriched database cataloging viral protein structures and their corresponding ligands. This resource will provide researchers with detailed annotations of solvent-exposed interaction sites, enabling targeted identification of degrader candidates. Additionally, the project incorporates advanced computational modeling, docking simulations, and artificial intelligence to predict optimal protein-ligand interactions, enhancing the accuracy and efficiency of degrader design.

By bridging gaps in bioinformatics, structural biology, and computational chemistry, this project provides a scalable framework to combat viral resistance, emerging pathogens, and global health challenges. Proof-of-concept applications targeting high-priority viral proteins, such as those in HIV, will validate the approach and establish its utility for addressing unmet medical needs.

Our contributions not only advance the field of TPD but also establish a paradigm for leveraging multidisciplinary approaches to revolutionize antiviral drug discovery. This work sets the stage for broader therapeutic impact, demonstrating the potential to translate the TPD framework to other disease areas, including cancer and neurodegenerative disorders, addressing global healthcare challenges.

Author(s): Joseph Schulz, Dr. Stephan Schurer

Oral Presenters

Activities Room South

Casey Posner

Ph.D. Student in Chemical, Environmental, and Materials Engineering

Engineering Biosurfactant Interactions for Optimized Cosmetic Performance

Exploration of biosurfactants over the use of traditional surfactants has expanded as consumers continue to push for green and sustainable products. These amphophilic molecules are understood to provide surface tension reduction and emulsification properties, however, understanding of how to engineer synergistic interaction through the combination of bio-based surfactants, polymers, peptides, and other formulation materials to influence cosmetic performance, such as foaming, cleansing etc. is still essentially unexplored. Work conducted in the Soft Matter and Product Design Lab aims to mend this gap in understanding and help add to the knowledgebase of these relatively new materials. While they have been adequately studied in enhanced oil recovery, food, and pharmaceuticals, their high cost and variable functionality makes them more difficult to explore through R&D industrially for cosmetics and personal care. This talk focuses on the basic chemical structures of biosurfactants, how they are created, how they can be used in cosmetic formulations, and highlights the findings of studies done in the Soft Matter and Product Design Lab.

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Qiufeng Lin

Postdoctoral Associate

Ferrate(VI) Transformation of Nitrogen in Secondary Wastewater Effluent: Implications for Water and Nutrient Management

Ferrate(VI), i.e., the oxyanion FeO42-, is an emerging, green, and safe wastewater treatment agent with negligible formation of disinfection byproducts (DBPs) and multiple treatment mechanisms, including chemical oxidation, disinfection, in-situ coagulation, precipitation, and adsorption. While targeting various contaminants, it can inevitably react with certain water matrix constituents, such as nitrogen (N) species. However, the reactions of ferrate(VI) with wastewater N compounds remain poorly understood. This study explores ferrate(VI)-mediated transformations of different N species in secondary wastewater effluent, elucidates the underlying mechanisms, and identifies their implications for water and nutrient management. Results show that ferrate(VI) oxidation minimally abates total dissolved nitrogen (TDN), while oxidizing dissolved organic nitrogen (DON) into dissolved inorganic nitrogen (DIN), primarily nitrate nitrogen (NO_3^--N), without noticeably altering ammonia nitrogen (NH3-N) levels. Consequently, ferrate(VI) treatment increases the fraction of bioavailable, soil-leachable NO_3^--N while lowering the portion of less bio-accessible DON. This study reveals the ability of ferrate(VI) to retain overall nitrogen, improve its bioavailability, mitigate precursors of harmful nitrogenous DBPs, and enhance nitrogen leachability in soil. These findingsunderscore the complex impacts of ferrate(VI)-enabled wastewater treatment on human and environmental health, water supply, and nutrient management in agriculture.

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Haixin Zhang

Ph.D. Student in Physics

Tunable Length-Dependent Charge Transport in dp-pp Conjugated Metallaaromatics

Charge transport is essential for designing advanced nanoelectronics devices at the single-molecule scale, including transistors, switches, and diodes. However, conventional π-conjugated systems exhibit an exponential decay in conductance with increasing molecular length, limiting their applicability in molecular electronics. In this study, we uncover an unconventional reversed conductance decay in carbolong complexes, a class of metallaaromatic molecules featuring dπ-pπ conjugation. Using scanning tunneling microscope break junction (STMBJ) measurements, we demonstrate that conductance increases with molecular length, resulting in a negative decay constant (β). This trend persists across both front-to-back (FTB) and back-to-back (BTB) molecular connections before and after protonation. Furthermore, protonation enhances the conductance of carbolong complexes, with the degree of enhancement increasing as more metal centers are incorporated. This tunable charge transport property paves the way for molecular electronics with robust and controllable conductivity. Additionally, we find that the rectification effect of protonated carbolong molecules can be amplified by increasing molecular length, offering a new strategy for designing high rectification ratio (RR) molecular diodes. Our findings not only challenge conventional charge transport paradigms but also establish a design framework for long-range, high-conductance single-molecule electronics. The ability to manipulate charge transport and rectification through molecular length, connectivity, and protonation unlocks new possibilities for engineering high-performance nanoelectronics devices. This work lays the foundation for developing metallaaromatic systems with superior charge transport properties.

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Liz Yanuskiewicz

Ph.D. Student in Ocean Sciences

Identifying Sources and Transformation of Particulate Organic Matter in the North Atlantic Spring Bloom using Isotopes, Amino Acids, and Carbohydrates

In May 2021, the EXPORTS (EXport Processes in the Ocean from RemoTe Sensing) program sampled a declining phytoplankton bloom in the North Atlantic. To understand the overall biogeochemical impact of particle flux during the bloom, including episodic flux of aggregates, questions remain about the chemical composition, sources, and degradative transformation of particulate organic matter (POM). We measured the concentrations of carbohydrate monomers and the concentrations, nitrogen isotope ratios, and carbon isotope ratios of individual amino acids in sinking and suspended particles collected from the surface to mid-mesopelagic (30-500 m) depths and over time during the bloom decline. In the euphotic zone, patterns in the nitrogen isotope ratios of amino acids indicated that POM derived predominantly from primary producers, with nitrogen sources varying across size fractions, and carbon isotopic fingerprints of essential amino acids identified major phytoplankton clades contributing to particle size fractions. Patterns in the nitrogen isotope ratios of amino acids confirm that phytoplankton-derived material persisted into the mesopelagic, but with significant overprinting by microbial degradation. Carbohydrate composition shifted from glucose-dominated in the euphotic zone to more amino-containing and acidic carbohydrates in the mesopelagic, which are components associated with the formation of sinking algal aggregates. We discuss how the observed POM composition may affect the export and dietary potential of sinking particles across the sampling period.

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Giaffon Lam Salinas

Master's Student in Real Estate Development and Urbanism

Resilient South Florida: Redefining Real Estate for a Climate-Challenged Future

Florida faces intensifying climate challenges, with hurricanes, storm surges, flooding, and rising sea levels threatening its communities and infrastructure. The financial impact is evident: Hurricanes Milton and Helene caused over $300 billion in damages last year, much of it uninsured. These hazards disrupted lives, displaced families, and left neighborhoods without power and water for weeks, underscoring the urgency of resilience as a critical pillar for sustainable development.

This study presents an innovative geospatial analysis, integrating FEMA flood zones, storm surge data, and sea level rise projections over the next 25 to 50 years. Risk assessments are a cornerstone of this analysis, as they provide the foundational understanding needed to identify vulnerabilities and inform decision-making. By layering these risks, the study exposes weaknesses often overlooked by traditional methods. For instance, areas currently deemed "low risk" are revealed to be susceptible to localized flooding and storm impacts. The findings are visualized in a comprehensive climate risk map which equips with actionable data to identify and prioritize resilience investments.

Resilience measures, such as elevating structures, advanced stormwater management systems, and hurricane-resistant designs, are not just cost-saving for developers but also life-saving for communities. For instance, incorporating advanced drainage systems can reduce flood risks by diverting water away from vulnerable areas, while hurricane-resistant designs ensure critical services remain operational during disasters, minimizing recovery time for businesses and residents alike. These strategies preserve neighborhood stability, protect tenants, and enhance long-term property values, creating ripple effects of safety and security across entire communities.

This initiative highlights that resilience is a shared responsibility extending beyond developers. Real estate impacts everyone who lives, works, or invests in South Florida, making climate adaptation an essential community-wide effort. The project's findings urge a shift in mindset, emphasizing resilience as both a moral obligation and an economic necessity to safeguard the region's future. With engaging visuals, this presentation provides clear, actionable insights that resonate with experts and the public alike. It advocates for a unified, forward-thinking approach to ensure South Florida's built environment remains livable, functional, and secure for generations to come.

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Collin Connors

Ph.D. Student in Computer Science

A Novel Blockchain Paradigm for Creating, Maintaining, and Sharing Personal Blockchain Ledgers

Blockchain technology has experienced substantial growth in recent years, yet the diversity of blockchain applications has been limited. Blockchain provides many desirable application features, including being append-only, immutable, tamper-evident, tamper-resistant, and fault-tolerant; however, many applications that would benefit from these features cannot incorporate current blockchains. This work presents a novel architecture for creating and maintaining personal blockchain ledgers that address these concerns. Our system utilizes independent, distributed, modular services, enabling individuals to securely store their data in a personal blockchain ledger. Unlike traditional blockchain, which stores all transactions of multiple users, our novel personal blockchains are designed to store the transactions of individual users. We show that our system satisfies the properties of blockchain. We then discuss our system's environment, design, and implementation before providing empirical results to validate our analysis. Our system paves the way for a more diverse blockchain technology, empowering more users and applications to leverage its potential.

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Sarvesh Saini

Postdoctoral Associate

Development of a Novel Digital Twin for Ureteroscopy with Laser Lithotripsy for Kidney Stone Surgery

The integration of robotic assistance and digital twin technology in minimally invasive surgery is advancing precision and control, particularly in ureteroscopy with laser lithotripsy for kidney stone removal. This research presents the development of a novel digital twin framework for a 3-degree-of-freedom (3-DOF) robotic system designed for endoscopic kidney stone lithotripsy. The proposed system utilizes a Wolf endoscope and aims to enhance procedural accuracy and real-time tracking of the surgical instrument. A physical prototype of the robotic system was designed and fabricated, replicating the critical degrees of freedom required for controlled endoscope maneuvering. A simulation model of the experimental setup was then developed using SolidWorks and subsequently integrated into NVIDIA Isaac Sim to enable real-time digital twin implementation. The mapping of physical joint movements to their virtual counterparts was achieved through precise motion tracking, ensuring an accurate representation of the system's behavior in a simulated environment. The digital twin was employed to monitor and validate the robotic system's performance, particularly focusing on the endoscope tip's positional accuracy. Initial in-air experiments demonstrated considerable tracking precision, confirming the effectiveness of the digital twin in replicating real-world motion. This advancement lays the groundwork for improving intraoperative guidance, reducing human error, and enhancing the overall efficacy of kidney stone lithotripsy procedures. This research highlights the potential of digital twin technology in robotic-assisted surgery, offering a scalable and interactive platform for refining surgical techniques. Future work will involve incorporating patient-specific anatomical models and validating system performance in clinically relevant conditions to further optimize surgical outcomes.

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Shubham Sinha

Ph.D. Student in Physics

Cell Movements Display Left-Right Asymmetry in Early Chicken Embryo Development

The collective movements of cells in tissues play an important role in several processes in animal physiology and development. Animals with bilateral symmetry, including humans, have a body plan with a morphological left-right (L-R) symmetry that is visible on the outside but there is an asymmetrical organization of the internal organs. The initiation of this L-R asymmetry and the role of physical and biological processes underlying this initiation are not well understood. In a developing embryo, cellular movements start with gastrulation, a process in which an embryo transforms from a flat, single tissue layer (2-dimensional) into a multi-layer (3-dimensional) structure. This process of gastrulation is crucial in patterning animal body plans and is an active area of research. Out of several model systems to study gastrulation, the chicken embryo is a good model system due to its large size, ease of microscopic imaging, easy availability, and close similarity to human gastrulation. In chick embryos, the early stage of gastrulation is accompanied by a bilateral cellular flow known as “Polonaise Movements” forming two counter-rotating vortices merging at the midline. The first known signature of asymmetry initiation is at a later stage when laterality gene regulatory programs take over at the beginning of organogenesis. A detailed physical understanding of the cell flow patterns and their consequences in early-stage gastrulation is still lacking. In the current work, we investigated these early-stage gastrulation cell flows before the activation of laterality genes in chicken. We quantify these cellular flows using parameters like speed and vorticity using the Particle Image Velocimetry (PIV) technique. The hourly time-averaging approach revealed a right dominance in the bilateral flow. Our results indicate LR asymmetry in bilateral cellular flows prior to the activation of LR laterality genes.

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Erin Gallop

Postdoctoral Associate

Perceived Neighborhood Social Cohesion is Associated with Lower Depressive Symptoms among Older Adults Diagnosed with Obstructive Sleep Apnea

Background and Objectives: To examine the relationship between perceived neighborhood social cohesion and depressive symptoms among older adults with an obstructive sleep apnea (OSA) diagnosis.
Research Design and Methods: Data were derived from a subsample of older adults with a doctor's diagnosis of OSA from the Health and Retirement Study (N=472), a nationally representative, population-based study of older adults conducted in 2016. Our outcome, depressive symptoms, derives from eight items from the Center for Epidemiological Studies-Depression scale. Our independent variable, perceived neighborhood social cohesion, is based on a four-item, previously validated scale. Negative binomial regression models were used to examine the relationship between neighborhood social cohesion and depressive symptoms among older adults with an OSA diagnosis, adjusting for demographic factors, neighborhood disorder, smoking, drinking, chronic conditions, health insurance, medication usage, and insurance policies.
Results: After adjusting for demographic factors, higher perceived neighborhood social cohesion was significantly associated with lower rates of depressive symptoms. Although the relationship was attenuated with the inclusion of behavioral and economic controls, it remained statistically significant. In additional analyses, we found that the mental health benefits of perceived neighborhood social cohesion do not vary by perceived neighborhood disorder.
Discussion and Implications: Our study emphasizes that strengthening neighborhood cohesion can enhance mental health as a structural-level intervention for older adults with OSA. The mental health benefits of improving social cohesion in one's neighborhood of residence do not vary across levels of perceived physical disorder. By highlighting the psychosocial factors influencing health outcomes among older adults with OSA in sleep deserts, we provide insights into potential community-wide interventions to improve sleep and mental health.

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Oral Presenters

Ballroom East

Isabella Altilio Bove

Ph.D. Student in Molecular Cell and Developmental Biology

Spatial Transcriptomic Analysis of Ductal Remodeling in FFPE Pancreatic Samples from Type 1 Diabetic, Autoantibody-Positive, and Non-Diabetic Donors

A longitudinal scRNAseq study from our lab previously identified ductal progenitor activation and insulin-producing cells transitioning from a ducto-acinar intermediate stage in long-term cultured human pancreatic slices. Using spatial transcriptomics, we aim to link these dynamic transcriptomic shifts to anatomical features in Type 1 Diabetes (T1D) donor samples. We expect to detect extensive ductal remodeling and sprouting of putative beta cells, directly correlating transitional clusters from scRNAseq with real anatomical structures. Formalin-fixed paraffin-embedded (FFPE) pancreatic tissue sections from T1D (nPOD #6240, #6263, #6083, #6380), autoantibody-positive (nPOD #6116, #6158), and non-diabetic donors (nPOD #6393, #6416) underwent immunofluorescence staining for CK7 (ductal), insulin (β-cells), and DAPI (nuclei). This identified the ductal and endocrine regions, as well as hypothesized transitional β-cells at the duct-islet interface, guiding region selection for transcriptomic analysis. We used the 10X Genomics Visium HD Spatial Gene Expression platform, enabling whole transcriptome analysis at single-cell resolution. Each capture area (6.5 mm x 6.5 mm) contained ~11 million barcoded capture spots (2 µm x 2 µm), allowing precise spatial mapping. Data were processed with 10X Genomics tools and visualized in Loupe Browser. Custom R and Python pipelines were used for downstream analysis, integrating reference scRNAseq data (GSE223713). Spatial transcriptomic analysis using Seurat v5 was performed on T1D, autoantibody-positive, and control pancreas samples. In control samples, beta cells were localized within islets, while in T1D samples, islets were largely devoid of beta cells, consistent with disease pathology. However, in T1D samples, we identified a subset of duct-adjacent cells expressing progenitor markers TFF1 and SPP1. Notably, some of these cells also expressed insulin (INS), suggesting a transitional state. These findings suggest potential progenitor activity near ducts in T1D-affected pancreas tissue. Further analysis will provide deeper insights into cellular heterogeneity and the potential role of progenitor cells in pancreatic remodeling and regeneration in T1D.

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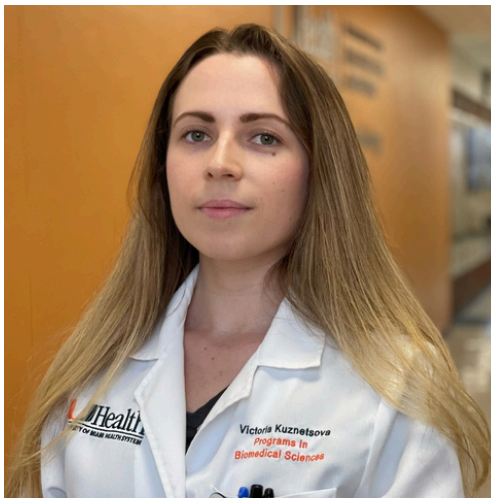

Victoria Kuznetsova

Ph.D. Student in Microbiology and Immunology

Upregulation of PDL-1 on Endogenous ß Cells by saRNA-Aptamers chimera

Victoria Kuznetsova1, Daria Ivanova2, Boutheina Marnissi2, Luciana Mateus Gonçalves2, Joana Almaca2, Silvio Bicciato2, and Paolo Serafini1,2
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Background:T cell exhaustion and the interaction between programmed cell death protein 1 (PD1) and PD1 ligand 1 (PDL1) play a crucial role in the progression of Type 1 Diabetes (T1D). Residual functional islets from patients with a long history of T1D express PDL1; patients with autoreactive antibodies undergoing PD1 inhibition as cancer treatment develop fulminant T1D; the length of the honeymoon phase correlates with circulating exhausted T cells. In mice, transgenic or viral expression of PDL1 on allogeneic islet grafts prevents their rejection. This aligns with the observations in oncology and viral infection settings that PD1/PDL1 interaction gradually modulates T cell differentiation, increases coinhibitory receptors, reduces their effector function, and plays a role in peripheral tolerance. While in these settings, the use of checkpoint inhibitors restored the anti-tumor and anti-viral immunity and revolutionized the treatment of these diseases, the opposite (induction of PDL1 in autoimmunity) has not been explored. We hypothesize that a temporal iatrogenic upregulation of PDL1 on β cells will delay or prevent T1D by inducing exhaustion on autoreactive T cells.To induce PDL1 upregulation specifically on β cells, we designed a bifunctional RNA therapeutic (called PS03) composed of mouse and human β cell-targeting RNA aptamers and small activating RNA (saRNA) for upregulating PDL1. In vitro, PS03 upregulated PDL1 on mouse insulinoma cell line MIN6. Similarly PS03 upregulated PDL1 in islets of living pancreatic slices from NOD mice and inhibited islet-infiltrating T cells' function. In vivo, systemic administration of PS03 increased PDL1 expression on endogenous β cells of NOD mice without affecting other tissues. Flow cytometry of pancreatic T cells revealed that longitudinal PS03 treatment increased the frequency of CD8+T cell clusters exhibiting exhaustion phenotype. Moreover, aptamer-saRNA induced upregulation of PDL1 delayed T1D onset in NOD mice, with 40% of treated mice remaining diabetes-free after 1 year, compared to ~90% of control mice that developed diabetes.
In conclusion, our islet-specific aptamers enable targeted gene modulation in β cells in vivo. PS03 molecule effectively upregulates PDL1 specifically on β cells, inhibiting T cell effector function in the islets by harnessing PD1-PDL1 pathway and longitudinally protecting NOD mice from diabetes.

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Caleb Calaway

Ph.D. Student in Exercise Physiology

Velocity-Based-Training Induces Positive Muscle-Ultrasound Morphology Changes in Persons with Parkinson's Disease

Velocity-based training (VBT) is a resistance training protocol that uses changes in velocity rather than traditional load changes to dictate progressions; however, its impact on muscle structure in Parkinson's disease (PD) patients is unknown. PURPOSE: To quantify changes in muscle thickness (MT), echo intensity (EI), fascicle angle (FA), and shear wave elastography (SWE) in the left and right rectus femoris (RF) and vastus lateralis (VL) muscles using small (10%) and moderately large (30%) velocity loss thresholds. METHODS: MT, EI, and FA were measured using ImageJ software on B-mode ultrasound images of the left and right RF and VL. SWE was measured using acoustic radiation force excitation. RESULTS: The mixed ANOVA for MT revealed significant time effects for all muscles; left-RF: (np2 = .287, p = .033); right-RF: (np2 = .482, p = .003); left-VL: (np2 = .338, p = .018); right-VL: (np2 = .273, p = .038). For EI, a significant time effect was seen for the left-VL: (np2 = .335, p = .019); with pairwise comparison showing a decrease in EI (-7.11 ± 2.68; p = .019), indicating an increase in muscle quality for the overall sample. However, group x time interactions were shown for all other muscles; left-RF: (np2 = .369, p = .013); right-RF: (np2 = .328, p = .020); right-VL: (np2 = .434, p = .005), with pairwise comparisons evidencing improvements exclusive to the 30% group for the left-RF (-8.298 ± 3.984, p = .056), right-RF (-6.489 ± 1.703, p = .002), and right-VL (-13.059 ± 2.786, p < .001). There were significant time effects for FA in the right-RF and SWE in the left-RF, with pairwise comparisons showing significant improvements in the right-RF for FA due to improved force transduction (-2.471 ± .844; p=.011), and the left-RF for SWE (-.292 ± .103; p = .013) indicating reduced stiffness. CONCLUSION: Results indicate that VBT is an effective training modality for inducing positive changes in muscle morphology for individuals with PD. Further, a 30% velocity threshold can produce greater changes in muscle quality than a 10% threshold.

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Omer Nadel

Postdoctoral Associate

Novel Small Viral Capsids Reveal Ancient Connections between Phages and Unicellular Organisms

Tailed phages are the most abundant viruses on the planet and display a wide range of icosahedral capsids. To date, the smallest isolated tailed phages form T=3-like capsids, with no evidence for tailed phages forming T=1-like capsids. Interestingly, cellular compartments called encapsulins, which share the HK97-fold with phage capsid proteins, form T=1 capsids. Phylogenetic analyses suggest encapsulins evolved from phages, suggesting a potential evolutionary link.
Analyzing metagenomic data, we recently identified uncultured phage-like genomes predicted to form HK97-fold T=1-like capsids. Here, we expressed their major capsid proteins in a heterologous bacterial model system and revealed their ability to self-assemble into small capsids. Transmission electron microscopy and light interferometry scattering indicated the formation of capsids with a diameter ranging from 21 to 28 nm and a mass distribution ranging from 2000 to 3500 kDa. These capsid dimensions are significantly smaller than those of isolated-tailed phages and suggest T=1-like capsid architectures.
These newly discovered small capsids fill a key structural evolutionary gap in the diversity of HK97-fold viruses, the most abundant group of viruses on Earth.
Our findings suggest a potential evolutionary pathway from ancient phages to modern unicellular organisms, demonstrating that structural constraints may have shaped viral diversity over billions of years.

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Stephanie Dancausse

Ph.D. Student in Biology

Characterization of the Behavioral Impacts of Persistent Dopamine Signaling on Drosophila larvae

Organisms have the ability to respond and adapt to different environmental contexts, which is crucial for their fitness. Sensory experiences and stimuli are detected by neurons in the peripheral nervous system and then transmitted to the central nervous system. Neurotransmitters, such as dopamine, allow for communication between neurons and have complex roles in a variety of organismal functions such as motor function, learning and memory, and mediation of reward-related behavior. Some circumstances such as disease states or exposure to neuroactive chemicals can lead to dysfunctional activity, including hyperactivity, for extended periods of time within the dopaminergic system. The effect of hyperactivation across the levels of behavior, circuit activity, and neural activity is relatively unexplored together in a single system. To investigate hyperactivation, I used neuroactive chemicals as tools to drive prolonged activation in dopaminergic circuits and record the resulting behavior using a novel robotic rig that allows for long-term behavioral assays over many hours. I find that larvae do modulate aspects of their navigation, consistent with effects of dopaminergic hyperactivity. In addition to that, long-term behavioral analysis was conducted that demonstrated shifts in the prevalence of a multitude of behavioral set points across exposure. To follow up, in vivo neural confocal microscopy was deployed during repetitive dopaminergic neural activation in order to identify sensitive neurons with single cell resolution and characterize changes within circuits. The neural activity found in the larval brain was consistent with brain regions rich in dopaminergic innervation. These experiments use novel approaches to understand the impact of hyperactivation on multiple levels of the dopaminergic neural system.

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Abbey Yatsko

Ph.D. Student in Biology

A Multiscale Remote Sensing Approach to Measuring Aboveground Tree Biomass

Tree above ground biomass (AGB) is an ecologically important yet threatened carbon sink, and continued carbon sequestration in trees is crucial for mitigating climate change. To effectively assess the carbon stored in trees, AGB needs to be accurately estimated at scale. While approaches to quantifying tree AGB exist, many face limitations when it comes to generating highly accurate, repeatable, and transparent AGB estimates at fine scales. However, this goal can be achieved via high resolution lidar measurements, satellite imagery, and machine learning models.
We developed a multiscale remote sensing approach to estimate AGB at 30m resolution across 55,000 ha on the Cape York peninsula in Queensland, Australia. First, we used terrestrial laser scanning (TLS) to establish an allometry between tree AGB and shade volume, a structural metric that describes the volume of space contained below a tree crown. Then, we trained a convolutional neural network (CNN) using both shade volume measured by aerial laser scanning (ALS) and high-resolution satellite imagery. The final CNN model predicted shade volume across the study area to which we applied the AGB-shade volume allometry to estimate AGB over 55,000 ha. We compared our AGB predictions with the M-layer of the Australian carbon accounting model, which defines maximum AGB for a given ecosystem.
We found a strong relationship between TLS-estimated woody AGB and shade volume (R2 = 0.95). The CNN model predicted shade volume at 30m resolution with 2.6% error and -1.9% bias. In applying the AGB-shade volume allometry to the CNN, we estimated 6.9 million tonnes of AGB across the study area. Our model estimated that approximately one-third of the study area was above the AGB indicated by the M-layer, calling into question the accuracy of the nation-wide carbon accounting model used in Australia.
Our study shows that a multiscale remote sensing approach can estimate AGB with low error at large scale. This method can provide more accurate baseline data on carbon stocks and allow for fine-scale monitoring of changes to AGB under different land management and through time. Our approach can be used for increased accuracy and integrity of AGB carbon accounting.

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Oral Presenters

Ballroom West

Linet Hernandez Moredo

Ph.D. Student in Literary, Cultural, and Linguistic Studies

From the Denial of Sexual Difference to Phallocentrism and Anti-inclusive Control in Paul B. Preciado's Countersexual Manifesto

Queer theories, anchored in defending the rights of persons whose sexual lives and identities have been historically despised, condemned, and persecuted, play an increasingly important role in current academic and political scenarios. While they can foster an exchange of ideas that enriches sexuality theories and promotes fairer sexual policies, their radical questioning of genders and sexes could imply controversial consequences. In this sense, I propose a critique of the Countersexual Manifesto (2002) by the queer author Paul Preciado, by showing how his denial of sexual difference paradoxically leads him to reinscribe a phallocentric logic, aligning to a projected society that disregards women and aims to establish a new hegemonic normativity, which ends up being anti-inclusive. Since every manifesto entails a calling for action, I not only explore its theoretical reductionisms but I also raise crucial practical concerns, such as how the reduction of AFAB and AMAB anatomies to a "fiction" of biopower could be weaponized to dismiss or override the specific health needs and rights of female-bodied and male-bodied people; how Preciado's proposal to decouple sexuality entirely from reproduction and to eliminate any social privilege based on male or female condition could undermine reproductive justice by devaluing the embodied experience of pregnancy and childbirth; how the instrumentalization of women's reproductive capabilities, seen as a large-scale solution to reproduce the countersexual society, detaches gestation of female subjectivity and aligns to the invisibilization of physical and emotional risks that contemporary surrogacy practices entail in poor women. My analysis is informed by feminism of difference (Irigaray, 1985), contemporary neorealism (Binetti, 2022), and new materialism (Dolphijn & van der Tuin, 2012). In dialogue with Foucault (1978) regarding control of sexuality by power, I argue that anti-inclusiveness and control in Preciado's Manifesto discard heterosexual and many non-heterosexual and queer current ways of life because of its practices and prohibitive rules (to abolish legal couples, nuclear family, conception through intercourse, etc.). Considering Preciado's concept of pharmacocapitalism, I argue that his countersexual proposal indeed reinforces technocapitalist power over individuals by reducing sex to technology and persons to bodies, exposing them to any technological experimentation.

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Chelsea McBride

D.M.A. Student in Jazz Composition

Press Play: How Video Game Music Reinforces Heroic and Gender Stereotypes

In topics theory, musical elements are employed to evoke a specific idea or concept that resonates with audiences who understand the cultural or stylistic reference. Though often applied to eighteenth-century music, this framework remains highly relevant in today's interactive media landscape. Film and video game music both contribute to and perpetuate these musical topics–a trend most recently analyzed in Lavengood and Williams's (2023) analysis of winter levels in 160 different video games, as well as Atkinson's (2019) analysis of flying themes in Final Fantasy IV and The Legend of Zelda: Skyward Sword. Expanding on this body of work, I propose that topics theory can offer insights into the gender dynamics of video game characters, specifically highlighting how composers differentiate between male and female protagonists. Composers' musical choices also often signal whether a playable character embodies a heroic archetype, often drawing on gender stereotypes that shape the distinction between male and female heroes. To demonstrate this concept, I will examine the top-selling video games on the Super Nintendo Entertainment System video games from the 1990s and select playable character themes from the top 20 games. By analyzing these themes, I will show that high-energy music in major keys, featuring driving percussion and expansive strings, is common. Minor tonalities are frequently used, particularly for sections involving non-human characters. In games such as Street Fighter 2, featuring more playable characters, minor tonalities are employed to create variety between character themes. Additionally, I demonstrate that when both male and female playable characters are present, female characters are more often associated with flutes and strings, while male characters are supported by brass and percussion. These instrumentation choices create two distinct musical topics: the "hero" and the "female hero/heroine". By constructing this dichotomy, game composers not only emphasize the differences between the hero and heroine, bu also reinforce traditional gender roles through musical representation. This framing shapes the player's perception of male and female characters, subtly influencing how each character's abilities, strengths, and roles are understood within the game's narrative. This ultimately reinforces or challenges broader cultural norms surrounding gender and heroism.

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Rachel Northrop

Ph.D. Student in English

Bye, Centennial: Revisiting the Non-Commemorative Literature of 1976

Because an institution commemorates a centenary does not mean those within it will also celebrate. As we approach the fiftieth anniversary of the United States bicentennial (or, in other terms, the nation's semiquincentennial) and find ourselves amidst the University of Miami's own centennial celebrations, revisiting literary works related to the 1976 Bicentennial of the American Revolution, as it was then called, reveals the effectiveness of redirecting commemorative attention—attention piqued and poised for narrative—to imagine otherwise.

Two essays that intervened in manifest-destiny-reifying narratives of "the spirit of '76" are the subject of this presentation: Kiowa writer N. Scott Momaday's "A First American Views His Land" in National Geographic and novelist Toni Morrison's "Slow Walk of Trees (as Grandmother Would Say), Hopeless (as Grandfather Would Say)" in The New York Times. Both essays, published in nationally prominent nonfictional outlets on July 4, 1976, question what it is that bicentennial celebrations commemorate. Morrison asks if Black Americans would be right to commemorate hopelessness or should celebrate the progressive trek of trees up a mountainside. Momaday asks how to situate the imported perspectives of a young nation state within a landscape that has been co-formed with its human inhabitants across tens of millennia. Momaday and Morrison do not directly challenge the national commemoration of July 4, 1776, but their choices to prioritize other narratives redirect the national interest in thinking about the past and imagining the future to, instead, remember different pasts and shape different futures.

Written for the mostly white audiences of The Times and National Geographic, both essays invite white readers to consider how the 1976 bicentennial commemoration marked an arbitrary date; the American Revolution was not a moment of freedom for Black and Indigenous people in the United States. Instead of inspiring commemoration, the bicentennial's focus on narrating the "spirit" of the US inspired the making of alternatives: narratives where Black and Indigenous lives are shaped not by their relation to European immigrants and descendants of settler colonists but by their relation to each other and to place.

Author(s): Rachel Northrop

Savannah Saavedra

Ph.D. Student in Literary, Cultural, and Linguistic Studies

Retelling History Through the Madwoman: Examining Gender, Nationhood, and the City in Colombian and Mexican Literary Production of the Nineteenth through the Twenty-First Century

My dissertation examines two Colombian novels, Soledad Acosta de Samper's Dolores (1867) and Laura Restrepo's Delirium (2004), and two Mexican texts, Elena Garro's short story "The Tlaxcaltecas are to Blame" (1964), and Cristina Rivera Garza's No One Will See Me Cry (1999). All four texts explore the complexities of women navigating society during critical moments in their nation's histories. These decisive historical moments include the process of nation-building following the wars of independence in Colombia in Dolores, the height of drug violence and economic uncertainty in Colombia's capital during the 1980s in Delirio, the tumultuous political climate of early twentieth-century Mexico during Porfirio Diaz's regime, and the ensuing Mexican Revolution years later, and, finally, the violence, racism, and inequality in 1960s Mexico narrated in relation to the fall of the Aztec empire and their grand capital city, Tenochtitlán, in "La culpa es de los tlaxcaltecas." In order to capture these turbulent and uncertain moments in Colombian and Mexican history, all four authors use the trope of the madwoman to create a space to reflect, denounce, and explore the above-mentioned socio-political moments through the eyes of a marginalized female protagonist. The hysteria or emotional breakdown the female characters suffer, interpreted as illness or in some cases "madness" is a result of the weight they carry both as women who feel the burden of restrictive expectations based on their respective society's traditional concept of womanhood and the precarious political climate crumbling around them. Therefore, I explore how these four Latin American female authors take this trope of the "madwoman" into their own hands, by placing women at the forefront of retelling their nation's history and denouncing injustices through their madness. Specifically, I examine how literature is a response to collective trauma and its social implications. Likewise, I incorporate how the decaying urban space in three of the texts mirrors both the protagonists' suffering and national trauma due to political violence and uncertainty during those decisive turning points in each nation's history. To bring all these concepts together my theoretical framework encompasses gender and feminist studies, historical memory, and urban studies.

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Nerissa Rebagay

Ph.D. Student in Music Education

Analyzing How Florida's Preservice Music Teachers Prepare for Teaching Students with Disabilities

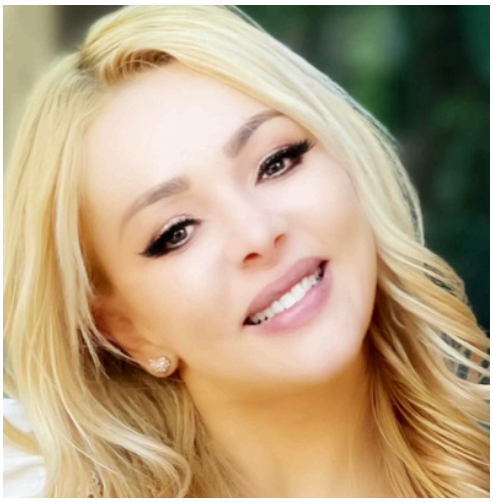
Federal legislation mandates the inclusion of students with disabilities in all classrooms, yet teacher preparation requirements vary by state. In Florida, while certification renewal requires coursework teaching students with disabilities, initial teacher preparation programs, including music education, lack this required specialization. This paper reviews the curricula of 15 National Association for Schools of Music (NASM) accredited music education programs in Florida. It reviews federal and state laws, critiques the curricular offerings of selected NASM-affiliated programs, and provides strategic recommendations for enhancing preservice educators' preparation.

The paper outlines the evolution of special education laws, highlighting the Individuals with Disabilities Education Act (IDEA) and its impact on inclusive education. It discusses the benefits of inclusion for students with and without disabilities and the challenges in aligning teacher preparation with legal and practical requirements. The disconnect between legislation, research, and teacher preparation implementation is emphasized, focusing on the need for specialized training in music education.

Preservice teacher education is critical for addressing attitudes toward disability and developing inclusive teaching strategies. Some programs integrate content into existing methods courses, while others offer specific courses or lack coverage entirely. There is a noticeable lack of consistency in preparing music teachers to teach students with disabilities. The variety of texts, ranging from those that adopt a medical model to those that embrace a social model of disability, highlights the absence of a unified pedagogical framework. This inconsistency may lead to varied levels of preparedness among future educators and philosophies and approaches to working with students with disabilities. Additionally, the limited fieldwork opportunities, with only a few institutions requiring direct interaction with students with disabilities, suggest that more practical, hands-on experience is needed to foster positive attitudes and develop effective teaching strategies for inclusive education.

The findings suggest a need for a unified pedagogical framework and more practical, hands-on experience in inclusive settings. The paper concludes with recommendations for improving the preparation of preservice music teachers, including the adoption of Universal Design for Learning (UDL) and differentiation strategies, and calls for further research to evaluate the effectiveness of these approaches.

Author(s): Nerissa R.M. Rebagay



Laura Bustillos

Ed.D. Student in Higher Education Leadership

Leadership, Integration, and Mental Health: Supporting College Student Success

College students face significant sociocultural challenges that impact their mental health, academic success, and overall well-being. Adjusting to a new environment often leads to social anxiety, isolation, and stress, which can hinder their academic performance and retention rates. Despite the growing number of students in higher education, limited research explores the intersection of leadership, sociocultural integration, and mental health in supporting their success. This study aims to examine the psychological and social difficulties students encounter and propose a leadership-driven program to enhance their social interactions, well-being, academic outcomes, and institutional retention efforts.

Using a narrative approach, this research will analyze qualitative data to assess college students' experiences, focusing on their challenges with adaptation, mental health concerns, and institutional support. The study will also explore how leadership in higher education can foster inclusive policies and programs that facilitate sociocultural integration. By examining best practices from successful student integration initiatives, this dissertation will propose a structured program designed to support students throughout their college journey. The program will emphasize mentorship, peer support, mental health resources, and leadership development, ensuring students feel connected, validated, valued and empowered in their new academic environment.

This research is significant for the field of higher education and community leadership, as it addresses a crucial gap in supporting students' holistic development. By integrating leadership principles with mental health strategies and sociocultural adaptation models, this study seeks to offer a comprehensive framework for institutions to enhance student engagement, retention, and academic achievement. Findings from this research will inform policymakers, educators, and student affairs professionals on effective strategies to cultivate an inclusive and supportive campus environment. Ultimately, this dissertation aims to contribute to a more student-centered approach in higher education, ensuring students receive the necessary resources, opportunities, encouragement and leadership-driven support to thrive academically, socially, and emotional

Author(s): Laura Bustillos

Celia Romero

Ph.D. Student in Psychology

Language as a Strength: How Bilingualism May Reduce Autism-Related Challenges

Approximately 1 in 54 children in the United States are diagnosed with autism spectrum disorder (ASD). ASD is associated with marked heterogeneity in executive function (EF) abilities. EF components, including inhibition and shifting, are related to ASD core symptoms such as perspective taking, social communication, and repetitive behavior. While approximately 12 million children in the United States are raised bilingually, there remains a lack of evidence to guide clinical practice or parents of children with ASD regarding language use. Recent research suggests that multilingualism may have a beneficial impact on EF abilities, especially in children with ASD. Still, despite the potential advantages that multilingualism may confer, families are commonly advised against providing a bilingual environment for their child with ASD. Furthermore, there remains a lack of understanding regarding the relationships between multilingualism, EF, and core symptoms in children with ASD. Here, we examined these associations in 7-12-year-old children with and without ASD (N = 116; 53 ASD, Mean age = 9.94 years). The Behavior Rating Inventory of Executive Function (BRIEF) was utilized to measure everyday EF skills. Parents completed the Children's Empathy Quotient (EQ-C; to assess perspective taking), Social Communication Questionnaire (SCQ; to assess social communication) and Repetitive Behavior Scale-Revised (RBS-R; to assess repetitive behaviors) to quantify the degree or severity of ASD symptoms. All statistical analyses included covariates of age, full-scale IQ, and social status. Results suggest that multilingualism is associated with stronger parent-reported inhibition, shifting, and perspective-taking skills as compared to monolingual children. Furthermore, we found a significant interaction between diagnosis and multilingual status on inhibition, such that the effects of multilingualism were stronger for children with ASD than typically developing (TD) children. Finally, we found indirect effects of multilingualism on perspective taking, social communication, and repetitive behaviors mediated by EF skills. These results demonstrate the supportive influences multilingual experience might have on EF and ASD-related symptoms.

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Kate Arnold

Ph.D. Student in Teaching and Learning

TikTok's English Influencers: Video Characteristics and Language Ideologies

This study explores the characteristics and language ideologies of popular English as an Additional Language (EAL) influencers on TikTok, a social media platform with over 1 billion active users. Specifically, it examines two key research questions:

1. What are the characteristics of videos produced by leading EAL influencers (e.g., video length, topics taught, creator demographics, and languages spoken)?
2. How do these influencers ideologically position the English language?

A content analysis of 125 videos from 25 popular TikTok influencers reveals distinct thematic patterns. Findings indicate that the most commonly taught topics are Vocabulary (38.4%), Pronunciation (24.8%), and Grammar (17.6%). Additionally, many influencers engage in translanguaging, using their native languages to explain English concepts or provide translations.

Regarding language ideologies, three dominant trends emerge: an emphasis on skill-based instruction, the privileging of native speakers, and a focus on English within 'inner-circle' countries. Despite TikTok's reputation for innovation, these influencers often replicate traditional teaching methods rather than leveraging the platform's potential for creative pedagogy.

Rather than reflecting individual biases, these patterns align with broader societal discourses, as evidenced by the staggering 1.8 billion total views across the analyzed videos. Their popularity suggests that conventional ideas, such as grammatical accuracy and accent conformity, remain deeply embedded in language learning culture. TikTok's algorithm further reinforces these norms, creating a feedback loop that sustains native-speaker-centric narratives.

Recognizing this dynamic highlights the need for a more critical approach to the language-learning content on social media. By expanding representation to include diverse dialects, cultural contexts, and teaching methodologies, TikTok (and social media more generally) can evolve into a more inclusive and equitable learning environment. A shift toward broader linguistic perspectives would challenge outdated ideologies and foster a richer, more nuanced understanding of English in a globalized world.

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Avi Hoffman

Master's Student in Documentary

The Global Yiddish Renaissance at UM

Avi Hoffman, School of Communications MFA Student and Founder/CEO of Yiddishkayt Initiative (yilovejewish.org) alongside Käthe Erichsen (PhD Candidate at Johns Hopkins University and Visiting Scholar at UM Miller Center for Contemporary Judaic Studies) will present their on-going archival and creative research in an oral presentation or TED-talk style. Their project, entitled The Global Yiddish Renaissance at UM will focus on the newly acquired Mendl and Miriam Hoffman Archive, housed at the UM Special Collections Kislak Center. In our talk, we will touch on the materials at the archive, including an 800-page handwritten WWI diary in Yiddish by Didye Schmulewitz spanning from 1914 until 1929, a rare photograph album and a teenager's illustrated song journal of Yiddish, Russian, Hebrew and Polish folksongs from the Hindenburg-Kaserne Displaced Persons camp in Ulm, Germany from 1945-1949. We will discuss the preservation process of these delicate materials and how having them at UM has opened up the world of untouched Yiddish literature, scholarship, and translation. We will then delve into the alliance of UM and the Yiddishkayt Initiative exploring how this small non-profit organization works with UM to engage with global Yiddish scholarship, bringing Jewish culture to life through staged theatrical events, lectures, and concerts dedicated to the preservation of Jewish heritage and the revival of Yiddish culture. Yiddish - A diasporic language born out of the Rhine River more than 1000 years ago and nearly exterminated during the Holocaust, has been brought back to life in the 21st century, established as an official minority language in Sweden, and continues to thrive in communities around the globe. Our academic and creative research will bring together multi-disciplinary interests from the School of Communication, the Frost School of Music, The College of Arts & Sciences, Theater Arts, Modern Languages and Literatures, and more.

Author(s): Avi Hoffman, Kathe Erichsen

Oral Presenters

Iron Arrow Room

Talia Berler

Master's Student in Data Science

ClassInsight: Developing an Agentic AIEd Application for Responsive Teaching and Learning

With artificial intelligence (AI) becoming increasingly central to professional industries, its potential to support and enhance educational practices is gaining significant attention through the growing field of AI education (AIEd). This paper explores the development of a new AI-based educational application, ClassInsight, designed to assist teachers in providing responsive, personalized feedback and gain empirical insight into their class's overall understanding of course material during in-class writing exercises. Responsive teaching is a key component of effective pedagogy, yet teachers often face challenges in delivering timely, individualized feedback due to time constraints and large class sizes. Particularly in humanities and social sciences subjects, evaluation of students' comprehension and providing timely feedback poses a great challenge to instructors.To address this, we present ClassInsight, an AI-powered, LLM-based agentic feedback application that analyzes student writing submissions in real time, generating actionable, contextually relevant feedback for students and teachers. Designed for use initially within the School of Law at the University of Miami, this tool is discussed in reference to its application in legal studies, but the tool may be applied to any social science or humanities subject. By interacting with the app, educators can generate anonymous visual metrics of their students' comprehension of concepts, automatically send individualized feedback on each student's response, and adapt their teaching strategies to meet students' needs. The ClassInsight app aims to improve teachers' ability to provide dynamic, targeted feedback, thereby fostering a more responsive, personalized learning environment within humanities and social sciences courses. As AI continues to reshape the industrial landscape, integrating it into education offers a promising avenue to enhance teaching practices, improve student engagement, and prepare instructors and learners alike for an increasingly AI-driven world. This study contributes to the growing body of research on AIEd, offering a model for how AI tools can be used to support educators in improving both their teaching efficacy and student outcomes.

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Qianjiang Xing

Postdoctoral Associate

Significant and Widespread Decline of the Observed Atlantic Meridional Overturning Circulation

Despite numerous model-based analyses indicating a significant decline in the Atlantic Meridional Overturning Circulation (AMOC) in recent decades, robust, long-term evidence from multi-latitudinal in-situ observations remains limited. This study analyzes observational data from four mooring arrays, positioned along the western boundary of the North Atlantic (from 42.5°N to 16.5°N), to produce time series of the deep western boundary contribution to AMOC below and relative to 1000 m. Comparisons of such a transport time series at 26.5°N at the Rapid-MOCHA array confirms the viability of using the deep western boundary contribution transport to represent long-term trends and interannual variability of the AMOC. Overall, we detect linear trends of the deep overturning transports at all four latitudes, corresponding to a meridionally widespread decline of the AMOC over the past 20 years.

Author(s): Qianjiang Xing, Shane Elipot, William E. Johns, David A. Smeed, Ben I. Moat, Matthias Lankhorst, John W. Loder

Ivenis Capistrano Pita

Postdoctoral Associate

Density Changes of North Atlantic Deep Water Cause Atlantic Meridional Overturning Circulation Weakening at 26.5°N

The Atlantic Meridional Overturning Circulation (AMOC) is a crucial system of ocean currents that helps regulate Earth's climate by moving warm surface water northward and cold deep water southward. Oceanographers measure the AMOC's strength at 26.5°N using data from the RAPID-MOCHA array, which combines information on wind-driven Ekman Transport, the Florida Current, and mid-ocean flows. The AMOC has exhibited a weakening trend since observations have started in 2004. However, the Ekman Transport has not shown a weakening trend during the analyzed period, and the Florida Current has remained stable over the past 4 decades. Consequently, the question of which component is responsible for the AMOC weakening remains unresolved. Our study focuses on the deep waters along the western boundary of the Atlantic, which carry cold, dense water formed in the Subpolar North Atlantic southward. These waters are made up of two layers—the upper and lower North Atlantic Deep Water (NADW)—each influenced by distinct regions: the Labrador Sea and the Nordic Seas, respectively. While most research has focused on the upper layer, our findings highlight the importance of the lower layer, which connects directly to cold waters overflowing from the Nordic Seas. We discovered that the density of these deep waters has decreased since 2004, primarily due to warming, with varying effects of salinity in the upper and lower layers. We recalculated the AMOC's strength by replacing the deep water density data with long-term monthly averages, allowing us to isolate how these changes impact the AMOC. We found that 77% of the AMOC's decline is due to these deep water changes, with the lower NADW, influenced by the Nordic Seas, playing a larger role than the upper NADW from the Labrador Sea. These results pinpoint the key regions contributing to the AMOC's weakening, helping us better understand this vital system of ocean currents and its role in our changing climate.

Author(s): Ivenis Pita, William E. Johns, Shane Elipot

Oshani Fernando

Ph.D. Student in Physics

Mapping Neural Responses to Thermal Stimuli in Drosophila Larvae

Navigating an environment of temporally and spatially varying stimuli is an important behavior for survival for all motile organisms. The Drosophila larva, an organism with relatively simple brain circuitry, has a robust, quantifiable navigational response to many stimuli, especially temperature. Larvae navigate away from both too-cold and too-warm temperatures. Neurons in the peripheral nervous system strongly respond even to very small decreases and increases in temperature. In the absence of negative or positive stimuli, larvae explore their environment in a random walk pattern, and respond to sensory stimuli by modulating random walk parameters, particularly turning rate. Our goal is to build a comprehensive map of behavioral and neural responses to variations in temperature. We use reverse correlation to quantify responses to thermal fluctuations, generating probabilistic mathematical filters which describe neural computations in response to temperature changes at a range of offset temperatures. We give temporally varying white noise thermal stimuli to larvae and record behavioral responses, and, separately, responses from individual thermosensory neurons. At the neuronal level, we record calcium activity to generate probabilistic filters which can predict probability of neuronal activation. At the behavioral level, we plan to record and quantify larval navigation, particularly turning events, to generate probabilistic filters which can predict turning rate.

Author(s): Oshani Fernando, Mason Klein

Gopika Madhu

Ph.D. Student in Physics

Quantifying Ductile-Brittle Deformations in a Novel Epithelial System

Epithelial tissues play a vital role in providing protection and other essential biological functions. The mechanics of epithelial tissues are known to play an important role in influencing cell growth, proliferation, migration, and differentiation. Despite being ubiquitous in the animal kingdom, our current understanding of the mechanics of epithelial tissues is still very limited. Understanding how epithelial tissues maintain integrity and function under mechanical stress is expected to give us insights into the physiology of tissues and potential therapeutic interventions. This work focuses on measuring material responses of epithelial tissue, such as local stresses and strains within the cellular monolayers as they undergo ductile to brittle deformations using Particle Imaging Velocimetry (PIV). These rapid tissue deformations have been observed in the non-bilaterian marine organism Trichoplax adhaerens. Quantitative kinematics experiments and a simple ball-spring model developed previously, to understand the transition from ductile to brittle properties in these tissues, indicate this transition is to be purely force driven. This motility-induced properties are further investigated by measuring the tractions generated by Trichoplax adhaerens at the cilia-substrate interface using Traction Force Microscopy (TFM). Preliminary results show that these organisms generate tractions as small as a few Pascals. This study involves projects on three fronts: kinematic characterization using PIV, traction measurements using TFM, and localized yield force measurements using soft lithography during ductile-brittle tissue deformations. These projects are expected to contribute to building a size-dependent framework that governs ductility and brittleness in monolayer epithelial tissues.

Author(s): Gopika Madhu, Molly McCord, Jonah Spencer, Katherine Kafkis, Jacob Notbohm, Vivek N. Prakash

Snigdha Samantaray

Ph.D. Student in Meteorology and Physical Oceanography

What Sustains the Longevity of Water Vapor Lakes Drifting over the Western Equatorial Indian Ocean?

Over the Western Equatorial Indian Ocean (WEIO), isolated high-column Water Vapor (CWV) 'Lakes' emerge distinctly within relatively drier regions, signifi cantly infl uencing rainfall distribution along the African coast. This research delves into the origins, persistence, and maintenance mechanisms of these atmospheric features, putting forth two central hypotheses: fi rstly, that the dynamics of these vapor lakes are sustained through a synergy of horizontal advection, secondary radiative and thermally driven circulations, and the Precipitation-Evaporation (P-E) balance; and secondly, that these phenomena can be paralleled with instances of convective self-aggregation observed at synoptic scales [1], revealing how vapor-radiation-advection instability leads to the expansion of dry areas, with moist and cloudy regions remaining as residual zones of active convection. To test these hypotheses, the study defi nes vapor lakes by identifying closed contours of a 55 mm CWV threshold in MERRA-2 data. This approach distinguishes the moist regime and allows drawing focus on the moist dynamic processes at the boundary [2].

Observations show distinct seasonal patterns in the landfall of vapor lakes, with a notable intensifi cation in the southern hemisphere of WEIO. These lakes exhibit dynamic behaviors—merging, splitting, and an east-to-west drift, with a lifespan exceeding a week in several cases. Composite analysis for the selection of lake vapor has shown a signifi cant peak in cloud coverage and precipitation, alongside marked moisture convergence indicative of the Precipitation-Evaporation (P-E) sink. Building on this, the study proposes to use CWV, moist static energy, radiative cooling profi les, and momentum data to elucidate gradients in convective dynamics and secondary circulations at lake margins. Model forecasts and simulations would be evaluated for their ability to capture these processes.

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Oral Presenter - Physical Sciences and Engineering

Mazzen Eldeeb

Ph.D. Student in Biochemistry and Molecular Biology

Bioengineered Yeast Tethered Respiratory Supercomplexes Reveal Mechanisms Governing Efficient Substrate Utilization

The mitochondrial respiratory chain (MRC) enzymatic complexes, crucial for aerobic energy transduction in eukaryotic cells, form conserved higher-order structures called supercomplexes (SCs). The elucidation of SC physiological relevance is critical for our understanding of mitochondrial function and cellular bioenergetics but has been hindered by the limited availability of experimental models isolating SC formation as the sole variable. In baker's yeast, SCs comprise III2IV1 and III2IV2configurations, which enhance respiratory rates by facilitating cytochrome c diffusion along the SC surface. However, the role of distinct SC conformations and MRC plasticity remain unclear. To address these open questions, we engineered a yeast strain expressing a covalently linked III2IV2 SC, structurally identical to wild-type. This tethered SC supports robust respiratory activity but selectively impacts cytosolic NADH-driven respiration, in consequence of preferential SC interactions with distinct NADH dehydrogenases. We propose that in yeast mitochondria, substrate-specific respirasome-like SC configurations contributes to the optimization of electron fluxes across the MRC and supports metabolic flexibility.

Author(s): Mazzen H. Eldeeb, Zoe Cosner, Andreas Carlström, Jeffri-Noelle Mays, Gabriella F. Rodriguez, Jens Berndtsson, Martin Ott, and Flavia Fontanesi

Rizaldi Fadli

Ph.D. Student in Biomedical Engineering

Brain-Controlled Epidural Stimulation of Cervical Spinal Cord to Improve Recovery after Spinal Cord Injury

Approximately half of all spinal cord injuries (SCI) result in incomplete tetraplegia and two-thirds are at the cervical level. Physical and occupational therapy help restore voluntary upper-limb function, but recovery is limited due to the inability to adequately activate the central nervous system (CNS) spinal cord circuits post-injury. Neuromodulation approaches can enhance neuromotor recovery after SCI by incorporating activity-based training with stimulation to improve CNS activation and control. Epidural spinal cord stimulation (ESCS) has emerged as a promising approach to effectively assist neuromotor recovery after SCI. By activating the dorsal root proprioceptive fibers, ESCS can modulate the spinal circuits to better activate muscle motor pools. While ESCS has shown promise, combining brain-computer interfaces (BCI) with ESCS could further enhance neuromodulation by precisely synchronizing descending inputs sensorimotor activation to induce Hebbian plasticity. Here, we conducted a pilot clinical single-case study to investigate the efficacy and mechanisms of a novel BCI-ESCS therapy for improving hand motor function in an individual with chronic complete SCI (C4-C5 injury level, AIS A). The participant was implanted with two percutaneous ESCS leads over the C4-C7 level for 28 days. During the therapy, the participant performed therapist-guided motor tasks with BCI-ESCS support, with each session lasting up to 90 minutes.When the BCI detected the motor imagery, it triggered the ESCS, and the participant started to perform the motor task. We found that the assistive use of BCI-ESCS resulted in stronger maximum grip force (+30 N) and enhanced motor function (+17 in TRI-HFT block-subscore), thus enabling the participant to perform movements that were not possible without BCI-ESCS. Moreover, we observed neurorehabilitation effects from BCI-ESCS therapy. After a single session, BCI-ESCS therapy could improve fine motor function (+2 in box-and-block test) and facilitate corticospinal excitability. After the total of 18 therapy sessions, we observed improvements in gross motor function (+28 in TRI-HFT scores, exceeding minimal detectable change in clinical settings), enhanced muscle coordination and kinematics (smoother reaching movement), and strengthened corticospinal excitability. Therefore, our findings provide promising evidence that BCI-ESCS can strengthen the corticospinal tract and may serves as an effective neurorehabilitation approach for upper-limb recovery after SCI.

Author(s): Rizaldi Ahmad Fadli, Atsushi Sasaki, Akiko Yuasa, Zachary Boogart, Hiroki Saito, Nevena Musikic, Roberto Martens de Freitas, Nicollo Macellari, Kevin Davis, Abishek Prasad, James D. Guest, Joacir Graciolli Corderio, Marco Capogrosso, Matija Milosevic

Oral Presenters

Senate Room

Laurine Schnelzauer

Ph.D. Student in Biomedical Engineering

Using Machine Learning to Predict Oral Mucositis during Radiotherapy for Cancer Treatment

Background: Radiotherapy is one of the treatment modalities often combined with surgery and chemotherapy to treat cancer. It uses radiation beams to destroy tumor cells in the body. As with other medical interventions, radiotherapy is often associated with side effects that can negatively impact treatment and clinical outcomes due to the radiation diffusing to the normal tissue. In the case of head and neck cancers, nearly 50% of patients treated with radiotherapy experience adverse reactions, with oral mucositis being one of the most common and debilitating. This inflammation of the oral mucosa can lead to painful ulcers, require tube feeding, and even delay or interrupt treatment. To reduce this toxicity, physicists set radiation limits for the oral cavity based on data from X-ray therapy. Since protons interact with tissues differently, these limits are adjusted for proton therapy, but they are not perfect, and some risks remain unclear. This study aims to use machine learning to predict oral mucositis in head and neck cancer patients treated at the University of Miami and improve these constraints.
Methods: We investigated the occurrence of oral mucositis in 194 patients treated with X-rays and protons, using the type of radiation they received, the amount deposited in the oral cavity, and its ability to cause biological damage. The data was collected from the treatment planning system used in the clinic, physicians' notes, and Monte Carlo simulations. We then used this data to create a machine learning model capable of predicting the probability of each patient developing oral mucositis.
Results: We already know the incidence of oral mucositis in our patient cohort from the physicians' notes, but we aim to test the performance of our machine learning model to predict it in future patients. Our model has an accuracy of 80%, and we are able to determine which treatment parameters are most critical for predicting the outcome.
Conclusion: Creating a machine learning model allows us to accurately predict the occurrence of oral mucositis in head and neck cancer patients treated with radiotherapy. Hopefully, this will help us adjust treatment plans to reduce the incidence in future patients.

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Alejandro Cepero

Ph.D. Student in Medical Physics

Validation of a Novel Mathematical Model to Predict Relative Biological Effectiveness in Proton Therapy

Radiotherapy is a widely used treatment for cancer, employing radiation to destroy cancer cells. While photons are the most used radiation type, proton therapy has more recently been successfully implemented in clinical settings. Different types of radiation resulting in distinct energy deposition patterns. How the radiation releases its energy is important to assess to predict its final biological effect. The Relative Biological Effectiveness (RBE) is used in clinics as a measure of the effectiveness of different radiation types in causing biological damage compared to reference radiation (photons). It is commonly characterized by the average dose absorbed by a volume, but the radiation quality (particle type and energy) also plays a significant role. A fixed RBE of 1.1 is typically used for protons, despite known deviations across the range of a protons path.

To calculate this variable RBE across range a protons range and study the radiation pattern in biological tissue, an approach known as microdosimetry may be employed. Microdosimetry provides an accurate description of radiation quality by measuring the energy deposition of particles in micrometer sized volumes, meaning it can characterize radiation damage within a cell nucleus. This makes microdosimetry more accurate than more conventional ways of calculating the RBE that look at larger volumes. Mathematical models can use microdosimetric measurements as an input to assess the best possible clinical radiotherapy treatment. Models have already been successfully implemented in carbon ion therapy centers, but there is no consensus on the best model for RBE calculation. Recently, the Generalized Stochastic Microdosimetric Model (GSM2) was developed to predict cell survival and variable RBE using microdosimetry.

In this presentation, I will go over a biological and physical experiment conducted to validate GSM2. In the experiment, lung cancer cells were irradiated with protons, the biological effect of the radiation was determined, and the RBE was obtained. The irradiation conditions of the experiments were accurately replicated using Monte Carlo simulations. The simulated microdosimetric measurements were used as inputs for the model to predict the survival fraction and RBE that were compared to experimental values to validate the model.

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Shaocheng Shen

Ph.D. Student in Chemistry

Long-Range Resonant Charge Transport through Open-Shell Donor-Acceptor Macromolecules

Developing highly conductive molecular materials that enable efficient long-range charge transport is crucial for advancing molecular-scale technologies, including nanoelectronics, energy conversion, sensing, and quantum information science. Single-molecule junction (SMJ) studies have revealed that charge transport in π-conjugated systems predominantly occurs via off-resonant tunneling in the low-bias regime, resulting in conductance values orders of magnitude lower than the quantum of conductance (1G0). Additionally, off resonant tunneling leads to an exponential decay of conductance with increasing molecular length, imposing a fundamental challenge to achieving scalable and high-performance molecular wires. To address these limitations, an ideal molecular wire must be chemically robust, air-stable, and capable of supporting quasi-metallic charge transport with conductance values approaching 1G0 over extended length scales. Here, we report a charge-neutral open-shell donor-acceptor macromolecular wires that exhibit exceptionally high conductance close to 1G0 across molecular backbone lengths exceeding 20 nm. We employed scanning tunneling microscopy break junction (STMBJ) measurements and density functional theory (DFT) calculations for a series of macromolecules with different molecular weights to elucidate the underlying transport mechanism. Our results reveal that the unprecedented conductance arises from long-range resonant transport enabled by a combination of extended π-conjugation, a narrow bandgap, and an open-shell diradical character. These features introduce highly conductive midgap states and align the frontier molecular orbitals (FMOs) favorably with the electrode Fermi energy (EF), facilitating coherent resonant charge transport at low bias. Furthermore, we demonstrate that mechanical modulation enhances the conductance of a 20 nm-long macromolecular wire to $1G_0$, marking the first observation of ballistic electron transport in single molecules over tens of nanometers. These findings establish a new design paradigm for molecular wires, providing a robust platform for next-generation nanoelectronic devices with molecular-scale dimensions.

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Ilaria Pasolini

Ph.D. Student in Biomedical Engineering

In Vitro Model of the Confined Islet Transplant Site to Evaluate Direct and Indirect T Cell Cytotoxicity and Protective Effects of Islet Biomaterial Encapsulation

Statement of Purpose: In the context of islet transplantation therapy for treatment of Type 1 Diabetes, our goal is to create a simplified in vitro model of the islet transplantation site to specifically assess the effectiveness and the limitations of islet encapsulating biomaterials blocking direct pathways of islet cytotoxicity by autoreactive and alloreactive T cells.
Methods: We co-cultured murine insulinoma Nit-1 clusters from non-obese diabetic (NOD) mice, and MHC-matched beta cell autoreactive G9C8 or polyclonal CD45.2+ NOD CD8+ cytotoxic T cells (CTLs). An activation and expansion protocol up to 90-folds for both CD8+ T cells with anti-CD3/CD28 was developed. We used this platform to evaluate how Nit-1 1.2% MVG alginate or polyethylene glycol (PEG) conformal coating encapsulation affected functionality, viability and immunogenic phenotype within the presence of an IFNg and thapsigargin inflammatory treatment and within different concentrations of CTLs/well (36k, 144k, 720k).
Results: The Nit-1 overall insulin secretion was significantly reduced when cells were under inflammation or co-cultured with increasing concentrations of CTLs, even stronger when CTLs were autoreactive (G9C8).
Nit-1 viability drastically decreased after 24 hours co-culture as the number of CTLs increased with either autoreactive or polyclonal T cells, suggesting that T cell-mediated cytotoxicity on Nit-1 is at first given by indirect effects. However, after 72 hours, the viability declined with increasing numbers of autoreactive CTLs in the co-culture, indicative of direct CTL cytotoxicity. For Nit-1 phenotype, co-culture with autoreactive CTLs led to a concentration-dependent increased immunogenicity (MHC-I and PD-L1 upregulation) at 24 hours, similar to what observed with the inflammatory treatment followed by downregulation at 72 hours.
Alginate encapsulation reduced the stress on Nit-1 cells and effectively prevented the reduction in Nit-1 viability from co-culture with both autoreactive and polyclonal CTLs. However, MHC-I/PD-L1 upregulation still occurred, indicating mediation by soluble factors like indirect cytotoxicity.
Conclusions: Direct CTL effects on Nit-1 may take longer than indirect. Encapsulating biomaterials may reduce cytokine diffusion to the Nit-1 cluster core, delaying the viability loss and functional impairment happening with naked Nit-1 clusters. Additionally, the capsule biomaterial may sequester cytokines, reducing their local concentration, therefore their indirect cytotoxic effects on the cells.

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Foluso Adeosun

Ph.D. Student in Chemical, Environmental, and Materials Engineering

Self-healing, Injectable Hydrogel for Delivery of Skin Peptides

Skin peptides play a crucial role in regenerative medicine and cosmetic applications, providing benefits such as enhanced skin repair, hydration, and anti-aging effects. However, their clinical and commercial application is limited by challenges related to instability, enzymatic degradation, and poor skin penetration. This study aims to develop and characterize a self-healing, injectable hydrogel formulation designed to stabilize and deliver bioactive skin peptides in a controlled manner, improving their efficacy for both therapeutic and cosmetic applications. The hydrogel formulation is fabricated with biopolymers- k-Carrageenan and Hyaluronic Acid (HA), and physically crosslinked with potassium chloride (KCl).

Rheological characterization was conducted to evaluate the mechanical properties, injectability, and self-healing profile of the gels at different HA concentrations (0.1–5% w/w). The optimal formulation was determined based on its shear-thinning behavior, frequency-dependent viscoelastic properties, and rapid structural recovery post-deformation. The hydrogel with 1% w/w HA exhibited superior injectability, mechanical stability, and self-healing capabilities compared to the 5% w/w HA formulation, making it preferred for skin peptide delivery.

This research highlights the potential of k-Carrageenan/HA-based hydrogels as an effective platform for skin peptide delivery in both regenerative medicine and cosmetic applications. Future work will focus on optimizing peptide incorporation strategies to enhance stability and controlled release within the hydrogel matrix.

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Sofiane Amroun

Ph.D. Student in Civil Engineering

Mechanochemical Activation of Supplementary Cementitious Materials

Cement is often partially replaced with supplementary cementitious materials (SCMs) to reduce the CO2 emission caused by its production. However, there is a shortage of SCMs typically used. Multiple alternative SCMs exist, however, most of these need to be activated before being used as they would be inert otherwise. Mechanochemical activation (MCA) is one way for activation. It is performed by exposing SCMs to high-energy grinding. In this work, we focus on the effect of MCA on different SCMs, mainly basaltic fines (BF). BF showed increased heat release from the Modified R3 test with increasing grinding time (GT) and ball-to-powder ratio (BPR). Partial amorphization of the powders was evident from X-ray diffraction (XRD). Scanning electron microscopy (SEM) revealed the formation of rounded particles, aggregates, and agglomerates. Reactivity strongly correlated to the amorphous content, but not to the increased BET specific surface area. In this work, MCA was also performed on 12 different SCMs. The increase in reactivity after MCA was found to have a logarithmic correlation with the initial reactivity of the SCMs. Finally, we investigated the mechanical changes in cement paste and mortar specimens induced by the MCA of SCMs. The SCMs used are BF and Low-kaolinite clay (LC). The cumulative heat release from the paste specimens decreased in all cases compared to the control paste. In general, the CH consumption, compressive strength, and bulk resistivity increased after MCA attributed to the increase in reactivity. The workability increased for LC drastically after MCA.

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Mathieu Ratynski

Postdoctoral Associate

Rippled Clouds and Hidden Waves: Exploring Tropospheric Gravity Waves across Subtropical Oceans

In the vast expanse of the subtropical oceans, delicate ripples and patterns often appear in cloud decks, hinting at the presence of invisible waves traveling through the atmosphere. These are internal gravity waves: oscillations in the atmosphere caused by vertical displacements of air parcels. Though these waves remain hidden to the naked eye, advanced satellite technologies allow us to detect their imprints on clouds, providing a new lens to study atmospheric dynamics.

Using cutting-edge tools and high-resolution data from satellites, our research focuses on unveiling the story these waves tell. Visible light satellite images, with their striking cloud contrasts, reveal wave signatures during the day, while infrared images capture them even at night, using advanced filtering techniques. Wind divergence fields and water vapor data add another dimension, helping us piece together how these waves ripple through different atmospheric layers.

We apply wavelet transforms (a mathematical technique akin to turning a magnifying glass on specific features) to map the direction, speed, and size of these waves, which span tens to hundreds of kilometers. By connecting signals across multiple satellite fields, we can estimate how waves propagate both horizontally and vertically, providing clues about their sources and impacts.

Preliminary findings over the southeast Pacific reveal that these waves originate from a variety of sources: storm fronts in the upper atmosphere, tropical convection near the equator, and even interactions with mountains and coastlines. Beyond their beauty, these waves play an important role in the climate system, influencing cloud patterns, redistributing energy, and driving local weather changes. For instance, they can transition low cloud fields from closed to open formations, affecting how much sunlight is reflected back into space.

By expanding this analysis globally and over decades, we aim to unlock a deeper understanding of these waves' influence on atmospheric processes. Open-access data products from this research will pave the way for collaborations, enabling us to bridge the gap between fundamental wave dynamics and their practical implications, from improving weather forecasts to better predicting climate trends. Through these ripples in the clouds, we seek to unravel the atmospheric mysteries that shape our world.

Author(s): Mathieu Ratynski, Brian Mapes

Christian McDonald

Ph.D. Student in Microbiology and Immunology

Unraveling How Viruses Cause Cancer

Viruses are the most abundant organisms on the planet. From the smallest bacteria to immense whales, all lifeforms on Earth are susceptible to viral infections. In humans, it is estimated that over 95% of the human population is living with at least one kind known as a herpesvirus. This family of viruses encompasses well-known players such as the viral agent responsible for cold sores and the virus which causes chickenpox. Although many of us are infected with these pathogens, only a select few can do something quite damaging, inducing cancer in humans. This leads to an important question: why are only some of these viruses specialized to cause tumor formation? Our laboratory studies these cancer-causing viruses and seeks to uncover an answer to this question. Specifically, we are interested in Kaposi´s Sarcoma (KS) herpesvirus (KSHV), one of seven human cancer viruses on Earth. KSHV infection precedes the development of KS, an AIDS-defining illness. Although observable declines in AIDS-associated KS in western countries have been recorded since the advent of antiretroviral treatment (ART), over 50% of patients on ART do not exhibit total remission. Moreover, KS disproportionately affects marginalized communities and can be rapidly fatal for children in countries where KSHV is most prevalent. My dissertation aims to investigate how KSHV can form tumors in humans by investigating the importance of protein synthesis machinery found within our cells during infection. Our current project uses two human cellular models and one mouse cell model to explore the interactions between the virus and these proteins. Collectively, this study implicates a critical role for this machinery in KSHV replication and ultimately in allowing it to transform our cells into a cancer-like state. Findings from this research have not only provided insight into novel therapeutic targets but also serve as a model for understanding how other cancer viruses hijack and induce tumors in our cells.

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Oral Presenters

Vista Room

Anastasiia Beliaeva

Ph.D. Student in Biology

Neurophysiology and Laser Ablation in Drosophila Larva Thermal Response Circuit

The surrounding thermal environment is highly important for the survival and fitness of animals, and as a result, most exhibit behavioral and neural responses to temperature changes. We study signals generated by thermosensory neurons in Drosophila larvae and also the physical and sensory effects of temperature variation on locomotion and navigation. In particular, we attempt to elucidate the key components of Drosophila larva thermal navigation, compare temperature sensing across different stages of development, and determine the functions of single neurons that are involved. We utilize unique methods to understand the major components of Drosophila navigation. These methods include controlled stimulus delivery, in vivo calcium imaging, and single-cell femtosecond laser ablation.

Author(s): Anastasiia Evans, Mason Klein

Mike Cioffi

Postdoctoral Associate

Simulating Capsids of Uncultured Viruses

Viral capsids hold significant potential in biotechnological and medical applications, including gene delivery, vaccine development, antimicrobial therapies, and nanotechnology. However, the library of capsid structures is limited to viruses that can be cultured in laboratory conditions. Since most viruses are uncultured, this leaves a substantial gap in our understanding of the structural and functional diversity of capsids. One potential strategy is the use of molecular simulations. However, common methods relied exclusively on resolved crystal structures or their derivatives, which are not available for most uncultured viruses. Fortunately, advances in AI and deep learning have enabled the accurate prediction of protein structures, opening new avenues for studying uncultured viruses. Here, we present a generalizable procedure using available computational tools to build and simulate quasi-spherical icosahedral viral capsids without relying on crystal structure data. As a proof of concept, we applied this methodology to a protein candidate that was bioinformatically identified through the screening of small environmental viral genomes related to tailed-like phages. These viruses are particularly intriguing due to their structural diversity and widespread presence across ecosystems. This candidate was predicted to form small T=1-like capsids- a structure that is absent among isolated tailed phage capsids. After the construction of the viral capsid, coarse-grained molecular dynamics was used to assess the stability of the structure, quantifying various physical and thermodynamic properties. The results demonstrated a dynamically stable capsid under physiological conditions. Furthermore, another postdoctoral researcher in the lab expressed and assembled the uncultured capsid in a bacterial model system, confirming the formation of a small capsid. Given the vast and largely unexplored landscape of uncultured viruses, this in silico method serves as a valuable framework for investigating uncultured viral capsid's structure and dynamics, especially when experimental resources are limited, unlocking new possibilities for probing their use in various biotechnological applications.

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Natalia Lutsik

Postdoctoral Associate

Inter-Fraction Monitoring of Brain Metastases Resection Cavities during Fractionated Stereotactic Radiosurgery on the 0.35 T MRI-Linac

Purpose: Stereotactic radiosurgery is a cornerstone in the management of brain metastasis, offering targeted, high-dose radiation with minimal impact on the surrounding healthy brain tissue. Patients with large, symptomatic brain metastasis benefit from surgical resection of brain metastases, which is commonly followed by fractionated SRS (fSRS) to reduce the risk of local disease recurrence. Resection cavity volumes shrink gradually over time after surgical resection of brain metastases. Therefore, we sought to use 0.35 T MRI-guided fSRS to quantify post-surgical cavity changes during the fSRS course, as these cavities are typically not visualized during cone-beam CT.
Methods: A retrospective analysis was conducted on five patients treated with MRI-guided fSRS at three centers. Each patient underwent 3–5 treatment fractions. Pre-treatment and fractional MRIs were analyzed on the balanced Steady State Free Precession (bSSFP: TR=3.84 ms, TE=1.92 ms, Voxel size = 1x1x1 mm or 1.5x1.5x1.5 mm) images to assess relative planning target volume change (PTV index), PTV Hausdorff distances, and brain migration volume (the brain volume pulled into the PTV by shrinking cavity). Comparisons were made between initial and each fraction MRIs, focusing on changes in target coverage and healthy brain tissue sparing.
Results: Four of five patients exhibited resection cavity shrinkage during treatment. The PTV index ranged from 0.59 to 1.13, with a median value of 0.85 ± 0.14. Brain migration volume varied between -1.57 and 16.53 ml, with a median of 2.59±4.78 ml. PTV Hausdorff distances (maximum linear change) ranged from 2.34 to 9.84 mm, with a median value of 4.30±1.96 mm.
Conclusion: Per-fraction MRI imaging with a 0.35T MRI-Linac during fSRS identifies shrinking cavities in most post-operative brain metastasis patients. As cavities shrink, normal appearing brain moves into the high dose PTV. Since fSRS is correlated with the volume of brain receiving high dose radiation, this study identifies possible benefit of real-time adaptive PTV reduction to reduce treatment toxicity.

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Ethan Mimick

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Seasonal Dynamics of Polinton-Like Viruses

Viruses are an integral part of the organic nutrient cycling systems that maintain stable marine ecosystems. This is primarily through returning organic carbon from microbial life to marine ecosystems through viral lysis. In this process, viruses also modulate the abundances of key microbial populations in the ocean. An emerging group of viruses in the aquatic systems is Polinton-like viruses (PLVs) - a group that is known to infect diverse unicellular eukaryotes that encompass key photosynthetic microbes in the ocean. Some of the PLVs also associate with larger viruses (aka giant viruses) to influence their ecological success. Despite their recognition as a novel virus group in both marine and freshwater environments, we lack foundational knowledge regarding the extent of their diversity and the factors that drive their community in the ocean. Our findings indicate they are highly diverse even at one specific sampling site, suggesting the presence of a huge, untapped diversity in the ocean. Using size-fractionated environmental DNA (eDNA) collected over a six year period from 2009-2014 at the San Pedro Ocean Times series (SPOT) we have identified as of yet unseen patterns in PLV populations. Our findings indicate that a Majority of these viruses show seasonality suggesting strong influence of the changes in abiotic factors associated with season in shaping the community composition of PLVs in the ocean. This has key implications for their association with hosts and their influence on controlling key protist groups in the ocean.

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Sergio Gutierrez Roche

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Regeneration, Microbiome, and Estrogen Signaling: Unraveling AGR2's Role in Digit Tip Regrowth

In highly regenerative species like salamanders and zebrafish, AGR2 is a key protein related to appendage regeneration. While mammals cannot regrow entire limbs, species such as humans and mice can effectively regenerate digit tips. Our lab has identified a role for AGR2 in mice, as its absence delays the regeneration of digit tips. This delay is associated with structural epithelial defects and a dysregulated microbiome. Agr2 knock-out mice display an increased abundance of Adlercreutzia equolifaciens, a bacterium capable of producing the estrogen receptor agonist S-equol. We hypothesize that AGR2 contributes to digit tip regeneration by regulating microbiome composition, influencing bacterial metabolite production, and ultimately modulating estrogen receptor (ER) signaling. To test this, our study has two aims: (1) Determine how AGR2 modulates the microbiome and its metabolic productions, focusing on A. equolifaciens and S-equol; and (2) Investigate how S-equol influences regeneration via ER activation, particularly ERβ, which is associated with anti-inflammatory responses, cell migration, and proliferation.
Preliminary findings indicate that AGR2 mutants exhibit an increased abundance of S-equol-producing bacteria. S-equol treatment does not enhance regeneration in AGR2 mutants, suggesting that AGR2-dependent pathways are required for its effect. To further investigate, we will analyze endogenous S-equol levels in regenerating tissues as well as assess the impact of a soy-free diet, which eliminates precursor metabolites required for S-equol synthesis. We will also evaluate ER activation in response to S-equol treatment through immunostaining and Western blot analysis of phosphorylated ERα and ERβ.
By elucidating the interaction between AGR2, the microbiome, and estrogen receptor signaling, this research will contribute to our understanding of how host-microbiome interactions influence mammalian tissue regeneration, potentially uncovering novel strategies to enhance regenerative outcomes.

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Tericka Cesar

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A High Family Health Score Can Help Prevent Obesity

Introduction: The dual crisis of rising obesity rates and declining family health is overwhelming the nation. Family health plays a critical role in shaping the well-being of individuals, communities, and, the nation. Obesity exacerbates cardiometabolic issues, diabetes, and a range of other health problems. This study examines the connection between family health and obesity through a cross-sectional analysis of the Family Health Scale.
Methods: The primary data was conducted in 2020 by Dr. Crandall at Brigham Young University with a Qualtrics survey sent nationwide. Family health scale (FHS). FHS items were on a five point-likert scale and computed in composite form for the 31-item long form and short form. An index of (FHS Index) was computed with a ratio of variables positively correlated FHS items to Body Mass Index (BMI) to negatively correlated FHS items.Linear and binary logistic regression was performed to examine associations between Family Health Index and BMI. BMIcalculated, was assessed using a multiple regression analysis. The regression models included gender, age, number of children, education level (dichotomized), income, and FHS Index as predictors.
Results: Descriptive statistics for these variables, such as age (M = 40.63, SD = 17.54) and number of children (M = 2.28, SD = 1.21). My Preliminary results found that family health as measured by the FHS, is inversely associated with BMI as an indicator for obesity ($p<.001$) in randomly sampled US population. The association between FHS Index and BMI was significant $\beta=-1.555$, OR=.211 (95% confidence interval [CI], .071– .625; p=.005). Additionally, ANOVA found that for every one-unit decrease in the social factor, the BMI increased by 4.076 in an African American population. These findings expose how social and systemic forces can heavily influence familial health and obesity rates.
Conclusions & Implications: This research highlights the potential importance of the FHSShortForm Index in predicting BMI, even after accounting for demographic and socioeconomic factors.

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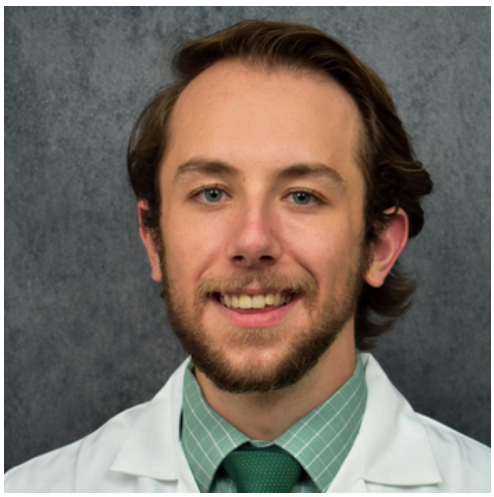

Michael Cobler-Lichter

Postdoctoral Associate

Refining Venous Thromboembolism (VTE) Risk Prediction Over Time with Machine Learning in Trauma

Objective: The risk of venous thromboembolism (VTE) is increased after emergency trauma laparotomy. There are several traditional risk-stratification systems that can identify the population at highest-risk, but the discriminatory abilities are only modest with areas under the receiver-operator curves (AUROC) of <0.8. Moreover, these tools only offer an initial risk estimate that does not change over time. We hypothesized that machine learning (ML) can accurately predict initial VTE risk and refine this prediction over the course of a patient's hospital stay.
Methods: Patients from the American College of Surgeons Trauma Quality Improvement Project database (TQIP) 2017-2021 who received a laparotomy within 90 minutes of arrival were included. ML models were created to predict VTE at three different time points: on admission (POD 0), POD 2-3, and POD 4-5. Models were optimized based on AUROC. Area under the precision-recall curve (AUC-PR), a metric that evaluates a model's tradeoff between precision and recall and can be informative in predicting rare events, was also evaluated for each model. A game theoretical approach (Shapley Additive Explanations) was used to estimate the relative significance of each variable towards the final prediction.
Results: In 74,643 trauma patients, the VTE and mortality rates were 4.6% and 18.2%. AUROC increased from 0.828 [95% CI 0.814-0.842] on admission to 0.877 [95% CI 0.866-0.887] at POD 4-5. The number of injuries sustained was the most important variable for POD 0 and POD 2-3 though this changed to ICU stay by POD 4-5. Facility VTE rate remained the second most important variable in each model, while the third most impactful variable changed from units of blood transfused in POD 0, to lack of VTE chemoprophylaxis initiation within 48 hours in POD 2-3, to greater than 3 days of mechanical ventilation by POD 4-5.
Conclusion: VTE risk in trauma patients requiring emergency laparotomy can be accurately predicted with ML algorithms, and these risks can be refined over the hospital course. Personalized risk profiles can allow for customized VTE prophylaxis regimens, though future prospective work is needed to validate the tool

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Ted-like Talk Presenters

Ted-like Talk

Dipan Karmali

Postdoctoral Associate

Sleep-Disordered Breathing Severity and Ventricular Repolarization: A Dose-Response Analysis

Rationale: Sleep-disordered breathing (SDB) is associated with an increased risk of cardiac arrhythmias. The QT variability index (QTVI), a marker of ventricular repolarization instability, is predictive of ventricular arrhythmias and sudden cardiac death (SCD). Recent evidence suggests that QTVI is elevated in individuals with severe SDB. This study will investigate whether a dose-response relationship exists between SDB severity and QTVI, assessing how SDB severity may correspond to difference in ventricular repolarization lability.

Methods: A cross-sectional analysis was conducted using participants from the Sleep Heart Health Study, matched by age, body mass index, and race. To minimize confounding, participants with medical comorbidities such as angina, stroke, myocardial infarction, heart failure type 2 diabetes, and chronic obstructive pulmonary disease, as well as those using medications affecting cardiac conduction (e.g., beta blockers, calcium channel blockers), were excluded. QTVI was quantified using ECG data obtained from overnight home polysomnography. The final sample included 98 men and 98 women. Participants were categorized according to SDB severity using the apnea-hypopnea index (AHI) as no mild, moderate, and severe SDB. Multivariable regression analyses were performed to examine the interaction between QTVI and SDB severity.

Results: Among men (mean age 62.8 years, range 40-78), a linear dose-response relationship (Figure 1) was observed between SDB severity and QTVI ($p = 0.04$ for linear trend). Study participants with severe SDB had a higher QTVI compared to those without SDB (-1.57 vs -1.31, $p=0.049$). Percentage of total sleep time with oxygen saturation below 90%, but not the arousal frequency, was associated with higher QTVI, indicating greater repolarization lability with worsening nocturnal hypoxemia. Among women (mean age 65.8 years, range 44-80), a similar linear dose-response trend was observed between QTVI and SDB severity ($p=0.067$).

Conclusion: This study demonstrates a direct association between increasing SDB severity and QTVI in both men and women, suggesting that SDB may aggravate cardiac repolarization instability. These findings suggest that the heightened risk of SCD among individuals with SDB may be related to the effects of nocturnal hypoxemia. Recognizing this association highlights the potential need for targeted monitoring and early intervention strategies to mitigate SCD in this population.

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Delaney Reynolds

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Energizing The Sunshine State

This article presents an in-depth analysis of the climate crisis with a focus on Florida, a state at the forefront of environmental vulnerability due to its extensive coastline and reliance on antiquated energy systems. It outlines the scientific consensus on climate change, emphasizing the critical role of human activities in exacerbating greenhouse gas concentrations and the resulting global warming. The article delves into the specific challenges faced by Florida, including rising sea levels and the state's historical dependence on fossil fuels, and argues for a pivotal transition towards renewable energy sources. Central to this discussion is the examination of Florida's current energy landscape, characterized by its substantial but underutilized potential for solar and wind energy, and the role that Florida electric utilities have played in preventing the renewable transition. It critiques the state's slow pace of adoption of renewable energy technologies and identifies regulatory, economic, and infrastructural barriers to sustainable energy transition. The article highlights innovative regulatory and legislative efforts, such as the introduction of Administrative Rule 5O-5: Renewable Energy, aimed at setting ambitious renewable energy targets to mitigate climate change impacts. Drawing on extensive research and models, the article proposes a comprehensive framework for Florida's energy transformation. It emphasizes the necessity of decarbonizing the electricity sector, improving energy efficiency, increasing the use of electricity for heating and transportation, and developing carbon capture and storage technologies. The study presents a roadmap for achieving net-zero carbon emissions by mid-century, grounded in scientific evidence and aligned with global climate goals. The article concludes by underscoring the urgency of collective action and robust policy measures to facilitate Florida's transition to a sustainable energy future. It calls for leadership, innovation, and community engagement to overcome the challenges of climate change and ensure economic, environmental, and social resilience. By charting a course towards clean energy, Florida can not only protect its unique ecosystems and populous cities but also set a precedent for sustainable development and climate leadership in the United States and beyond.

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British West Africa Students' True Story of the Golden Fleece for "The New Africa"

This presentation explores the experiences of British West African students studying abroad in Great Britain and the United States during the early to mid-twentieth century. Their pursuit of higher education was not just a personal aspiration but a strategic effort to prepare themselves with the knowledge and skills necessary to challenge colonial rule and advocate for Africa's independence. The period beginning in 1925 marks what historian Olanipekun Oladotun Laosebikan describes as the "clearest demarcation of the 'shift from the missionary phase to the political one,'" a turning point in the intellectual and political awakening of these students. As British West African students arrived in the West, they encountered numerous challenges, including racial discrimination and economic hardships. These obstacles varied depending on location and time period but ultimately strengthened their resolve. Their exposure to global politics, particularly through the impacts of World War I and World War II, further galvanized their commitment to Pan-African activism. Organizations such as the West African Student Union (WASU) in Great Britain and the African Student Association (ASA) in the United States became critical spaces for political mobilization, fostering a shared vision among Africans and the broader diaspora. The study follows this historical trajectory into the 1960s, a period that saw independence struggles transition into revolutionary movements. Nigerian student Christopher Orizu's concept of "The New Africa" exemplifies the collective aspiration of these students to build a self-determined, post-colonial Africa. This presentation particularly highlights the narrative of Nnamdi Azikiwe, who likened higher education in the West to the pursuit of the "golden fleece."

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